IMPACT OF MARINE AGGREGATE DREDGING & OVERBOARD SCREENING ON BENTHIC BIOLOGICAL RESOURCES IN THE CENTRAL NORTH SEA.

PRODUCTION LICENCE AREA 408 COAL PIT.

prepared for

British Marine Aggregate Producers Association (BMAPA).

by

Marine Ecological Surveys Limited.

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STATEMENT.

The **British Marine Aggregate Producers Association (BMAPA)**, a constituent body of the Quarry Products Association, commissioned and wholly funded **Marine Ecological Surveys Limited** to carry out a research project in 2000 into the impact of marine aggregate dredging on benthic biological resources. The objective of the study was to investigate the impacts of trailer dredging within an existing marine aggregate production Licence area and to assess the impacts of discharge of sediments rejected overboard during the screening process. The fieldwork was undertaken in conjunction with a routine monitoring survey that was carried out by the licensee, **Hanson Aggregates Marine Limited** in July - August 2000.

The survey was carried out by Dr.R.C.Newell B.Sc., Ph.D., D.Sc.(Lond) and Mr.J.E.Robinson B.Sc. in collaboration with the staff of Andrews Survey aboard the survey vessel *Bon Accord*. The separation and faunal identification was carried out by Mr.J.E.Robinson B.Sc., Ms.N.M.Simpson B.Sc., M.Sc. and Ms.N.M.Stearn B.Sc. of Marine Ecological Surveys Limited. Ms.N.M.Stearn holds a Natural History Museum IdQ qualification in marine macrofaunal identification. Community analysis was carried out by Mr.J.E.Robinson, Dr.L.J.Seiderer and Dr.R.C.Newell. Ms.S.C.Newell carried out the biomass determinations. Particle Size Analysis (PSA) was carried out by Andrews Survey of Gt.Yarmouth.

Dr R.C.Newell is an accredited Environmental Auditor certificated with the Institute of Environmental Management and Assessment (IEMA) and is registered as an Expert Witness with the Law Society of London and the UK Register of Expert Witnesses. Marine Ecological Surveys Limited is a member of the Environmental Law Foundation

Marine Ecological Surveys Limited

30th April 2002

SUMMARY.

1. The survey which we carried out in July - August 2000 was designed to investigate whether there was an impact of marine aggregate dredging on the benthic macrofauna at Production Licence Area 408 - Coal Pit in the central southern North Sea. The area is approximately 100 km east of the Humber Estuary and is isolated from the possible impacts of other licence areas. It is therefore well-suited to an assessment of the impacts of both trailer-dredging within the Production Licence Area and the impact of discharge of material rejected overboard during the screening process.

2. The intensity of dredging at sites within production Licence Area 408 is also known in some detail, both in terms of the hours of aggregate production and the tonnages removed. One site was in the process of aggregate production up to the time of our survey, others had been exploited earlier but had been abandoned for approximately 12 months. This gave us an opportunity to examine not only the impact of dredging and overboard screening in relation to the actively-dredged area, but also to obtain some information on the likely rates of recovery in areas at which dredging had ceased.

3. In all, a total of 194 samples were taken in July - August 2000. The stations were carefully selected to allow a detailed examination of the species variety (***S***), population density (***N***), biomass (***B***) and a variety of indices of population structure in some detail within areas of known dredge history. Stations were also selected to extend along the axis of dispersion of material released during the screening process and carried north-west and south-east by the tidal streams.

4. Direct studies on the behaviour of plumes from marine aggregate dredgers during normal loading operations suggest that the majority of the material is deposited on the sea bed within 3 km from the site of discharge (Hitchcock & Drucker, 1996; Newell *et al*, 1998, 1999). We therefore confined our survey grid to a distance of up to 4 km on each side of the Licence Area, with stations closely-spaced in areas where the majority of deposition of reject material was likely to occur. "Control" areas were selected well outside the likely boundaries of impact of dredging at Area 408 for comparison with the near-site stations.

5. The seabed sediments in the survey area comprise mixed sands and gravels. Coarse sandy gravels occur mainly within the boundaries of Production Licence Area 408, with areas of fine well-sorted sands extending to the south-east of the dredged sites.

6. Studies of the morphology of the sea bed with side-scan sonar suggest that net sediment transport is to the south-east, with local variations associated with the effects of sea bed configuration on tidal streams at the sediment-water interface. This work by Coastline Surveys Europe Limited (2002) and by Evans (2002), suggests that dredging and overboard screening may be associated with deposition of well-sorted fine sands, & their subsequent transport for at least 2000 m to the south-east of dredge sites within the boundaries of Licence Area 408.

7. The biological community comprises a typical species variety and abundance of benthic macrofauna. In all, a total of as many as 246 taxa were recorded. These comprised a mean of 38.9 species, 475 individuals and a biomass of as much as 2.0 g ash free dry weight (AFDW) expressed per 0.2 m^2 of sea bed. This is compatible with values recorded for coastal deposits.

8. The community as a whole is dominated by large numbers of small Polychaeta, and by Crustacea, although many other groups contribute to the assemblage. The community comprises typically small mobile "opportunistic" species that have a high rate of recolonisation and growth. This enhances their ability to recolonise deposits rapidly after episodic disturbance under natural conditions.

9. Multi-variate analysis of the benthic community composition, based on the species variety and population density of the macrobenthos shows little evidence of an impact of dredging within the actively dredged area or an impact, from increased sedimentation or sediment transport resulting from the screening process, on biological community composition based on species variety or population density.

10. There is some evidence of a change in the relative dominance of some components of the macrofauna community both within the boundaries of actively-dredged sites, & in seabed sediments likely to have been affected by transport of sediments outside the boundaries of the actively dredged site. One species (*Ophelia borealis*) is more common within the sediments of dredged areas than in the deposits elsewhere in the survey area. Other impacts include an absence of the polychaete *Nephtys caeca* from the actively-dredged site and the presence of juveniles of this genus in deposits where dredging had ceased in 1999. This implies that a process of recolonisation and restoration of community composition had occurred in the dredged deposits within the 12 months period since dredging ceased.

11. The evidence suggests that at the levels of aggregate production recorded for Area 408 up to the time of our survey, the rates of recolonisation by larvae and juveniles from the surrounding deposits were sufficiently high to allow restoration of the species variety and numbers of individuals even within actively-dredged areas. Hence we are unable to detect significant changes in community structure based on species variety and population density.

12. However restoration of biomass by growth of the colonising individuals takes longer. In contrast to the relatively minor impact of dredging and associated discharge of screened material on species variety and population density of benthic invertebrates, dredging at Production Licence Area 408 has a major impact on both biomass and body size of the fauna. The biomass is suppressed by as much as 82% in the dredged areas and by 34.4% in the adjacent non-dredged deposits potentially affected by re-mobilised sediment introduced by the screening process.

13. The zone of impact on benthic biomass extends for up to 500 m to the north-west of the actively-dredged site, but for as much as 2000 - 4000 m to the south-east. This accords well with the net south-east dispersion of sediment from the dredge site established from tide and bedform evidence in the survey area, and with what is known from direct studies of the zone of dispersion and subsequent mobilisation that result from normal loading operations at other production licence areas in UK waters.

14. Beyond the zone of suppression of biomass to the north-west of the actively dredged site, biomass values are over 10-fold that reached close to abandoned sites. This enhancement of biomass remains at distances up to 2000 m to the north-west of the actively dredged site and is consistent with enrichment by organic matter released either from the settlement of material from the screening process or by transport of organic matter in a benthic boundary layer plume.

15. The results show that restoration of the biomass within the boundaries of this particular dredged area is accomplished within 12 months of cessation of dredging and that thereafter the benthic communities are indistinguishable from those in the surrounding deposits. This appears to coincide approximately with the time taken for trailer-tracks to be partially infilled by the natural sediment transport processes in the study area, evidenced by side scan sonar records made independently in the survey area at the time of our study (see also Coastline Surveys Europe Ltd 2002, photos 8 & 9).

16. We caution that in other more stable environments the community comprises a higher proportion of slow-growing "equilibrium" species. These components of the marine community may take significantly longer for restoration of species variety, population density and biomass than those reported here for Area 408. The results obtained for Production Licence Area 408 probably represent those for one end of a spectrum of habitat types. Whilst we consider that they are likely to be generally applicable to shallow water environments in the North Sea, a more persistent biological "footprint" may occur where aggregate production levels are higher than those recorded in August 2000, in deep-water extraction sites or in sheltered areas where the biological community is less well adapted to disturbance of the sea bed under natural conditions.

CONTENTS.

A. INTRODUCTION.

A1. BACKGROUND TO STUDY

There have been many studies on the impact of dredging on biological resources on the seabed, ranging from capital and maintenance dredging in shallow coastal lagoons and embayments to offshore gravels and sands. In almost all instances the work has been confined to the impacts within the boundaries of the dredged area compared with reference stations some distance away. The main results of earlier studies up to 1997 have been summarized in Newell *et al*, (1998). They show that dredging is commonly associated with a 30-70% reduction of species diversity, a 40-90% reduction in population density and a similar reduction in the biomass of marine organisms living within the boundaries of dredged areas.

Recent work by Desprez & Duhamel, (1993) and Desprez, (2000) have confirmed that the impact of marine aggregate extraction off Dieppe, France amounted to an 80% reduction of species richness and as much as a 90% reduction of both abundance and biomass of benthic macrofauna. Furthermore, Desprez, (2000) reports an equally large impact in the surrounding deposits affected by the deposition of material rejected during the screening process.

Studies on the nature and rate of recolonisation processes in marine sediments following cessation of dredging were carried out on a relatively small experimentally-dredged site off the Norfolk coast by Kenny & Rees (1994, 1996) and Kenny *et al*, (1998). They showed that initial recolonisation resulted in communities of macrofauna that were significantly different in species composition to those in the surrounding deposits, but that over a period of 2-3 years the structure of the communities in the deposits approached that of the pre-dredged sediments. Significant differences remained however even 3 years after dredging had ceased. This may reflect the longer time required for establishment of the long-lived and slow growing components of the community such as bivalves (see also Newell *et al*, 1998).

More recently, Desprez, (2000); van Dalfsen *et al*, (2000); and Sardá *et al*, (2000) have also shown that dredging for marine sands and gravels is accompanied by significant changes in species composition as well as in the absolute values for species variety, population density, and biomass.

In general these studies confirm that deposits of shallow water, turbulent sea areas are populated by highly mobile "opportunistic" species that are capable of rapid recolonisation and recovery. In contrast, deeper water, less disturbed deposits are colonised by slow-growing "equilibrium" species that have a slow rate of recolonisation and recovery (for review see Newell *et al*, 1998). The work of van Dalfsen *et al*, (2000) suggests that recolonisation by polychaetes in disturbed sediments occurred between 5-10 months after cessation of dredging in the North Sea site, with full recovery of biomass anticipated within 2-4 years. In low dynamic sediments such as a site in the Mediterranean, recovery was anticipated to take longer, especially where changes in sediment composition accompany large-scale dredging operations.

Such work has been mainly confined to the dredge sites themselves. There is much less information on the scale and extent of impact of material discharged during the screening process from the dredger on seabed resources beyond the immediate boundaries of the dredged site. Significant changes in particle size composition both within the dredge site and in the surrounding deposits have recently been reported by van Dalfsen *et al*, (2000) at a site in Costa Daurada, Spain. At a site at Torsminde, Denmark the median grain size of the surface sediments changed from a predominance of coarse sand (MD_{50}=0.55 mm) in May 1994 towards medium sand (MD_{50}=0.46 mm) after sand extraction in September 1995. A similar trend was however also recorded at a reference area that was not directly affected by sand extraction. This indicates that major changes in sediment composition can occur in shallow water sites under natural turbulent conditions. In contrast, at a site at Costa Daurada, Spain deposition of material from spillways is reported to have resulted in a 5-20 cm layer of very fine sediment (MD_{50}=0.016-0.018 mm) on top of the native sand (MD_{50}=0.1-0.15 mm) two months after dredging started in 1993. Subsequent work showed that by 1995 the fine sediment still formed an average of 27% of the sediment by weight Manzanera *et al*, (1997).

Desprez, (2000) showed that for a dredge site off Dieppe, France the structure of the benthic community changed from one of coarse sands with the lancelet *Branchiostoma lanceolatum* to one of fine sands with the polychaetes *Ophelia borealis*, *Nephtys cirrosa* and *Spiophanes bombyx* within and surrounding the dredge site. He showed that species richness had been fully restored after 16 months whereas population densities were still 40% and biomass 25% lower than in reference stations after 28 months. The community structure differed from that prior to dredging and was considered to reflect a change in sediment composition following dredging.

The quantities of material rejected by screening can be significant, and have a potential impact on biological communities outside the boundaries of the dredged area. Estimates by Hitchcock & Drucker (1996) and Newell *et al*, (1999) suggest that 1.6-1.7 times the cargo load is discharged into the surrounding water column during normal loading of a screened cargo at some coastal sites. At other sites including Area 408 however, a value of 30-90% of the loaded cargo is a typical estimate for the proportion of material rejected by screening (see Text Table 2).

This material contains not only a large inorganic particulate load, but also significant quantities of organic matter which appears to be derived from fragmented invertebrates "processed" during dredging (Newell *et al*, 1999). Such material has a lower specific gravity than the inorganic components of the dredger outwash and may be associated with "far field" acoustic backscatter which is detectable at distances of as much as 3335 m downstream of a dredger during normal loading of a screened cargo (Hitchcock & Drucker, 1996; Hitchcock *et al*, 1998).

Settlement from the water column in the vicinity of the dredge site is only part of the potential impact on biological resources. There is now a considerable body of evidence supporting the view that sediment recently deposited (or settling sediment) can be re-mobilised at the sediment-water interface to form a benthic boundary plume that can extend for as much as one tidal excursion in each direction from the dredge site (Dickson & Rees, 1998; Hitchcock *et al*, 2002). The potential physical and biological impacts of marine aggregate dredging and associated discharge of screened material may therefore extend for as much as one tidal excursion in each direction from the dredge site, even though most studies suggest that the initial zone of settlement of inorganic components from the water column is confined to the immediate vicinity of the dredge site (see also Desprez, 2000; Newell & Seiderer, 2002).

The area selected for this study is located approximately 100 km east of the Humber estuary (Figure 1) and may be regarded as fairly typical of a licence area that is exploited for marine sands and gravels using a trailer suction dredger. The study area, known as Production Licence Area 408 (Coal Pit) has been subjected to sand and gravel removal by trailer dredging since 1996 and both the amounts of cargo removed and the relative intensity of dredging within different parts of the Licence Area is well documented.

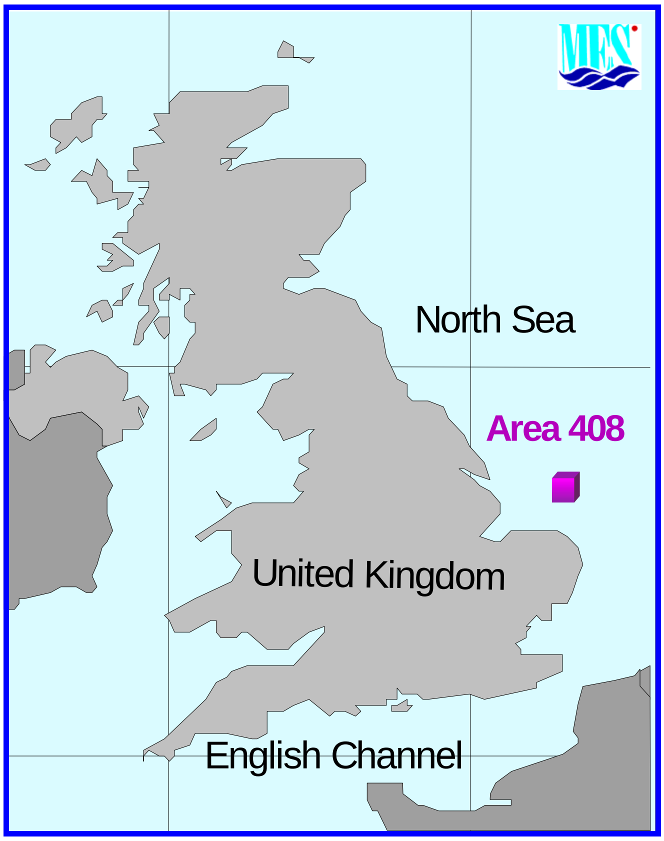


Figure 1. Map showing the general location of Production Licence Area 408 - Coal Pit.

The variable gravel content (20-50% *in situ*) of the resource deposits that are dredged within Area 408 require overboard screening to a varying extent. The construction industry typically requires marine aggregate to be supplied with a gravel content of >50%. Where the *in situ* gravel content of the resource being dredged falls below this, dredging vessels employ on-board screening to increase the gravel content of cargoes.

Vessels use either static screen boxes or screening towers to alter the composition of the dredged aggregate retained, by passing the water/aggregate mix over a coarse mesh screen. Assuming that the intention is to increase the gravel content, a proportion of the finer aggregate and water will pass through the screen, and be returned to the sea by means of a reject chute. The remaining fine aggregate, together with the coarse element and remaining water enters the cargo hold. This process can be reversed, if the intention is to retain a sand cargo, the coarse element of the dredged aggregate then being rejected. The techniques employed on board dredging vessels are very simple, relying upon water (as the transport mechanism across the screens) and gravity. Plate 1 shows a typical suction trailer dredger operating at sea with screened material being discharged through reject chutes. The discharge plume being carried astern of the dredger can be seen in the upper photographs.

Plate 1. Photographs showing a selection of marine aggregate dredgers in operation (these photographs were not taken from Production Licence Area 408 Coal Pit, but were obtained on other dredging grounds). Photographs copyright ©MESL-PhotoLibrary.

The following Report is based on a survey carried out in July - August 2000, and comprises a description of the benthic biological resources together with an assessment of the impact of trailer dredging and overboard screening, in and adjacent to the Production Licence Area. Because information is available on the times during which commercial dredging was carried out within the boundaries of the Licence Area, we are also able to make some assessment of the rate of recovery of benthic biological resources following cessation of dredging.

A.2. STUDY OBJECTIVES

The following key questions were addressed in the study:-

- Is there a detectable impact of marine aggregate mining on key features of benthic biological community structure including species diversity (***S***), population density (***N***), biomass (***B***), or body size (***B/N***)?
- Is there a detectable impact on community structure assessed by non-parametric multi-variate techniques?
- How far beyond the immediate boundaries of the dredged area do such impacts extend?
- Do these coincide with changes in sediment composition and with likely limits of transport of screened material ?
- Are there differences between community structure of worked areas and those in which dredging has recently ceased?
- What is the likely rate of recovery of biological resources in the sands and gravels of this relatively shallow-water North Sea site?

A.3. DREDGE HISTORY

A condition associated with the issue of the Government View in 1995 by the Department of the Environment for Area 408 required the licensee to introduce a zoning plan that subdivided the licence area into a series of smaller areas. This minimised the area of sea bed which was available for dredging at any one time, and assisted with fisheries liaison. Hanson Aggregates Marine Limited subsequently refined these zones to assist monitoring and control of the quality and consistency of cargoes dredged from the licence area.

The production rates are summarised in terms of the total tonnages dredged and the loading times in Text Table 1 (from data supplied by Hanson Aggregates Marine Limited).

Text Table 1. Dredge data for the years 1996-2000 (tonnage and loading times) for the Dredge Zones in Production Licence Area 408 as provided to us by Hanson Aggregates Marine Ltd.

Year	Zone 2	Zone 7	Zone 5 + 6	Zone 10	Zone B	Annual Total
408 Tonnage						
1996	174094					174094
1997	352665	306370				659035
1998	907048	41411				948459
1999	25324	42356	74646	16682	90132	249140
2000					289208	289208
408 Loading Times (hours)						
1996						not available
1997	260.5	256.5				517
1998	701.7	44.9				746.6
1999	19.4	33.4	72.6	16.52	87.5	229.4
2000					351.4	351.4

The data for tonnages are based on ships tonnages (displacement) whilst information on screening reports submitted to the DTLR as part of the licence conditions are based on the volume of material in the hopper ("Royalty Tonnages"). Density differences affect displacement and result in figures for the ship's tonnages being somewhat higher than those calculated from cargo volumes in the hopper.

The positions of the dredge zones are shown in a map of the survey area in Figure 2 which also shows the tidal direction and strength for a 12-h Spring tidal cycle based on ARCS Chart 1187 (tidal diamond **G**). The boundaries of Production Licence Area 408 are shown, together with the positions of benthic survey stations at which samples were taken in July - August 2000. The benthic survey stations have been colour-coded:-

non-dredged stations
stations which were being dredged up to the time of our survey
stations which had been previously dredged but at which dredging had ceased
"control" stations that were considered to be beyond the boundaries of impact of dredging

Text Table 1 shows that the total tonnage removed was 174,094 tonnes (from Zone 2) in 1996. It amounted to 659,035 tonnes (from Zones 2 & 7) in 1997, increasing to as much as 948,549 tonnes (from Zones 2 & 7) in 1998. Dredging for aggregates was carried out over a wider area at each of dredge Zones 2, 7, 5+6, 10 and Zone B in 1999, but the total removed amounted to only 249,140 tonnes. Subsequent aggregate production in the year 2000 amounted to a removal of 289,208 tonnes exclusively from Zone B in the central part of Area 408.

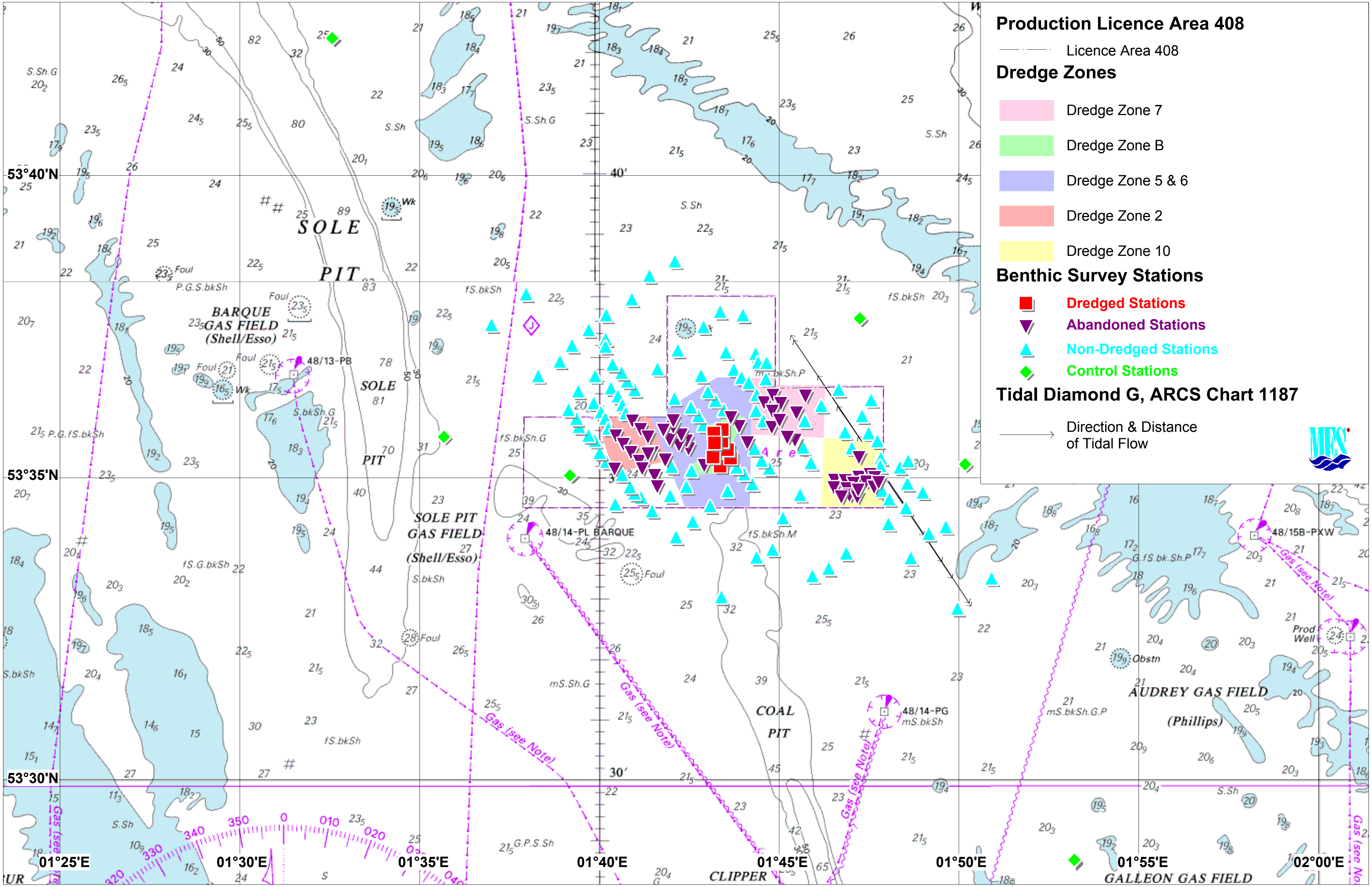


Figure 2. Map of the Licence Area 408 (Coal Pit) showing the position of non-dredged, dredged, abandoned, and control sampling stations within the survey area in July/August 2000. The dredge zones within the Production Licence Area are also shown.

ARCS chart 1503 & 1187 used under licence from the UK Hydrographic Office. To access the MapInfo workspace, click the logo

The extent of dredging operations were compiled from the Electronic Monitoring System (EMS) which is installed on all vessels dredging aggregates from Crown Estate licences. The system records dredging status and positional data which are analysed by the managing agents for the Crown Estate each month. Whilst principally a regulatory tool, the data from the EMS can be further analysed to provide plots of dredging intensity, based on hours dredged per 100mx100m block. These data are summarised in Figure 3.

Text Table 2. Summarising aggregate production in Licence Area 408 between 1996-2000. Compiled from data made available by Hanson Aggregates Marine Ltd. The figures show the total cargo loaded (tonnes), the total time spent loading (hours), the loading rate (tonnes/hour) and the estimated tonnage of material rejected by screening based on figures from Hanson Aggregates Marine Limited.

Year	Total tonnes Dredged	Total hours Loading	Estimated tonnes rejected by screening	% Rejected
1996	174094	-	-	-
1997	659035	517	179081	29
1998	948459	747	506534	62
1999	249140	229	205444	90
2000	289208	351	248137	85

Inspection of Text Table 2 and Figure 3 shows the hours spent loading cargo in each of the dredge sites between 1997 & 2000, together with the total tonnes loaded. Loading of 659,035 tonnes mainly from Zones 2 & 7 was achieved in 517 hours in 1997. In 1998, a total cargo of 948,459 tonnes was loaded in 746.6 hours from dredge Zone 2 with some light aggregate production of Zone 7. In 1999, a total cargo of 249,140 tonnes was loaded by a relatively light aggregate production over a large part of the Licence Area in 229.4 hours but in the year 2000 the rate of loading was lower and was concentrated in dredge Zone B. In this case 289,208 tonnes were loaded in a total of 351.4 hours. This slower rate of loading may reflect a lower *in situ* gravel content of the resource that was being dredged, or a requirement for a higher retained gravel content in the cargo during the year 2000.

The figures also allow some estimates of material likely to have been discharged through the overboard screening chutes. As an example, an A-class suction trailer dredger with a cargo capacity of 4500 tonnes is capable of loading an "all-in" cargo (with no screening) in 3 h. This equates to a loading rate of 1500 tonnes per h. When screening is taking place, the loading times typically increase because only a proportion of the dredged material is retained within the cargo hopper - the remainder being returned overboard.

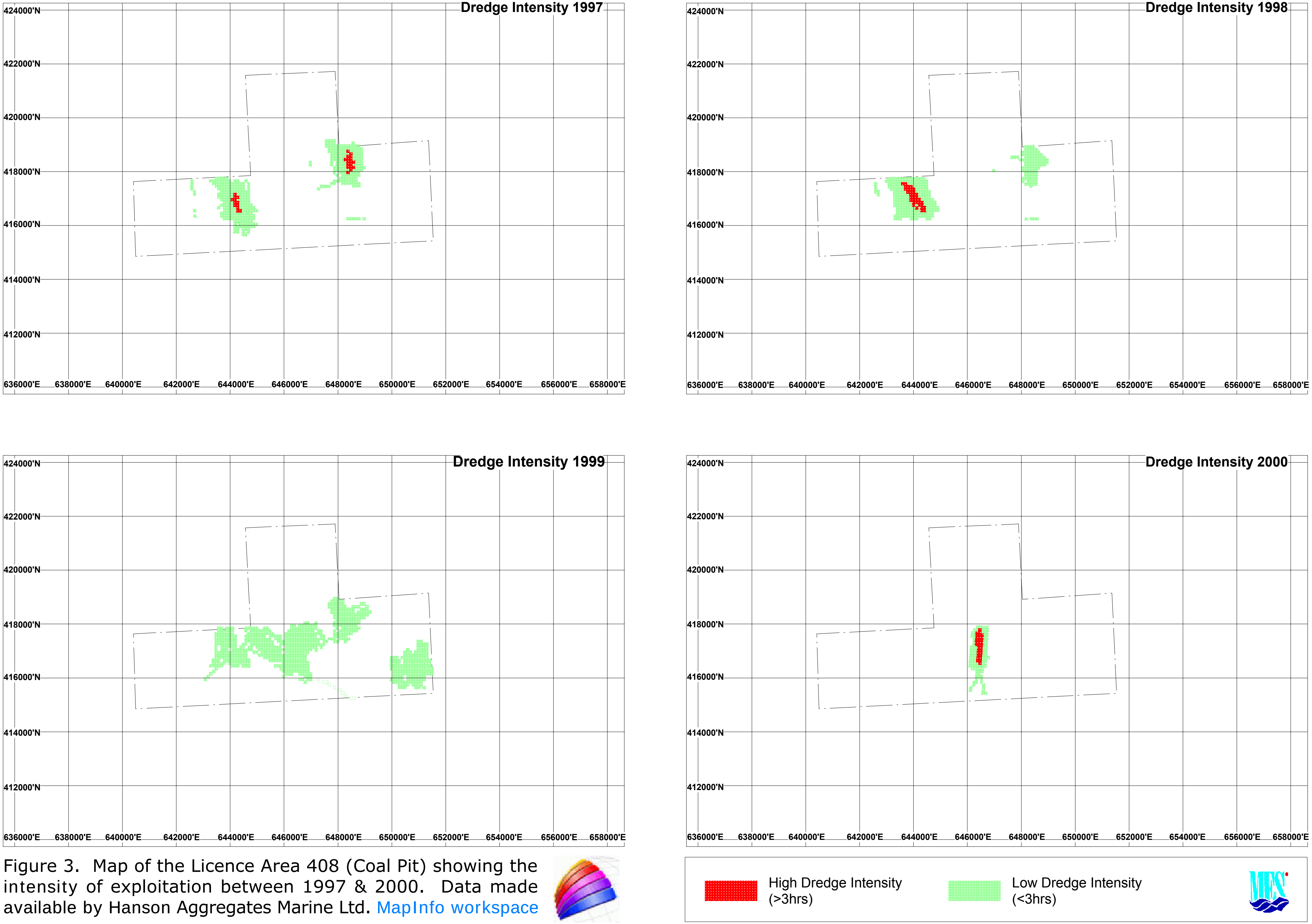


Figure 3. Map of the Licence Area 408 (Coal Pit) showing the intensity of exploitation between 1997 & 2000. Data made available by Hanson Aggregates Marine Ltd. MapInfo workspace

Assuming a constant dredge rate, and knowing the tonnage of cargo retained within the hopper, an estimate can be made of the sediment returned to the sea bed during the screening process from the known loading time. These estimates are summarised in Text Table 2, along with the percentage of the total material dredged which is represented by screened material. These estimates suggest that the proportion of material rejected during the screening process increased during the period of exploitation between 1997 and 2000. This may reflect the progressive depletion of the coarser material within the licenced dredge sites, but is more likely to reflect adjustments in the cargo required to meet customer requirements.

It should be emphasized that estimates of the amount of material rejected during the screening process are very variable according to locality. In some cases the above calculations will result in an over-estimate of the amounts rejected by screening because the vessel does not process material uniformly during the loading time. Natural factors such as weather can increase the loading time and reduce the rate of removal of material from the sea bed. In other areas, higher values of as much as 1.7x the cargo load have been estimated for material rejected during screening (Hitchcock & Drucker, 1996; Newell *et al*, 1999).

In general the survey carried out in July - August 2000 evidently reflects the impact of trailer dredging at an intensity of up to 800,000 tonnes per year and a rejection of an estimated 200,000 - 500,000 tonnes of screened material which is likely to be dispersed to the north west and south east of the dredge area (Zone B) along the axis of the tidal streams. An average value based on estimates of rejection of screened material from the site between 1997 and 2000 is approximately 285,000 tonnes.

A.4. SURVEY PROTOCOL

A requirement for the survey was to quantify the biological resources in the survey area as a whole, and to assess the potential impacts of dredging and overboard screening on benthic community structure. One area (Dredge Zone B) was being actively exploited in the year 2000 up to the time of our survey. Dredging in other areas had ceased in the previous year after varying levels of aggregate production prior to 1999. This allowed an assessment of the processes of recolonisation and rates of recovery of biological resources following cessation of dredging, as well as an assessment of impact within an actively dredged area.

It is well-established from the literature that for the purposes of multi-variate analysis of community composition, single samples with a conventional grab yield so much "excess" information that analysis of only a small proportion of the species present, or analysis to genus or even family level yields the same definition of communities as obtained by multiple sampling or analysis down to species level. A relevant review which summarises this is given by Somerfield & Clarke, (1995), although there is a substantial body of literature supporting this view in earlier studies by Warwick, (1988,1993); and Warwick & Clarke, (1994). We have therefore defined the community composition of the benthos on a basis of the analysis of a series of single 0.1 m² Hamon Grab samples distributed over a wide area along the axis of the tidal streams in the vicinity of Production Licence Area 408.

The position of the sampling stations are shown in Figure 4. Sampling stations have been colour-coded according to their dredge-status:-

non-dredged stations

stations which were being dredged up to the time of our survey

stations which had been previously dredged but at which dredging had ceased

"control" stations that were considered to be beyond the boundaries of impact of dredging.

A second objective was to assess the impact (and recovery) of a number of characteristics of benthic community composition including species variety (***S***), population density (***N***), biomass (***B***) and body size (***B/N***). It is well known that several replicate samples are required to obtain a reliable estimate of these uni-variate indices. We have shown that 2-3 replicates are required to define at least 80% of the species composition of sandy deposits, but that at least 5 replicates may be required to define the more complex species assemblages of gravels and stones (Newell *et al*, 2001).

The question of the spacing between replicate samples for macrofauna analysis has been addressed by Clarke & Green, (1988); Warwick & Clarke, (1996); and more recently by Somerfield & Gage, (2000). Essentially the problem is that the macrofauna are inherently patchy. Sampling stations that are placed very close to one another thus run the risk of "pseudoreplication" (Hurlbert, 1984) where several samples are taken in a patch and the results are wrongly assumed to apply to a much wider area. Somerfield & Gage, (2000) recommend that sampling stations should be "*at least 40 m apart*" and that "*placing samples further apart (up to 100 m) will tend to lead to a higher estimate of variability and therefore reduce the chances of concluding that a difference exists when it does not*."

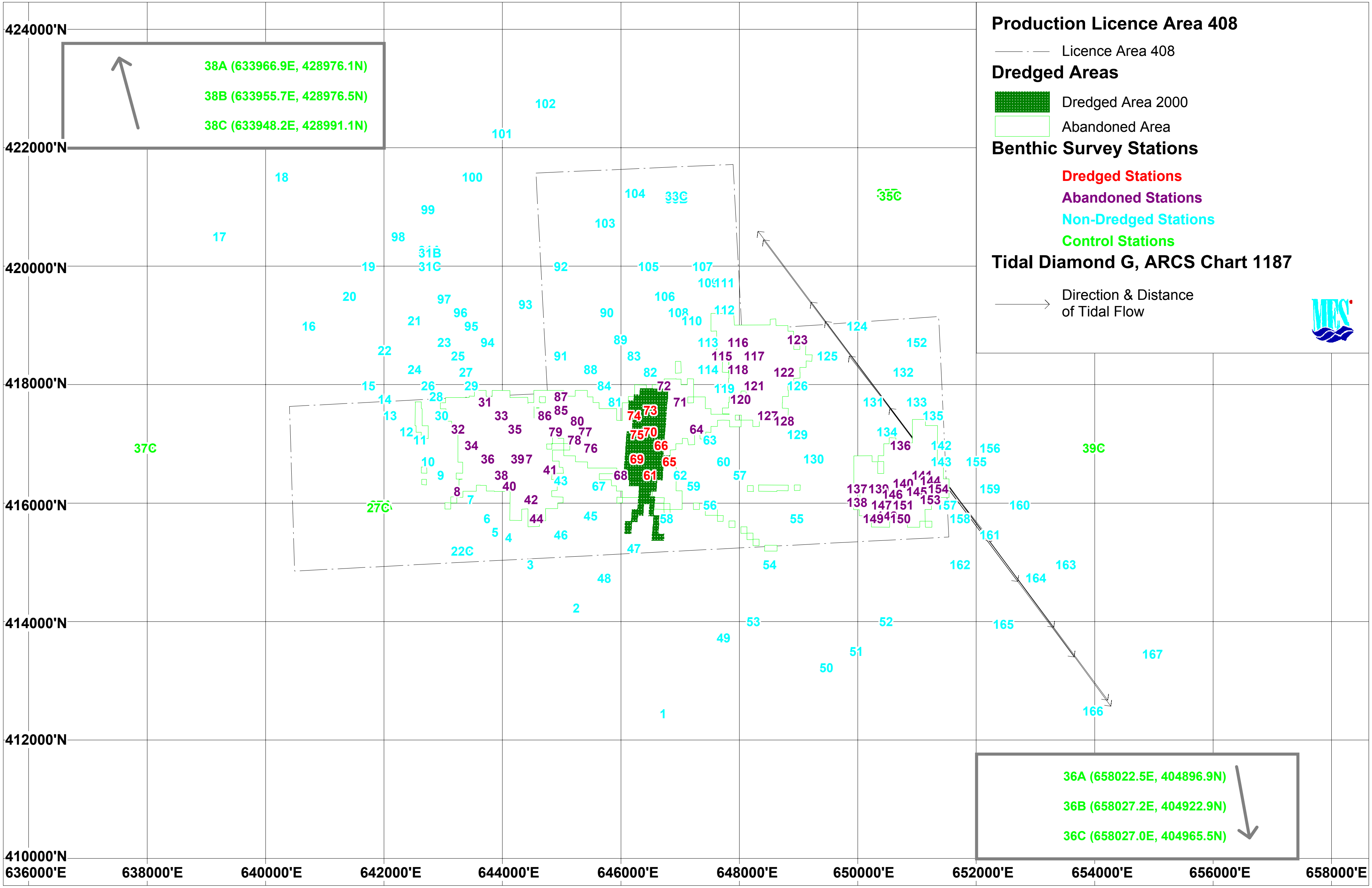


Figure 4. Map of the Licence Area 408 (Coal Pit) showing the positions of stations sampled in July/August 2000 in relation to the dredging areas exploited up to and including 1999 (1996-1999) and those under exploitation in 2000. To access the MapInfo workspace, click the logo

They conclude that *"for the majority of studies of the benthos e.g. General studies of large areas and investigations relating community structure to environmental conditions, a larger scale of sampling is appropriate..."*.

We have therefore arranged the sampling grid to allow the results of grab samples at each site to be pooled to produce values taken at distances of approximately 200 m to avoid "pseudo-replication". The pooled samples for **Dredged Stations**, for **Abandoned Dredge Stations** and for **"Control" Stations** can then be used to assess the impact of dredging on uni-variate indices of community composition and on the rates of recolonisation and recovery following cessation of dredging.

Further, the stations outside the dredged zones are arranged in such a way that samples can be pooled as grouped samples at distances of 200 m up to 4000 m along the axis of dispersion of material rejected by screening. This allows an estimate of the impact of overboard screening in relation to distance from the dredge sites, and the extent of recovery outside the boundaries of zones where dredging has ceased.

The selection of this form of survey thus allows definition of the community composition of biological resources over a relatively wide area based on multi-variate analysis of a series of single 0.1 m^2 Hamon Grab samples. At the same time it also allows an assessment of impact and recovery from pooled samples along the axis of dispersing materials rejected by screening without the problem of "pseudo-replication" referred to above.

A.5. PREVIOUS STUDIES

A monitoring survey was carried out by Marine Ecological Surveys Limited in the Area 408 Production Licence Area during July - August 2000 in order to provide information on the nature of the macrofauna and the distribution of sediments (Marine Ecological Surveys, 2000c). The data from the July - August 2000 monitoring survey have been included in the analysis of the Research data described here.

B. MATERIALS & METHODS

B.1. POSITIONS OF THE SAMPLING STATIONS

A survey of benthic biological resources at a total of 194 sampling stations in the vicinity of Production Licence Area 408 in the Southern North Sea to the east of the Humber estuary was carried out between 29th July & 1st August 2000. Positions were fixed with a Trimble Mk 1 Primary System and Veripos dGPS with corrections from Denmark to OSGB 36. The position of the grab on the vessel was offset from the antenna to the grab position on the vessel. The accuracy of the positions was stated to be within 5 metres.

The positions of the sampling stations are shown in Figure 2. The Research survey stations were arranged in transects stretching in north-westerly and south-easterly directions in accordance with the tidal streams, with their origins in areas which were currently being dredged or in areas which had been dredged and subsequently abandoned. The tidal streams indicated at Tidal Diamond **G** on ARCS Chart 1187 (52°59.0'N 01°34.9'E) reach a maximum of 2.7 knots at 327° and 2.4 knots at 147° on Spring tides. The tidal excursion for a Spring tidal cycle is indicated for each hour of a spring tide cycle in Figure 2.

Triplicate samples were taken and analysed separately from the 18 stations specified in the Terms of Reference for the Monitoring Survey, of these 4 stations were **"control" stations**. Nine of the triplicate stations were added to the Research project data set (27 samples). Single samples were taken for all of the Research stations (167 samples). The positions of all the benthic sampling stations are shown in Appendix Table 2 and Figure 2 (a total of 194 samples). Also shown in Figure 2 are the outlines of Production Licence Area 408 and the dredge zones as provided to us by Hanson Aggregates Marine Limited.

Sub-samples of sediments were also taken at each of the sampling stations for particle size analysis of the deposits. Notes on the position of each sample, the depth at which the sample was taken, the volume of sample taken with the Hamon grab, and the nature of the deposits are included in Appendix Table 2.

B.2. COLLECTION & EXTRACTION PROCEDURES

Samples were taken with a 0.2 m² Hamon grab deployed from an A-frame on the survey vessel *"Bon Accord"* operated by Andrews Survey. Use of this grab has the advantage that loss of material by "washout" from the jaws experienced with conventional grabs is reduced (see Holme & McIntyre, 1984; Sips & Wardenburg, 1989; Kenny & Rees, 1994; van Moorsel, 1994). The samples also allow strict comparison with the results of surveys elsewhere using a similar grab. Some stages in the deployment of the Hamon grab and the subsequent separation and preservation of the fauna are shown in Plate 2.

The samples were released from the grab into a large plastic fish box. Half of the sample was transferred to 10 litre buckets and preserved in formalin for subsequent separation and identification of the biological material. Separation was carried out in the laboratory by elution with a large volume of tap water through a 1 mm mesh sieve, and by careful manual separation of the residual fauna from the remaining sediment. The biological material was then preserved in methanol for subsequent identification and enumeration (Plate 3). A reference collection of key taxa was retained for future reference. All data were then expressed as numbers per 0.1 m² of sea bed surface.

B.3. BIOMASS DETERMINATION

The blotted wet weight of the main faunal groups was measured. These data were then used to estimate total biomass as ash-free dry weight in grams using conventional conversion factors for each of the faunal groups. These wet weight conversion factors are as follows:- Polychaeta = x 0.155; Crustacea = x 0.225; Mollusca = x 0.085; Echinodermata = x 0.08; Miscellaneous Groups including Porifera and Bryozoa = x 0.155 (Eleftheriou & Basford, 1989).

B.4. PARTICLE SIZE ANALYSIS

One factor which has been thought to affect benthic community composition in sea bed deposits is sediment type (see Pearson & Rosenberg, 1978; Weston, 1988; Clarke & Miller-Way, 1992), although much recent evidence suggests that particle size composition of the sediments may be less important than other variables, including the compaction of the deposits (see Snelgrove & Butman, 1994; Seiderer & Newell, 1999; Newell *et al*, 2001).

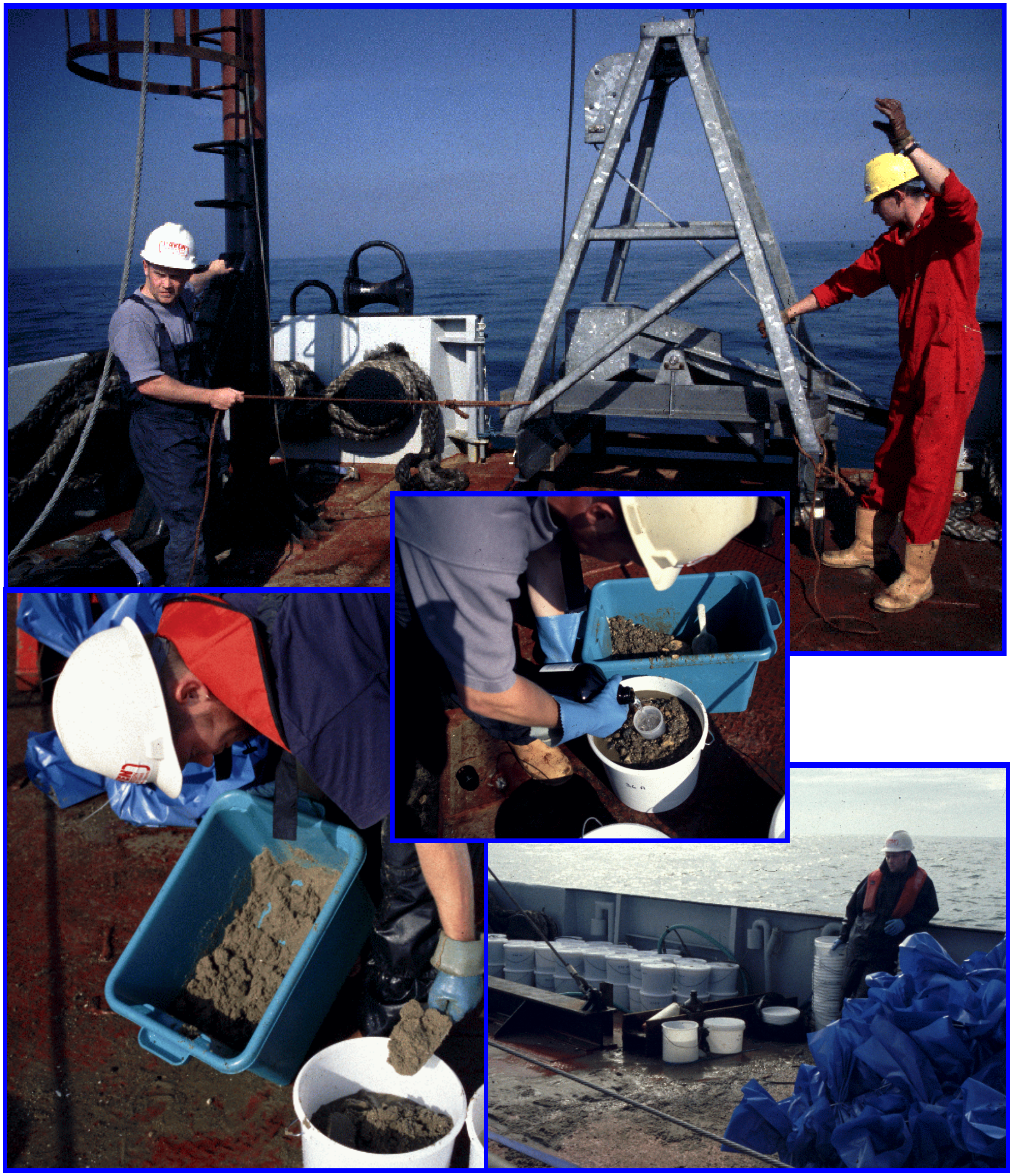


Plate 2. Photographs showing the sampling of benthic stations at Production Licence Area 408 Coal Pit in July/August 2000. Photographs copyright ©MESL-PhotoLibrary.

Plate 3. Photographs showing the identification and enumeration of fauna being carried out in the laboratory on samples taken in & adjacent to the Production Licence Area 408 Coal Pit in July/August 2000. Photographs copyright ©MESL-PhotoLibrary.

A sub-sample of sediment was taken for particle size analysis from each of the grab samples at each station. This material was sealed in strong plastic bags with a label both inside and outside of the bag. The material was sieved over the range 75 mm down to 0.063 mm to BS 1377 (Part 2: 1990) by Andrews Survey. The results were expressed using conventional Wentworth Classification to give percentage composition of each particle size. These results were then used by Marine Ecological Surveys Limited as an input to similarity analysis of sediment composition in the survey area using untransformed data and multivariate techniques similar to those outlined in Section B.6 for biological community composition. The data input to the multivariate analysis of sediment composition is summarised in Appendix Table 3.

B.5. THEMATIC MAPS - GIS

All of the GIS maps used in this report were generated using **MapInfo Professional** Version 6.5. This is a comprehensive desktop mapping tool that enables multiple layers of data to be visualised geospatially.

Thematic mapping is a powerful method for analysing and visualising uni-variate data. The data are given graphic form by scaling or shading so that they are visible on a map and therefore readily comparable with other data already located on the map. Patterns and trends that are difficult to detect in tabular form can be easily visualised. In addition to this, thematic scaling or shading does not entail interpolation between the stations at which samples were taken and thus problems associated with interpolation of results between spatially distinct stations are avoided.

B.6. ANALYSIS of INVERTEBRATE COMMUNITY STRUCTURE

The statistical methods used to analyse the nature of the sediments, and the structure of the biological communities in the survey area off the coast of East Anglia follow those of Field *et al.* (1982; see also Clarke & Warwick, 1994). The Plymouth Routines in Multivariate Research (PRIMER) version v5.2.1 software (Clarke & Gorley, 2001) was used for analysis of community structure. We have also used the PRIMER version in a series of studies of invertebrate community structure in relation to potential perturbation from dredging activities (Marine Ecological Surveys, 1996a,b; 1997a,b, 1999a,b,c, 2000a,b,c). The groups which were identified as different communities have been colour coded and the corresponding colours superimposed onto a map of the survey area.

The PRIMER software package includes a sub-routine (BIOENV) which allows analysis of how well information on a variety of environmental variables taken singly or in combination matches the biological community structure (Field *et al*, 1982; Clarke & Ainsworth, 1993; Clarke & Warwick, 1994). The sub-routine calculates the agreement, measured as the Spearman Rank Correlation Value between similarity (or dissimilarity) matrices for the biotic data and the range of environmental determinands measured in the survey. In the case of our survey the following variables were used:- Easting; Northing; Log depth m; particle size composition; Quartile deviation; Skewness.

C. RESULTS.

C.1. SEDIMENTS

C.1.1. Composition of the Sea Bed Sediments

A summary of the field notes showing the time of sampling, the position of the sample stations, the depth of water at each site, the volume of sediment samples per 0.1 m^2 and notes on the type of deposits is shown in Appendix Table 2. The full data for particle size composition in each of the samples has been submitted as a separate Report (Andrews Survey, 2000). Summarised data showing the percentage retained on a series of sieves from 75 mm down to 0.063 mm are shown in Appendix Table 3.

C.1.1.1. Thematic GIS Plots

The percent sediment composition within the survey area is shown in Figure 5 in which a thematic map of the % gravel, % sand and % silt has been shown as pie diagrams representing each survey station. Note that the **"control" stations** 36A,B,C and 38A,B,C have been inserted into the main body of the map for ease of viewing. The data used for Figure 5 are summarised in Appendix Table 4.

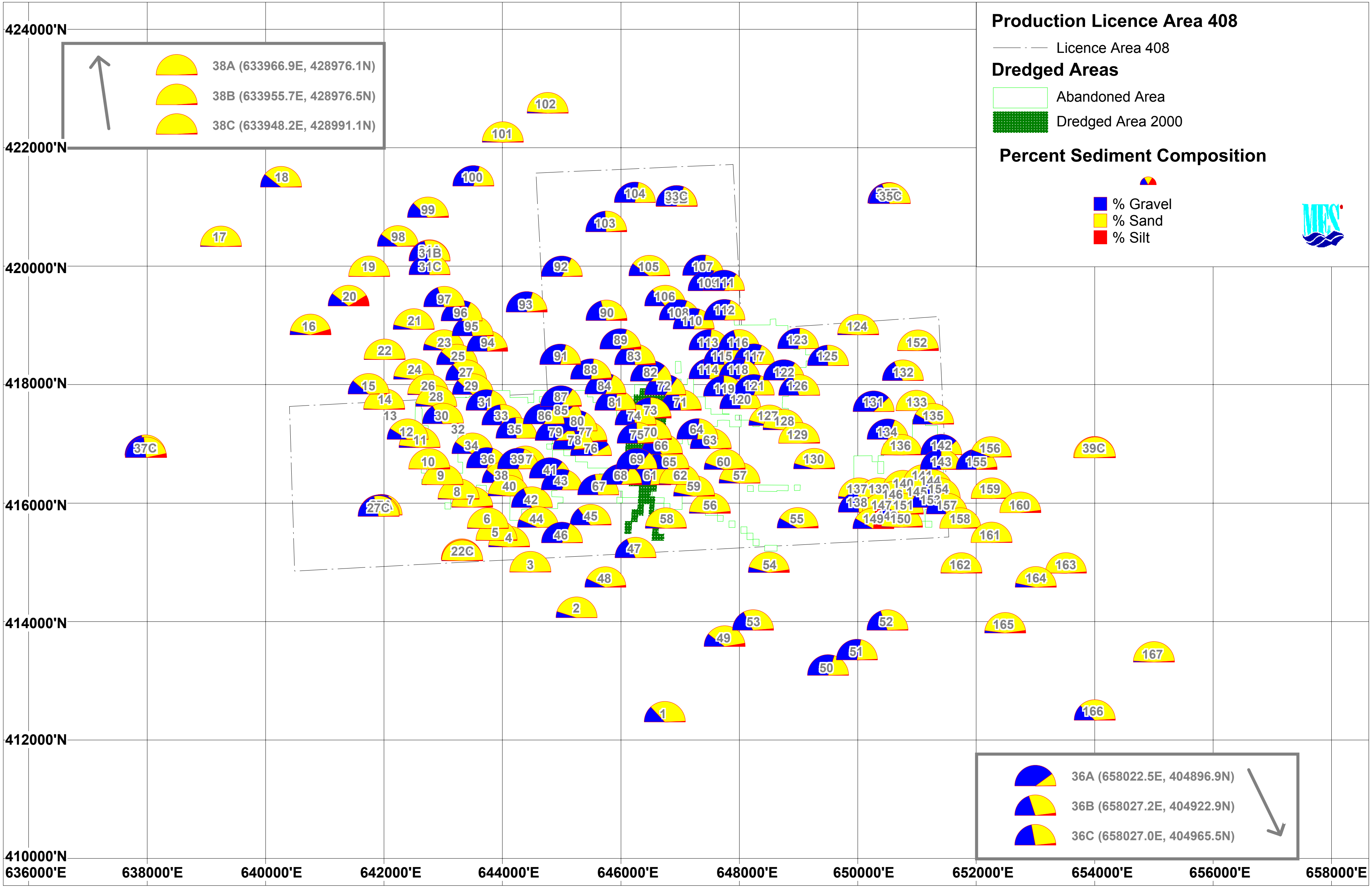


Figure 5. Map of the Licence Area 408 (Coal Pit) showing the relative proportions of silt (<0.063mm), sand (0.063-2mm) and gravel (2-60mm) in July/August 2000. Data from Appendix Table 4. To access the MapInfo workspace, click the logo

Inspection of Figure 5 shows that the **"control" stations** to the north west of the main survey area (38A,B,C) comprise mainly sand with a small proportion of silt. Sandy stations also predominate in the west of Licence Area 408 as well as to the east and south east of the Licence Area. In contrast, gravels are found mainly in the central part of the survey area as well as to the south east at **"control" stations** (36A,B,C).

C.1.2. Multivariate Analysis of Sediment Composition

A more sensitive analysis of the nature and distribution of deposits in the survey area can be carried out by group average sorting techniques and multidimensional scaling (MDS) ordination methods. In this case we have used the untransformed data to compare the similarity of deposits based on the relative distribution of particles summarised in Appendix Table 3. Results reported by Kenny (1998) for the Hastings Shingle Bank, as well as by ourselves for a number of survey areas including West Varne Area 432, Lowestoft Area 454, Shipwash Gabbard Area 452, West Bassurelle Areas 458 & 464, Triton Knoll Area 440 & Outer Dowsing Area 441, as well as Lowestoft Area 401 (summarised in Seiderer & Newell, 1999; Newell *et al*, 2001), all suggest that sediment groups can be satisfactorily identified by multivariate techniques.

A group average sorting dendrogram showing the percentage similarity of the sediments at each of the stations sampled in July - August 2000 is shown in Figure 6. Also shown is an MDS-ordination for sediment samples which have been grouped into those for **non-dredged stations**, **previously dredged stations which had been abandoned**, **actively-dredged stations** and **"control" stations** located some distance from the boundaries of Area 408. The lack of obvious groups of sediments that correspond with the dredge history of the sediments suggest that dredging had not resulted in major differences in sediment composition at the time of our survey.

The sediments of the survey area evidently comprise 3 types. These are identified in Figure 6 as Group 1 Sediments, Group 2 Sediments and Group 3 Sediments. The two-dimensional MDS ordination in Figure 6 shows that there is a gradation in sediment type with each group having some common features.

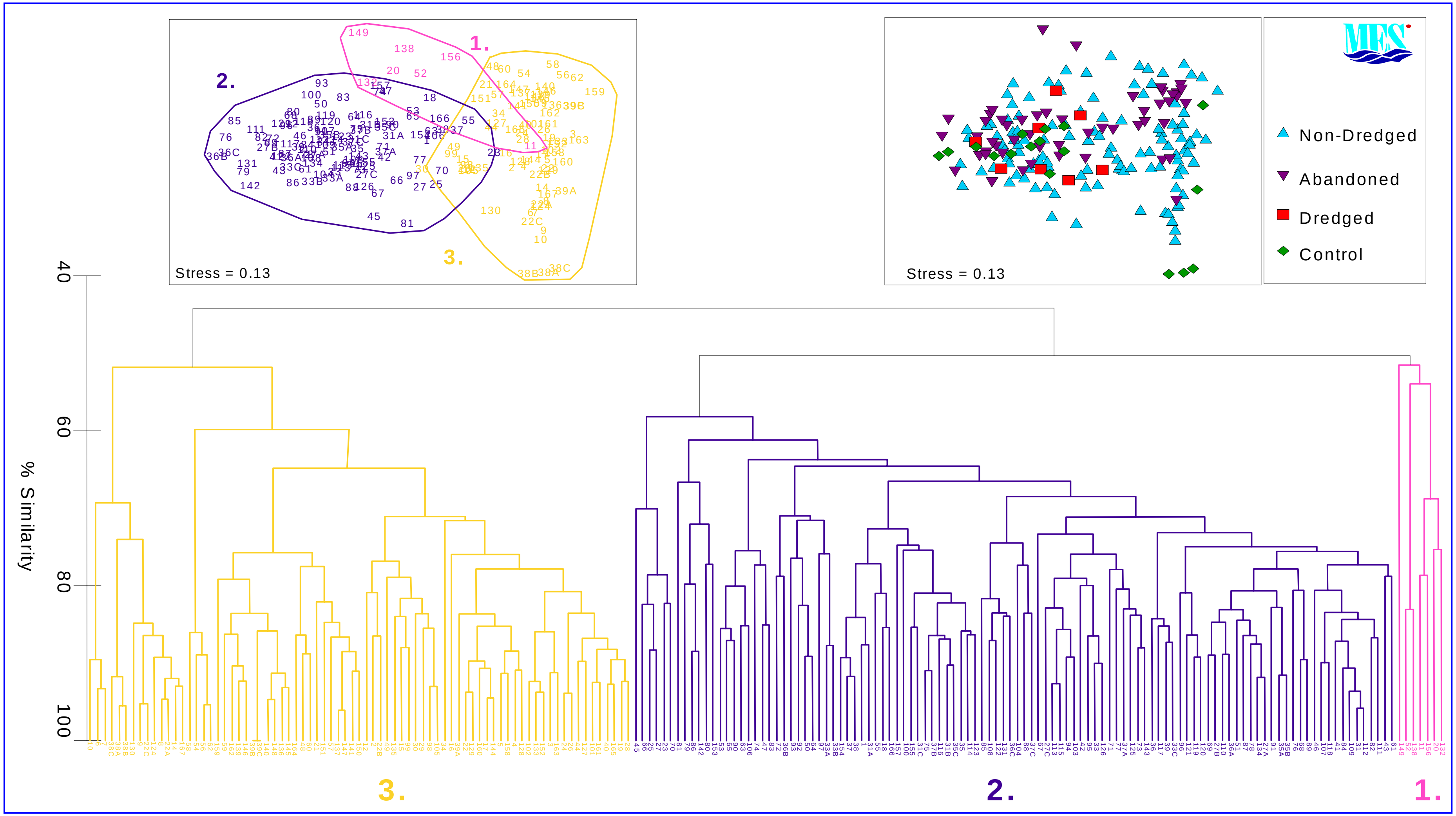


Figure 6. A group average sorting dendrogram showing the percentage similarity of the sediments at each of the stations sampled in July - August 2000. The corresponding two-dimensional MDS ordinations is also shown together with an MDS representing the ordination of the **non-dredged**, **dredged**, **"control"** and **abandoned** stations.

Text Table 3 shows the particle sizes that account for the similarity within each of the 3 sediment groups in the survey area.

Text Table 3. Table summarising the components of the sediments that contribute up to 78% of the similarity within each of the 3 sediment types identified by multi-variate analysis in Figure 6.

Sieve Aperture	Average Abundance	Average Similarity	Similarity: Standard Deviation	% Contribution	Cumulative %
Sediment Group 1 Average similarity: 59.71					
1.18mm	16.12	10.76	1.82	18.02	18.02
425um	13.89	10.10	3.90	16.91	34.93
2mm	12.16	9.38	3.40	15.71	50.64
5mm	17.30	9.12	1.45	15.27	65.91
600um	9.44	7.38	5.25	12.36	78.28
Sediment Group 2 Average similarity: 66.98					
10mm	16.29	12.91	2.78	19.27	19.27
20mm	12.76	8.94	1.76	13.34	32.62
5mm	11.25	8.64	2.50	12.90	45.52
300um	12.42	8.31	1.53	12.40	57.92
425um	12.15	8.27	1.97	12.35	70.27
600um	5.22	3.89	2.41	5.81	76.08
Sediment Group 3 Average similarity: 64.78					
425um	29.49	22.03	2.19	34.01	34.01
300um	30.74	19.71	1.52	30.42	64.44
600um	12.14	8.02	1.60	12.38	76.82

Sediment Group 1 is evidently characterised by coarse-medium sands. Group 2 Sediments are characterised by coarse gravel-sized particles and sand whilst Group 3 Sediments are dominated by fine sands.

The distribution of deposit types in the survey area is shown in Figure 7. These results show that the Group 2 sediments which comprise significant proportions of coarse gravel-sized particles occur mainly (as would be anticipated) within the boundaries of Production Licence Area 408. Of particular interest is that the fine sandy deposits that comprise the Group 3 sediments coincide in general with what might be expected for deposition of material rejected during the screening process and transported north-west and south-east along the axis of the tidal streams. It should be pointed out, however, that the Group 3 sediments are also widespread naturally, and are representative of the sediment transport taking place from shallower water in the north, to deeper water in the south (see also Coastline Surveys Europe Ltd 2002 p 15 & 17).

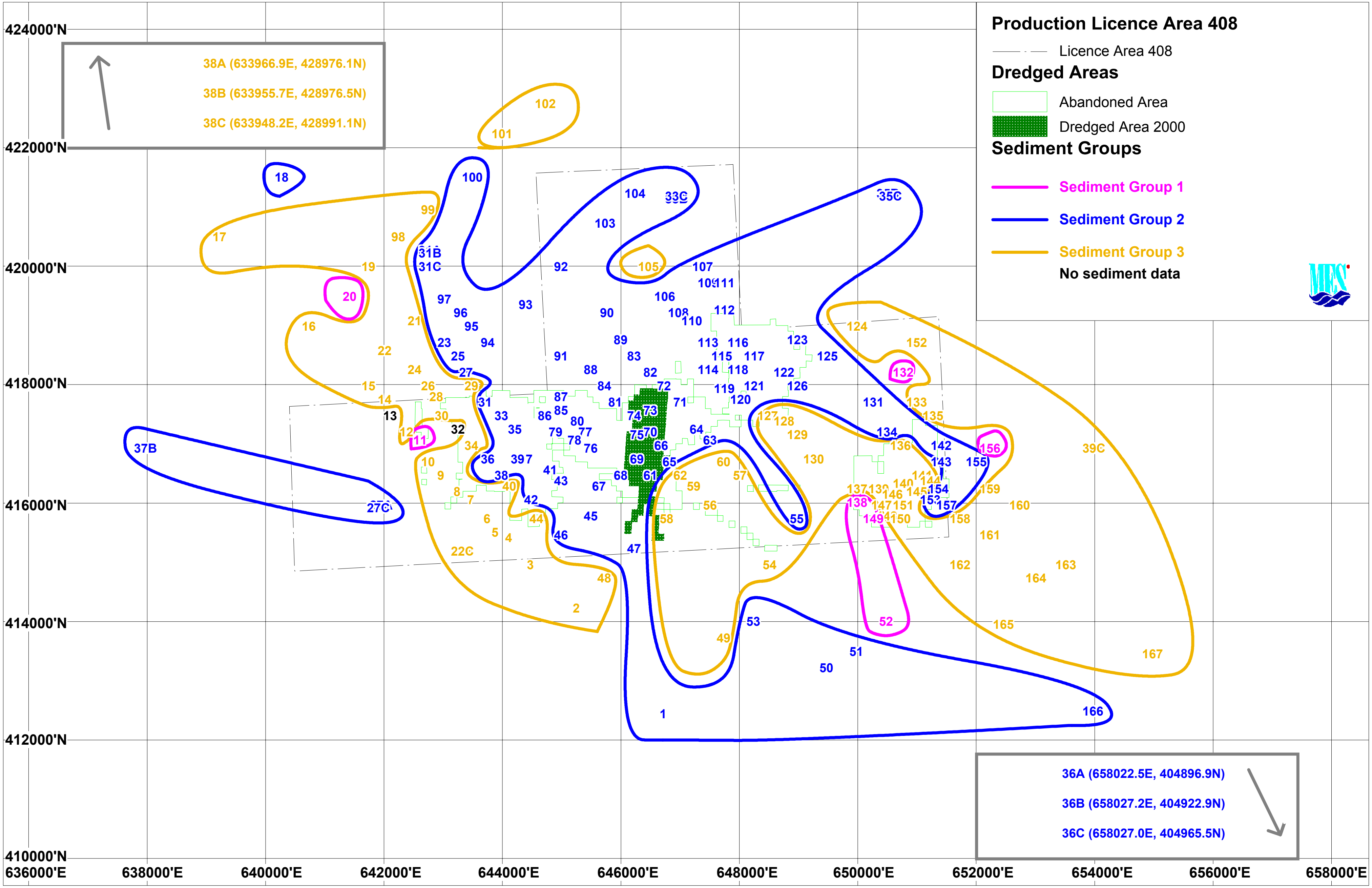


Figure 7. Map of the Licence Area 408 (Coal Pit) showing the distribution of sediment types identified by non-parametric multivariate analysis of particle size composition in Figure 6. To access the MapInfo workspace, click the logo

Interpretation of these data for distribution of the sediments in the survey area is however, complicated by the complexity of the geology of the sea bed and by the presence of natural sand waves and other topographic features. Additional surveys were therefore carried out in August 2000 at the same time as our survey, to determine the sea bed configuration, and in particular to assess the likely dispersion patterns of sediments mobilised by the dredging process. These have been reported by Coastline Surveys Europe Limited (2002) and by Evans (2002).

C.1.3. Sea Bed Morphology and the Distribution of Surface Sediments

Coastline Surveys Europe Limited (2002) showed that on a basis of asymmetry in the velocities of the ebb and flood tides, net sand transport in the survey area was likely to be in a south-easterly direction. Finer sediment in the vicinity of the dredge site will, however, be mobilised by the ebb and flood tides. Hence, individual sediment particles are likely to follow an elliptical path whose centre migrates to the south-east with successive tidal cycles.

These inferences are supported by observations on bedform morphology across the survey area. In general, the sand ribbons identified on sonographs tended to broaden and merge in a south-easterly direction which suggests that net transport is to the south-east. Localised sand-ribbons, comprising well defined, short wavelength (1-2 m) mega-ripples were reported for the central and northern section of the survey area, with their slightly sinuous crests orientated transversely to the dominant tidal flow. The avalanche faces of these mega-ripples are orientated towards the south-east, suggesting sediment transport in that direction.

This net transport stream is however influenced by the morphology of the sea bed. A series of bedforms located in the west of Area 408 suggests a reversal in transport direction. This local sediment transport reversal towards the north-west is thought to be due to the rapidly changing sea bed topography which locally affects the direction and strength of ebb and flood tidal streams.

Subsequent work by Evans (2002) identified the presence of areas of well-sorted sand with a sorting coefficient of <0.5 to the south-east of the two eastern dredged areas, and to the north-west and west of the western dredged areas. These areas of well-sorted fine sand overlay seabed sediments with a more variable composition, and could be associated with re-mobilised screened material. Furthermore, their distribution corresponds with what might be predicted from the net sediment transport identified in other parts of the survey area.

The distribution of sediment with a sorting coefficient of <0.5 phi is superimposed onto the sea bed morphology of the study area interpreted from high resolution side-scan sonar data acquired during 2000 (Figure 8). This shows areas where the sea bed is disturbed by drag-head trails from dredging, and areas of fine well-sorted sediments. Clearly the dredge sites are associated with areas of relatively well-sorted fine-grained deposits extending along the net transport direction to the south-east of dredge sites in the centre and east of the licence area, and along the west and north-west net residual transport streams in the west of the licence area. These results are very similar to those shown in Figure 7 for the distribution of Group 3 sediments in the survey area.

These studies on the morphology and sediment characteristics of the dredge site and surrounding deposits lead to the following main conclusions:-

- sand transport in the region is oscillatory with a net movement to the south-east
- dredge trails appear to be rapidly degraded after cessation of dredging through in-fill of mobile sand from the natural sediment transport moving across the study area, from north-west to south-east
- in the central and eastern parts of the licence area, net transport to the south-east coincides with areas of naturally occurring, relatively well-sorted fine sand that extend for at least 3 km to the south-east of the dredged areas (Figures 7 & 8)
- in the western part of the licence area, there is evidence of localised sediment transport towards the west and north-west as result of the local influence of seabed topography on tidal streams. Areas of well-sorted fine sand can be identified to the west of the dredge sites in this sector (Figures 7 & 8)

These conclusions are important because they suggest that the impacts of dredging on both the morphology of the dredge site and surrounding seabed sediments are likely to be strongly asymmetric in the vicinity of Area 408, albeit with local variations as a result of sea bed topography, current speed and direction. In general, an "impact zone" can be associated with the potential transport direction of screened sediment returned to the sea bed during the dredging process. This extends for at least 2 km down-current to the south-east of the actively-dredged sites. In contrast, a much shorter "impact zone" has been identified to the north-west of some of the dredged sites reflecting the lower velocity of tidal streams in this direction, and the reduced influence this is able to exert on mobile sediment.

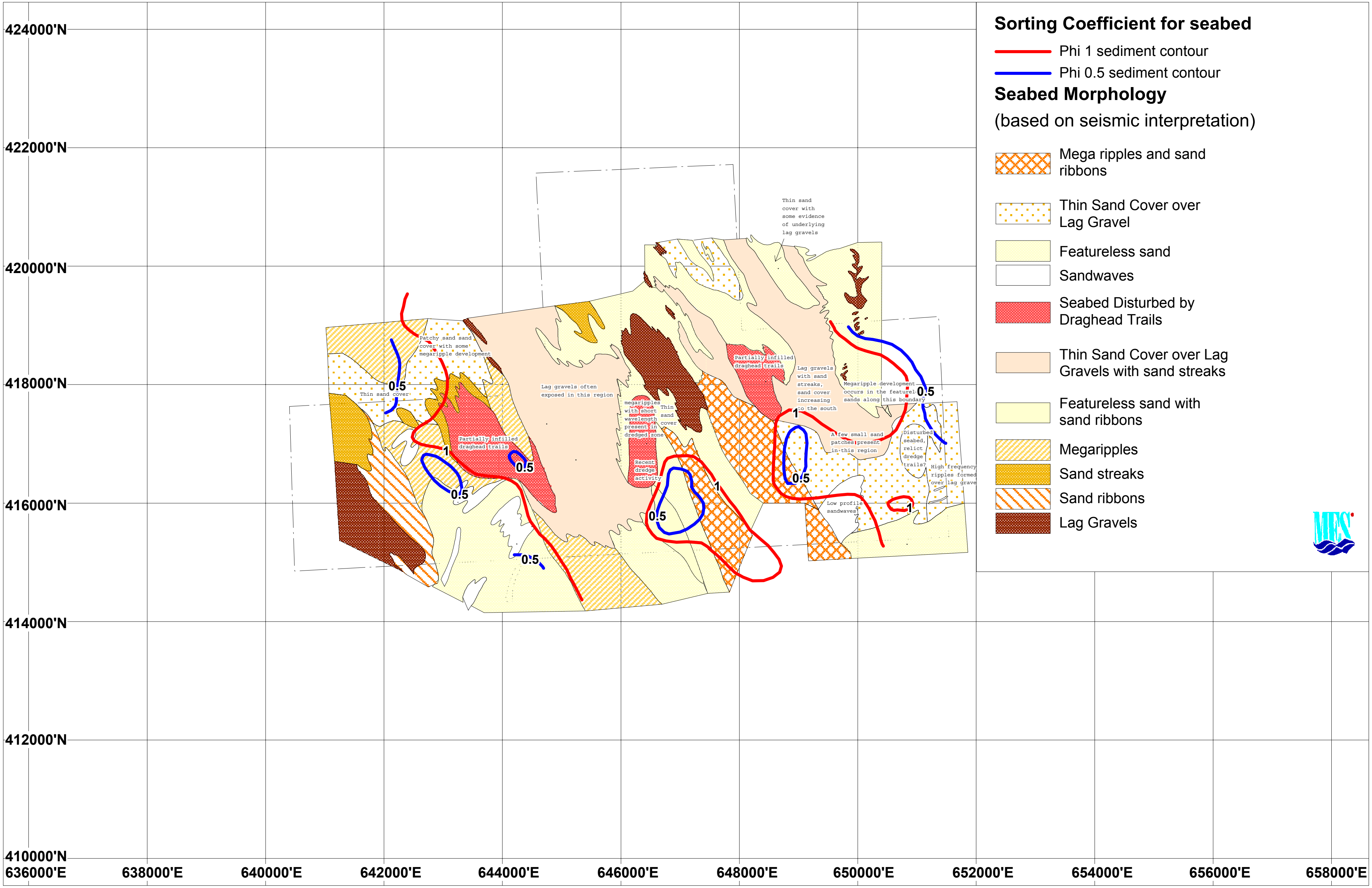


Figure 8. Map of the Licence Area 408 (Coal Pit) showing the seabed morphology based on seismic interpretation. Superimposed on the map are contours of sorting coeffcient for seabed sediments with grain size finer than 0.5phi. Based on Evans (2002). Click to access the MapInfo workspace

The following sections report the results of an analysis of the community composition, and distribution of benthic biological resources in relation to the dredge sites at Area 408.

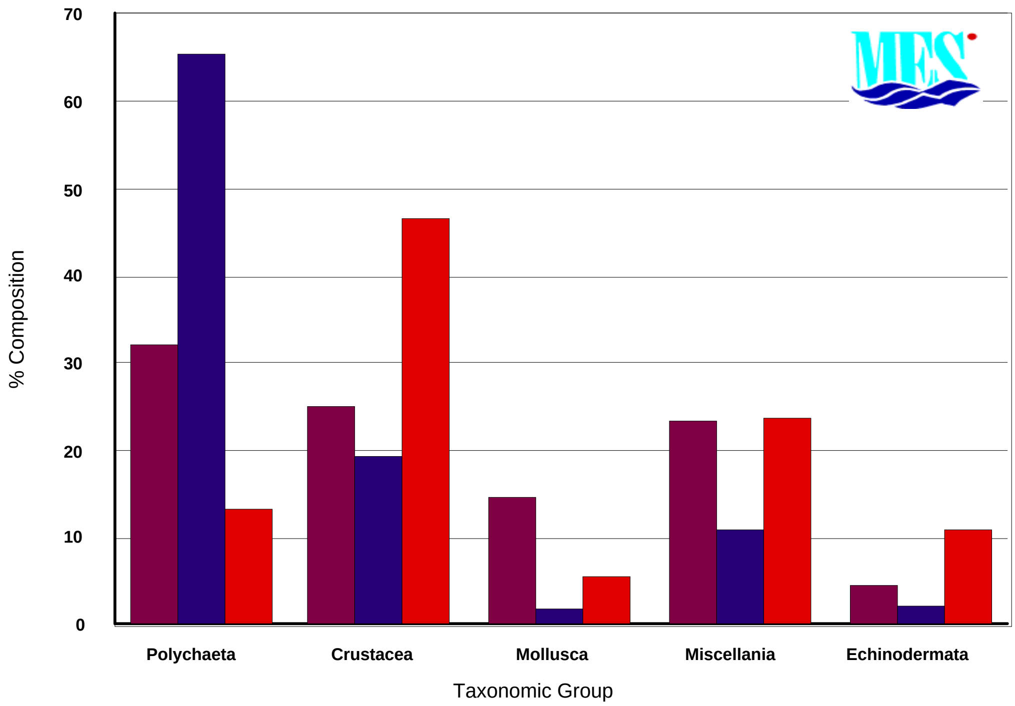
C.2. BIOLOGY

C.2.1. Biological Resources

Appendix Table 5 shows a list of the taxa of fauna recorded from the survey area in the vicinity of Production Licence Area 408 in July - August 2000. A total of 246 taxa of macrofauna was recorded. Appendix Table 6 shows the number of each species of macrofauna recorded per 0.1 m^2 Hamon grab sample at each of the stations sampled in the survey area. The species identification codes from Appendix Table 5 are shown in parentheses. These are followed by the number of individuals of each taxon per 0.1 m^2. The final columns of Appendix Table 6 shows the total number of species and the number of individuals per 0.1 m^2 in each sample. Colonial organisms have been ascribed a value of 1 in the analysis of community structure.

The corresponding values for biomass (grams AFDW) are summarised in Appendix Table 7. This shows the summed values for the key faunal groups calculated from the blotted wet weight using conversion factors from Eleftheriou & Basford (1989). The final column of Appendix Table 7 shows the total biomass of macrofauna at each of the stations sampled in July - August 2000. A summary of the results for the number of species, number of individuals, biomass, and size per individual are shown in Appendix Table 8.

The percentage composition of the taxonomic groups broken down into number of species, number of individuals and biomass for the entire data set are shown in Figure 9.



Taxonomic Group	Species	Individuals	Biomass
Polychaeta	32.2	65.6	13.2
Crustacea	25.2	19.3	46.5
Mollusca	14.5	2	5.7
Miscellania	23.3	10.9	23.6
Echinodermata	4.7	2.2	11

Figure 9. Histogram showing the percentage composition of the principal taxonomic groups of macrofauna expressed for species variety, numbers of individuals, and biomass (g AFDW) in the sediments of the survey area in July - August 2000.

This shows that in common with many other sites in the North Sea, the benthic macrofauna was dominated by Polychaeta. These comprised almost 66% of the number of individuals and 32% of the species recorded, but only 13% of the biomass. The Polychaeta therefore constitute numerous small organisms compared with other faunal groups.

In contrast, the Crustacea comprise only 19% of the number of individuals and 25% of the species variety, but as much as 47% of the total biomass of macrofauna recorded from the survey area. This reflects the relatively large size of many of the Crustacea in the survey area compared with the polychaete worms. Mollusca comprised only a small component of the macrofauna, whilst Echinodermata and miscellaneous groups contributed 11% and 24% respectively to the total biomass recorded from the sediments.

The assemblage as a whole conforms in general with that characterised as "*Nephtys cirrosa* & *Bathyporeia* spp. in infralittoral sand" (IGS.Neir.Bat) by Connor *et al*, (1997) in their classification of marine biotopes for Britain & Ireland, but with species more characteristic of deeper water habitats.

The number of species (***S***), number of individuals (***N***), the total biomass (***B***) and mean size (***B/N***) of the fauna in each of the samples summarised in Appendix Table 8 shows that the samples contained an average of 38.85 species, 237.56 individuals and a macrofaunal biomass of 1.0124 g AFDW per 0.1 m² Hamon Grab sample. The mean size of individuals was 0.00435 g AFDW. These values may now be compared with typical values obtained in other surveys of shallow water habitats. The values for Area 408 have been recalculated for a 0.2 m² sample for comparison with other surveys that have used a 0.2 m² Hamon grab.

Text Table 4. Summary of Production Licence Area 408 - Coal Pit benthic survey data, and selected benthic survey data from shallow water deposits. **n** = number of sample stations.

Site	Total Taxa	Mean Species per 0.2m²	Mean Individuals per 0.2m²	Biomass g AFDW	n	Source
Area 407 St.Catherine's, Isle of Wight	270	37±22	918±1166	5.59±8.97	52	MESL,1996a
Area 432/1-2 West Varne, English Channel	343	37±25	595±777	4.95±23.6	70	MESL, 1996b
Area 452 Shipwash Gabbard, Orford Ness, North Sea	223	30±20	949±4056	3.18 ±9.7	60	MESL, 1997b
Experimental Dredge Site Lowestoft, North Sea	-	36	1488	5.66	-	Recalculated from Kenny *et al* 1998
Area 454 Lowestoft, North Sea	112	9±5	134±272	1.49±3.49	60	MESL, 1997a
Tay Estuary	38	6±4	108±243	0.036± 0.076	25	MESL, 1998
Area 465/1-2 West Channel, Isle of Wight	229	20.78±14.79	77.97±89.09	1.47± 2.45	91	MESL, 1999a
Area 122/3 North NAB Isle of Wight*	316	26.77±14.96	199.52± 244.08	10.38± 14.77	131	MESL, 1999b
Areas 458 & 464 West Bassurelle, Central Channel	294	44.04±18.84	186.44± 109.95	2.41± 2.85	100	MESL, 1999c
Areas 440 &441 Triton Knoll & Outer Dowsing, North Sea	292	40.8±27.52	561.11±836.9	9.53±25.38	61	MESL, 2000a
Area 401 off Lowestoft, North Sea*†	89	8.72±7.26	82.50±257.94	0.26±0.32	36	MESL, 2000b
Area 408 Monitoring Coal Pit, North Sea*†	194	36.35±14.25	417.82±250.66	1.55±2.50	54	MESL, 2000c
Area 408 Research Coal Pit, North Sea*†	**246**	**38.85±13.08**	**475.12±370.5**	**2.01±4.65**	**194@**	**This study**

* Worked area
† Recalculated for 0.2m²
@ Representing 27 monitoring stations (9 triplicates)+ 167 research stations
MESL = Marine Ecological Surveys Limited

Inspection of Text Table 4 shows that when the data from our 27 (9 triplicate) monitoring stations are included, the Area 408 survey yielded a total of 246 taxa and a mean of 39 species, 475 individuals and 2.02 g AFDW biomass of macrofauna per 0.2 m^2 of sea bed surface. These values are within the range commonly reported from pre-dredge surveys of other shallow water deposits and considerably exceed those recorded in a recent survey of Production Licence Area 401, off Lowestoft (Marine Ecological Surveys, 2000b).

A thematic map representing the number of species per 0.1 m^2 in and adjacent to Production Licence Area 408 is shown in Figure 10. This shows that as is well known from other surveys in UK waters, sandy sediments in the survey area generally support a smaller species variety than deposits containing a higher proportion of gravels.

Figure 11 shows a similar map of the survey area for the number of individuals per 0.1 m^2 recorded at each of the survey stations in July - August 2000. Population densities of benthic invertebrates were evidently higher in the central parts of the survey area corresponding with deposits containing a higher proportion of gravel than elsewhere in the survey area.

It is noteworthy that despite the fact that marine aggregate dredging may result in a major impact on both species richness and abundance of the benthos (see Newell *et al*, 1998; Desprez, 2000 & van Dalfsen *et al* 2000) high species diversity and population density occurred within the boundaries of Production Licence Area 408. This suggests that trailer dredging at the intensity used at Area 408 and associated discharge of screened material has not apparently resulted in a major reduction in species variety or population density of benthic invertebrates, despite the fact that the site has been dredged for marine sand and gravel since 1996. The impact of aggregate dredging on the benthos is analysed in more detail in the following section.

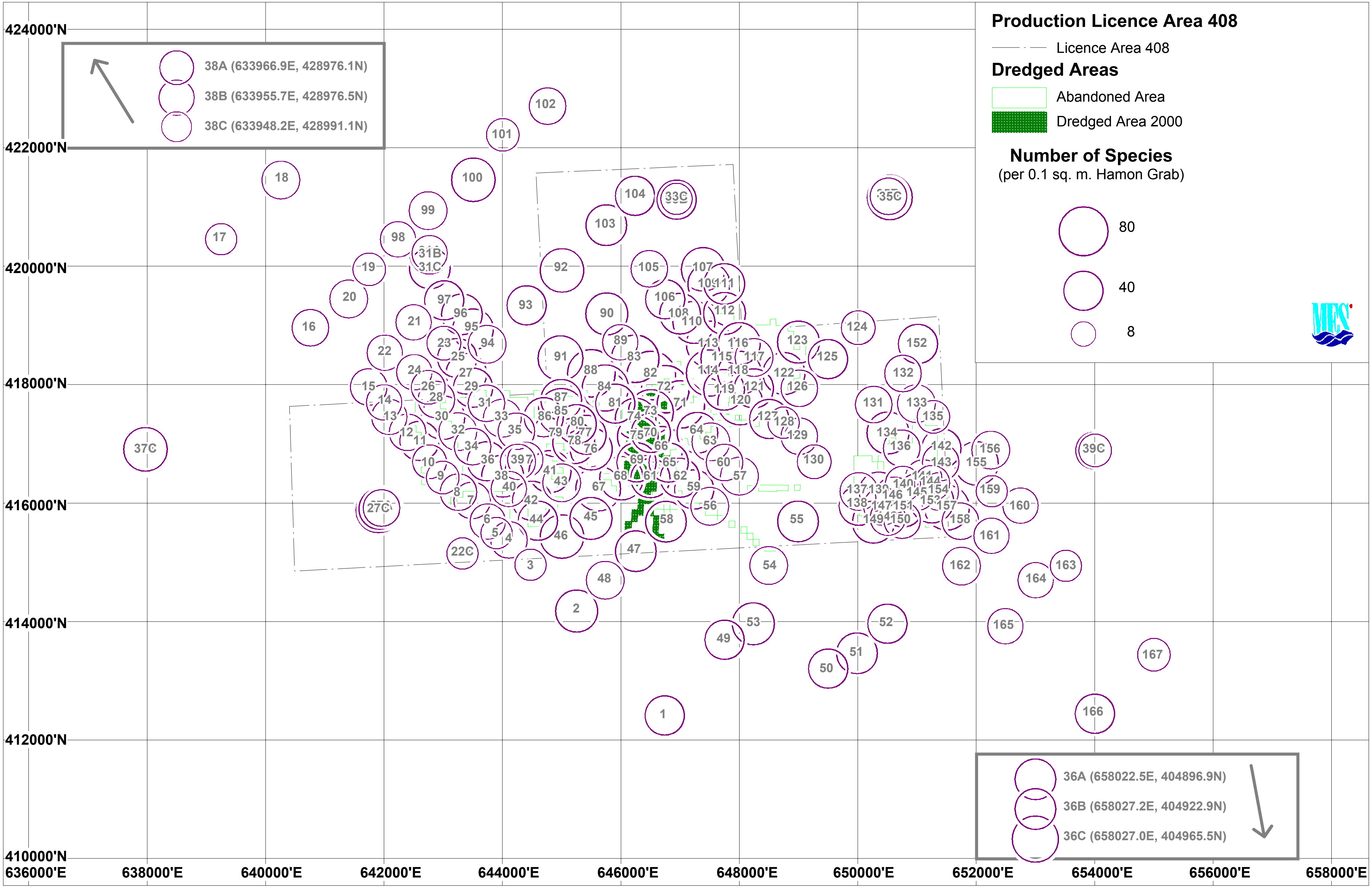


Figure 10. Map of the Licence Area 408 (Coal Pit) showing scaled thematic maps for the number of species of macrofauna (>1mm) per 0.1 square metre in the area surveyed in July/August 2000. To access the MapInfo workspace, click the logo

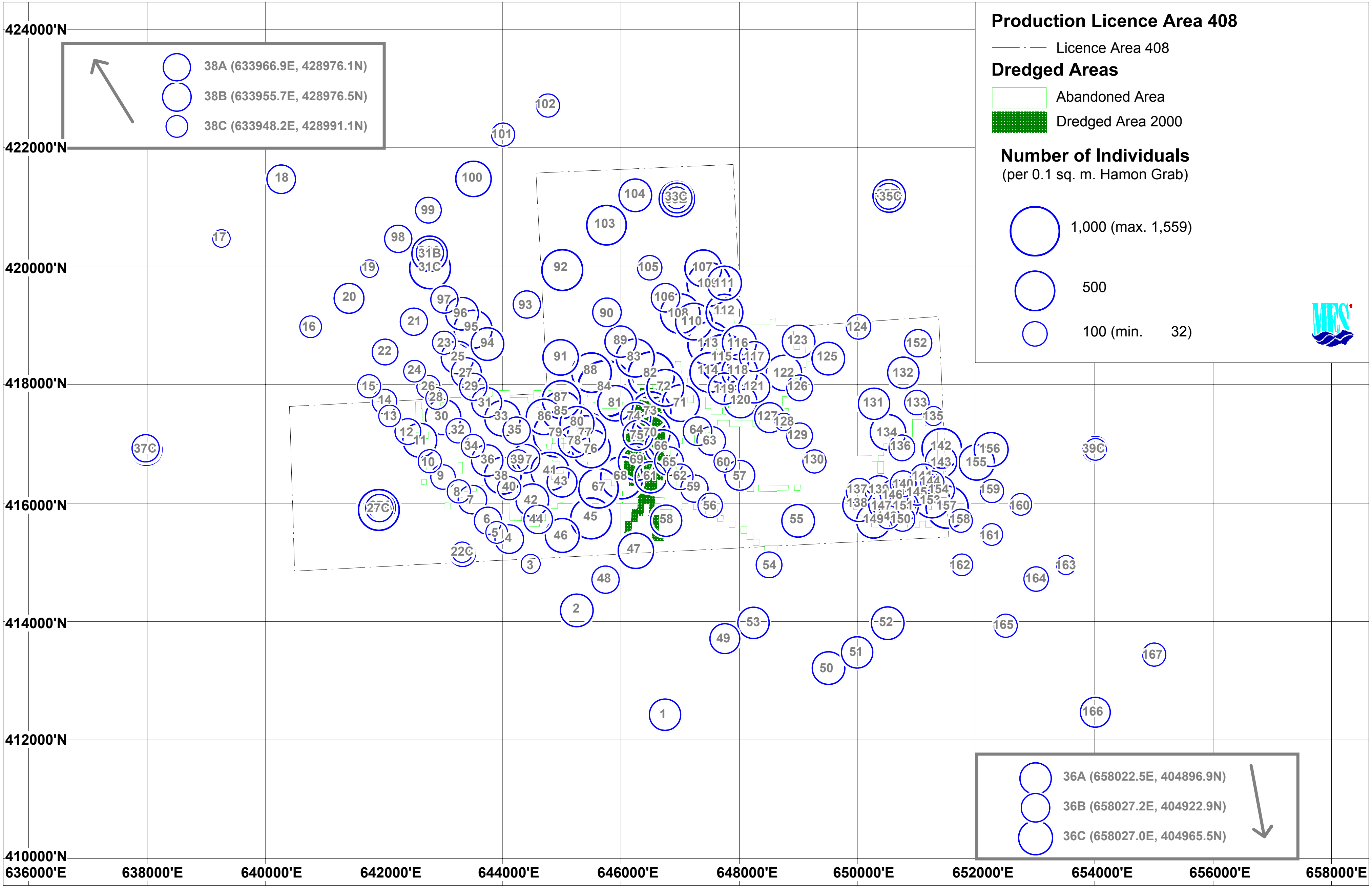


Figure 11. Map of the Licence Area 408 (Coal Pit) showing scaled thematic maps for the number of individuals of macrofauna (>1mm) per 0.1 square metre in the area surveyed in July/August 2000. To access the MapInfo workspace, click the logo

C.2.2. Impact of Dredging on Benthic Community Composition

C.2.2.1. Multi-variate analysis of community structure

Analysis of the nature and distribution of macrofaunal communities in the survey area is best accomplished by multivariate statistical techniques. A group average sorting dendrogram showing the percentage similarity of the macrofauna at each of the stations in the survey area in July - August 2000 is shown in Figure 12. The corresponding two-dimensional MDS ordination is also shown, together with an MDS ordination of **non-dredged**, **abandoned**, **dredged** and **"control"** stations.

The evidence suggests that the sediments of the 408 survey area support four main communities of macrofauna. These comprise a Group A assemblage, a Group B assemblage, a Group C assemblage and a small Group D assemblage. The groups should however be regarded as forming a continuum of macrofaunal communities as evidenced by the MDS. Although the dredged stations form a group within the MDS, it should be noted that the stress level is very high, and the non-dredged stations are spread throughout the ordination plot.

This shows that within the context of the variability of benthic biological samples, the community composition based on species variety and population density of the macrofauna of dredged stations is similar to that of abandoned and non-dredged stations. It suggests that the rate of recolonisation of the deposits by the small mobile species that characterise the disturbed shallow water sediments of the survey area is sufficiently rapid to obscure any changes imposed by trailer dredging. Recolonisation of disturbed areas in the North Sea is known to be fast owing to the rapid increase of opportunistic species compared with that recorded in low dynamic systems such as are present in the Mediterranean (van Dalfsen *et al*, 2000 & Sardá *et al*, 2000).

The distribution of the four faunal groups in the survey area is summarised in Figure 13. It is noteworthy that the main area of coarse gravelly sands (Group 2 sediments) in Figure 7 coincides with the Group B biological assemblage in Figure 13. Faunal Group C corresponds in general with areas of superficial well-sorted fine sand shown in Figures 7 & 8. This suggests that fine material re-mobilised from within the dredged areas may have an impact on community composition of the benthos for at least 2-3 km along the zone of net tidal transport.

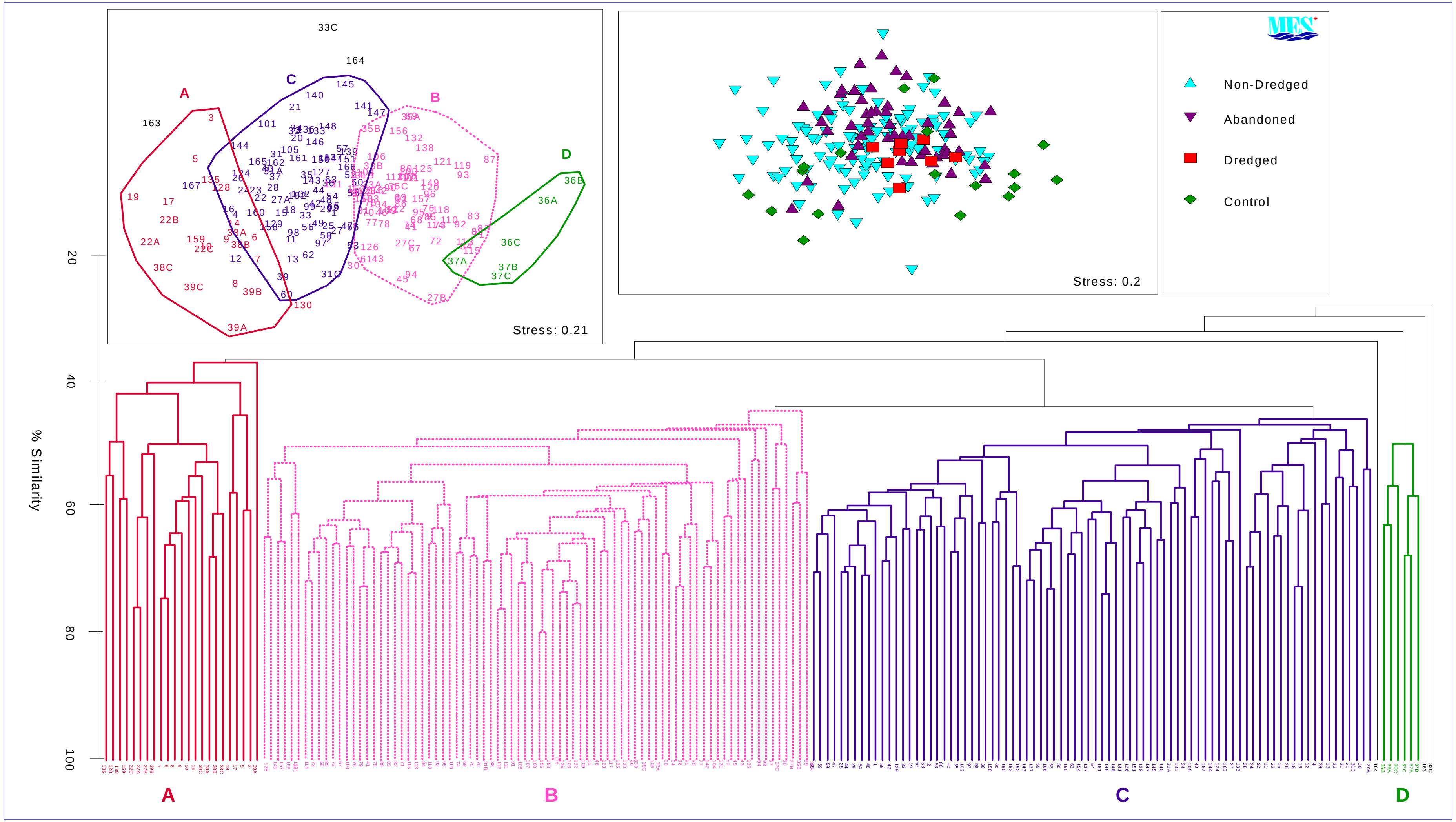


Figure 12. A group average sorting dendrogram showing the percentage similarity of the fauna at each of the stations sampled in July - August 2000. The corresponding two-dimensional MDS ordinations is also shown together with an MDS representing the ordination of the **non-dredged**, **dredged**, **"control"** and **abandoned** stations.

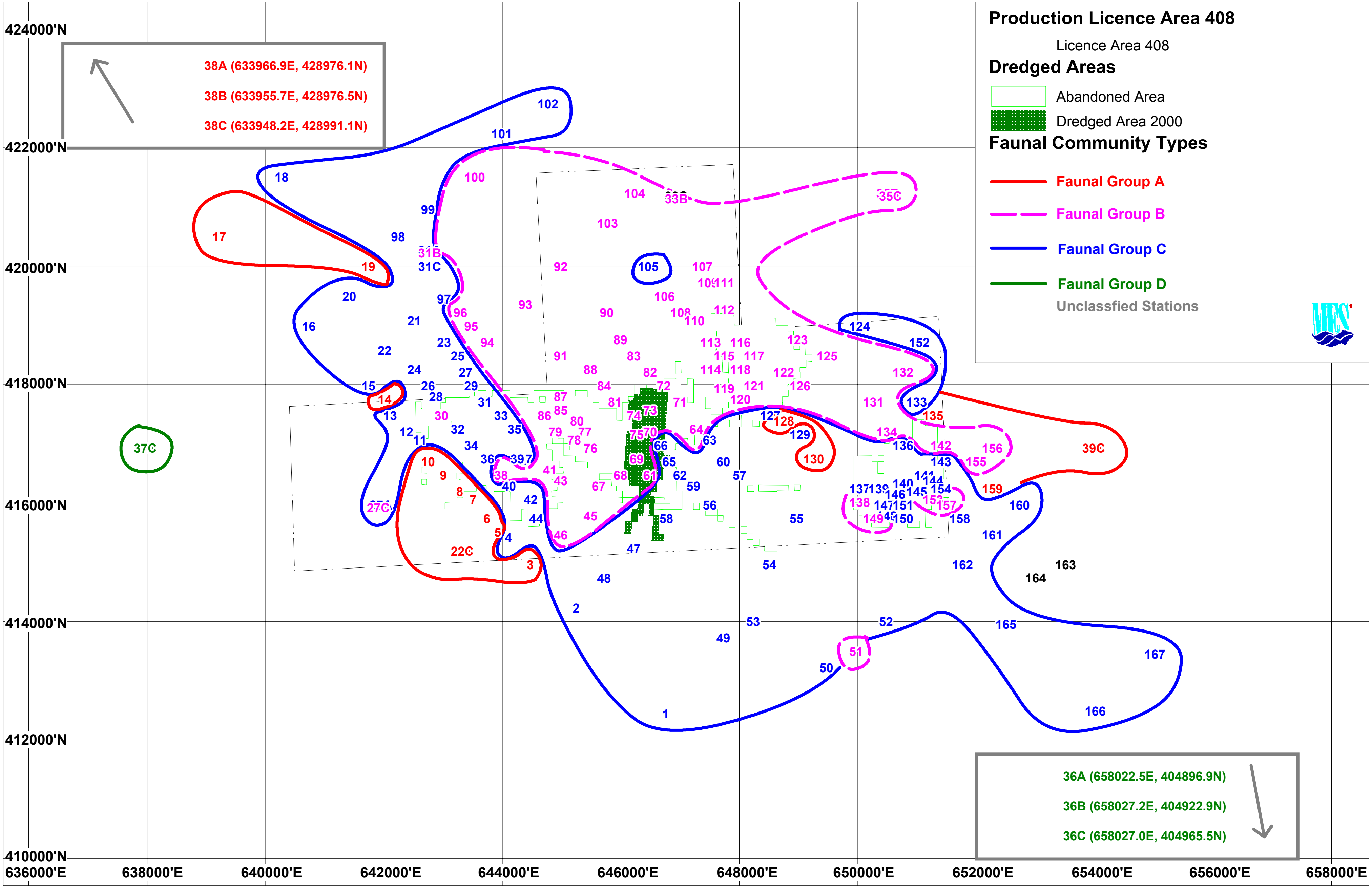


Figure 13. Map of the Licence Area 408 (Coal Pit) showing the distribution of the macrofaunal community types identified by multivariate analysis in Figure 12.
To access the MapInfo workspace, click the logo

C.2.2.2. Correlation with Environmental Variables

Correlation of the distribution of the macrofaunal communities in the survey area with environmental variables has been carried out using the BIOENV sub-routine within the PRIMER software package. In this case, the similarity of each of the groups of macrofauna identified in Figure 12 has been matched against the following variables:- Easting; Northing; Log depth m; particle size composition; Quartile deviation; Skewness. These have been correlated with the environmental variables singly and in combination using the Spearman Ranked Correlation (see Clarke & Warwick, 1994b).

Text Table 5 shows the best combination of environmental variables that are matched to each of the 4 faunal groups identified in Figure 12. All of the faunal groups show a high correlation with the proportion of gravel in the deposits and the sorting as indicated by the quartile deviation. The Group A assemblage was also correlated with easting, whilst the Group D assemblage was correlated with the silt content of the deposits.

Text Table 5. Table showing environmental variables that give the best correlation for four faunal groups identified by multivariate techniques. The data which are summarised in this table are shown in Appendix Table 8. **n** = the number of stations in each faunal group.

Faunal Group	Best Correlation Environmental Variable(s)	Correlation Value (Spearman's Rank)	n
A assemblage	Easting, %Gravel, Quartile Deviation, 37.5mm, 150um	0.85	23
B assemblage	%Gravel, Quartile Deviation, 5mm, 2mm, 212um	0.815	80
C assemblage	%Gravel, Quartile Deviation, 5mm, 1.18mm, 63um	0.843	80
D assemblage	%Gravel, %Silt, Quartile Deviation, 1.18mm, 600um	0.982	6

C.2.2.3. Impact on other Measures of Community Structure

Figure 14 shows a series of histograms for the number of species (*S*), the number of individuals (*N*), the species richness index (*d*), the evenness (*J*), the species diversity (*H'*) and dominance. Values have been calculated on a basis of the average values for all the pooled sampling stations, as well as for **non-dredged** stations, **dredged** stations, **"control"** stations and **abandoned** stations.

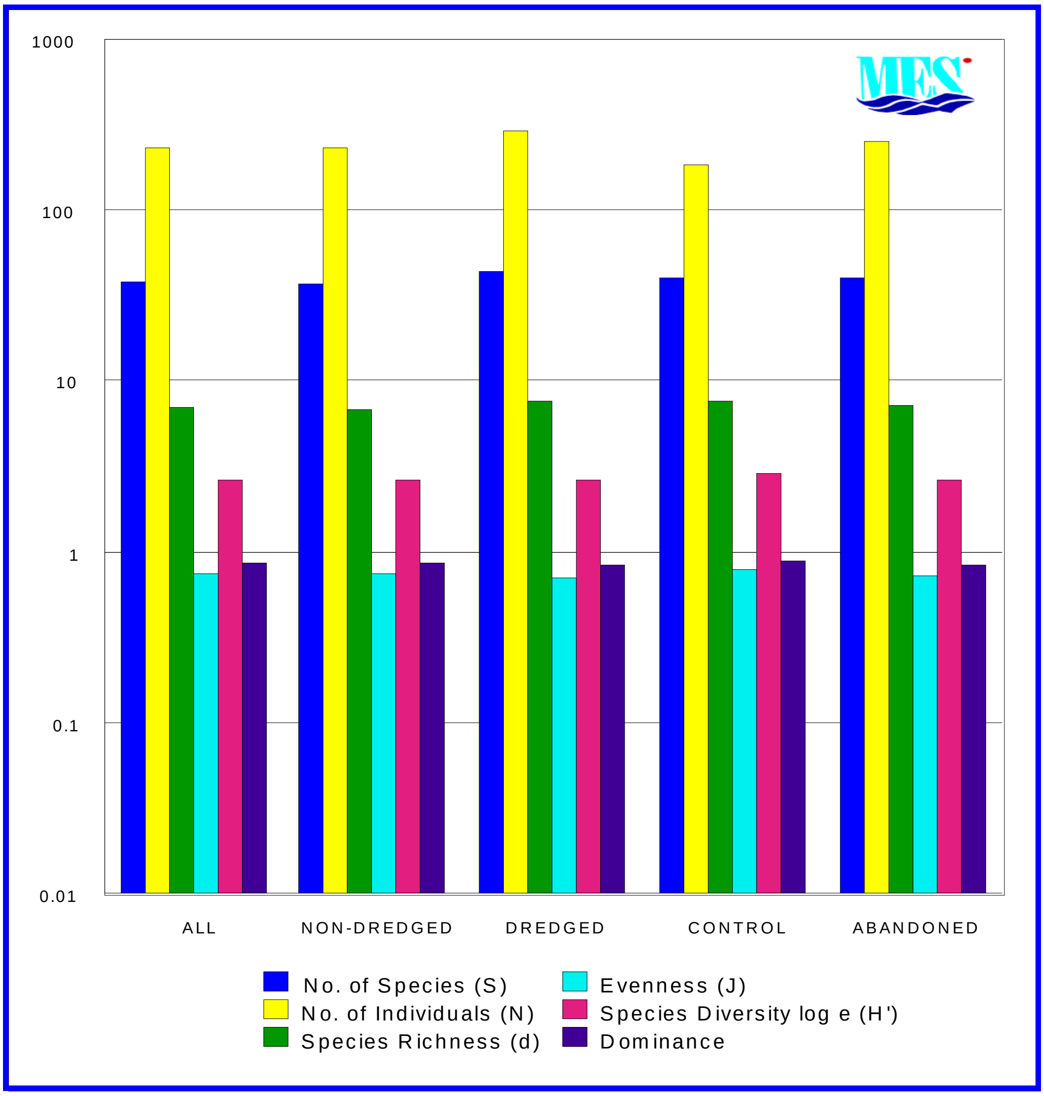


Figure 14. Histograms showing the average values for the number of species, the number of individuals, the species richness, the evenness, the species diversity and dominance for the macrofauna in the survey area in July - August 2000.

Inspection of Figure 14 shows that there is no apparent difference between the average values for the number of species, number of individuals, or any of the above indices of population structure. This supports the view that at the dredging intensity recorded for Area 408 in August 2000, there is no detectable impact on the average values for these indices of community structure either within the actively dredged stations or in the adjacent deposits.

The species abundance in **"control"** deposits (well outside any likely impact of dredging), in non-dredged deposits (potentially affected by deposition of material from the screening process), in previously dredged deposits (at which dredging had ceased since 1999), and in deposits that were dredged up to the time of the survey in July - August 2000 are shown in Figure 15 (see also Text Table 7).

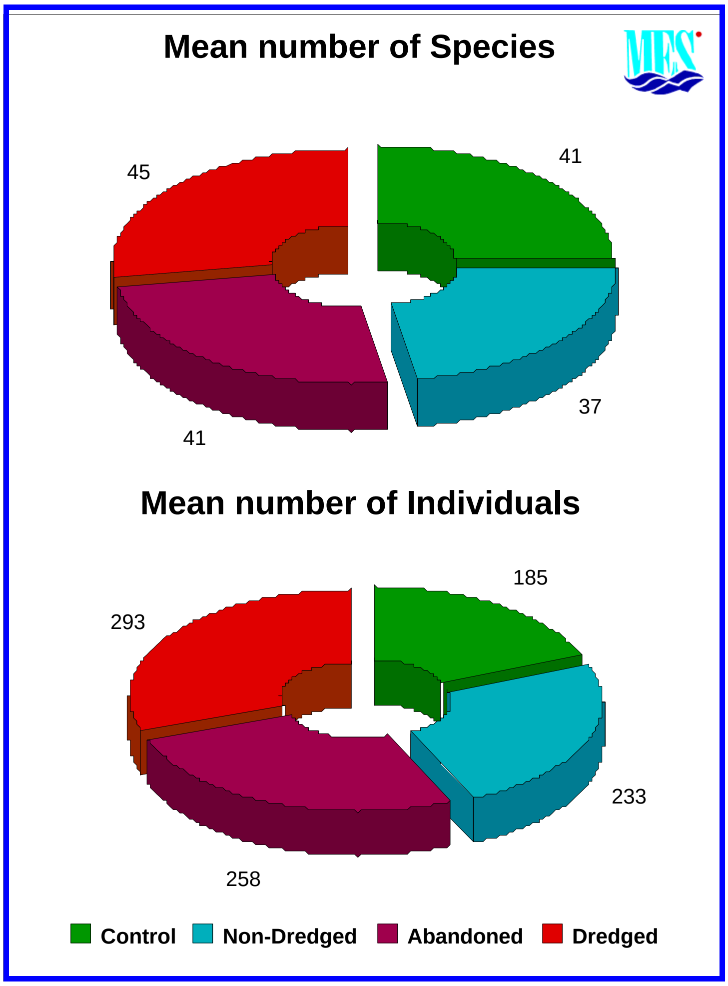


Figure 15. Diagrams showing the mean number of species (upper) and mean number of individuals (lower) per 0.1 m² Hamon Grab sample in the deposits at "control" stations, non-dredged stations, dredged but abandoned stations and dredged stations in the survey area in July - August 2000.

A corresponding diagram for the mean population density of macrofauna per 0.1 m² Hamon Grab sample is also shown in Figure 15. In both cases it is clear that within the limits of variability of benthic biological communities, there is little difference in either species variety (*S*) or population density (*N*) between the abandoned dredge stations and the surrounding deposits. This suggests that recolonisation by a representative species variety and an increase in population density occurred within 12 months after cessation of dredging.

The fact that deposits within the actively-dredged site also supported a species variety and population density similar to that elsewhere in the survey area, suggests that the initial processes of recolonisation of species variety and population density are sufficiently fast for the rate of recolonisation to be in equilibrium with the rate of removal by dredging at the rate of production recorded up to August 2000.

C.2.2.4. Impact on Dominance

A rather more sensitive measure of the uniformity of species composition in natural communities in relation to environmental gradients is to plot so-called "***k***-dominance" curves which show the percentage of a population which is represented by each of the species within the community (see Lambshead *et al*, 1983; Clarke, 1990; Warwick, 1993). Communities with a wide range of species generally have a ***k***-dominance curve which shows no evidence of a major dominance by one or a few species. In contrast, where there is an environmental stress imposed on a community, sensitive species are replaced by large numbers of those (resistant) species which are capable of survival. This leads to a reduction in species variety and a numerical dominance by one or a few resistant species. In these cases the community may show as much as 80-90% dominance by one or two (resistant) species.

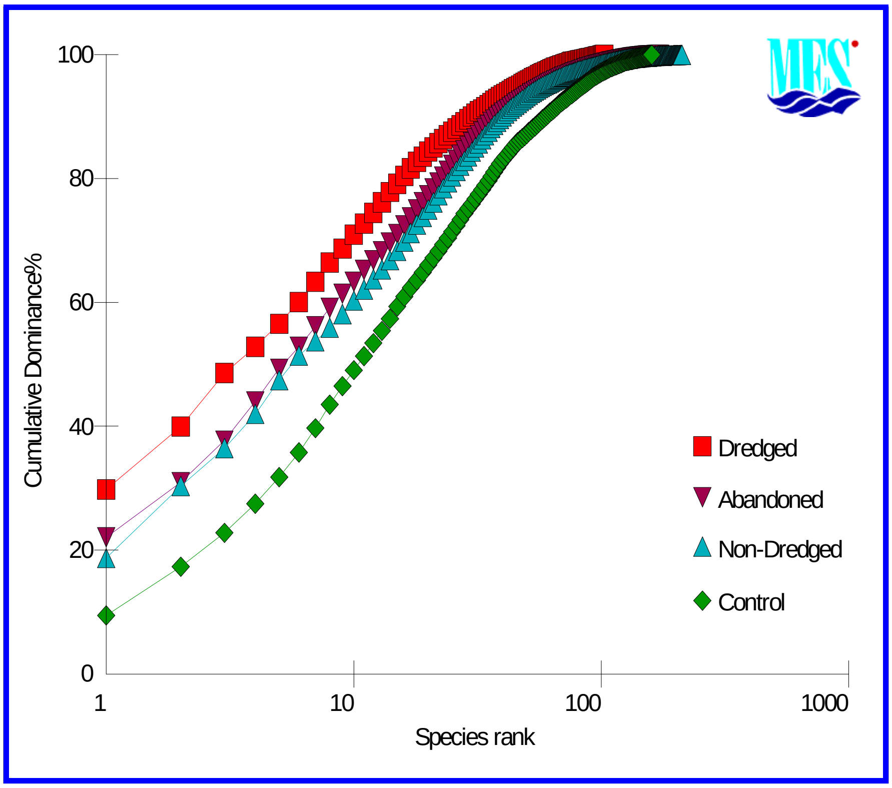


Figure 16. ***K***-dominance plots showing the numerical dominance of component species in dredged stations, abandoned stations, non-dredged stations and "control" stations in the survey area in July - August 2000.

Inspection of the ***k***-dominance plots in Figure 16 suggests that there is some increase in dominance in the macrofaunal communities of **dredged areas** compared with **"control" areas**. One species (*Ophelia borealis*) accounts for as much as 30% of the population density in the dredged stations whereas the same species accounts for only 10% in the **"control" stations**.

Again, although there are no obvious differences between the relative species composition of **non-dredged stations** and **previously dredged stations** at which dredging had ceased for at least 12-months, both of these groups of stations showed a higher dominance than the **"control" stations**. This implies that there are some differences in community composition remaining in sites at which dredging had ceased, and in sites potentially affected by sand released by the dredging process and subsequently transported outside the boundaries of the dredged areas.

The relative contribution of the most important species contributing 40% of the species for **dredged stations**, **previously dredged (abandoned) stations**, **non-dredged stations** and **"control" stations** situated beyond the boundaries of potential impact are summarised in Text Table 6. This shows clearly that the communities are all characterised by Polychaete and Crustacean species that are typical of circalittoral mixed sediments, although the absence of *Sabellaria spinulosa* and *Polydora* spp. excludes the community from that described by Connor *et al*, (1997) for marine biotopes in UK waters. Many of the Crustacea are more typical of shallow water mobile sands and are likely to contribute to a relatively rapid recolonisation of the deposits following disturbance by natural events or by dredging.

Text Table 6. Table summarising the average SIMILARITY and key species contributing to the internal similarity of each of four groups subject to differing levels of dredging impact. The average abundance, the average similarity, the ratio of average similarity to standard deviation and the % contribution to the similarity made by each key species is shown. Also shown is the cumulative percentage. The cut-off for low contributions was 40%.

Taxonomic Group	Average Abundance	Average Similarity	Similarity: Standard Deviation	% Contribution	Cumulative %
Group Non-dredged – Average Similarity = 44.30					
Ophelia borealis	43.54	4.26	2.98	9.62	9.62
Spiophanes bombyx	12.68	2.73	1.79	6.16	15.77
Nematoda spp.	12.79	2.04	1.43	4.61	20.39
Nemertea spp.	3.85	1.72	1	3.89	24.27
Nephtys caeca	5.02	1.69	1.13	3.81	28.09
Scoloplos armiger	5.12	1.67	1.19	3.77	31.86
Pseudocuma longicornis	3.69	1.64	1.18	3.71	35.57
Eteone longa	5.14	1.5	0.92	3.38	38.94
Bathyporeia sp.	4.2	1.45	1.22	3.27	42.22
Group Abandoned – Average Similarity = 47.48					
Ophelia borealis	59.96	3.58	2.22	7.53	7.53
Nematoda spp.	16.25	2.68	2.09	5.64	13.18
Exogone hebes	9.21	2.60	2.42	5.47	18.65
Spiophanes bombyx	13.62	2.38	1.99	5.02	23.67
Nemertea spp.	5.98	2.28	2.20	4.80	28.47
Laonice cirrata	2.90	1.71	1.65	3.61	32.08
Pseudocuma longicornis	4.04	1.61	1.24	3.38	35.47
Nephtys sp. (juv)	2.79	1.46	1.16	3.07	38.54
Scoloplos armiger	2.46	1.44	1.27	3.02	41.56

Taxonomic Group	Average Abundance	Average Similarity	Similarity: Standard Deviation	% Contribution	Cumulative %
Group Dredged 2000 – Average Similarity = 58.27					
Ophelia borealis	87.25	3.93	3.54	6.74	6.74
Spiophanes bombyx	29.75	3.23	6.40	5.55	12.29
Nematoda spp.	12.38	2.68	5.75	4.6	16.89
Poecillochaetus serpens	10.88	2.65	6.92	4.54	21.43
Pectinaria koreni	25.38	2.45	3.53	4.21	25.64
Eteone longa	9.13	2.45	8.21	4.21	29.85
Ophuiura affinis	9.63	2.42	4.67	4.15	34.00
Nemertea spp.	4.88	2.27	10.14	3.89	37.89
Pseudocuma longicornis	5.13	2.11	5.16	3.62	41.51
Group Control – Average Similarity = 36.36					
Spiophanes bombyx	7.28	2.68	2.97	7.36	7.36
Ophelia borealis	14.56	2.54	1.62	7	14.36
Nephtys caeca	5.5	1.85	1.07	5.1	19.46
Nemertea spp.	3.67	1.41	1.16	3.88	23.34
Pholoe inornata	7.06	1.31	1.16	3.61	26.95
Nematoda spp.	8.72	1.22	0.82	3.37	30.32
Eteone longa	2.28	1.11	0.91	3.05	33.37
Urothoe marina	4.22	1.09	0.78	3	36.37
Laonice cirrata	1.5	1.05	0.79	2.9	39.27
Eteone picta	2.22	1.04	0.94	2.87	42.13

The similarity of species composition confirms that dredging and associated return of screened material has not had an impact on species composition of sediments in and adjacent to Area 408 at the levels of production that occurred up to August 2000. Text Table 6 shows that the **"control"** stations well outside any likely impact of dredging at Production Licence Area 408 were dominated by a similar species assemblage to that in **dredged** stations, **non-dredged** stations close to the dredge zones and in deposits where dredging had ceased (**abandoned**).

What is probably of significance is that dredging and associated discharge of screened material does appear to have had an impact on the relative contribution of each of the species to the community composition. The main difference between the dredged stations and the other areas is an absence of the polychaete *Nephtys caeca*. It is of interest also that juvenile *Nephtys* were recorded at the previously-dredged stations at which dredging had ceased in 1999. This suggests an active process of recolonisation by species that had been removed from dredged deposits.

C.2.2.5. Summary of Impacts on Population Density & Species Composition

We conclude that the community of benthic macrofauna in the survey area in July - August 2000 is one that is dominated by Polychaetes and Crustaceans. It is generally typical of mixed sandy deposits in areas that are regularly disturbed by natural sediment transport such as described in this area by Coastline Surveys Europe Limited (2002). Such communities characteristically comprise "opportunistic" species that are capable of rapid recolonisation following disturbance. The community composition as assessed from the species variety and population densities of marine invertebrates in dredged areas, those outside the dredge zones that are potentially affected by deposition of material rejected during the screening process, and those at which dredging had ceased since 1999, are similar to those from "control" areas well outside any likely impact of dredging at Production Licence Area 408. Such communities are indistinguishable from one another by multi-variate techniques, within the context of the variability of biological samples from marine deposits.

Within the communities, however, there is evidence of differences in the relative proportions of the component species in dredged deposits compared with both non-dredged and abandoned dredged areas, and with "control" areas. Some components such as *Nephtys caeca* are absent from the dredged deposits and are replaced by juveniles in deposits at which dredging had ceased in 1999. This implies that a process of recolonisation and restoration of community composition has occurred in the dredged deposits within the 12 month period since dredging ceased.

The scale of impact of dredging and overboard screening on community structure of the benthic macrofauna is analysed in relation to distance along the potential dispersion gradient in the following section.

C.2.3. Impact along Dispersion Gradient

The position of the stations was arranged in order to analyse potential gradients of impact along the sediment transport axis (north-west/south-east) associated with the tidal streams in the study area. Figure 17 shows a map of the survey area in which 4 different transects have been identified. All four transects extend a distance of 4000 m to the north west and to the south east of each of the component dredge zones within Licence Area 408.

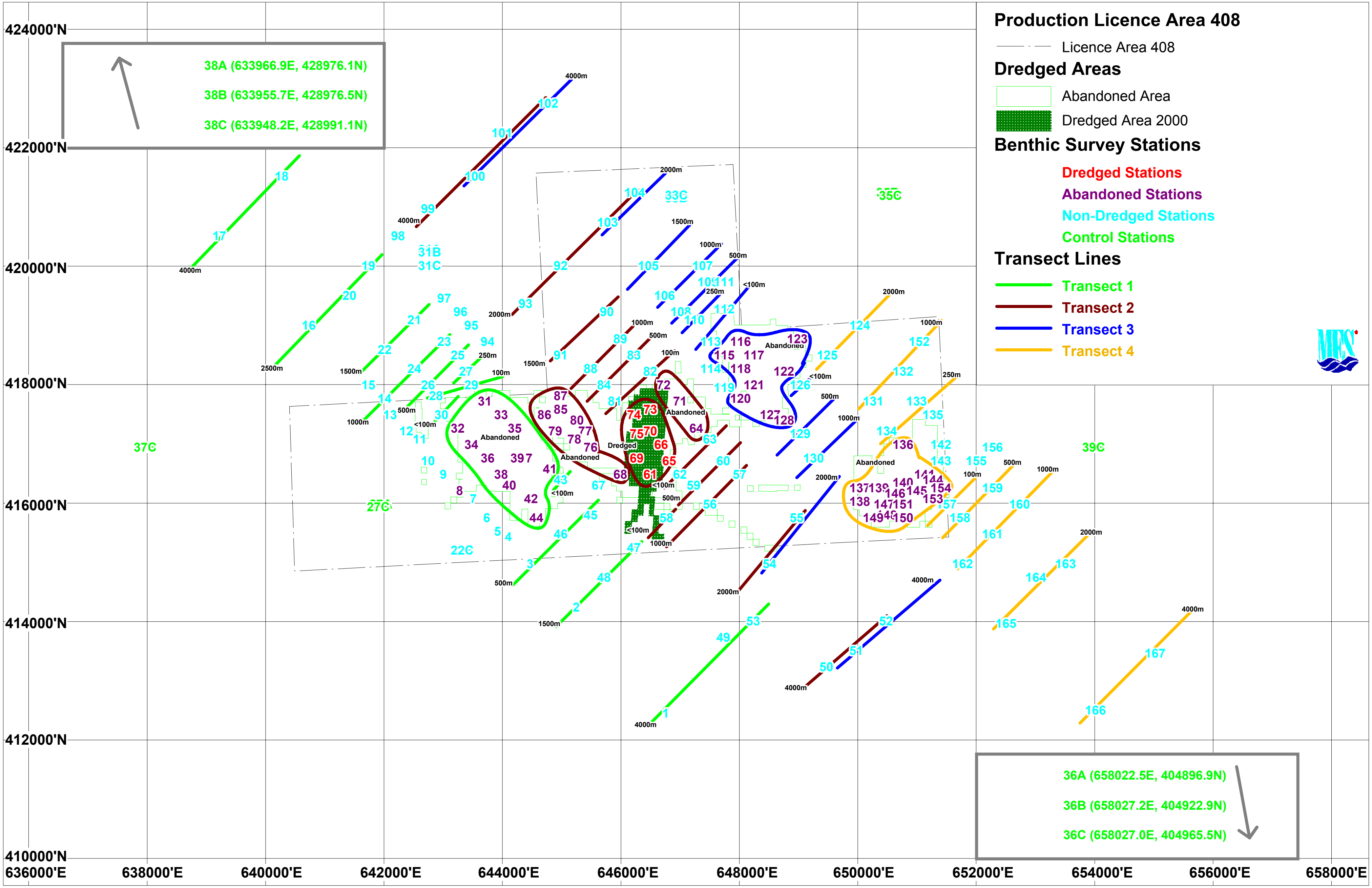


Figure 17. Map of the Licence Area 408 (Coal Pit) showing four transects taken across the surveyed area to analyse the effects of dredging disturbance with distance from source. To access the MapInfo workspace, click the logo

They have been identified as:- ***Transect 1***, ***Transect 2***, ***Transect 3*** and ***Transect 4***. A feature of the transects is that they each comprise a series of stations which can be grouped together to assess the impact of dredging within particular dredge zones and at known distances along the sediment transport axis, away from the dredge site up to a maximum distance of 4000 m.

Transect 1 covers the abandoned dredge area known to Hanson Aggregates Marine as Dredge Zone 2 that was last dredged heavily in 1998 and lightly in 1999.
Transect 2 covers the current dredge area known to Hanson Aggregates Marine as Dredge Zones 5+6, and Dredge Zone B, the second of which was heavily dredged prior to this survey carried out in July - August 2000.
Transect 3 covers the abandoned dredge area known to Hanson Aggregates Marine as Dredge Zone 7 that was last dredged heavily in 1997 and lightly in 1998 & 1999.
Transect 4 covers the abandoned dredge area known to Hanson Aggregates Marine as Dredge Zone 10 that was last dredged lightly in 1999, and not dredged at all prior to that.

The community composition based on the species variety and population density of benthic invertebrates at each of the transects is summarised in Figure 18. The stations for each transect have been shown as different colour-coded symbols for distances ranging from < 100 m to as much as 4000 m from the dredge sites.

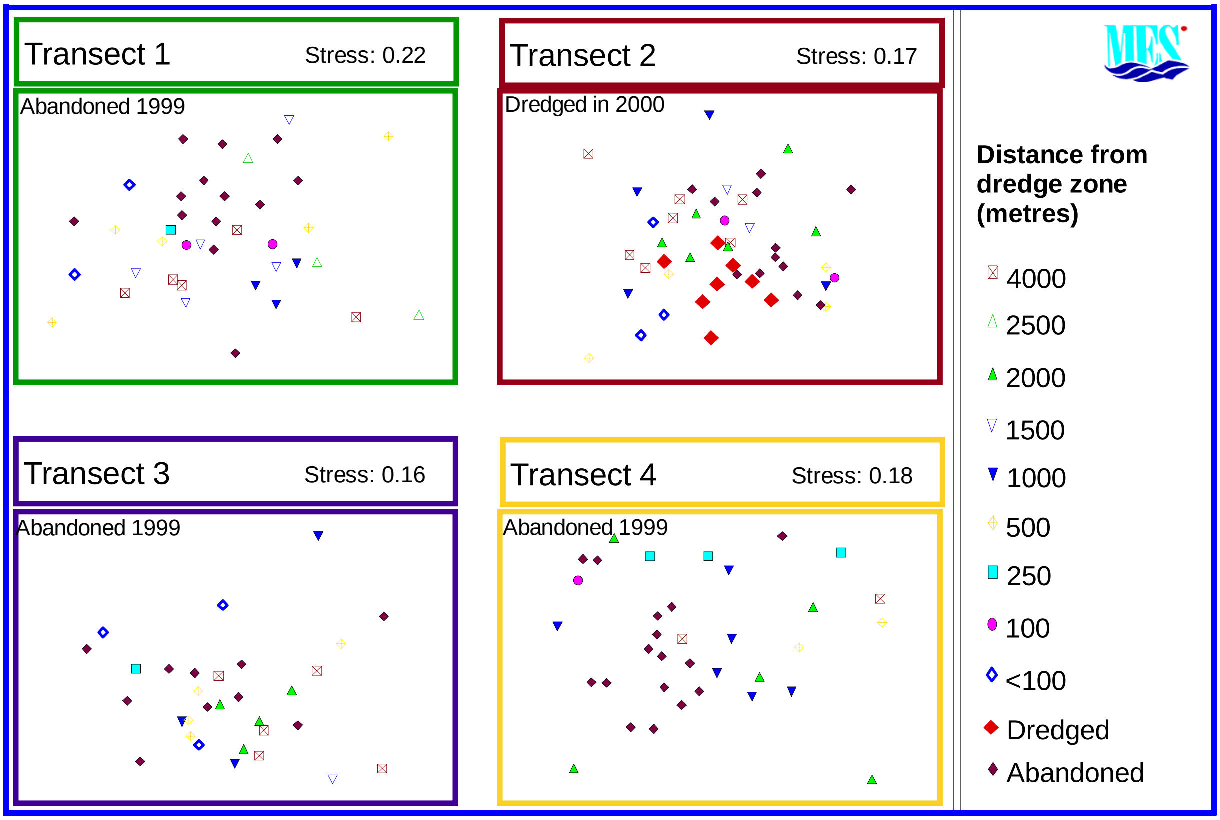


Figure 18. MDS ordination plots for the macrofauna in deposits at which dredging had ceased (abandoned) and those that were being dredged up to August 2000. The data are plotted for 4 transects extending along the tidal stream axis as shown in Figure 17. Samples have been pooled for stations within 100 m of the dredge sites, and for varying distances extending up to 4000 m in each direction along the tidal stream.

Inspection of Figure 18 shows no clear separation of communities based on an analysis of species composition and population density of benthic invertebrates that are characteristic of near-site sediments compared with those up to 4000 m from the dredge sites. We therefore conclude that within the context of the variability of benthic biological samples from marine deposits, there is no clear evidence of a systematic alteration in community structure of the benthic macrofauna in relation to either previously-dredged stations or those being dredged up to the time of our survey in July - August 2000.

The species contributing to 75% of the overall abundance of macrofauna at all stations of the survey area are ranked in order of importance in Figure 19.

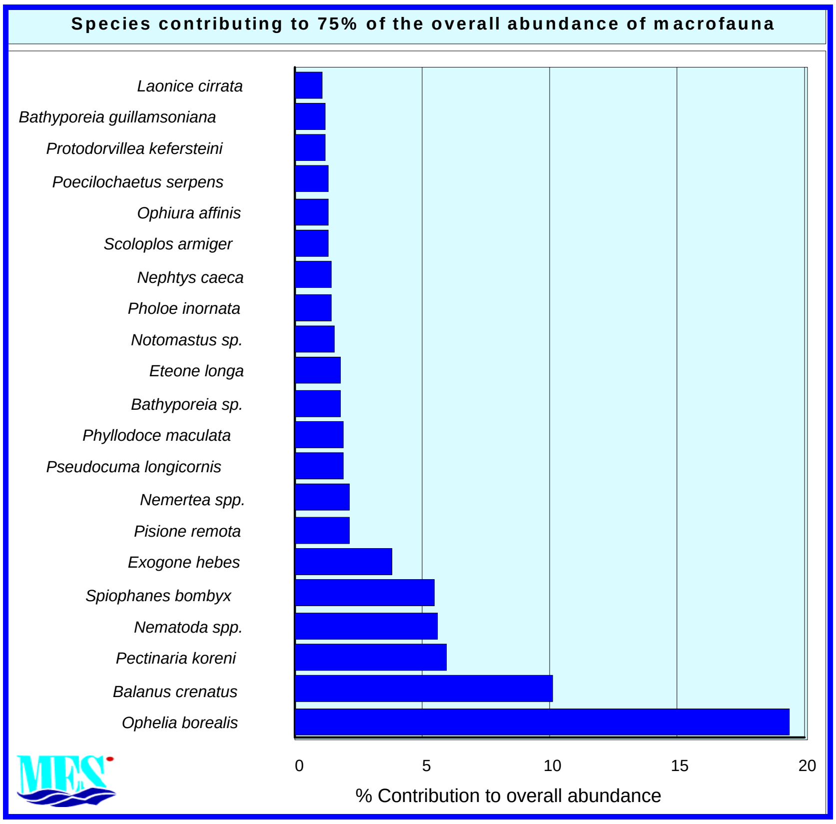


Figure 19. Histogram showing the species contributing to 75% of the numerical abundance of macrofauna in the survey area in July - August 2000.

This shows that the community is mainly dominated by polychaetes. The barnacle (*Balanus crenatus*) occurs in high densities at some stations and therefore contributes as much as 10% to the overall numerical abundance of macrofauna in the survey area as a whole. In most sites, however, the community is represented mainly by small mobile species that are capable of rapid recolonisation of the deposits following disturbance. From the type of community in the survey area, a rapid rate of recolonisation and recovery of species variety and population density would be anticipated following cessation of dredging.

Averaged values for a range of indices of biological community composition along the sediment transport axis to the north-west and south-east of the actively dredged site (Transect 2) are shown in Figure 20.

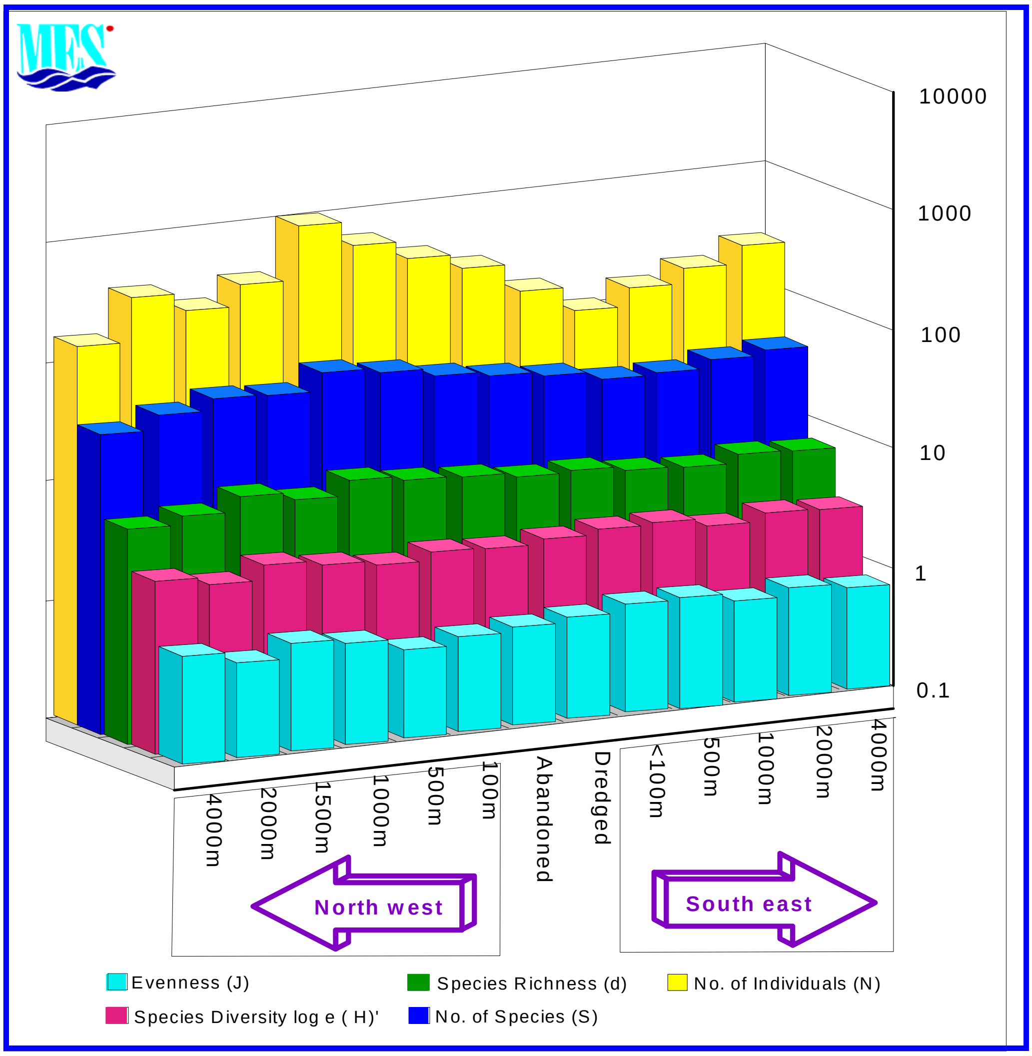


Figure 20. Histograms showing the averaged values for a range of indices of biological community composition in relation to the axes of dispersion of material to the north-west and south-east of the actively dredged site (***Transect 2***) in July - August 2000.

As in the case of pooled samples from **dredged**, **abandoned**, **non-dredged** and **"control"** areas shown in Figure 14, the averaged values for the species variety (***S***), the population density (***N***), species richness (***d***), evenness (***J***) or species diversity (***H'***) are similar to one another in sea bed sediments both within the dredged site in July - August 2000 & at distances of up to 4000 m in each direction along the axis of the tidal streams. There is thus no evidence of an impact of dredging at the intensity recorded up to August 2000 from either the analysis of community composition or the indices of community structure based on species variety and population density of benthic invertebrates averaged for different distances along the sediment transport axis.

Figure 21 shows a series of ***k***-dominance curves compiled for stations within the **actively-dredged** Zone B, and those in previously dredged (**abandoned**) sites. These are compared with stations at varying distances along the axis of the tidal streams on each side of the dredged site. These comprise stations within 500 m of the dredged deposits, those between 1000-1500 m from the dredged site, those at 2000 m from the dredged site, those 4000 m from the dredged site, as well as for **"control"** stations well outside the boundaries of likely impact of aggregate dredging at Area 408.

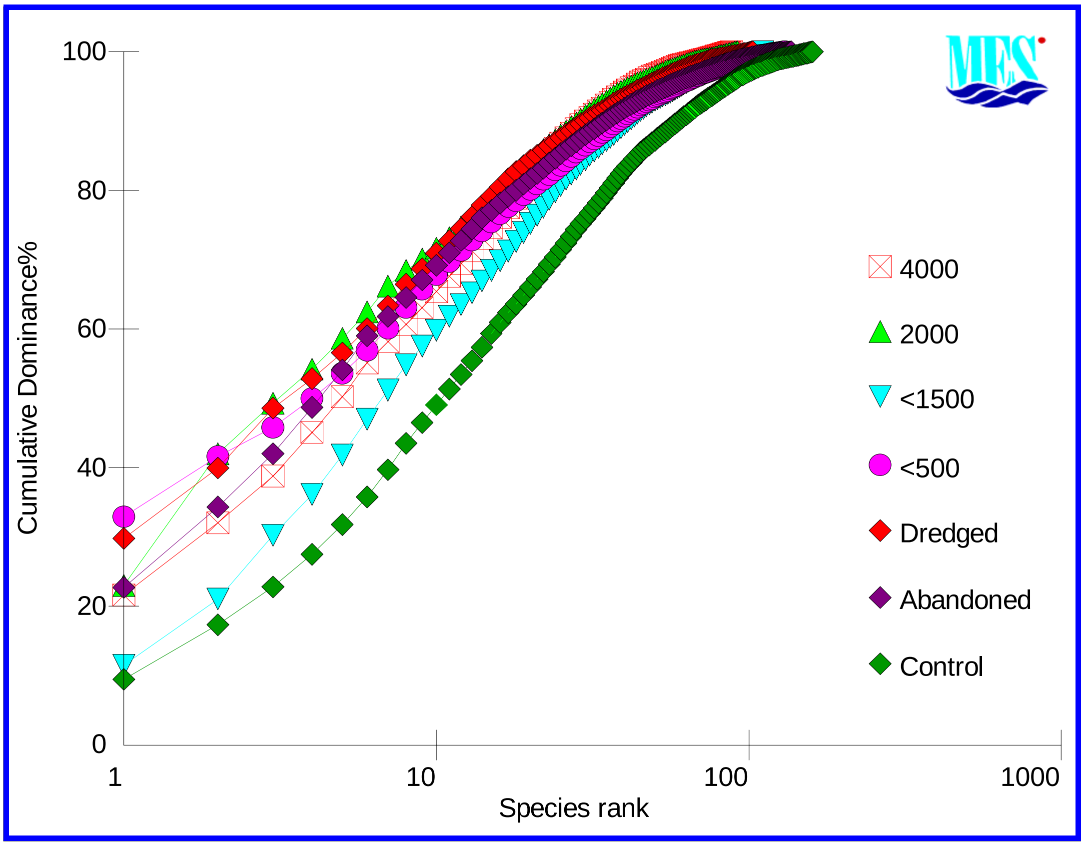


Figure 21. ***K***-dominance curves showing the numerical dominance of component species within the actively dredged Zone B and at varying distances from the actively dredged site in July - August 2000.

Inspection of Figure 21 shows that stations within the **actively dredged** site in Zone B, and those within 500 m of this area have a somewhat higher dominance by one or a few species than those at 1000-4000 m downstream from the dredge zone. This is consistent with the results of pooled data for **"control"**, **non-dredged**, **dredged** and **abandoned** stations shown in Figure 14. Any such impact on community structure appears to be close to the limits of natural variability between samples taken of the macrobenthos by conventional grabs (see Newell *et al*, 2001) and is confined to stations within 500 m of the actively dredged site in July - August 2000.

C.2.3.1. Summary of Impacts on Species Variety & Population Density in Relation to distance from Dredge Sites

The results for both pooled samples of **"control"**, **non-dredged**, **dredged** and **abandoned** dredge stations and for samples in relation to distance from the actively dredged Zone B site in July - August 2000 thus suggest the following:-

- The community is dominated by Polychaeta and Crustacea and is typical of shallow water deposits that are subject to natural disturbance. Such communities are well-adapted to rapid recolonisation and recovery.

- Within the variability of biological samples taken from sea bed sediments, there is no evidence of an impact from dredging directly or by the return of screened material on community composition as assessed by the species variety and abundance of macrofauna in the survey area.

- Averaged indices based on species variety and population density also show no impact of dredging either within the **dredged** site or in relation to distance along the sediment transport axis of sediment returned during the screening process compared with values for **"control"** stations.

- ***k***-dominance curves plotted for pooled samples from **"control"**, **non-dredged**, **abandoned** and **dredged** areas do show some evidence of increased dominance by some components of the macrofaunal community in **dredged** areas and in those potentially affected by sediment returned during the screening process, which had subsequently become incorporated into the natural bedload movement along the sediment transport axis.

- This impact appears to be mainly confined to samples taken within 500 m of the dredge site, with some evidence of an impact on numbers of individuals at distances of 1500 m or more to the south-east of the actively-dredged site.

- The statistical significance of this impact on community structure is open to doubt in view of the sample-to-sample variability in benthic macrofauna from marine deposits. However the possibility of an impact on the relative abundance of species within the dredge site, and for a distance of up to 1500 m cannot be excluded.

C.2.4. Impacts of Dredging on Biomass: Evidence of Recolonisation

In the previous section we have shown that there is little evidence of an impact of marine aggregate extraction on community composition of benthic invertebrates when assessed in terms of the species variety (***S***), population density (***N***) or indices that depend on them. This also supports what is known for many other shallow water deposits where the species comprise mobile "opportunists" that are well-adapted to recolonise deposits after episodic disturbance and mortality (for review see Newell *et al*, 1998). More recently, Desprez (2000) has reported full restoration of species richness in deposits of the eastern English Channel 16 months after cessation of dredging, although population density (***N***) remained 40% lower than that at reference stations for 28 months. Initial recolonisation is also reported to be rapid in North Sea deposits off the UK coast (Kenny & Rees, 1994, 1996) and eastern North Sea coasts (van Dalfsen *et al*, 2000).

Restoration of the biomass (***B***) of benthic communities is achieved by growth of the individuals following initial recolonisation and therefore takes longer than initial restoration of species variety and population density. Commonly a period of 2-4 years is reported for typical sands and gravels of the North Sea before the biomass of benthic communities is restored to pre-dredge levels (for review see Newell *et al*, 1988; also Desprez, 2000; van Dalfsen *et al*, 2000). In more stable deposits however there is a higher proportion of slow-growing "equilibrium species" that may require a longer period for restoration of both species composition and biomass. van der Veer *et al* (1985) reported long recovery times of as much as 15 years for benthos in low-dynamic environments such as the Danish Wadden Sea. More recently, a recovery time of at least 4-10 years has been reported for populations of the bivalve *Callista chione* at Costa Dauvada in the western Mediterranean (Strada, 1985; Manzanera *et al*, 1997; van Dalfsen *et al*, 2000).

We have recently shown that long-lived components of gravel deposits in the Eastern English Channel have a slow growth rate and an episodic recruitment (Newell *et al*, 2002; Newell & Seiderer, 2002). Estimates based on the size-frequency distribution and age structure of the dog cockle (*Glycymeris glycymeris*) suggest that individuals within the population are up to 14 years old, and appear to be recruited as juveniles following episodic settlement at intervals of approximately 5 years. Whilst many short-lived components of the community will recolonise and grow to adult size within a relatively short period of time, it is clear that long-lived species such as the dog cockle may take as much as 15-20 years for colonisation and subsequent restoration of biomass.

Because restoration of the biomass of macrofauna in marine deposits is a slower process than restoration of species variety and population density, the "foot-print" of impact on biomass is more likely to be a persistent feature of community structure than impacts on species variety or population density. The process of growth in relation to spatial gradients and time can be followed from estimates of the body size (***B*/*N***) of key faunal groups and the biomass of the benthic community as a whole.

C.2.4.1. Total Biomass of the Benthic Community

A thematic map showing the biomass (***B***)(g AFDW) per 0.1 m² Hamon Grab at each of the stations sampled in July - August 2000 is shown in Figure 22. This shows that there is a wide variation in the biomass of the macrofauna in the area surveyed. In general, sandy deposits are associated with lower biomass values that the mixed gravels and sands in the survey area, much as recorded for species diversity (***S***) and population density (***N***). This may reflect the presence of well-sorted fine sand mobilised by dredging and overboard screening within the licence areas, but is also likely to be associated with natural sand waves which occur extensively to the south-east of the survey area.

Inspection of Figure 22 also shows that the biomass of the actively-dredged Zone B was very low compared with that of the surrounding deposits. This is consistent with the well-known suppression of biomass recorded for dredged sites elsewhere (for review see Newell *et al*, 1998; also Desprez, 2000).

The biomass values in deposits that had not been dredged since 1999 show a less consistent pattern and are not dissimilar to the range of values recorded outside the boundaries of the dredged area. This suggests that the process of recovery, if not complete within 12 months, had allowed restoration of biomass values to within the limits of variability recorded for the survey area as a whole.

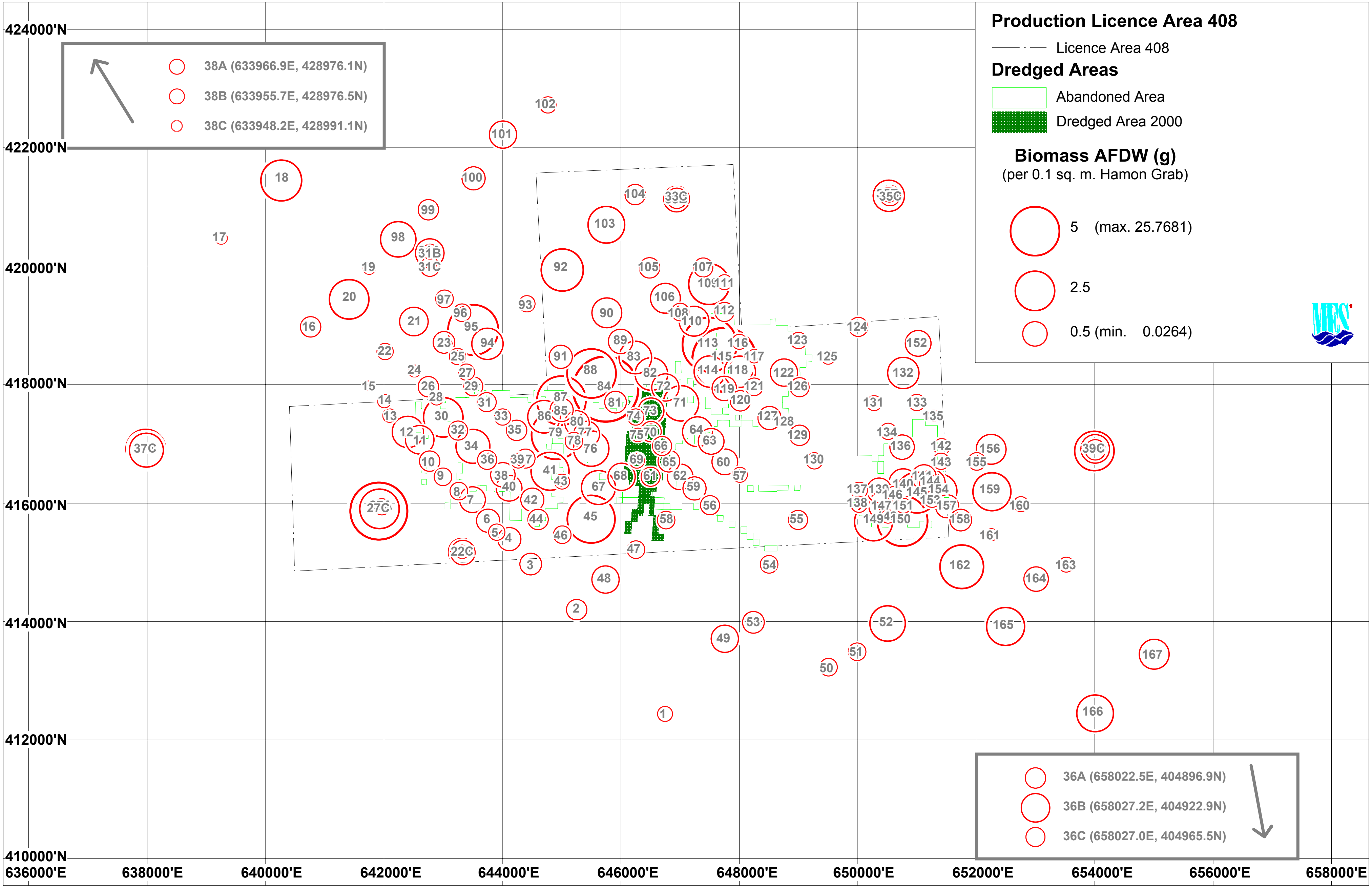


Figure 22. Map of the Licence Area 408 (Coal Pit) showing scaled thematic maps for the biomass (g AFDW) of macrofauna (>1mm) per 0.1 square metre in the area surveyed in July/August 2000. To access the MapInfo workspace, click the logo

Values for the biomass g AFDW of macrofauna per 0.1 m² Hamon Grab sample in the survey area in July - August 2000 are summarised in Figure 23 and Text Table 6.

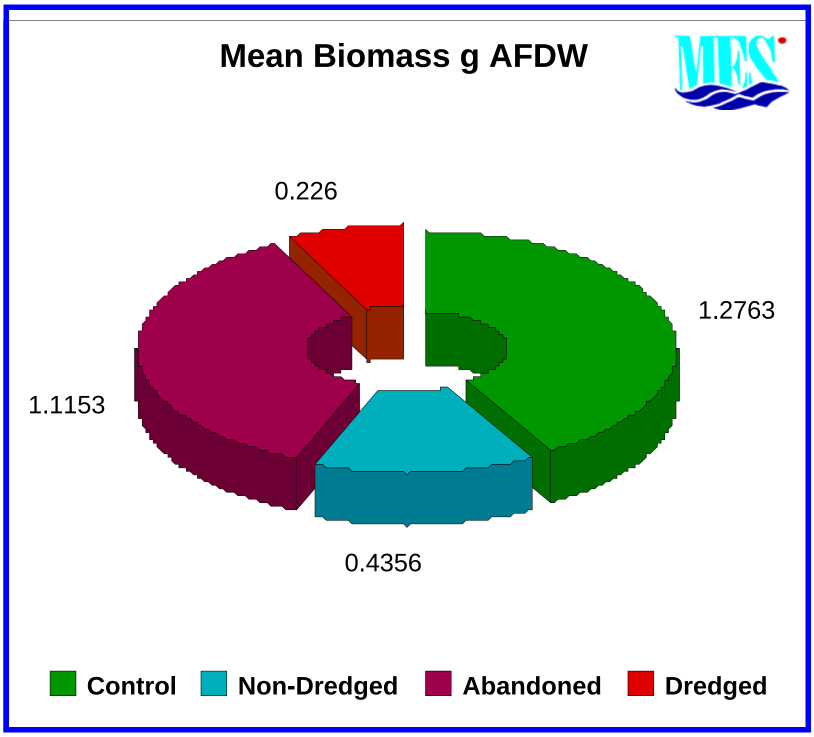


Figure 23. Diagram showing the mean biomass (g AFDW) per 0.1 m² grab sample in "control" stations, non-dredged stations, stations at which dredging had ceased (abandoned) and actively dredged stations in the survey area in July - August 2000.

Figure 23 shows that the **"control"** deposits supported an average biomass of 1.28 g AFDW per 0.1 m². The deposits of the **actively-dredged** area, in contrast, supported a mean biomass of only 0.23 g AFDW per 0.1 m². This represents a suppression of biomass by 82%, much as reported for many other sand and aggregate dredged sites (for review see Newell *et al*, 1998; Desprez, 2000). Dredge sites that had been **abandoned** for 12 months prior to the survey supported an essentially similar biomass to that of the **"controls"**. This suggests that restoration of the biomass in deposits at which dredging had ceased was accomplished within 12 months in the deposits of Area 408.

Of particular interest is that the **non-dredged** deposits which are potentially affected by deposition of screened material rejected from the dredge sites, also show a significant suppression of the biomass of macrofauna compared with that in **"control"** areas. Figure 23 shows that the mean biomass of the **non-dredged** deposits was 0.44 g AFDW per 0.1 m², a value that is only 65.6% of that in **"control"** areas well outside any likely impact of dredging within the Licence Area.

These results support those of Desprez (2000). He showed that significant differences existed between the sediment composition of a dredged area off Dieppe, France compared with that of the surrounding zone of deposition located 200 m outside the boundaries of the dredge site, and with a non-dredged reference area. As in the case of Area 408, there was an increase in fine sands in the deposition area compared with either the dredge area or a non-dredged reference area. The biomass of invertebrates was lower in the deposition area than in the dredge area, and this in turn was lower than in the non-dredged reference area. Presumably this reflects the patchy impact of the dredge head within the dredge site, in contrast to the more uniform impact resulting from the deposition and subsequent transport of sediment returned by the dredging process.

Desprez (2000) also reported that the benthic community in the near-site deposits located 200 m outside the dredge site off Dieppe, France was different from that within the dredge site, and was dominated by species characteristic of fine sands. Species included the bivalve *Tellina pygmaea* (29% of the community), and the polychaetes *Nephtys cirrosa* (22% of the community), *Scoloplos armiger* (3% of the community) and *Spiophanes bombyx*. Species characteristic of coarse sands comprised only 1% of the community and included the sea urchin (*Echinocyamus pusillus*) and the brittle star (*Amphipholis squamata*). Species characteristic of gravels were absent from the zone of sediment deposition surrounding the dredge site.

These results show that the impacts of deposition of material resulting from the dredging and screening processes can have a significant effect on the nature and abundance of benthic macrofauna, as well as on biomass. It is of interest, therefore to assess whether all types of macrofauna are uniformly affected or whether there is a different impact on some components of the community relative to others.

C.2.4.2. Contribution of Different Phyletic Groups to Total Biomass

Figure 24 shows the relative contribution of the different phyletic groups to the macrofaunal biomass in **non-dredged** areas, **dredged** areas, **"control"** areas and in areas at which dredging had ceased since 1999 (**abandoned**).

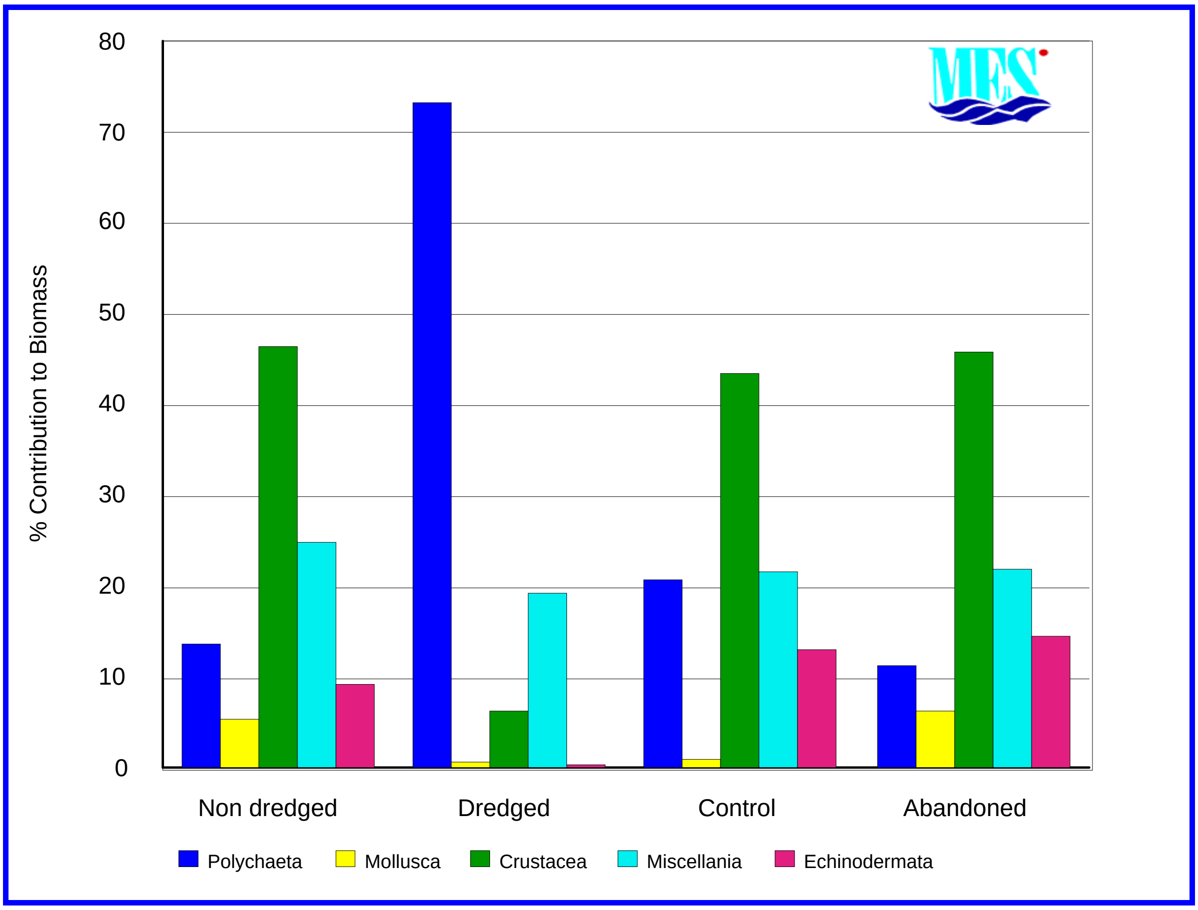


Figure 24. Histograms showing the relative contribution of different phyletic groups of macrofaunal biomass in non-dredged, dredged, "control" and abandoned dredge stations in the survey area in July - August 2000.

This shows several features of interest:-

- The relative contribution of the different faunal components to the total biomass of the macrofaunal community is essentially similar in **non-dredged** and **abandoned** deposits. This implies that restoration of biomass following cessation of dredging has been achieved in all faunal groups 12 months after cessation of dredging.
- The sandy deposits of the **"control"** areas have fewer Mollusca than the coarser deposits of the **non-dredged**, **dredged** and **abandoned** stations, but are otherwise similar in the relative contribution of other components of the fauna to the total biomass.
- The **dredged** area shows a relative increase in Polychaeta and "miscellania" groups but a major decline in the relative importance of Crustacea, Mollusca and Echinodermata.

We conclude that marine aggregate dredging has a significant impact on the biomass of benthic macrofauna within the boundaries of the actively dredged zone B at Area 408 at the time of our survey. This effect reflects a decrease in the proportion of relatively long-lived "equilibrium species" such as Crustacea, Mollusca and Echinodermata and a relative increase in the proportion of Polychaeta.

C.2.4.3. Body Size & Evidence of Recolonisation

The average body size of the main components of the benthic macrofauna can be used to track the growth and subsequent restoration of biomass of the benthos following cessation of dredging. It can be calculated from the biomass (***B***) and population density (***N***) values both for the total community as a whole and for it's component phyla.

A thematic map of the survey area showing the mean body size (***B/N***) for the macrofauna at each of the stations sampled in July - August 2000 is shown in Figure 25. This shows that the dredged Zone B is characterised by small individuals compared with non-dredged stations and those at which dredging had been abandoned since 1999. This no doubt reflects the active processes of recolonisation that evidently occur within the boundaries of the dredge site even whilst the area is being dredged for sand and gravel.

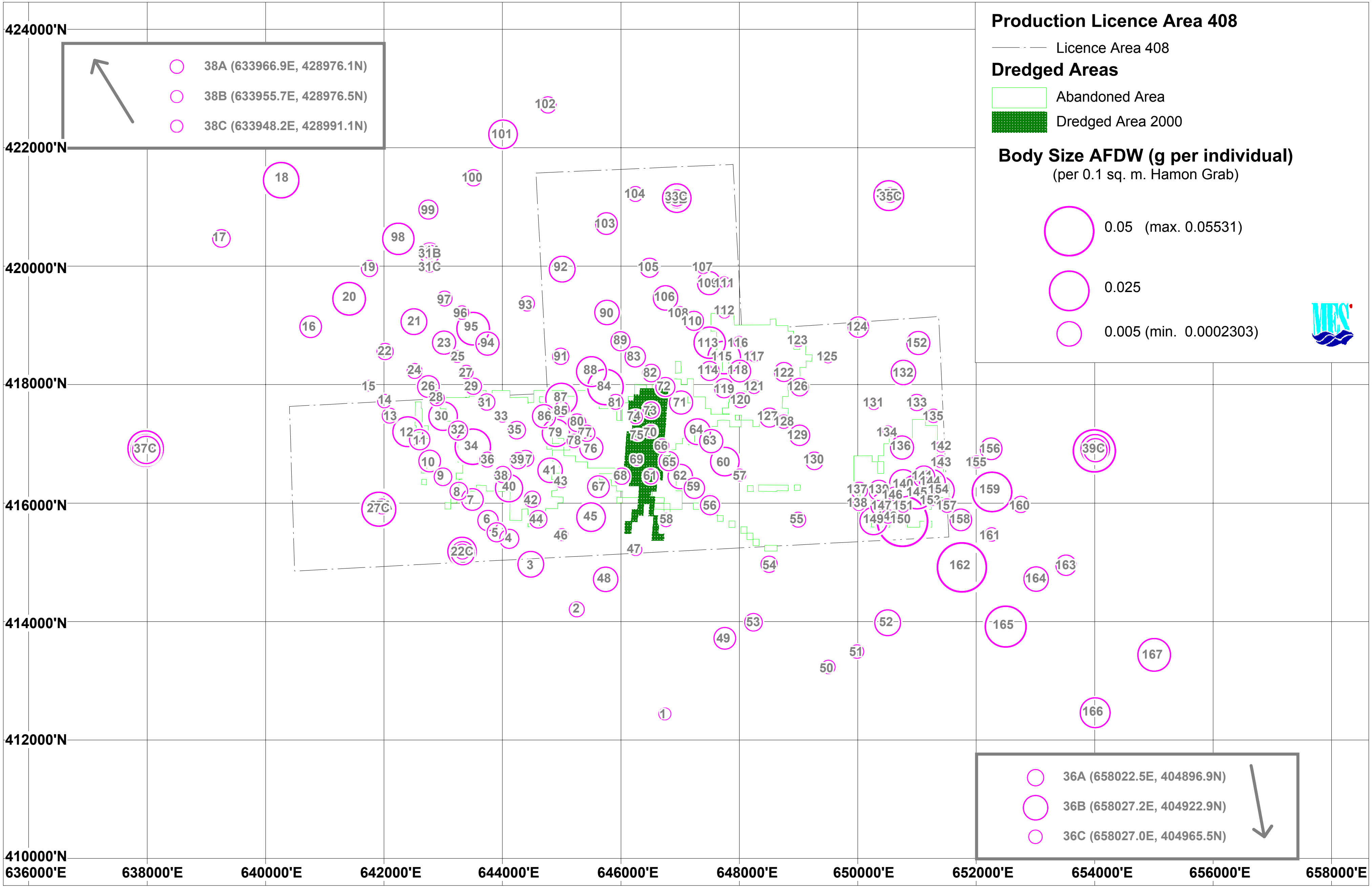


Figure 25. Map of the Licence Area 408 (Coal Pit) showing scaled thematic maps for the body size (g AFDW per individual) of macrofauna (>1mm) per 0.1 sq. m. in the area surveyed in July/August 2000. To access the MapInfo workspace, click the logo

Figure 26 shows a diagram for pooled samples from non-dredged areas, from dredged Zone B, in "control" areas well outside any potential impact of dredging, and from stations that had been abandoned since 1999 following dredging.

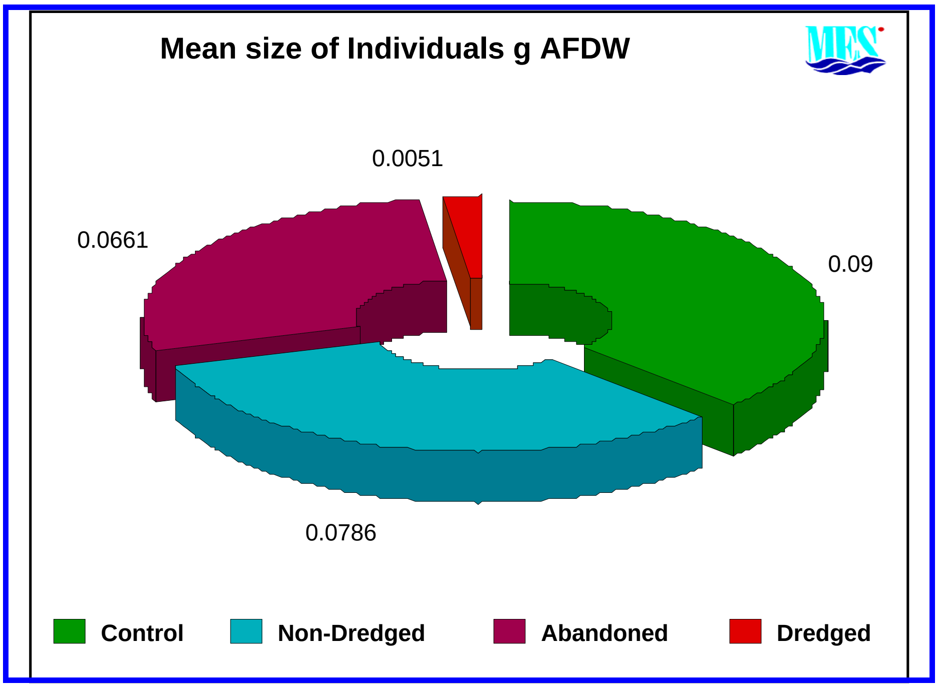


Figure 26. Diagram showing the mean size of individual (g AFDW) of macrofauna at "control" stations, non-dredged stations, those at which dredging had ceased (abandoned) and actively dredged stations within the survey area in July - August 2000.

Inspection of Figure 26 shows that the mean value for body size of the macrofauna in **"control"** stations was 0.09 g AFDW per 0.1 m²; that for previously dredged (**abandoned**) stations was 0.066 g AFDW per 0.1 m²; and that for **non-dredged** stations was 0.079 g AFDW per 0.1 m². In contrast, the mean size of the macrofauna in the actively **dredged** stations in July - August 2000 was only 0.005 g AFDW per 0.1 m². That is a suppression of body size by approximately 94% compared with that of the community in the adjacent deposits.

This supports the view that:-

- Marine aggregate dredging has a major impact on the body size of the macrofauna within the boundaries of an actively **dredged** site.
- Restoration of the mean body size in **abandoned** dredge stations was complete within 12 months after cessation of dredging.
- There is no significant impact of dredging on the mean body size of macrobenthos in deposits adjacent to the dredge site where deposition of material rejected during the screening process might be expected. The suppression of biomass recorded in this zone thus appears to reflect a decrease in the numbers of macrofauna, rather than the presence of small individuals.

C.2.4.4. Impacts on Different Faunal Components

Values for the mean body size (g AFDW) of each of the component faunal groups are plotted as histograms in Figure 27.

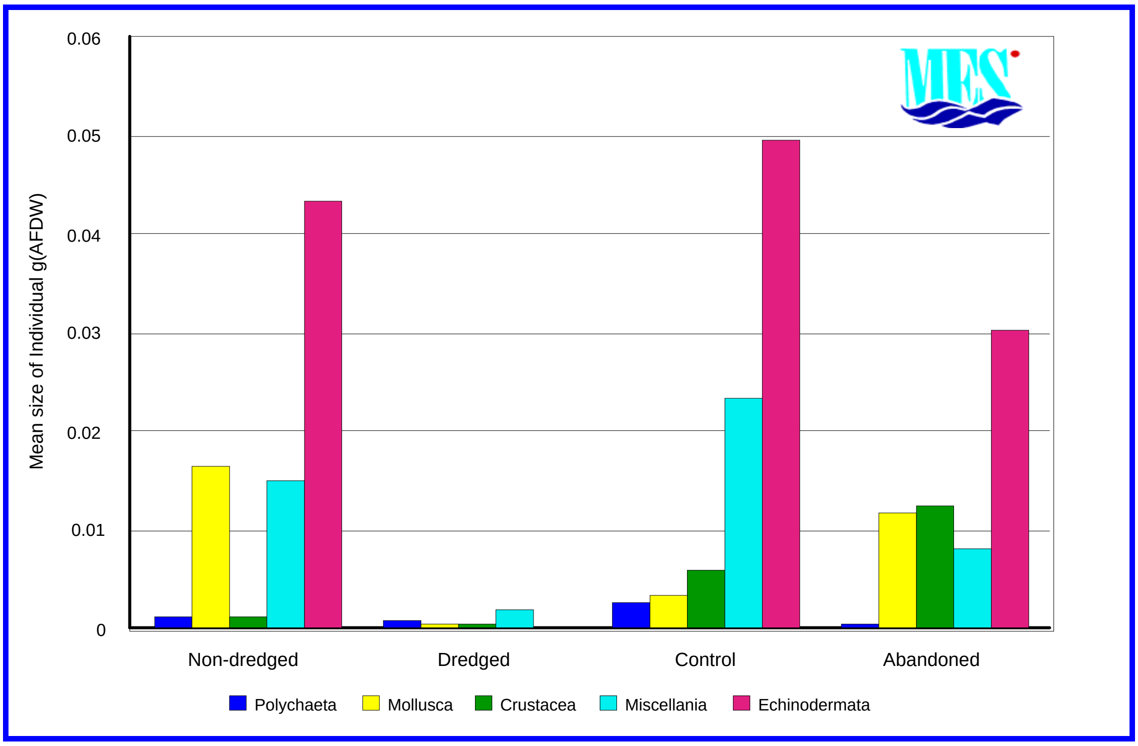


Figure 27. Histograms showing the mean size of individuals (g AFDW) of the different faunal groups in non-dredged stations, dredged stations, "control" stations and abandoned stations in the survey area in July - August 2000.

Inspection of Figure 27 shows that despite the large numerical contribution of the Polychaeta to the population density of the macrofauna (see Figure 8) they are represented by individuals of small body size. In contrast, Echinodermata, miscellaneous groups and to a lesser extent Mollusca, are represented by relatively larger individuals. It is also clear that the dredged Zone B is characterised by small individuals of all faunal groups.

Dredging at the levels of aggregate production recorded for dredge Zone B up to August 2000 thus has a major impact on mean body size of the macrofauna. This reflects the active process of recolonisation which occurs within the **actively-dredged** site which is evidently characterised by larval-juvenile species of a similar community composition to that which occurs in the surrounding deposits.

C.2.4.5. Impact on Biomass outside the Boundaries of the Dredged Area

We have shown that the **non-dredged** deposits outside the boundaries of the dredged site show a suppression of biomass by approximately 34% compared with that in **"control"** areas, or in **abandoned** areas where dredging had ceased for approximately 12 months prior to our survey in July - August 2000 (see Figure 23). We have presented evidence which suggests that there are some impacts of dredging on the relative composition of the macrofauna along the sediment transport axis from material returned by screening within the actively **dredged** site. The evidence suggests that this impact occurs mainly within 500 m of the dredge site, but that there may be impacts on community structure and biomass up to 1500 m to the south-east of the site of dredging.

The extent of impact of dredging on the biomass of benthic macrofauna can be investigated from pooled data for stations extending along the axis of the tidal streams through the actively-dredged zone B, and through stations at which dredging had ceased. Figure 28 shows histograms for the mean biomass of macrofauna (g AFDW) per 0.1 m² calculated for pooled samples (transect 1, 3 & 4, Figure 16) extending both north-west and south-east beyond the boundaries of the **abandoned** dredged stations and on each side of the **actively-dredged** site (transect 2, Figure 16).

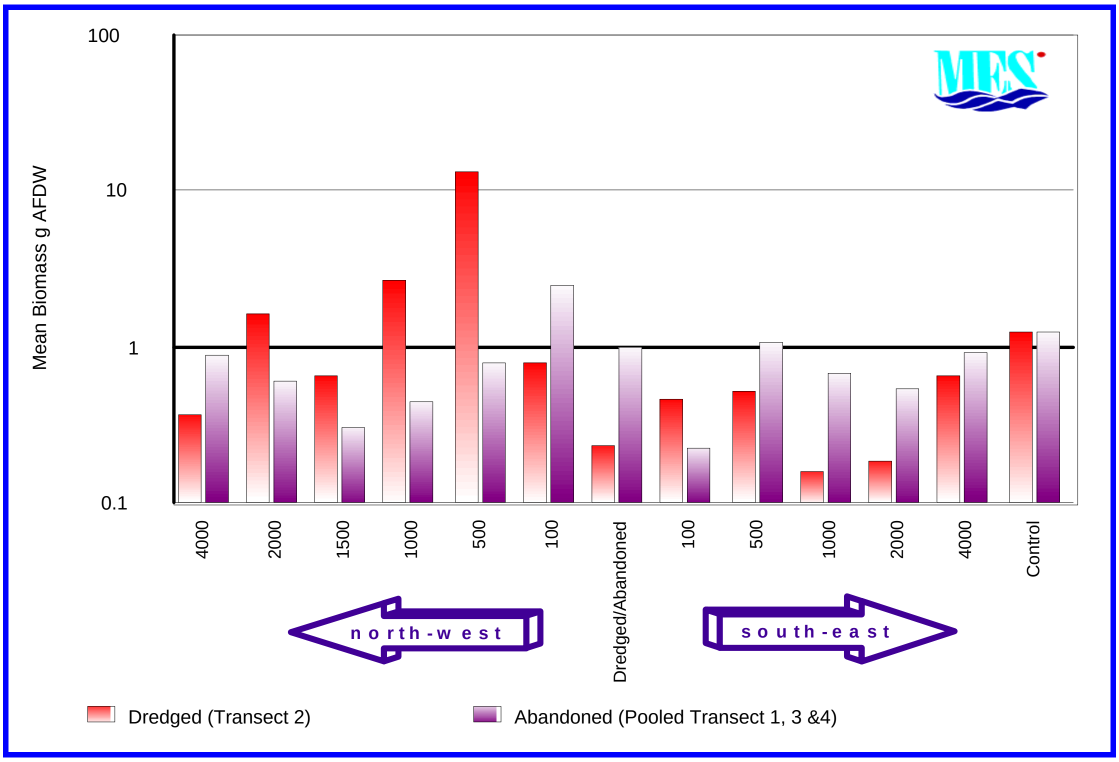


Figure 28. Histograms showing the mean benthic biomass (g AFDW per 0.1 m²) at a series of stations extending north-west and south-east along the axis of dispersion of material rejected from an actively dredged site and at pooled stations which had been abandoned (based on Appendix Table 9).

Several features emerge from inspection of Figure 28 (see also Appendix Table 9):-

1. The mean biomass of the actively dredged site was lower than that of the abandoned area where the biomass approached that of "control" stations. This confirms the conclusion that biomass is restored in the deposits within 12 months of the cessation of dredging.
2. The biomass of macrofauna in deposits to the north-west of the actively dredged area remains suppressed compared with either controls or those close to abandoned dredge stations 100 m outside the boundary of the dredged site.
3. The suppression of benthic biomass beyond the boundaries of the actively-dredged area appears to be asymmetrical, with significant suppression extending for less than 500 m to the north west but for at least 2000 m (and probably as much as 4000 m) to the south-east compared with the transect for stations at which dredging had ceased.
4. This closely reflects the asymmetry in tidal flows around Area 408 (see Section C.1.3.) which in turn strongly influences net sediment transport. It suggests that the transport of fine sands mobilised by the dredging and screening processes has a direct impact on the biomass of marine invertebrates outside the boundaries of the dredge site. A similar impact of mobile sediments in transit across the sea bed has been reported for benthic communities in the English Channel by Holme & Wilson (1985).
5. The observed impact on benthos to the north-west of the dredged area is not inconsistent with net sediment movement to the south-east. Although the residual movement is associated with the south-east flood, the north-westerly ebb still has the ability to move fine sediment - particularly where local currents are altered by changing sea bed topography.
6. At a distance of 500 m to the north-west of the actively dredged site, the biomass of benthic invertebrates is over 10-fold that recorded close to abandoned dredge stations. This enhancement of biomass remains at distances up to 2000 m to the north-west of the actively dredged site. An enhancement of benthos close to the boundaries of dredge sites has been reported by Poiner & Kennedy, (1984) and in a recent study of the macrobenthos close to a dredge site at North Nab to the east of the Isle of Wight (Newell *et al*, 2002; Hitchcock *et al*, 2002; see also www.marineecologicalsurveys.co.uk). These results are consistent with enrichment by organic matter released either during the settlement of material from the screening process (see Newell *et al*, 1999) or during the subsequent transport of organic matter in a benthic boundary layer plume, similar to that reported for a dredge site at Area 107 off Skegness (Dickson & Rees, 1998), and for the Owers Bank (Hitchcock *et al*, 2002; see also Newell & Seiderer, 2002). We do not have information on whether the biomass of benthos is enhanced beyond the zone of suppression at distances greater than 4000 m to the south-east of the dredge site.

C.2.4.6. Summary of Impacts on the Biomass of Benthic Macrofauna

The impact of marine aggregate dredging on the biomass of benthic macrofauna at Area 408 may therefore be summarised as follows:-

1. Dredging within the Zone B dredge site is associated with a major reduction in the biomass of benthic macrofauna.

2. **Dredged** areas are characterised by uniformly small individuals. This reflects the active process of recolonisation which results in restoration of species variety and population densities achieved within the dredged site at the aggregate production levels recorded in Area 408 up to August 2000.

3. Benthic biomass appears to be restored to that characteristic of the surrounding deposits within 12 months after cessation of dredging.

4. Benthic biomass is somewhat suppressed in **non-dredged** deposits, compared with that in **"control"** areas well outside the boundaries of likely impact of dredging activity in Area 408. This suggests that there is an impact from sediment released by the screening process beyond the boundaries of the **actively dredged** area, over and above the effects of natural sediment transport from north-west to south-east through the survey area.

5. The zone of suppression of biomass can extend for as much as 2000-4000m outside the boundary of the dredge area to the south-east, but is associated with a suppression for <500 m to the north-west.

6. There is evidence of an enhancement of benthic biomass at distances >500 m to the north-west consistent with an enrichment of the benthos from organic matter released either from the water column or from benthic boundary plumes associated with the dredging and screening processes. Whether an enhancement of biomass occurs at distances greater than 4000 m beyond the zone of suppression to the south-east of the **actively dredged** site is not known.

D. CONCLUSIONS.

1. The results that have been presented above suggest that the macrofauna in the deposits of the survey area at Production Licence Area 408 comprise a wide variety of components, many of which are "opportunistic" species capable of a rapid rate of recolonisation and recovery following disturbance.

2. We have been unable to detect any impact through dredging or the deposition of material returned to the sea bed during the screening process on the mean species variety or population density of benthic invertebrates in the survey area. Values summarised in Text Table 7 show that both species variety and population density were similar in **dredged** stations, stations at which dredging had been **abandoned** for up to 12 months, **non-dredged** stations situated outside the boundaries of the dredged area where sediment released by the screening process potentially could be transported, and in **"control"** areas well beyond the boundaries of potential impact of dredging at Production Licence Area 408.

3. In contrast, dredging within the Production Licence Area has a major impact on the biomass of marine invertebrates. These are suppressed by as much as 82% within the **actively-dredged** zone and by 34.4% in the **non-dredged** surrounding deposits that are likely to be affected by fine sands released by the dredging and screening processes.

4. The mean body size of individuals within the **dredged** site is less than 1% of that in **"control"**, **non-dredged** and **abandoned** dredge-sites. This reflects the presence of relatively small colonising individuals in the dredged area. In contrast, the suppression of biomass recorded outside the boundaries of the actively dredged site evidently reflects a relative suppression of species variety and numbers of macrofauna that are of a similar size to those in other parts of the survey area.

Text Table 7. Table showing the mean number of species, individuals, biomass g(AFDW) and size of individual g(AFDW) per 0.1m^2 Hamon Grab sample. Samples were taken in and adjacent to Production Licence Area 408 Coal Pit during July - August 2000. **n**=the number of samples taken.

	Mean No. of Species	Mean No. of Individuals	Biomass g(AFDW)	Mean Body Size per Individual g(AFDW)	n
Control	41	185	1.2763	0.09	18
SD	16	111.6	1.8636	0.1843	
Non-Dredged	37	233	0.4356	0.0786	115
SD	12.9	201	0.2769	0.2289	
Abandoned	41	258	1.1153	0.0661	52
SD	12.7	175	1.9976	0.1668	
Dredged	45	293	0.226	0.0051	8
SD	6.8	120.7	0.1642	0.0057	

5. The zone of suppression of biomass extends for up to 500 m to the north-west of the actively dredged Zone B and for 2000-4000 m to the south-east. This reflects the net residual sediment transport to the south-east.

6. Beyond the zone of suppressed biomass to the north-west, the biomass of benthic macrofauna is high compared with that elsewhere in the survey area. This may reflect enhancement by organic matter released from the dispersing plume, and is consistent with what is known from direct studies on the zone of dispersion and settlement of sediment returned during screening at other sites in UK waters. We do not have any information on whether the biomass of benthic invertebrates is enhanced beyond the boundaries of suppression at a distance of 4000 m to the south-east of the actively dredged area.

7. Deposits where dredging had ceased for approximately 12 months (**abandoned**) supported a similar biomass to that in the **"control"** areas, indicating a recovery of biomass within the 12 month period since dredging ceased. This accords with the time taken for obliteration of trailer-dredge furrows recorded on sonographs for the area at the time of our survey (see Section C.1.3.). From the similarity of species diversity and population density of the **actively-dredged** zone with deposits elsewhere in the survey area, it appears that recolonisation is sufficiently rapid to be in equilibrium with the rate of loss by trailer dredging at the production rates recorded for August 2000. Whether the rate of replenishment of species and population density would remain in equilibrium with the rate of removal of macrofauna by dredging at the higher production rates recorded at Area 408 in 1998 is unknown.

8. Restoration of the biomass by growth of the individuals can only occur after recolonisation and restoration of population density. Hence it is not surprising to find that the **actively-dredged** deposits have a low biomass comprising small (newly colonised) animals.

9. The evidence suggests that restoration of species composition and population density is accomplished rapidly even within the boundaries of the trailer-dredged area. Restoration of biomass appears to be substantially complete within 12 months after cessation of dredging at Area 408.

10. It should be pointed out that whilst the rapid restoration of community structure by active recolonisation of the deposits by mobile "opportunistic" species from the surrounding deposits is characteristic of shallow marine environments, subject to the influences of tide and wave action, these results described for North Sea Area 408 should not be applied uncritically to other areas. At higher levels of aggregate production, for example, it is probable that the rate of removal of macrofauna by dredging may exceed the rate of recolonisation. Again, where the deposits are stable, as in deeper waters or where the deposits are coarse, the biological community is represented by long-lived and slow-growing components which have a slow rate of reproduction (for review see Newell *et al*, 1998). These "*k*-strategists" or "equilibrium species" may take longer to recover both species variety and population density and for the biomass to be restored by growth of the individuals. In such areas a "footprint" of impact on species variety, population density and biomass might be anticipated within both actively dredged sites, and also the zone of deposition/transport of sediment returned during the screening process even at relatively lower rates of dredging. The size of "footprint" of impact on species variety and population density may thus reflect the equilibrium between recolonisation rates for a particular habitat type and dredging intensity.

11. We regard our results showing the rapid rate of recolonisation and restoration of community structure at Production Area 408 as probably typical of shallow water sites such as occur elsewhere in the North Sea and eastern English Channel. Studies on a heavily screened production licence area in deeper water, where disturbance by waves and tidal currents is low, are necessary to establish the extent to which the results we have obtained can be generally applied to other production licence areas.

Acknowledgements

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Appendix to:-

IMPACT OF MARINE AGGREGATE DREDGING & OVERBOARD SCREENING ON BENTHIC BIOLOGICAL RESOURCES IN THE CENTRAL NORTH SEA.

PRODUCTION LICENCE AREA 408 COAL PIT.

Appendix Tables 1 - 9 on pages i - xxxiv

Appendix 1. Outline of Collection and Quality Assurance Procedure.

1. Collection of the samples was carried out by Marine Ecological Surveys staff, all of whom have B.Sc. or higher degrees in Marine Science. The sampling programme was supervised by our Managing Director, Dr.R.C.Newell B.Sc., Ph.D., D.Sc.

2. All positions were checked with the ship's navigational officer at the time of collection of the samples and careful notes entered into a Field Note book which contained the following information: Fix number, position of sample, time of sample, depth of water, volume of sample taken and type of deposit. In the event that insufficient material was collected for proper evaluation of the macrofauna, the supervising scientist specified repeat samples to be taken.

3. The field staff were responsible for careful labelling of the sealed vessels for the samples, for addition of formalin and for collection of sediment samples. The labelling and addition of formalin was checked at each station by the supervising scientist before moving to the next sampling station.

4. A series of photographs of each sample taken, together with representative steps in the survey procedure are included in our standard survey protocol.

5. Following completion of the survey, the sealed samples are carefully checked against the Field notes and transported to the relevant laboratory for analysis. In the case of the biological samples, the vessels are checked on arrival at the laboratory by our senior analyst J.E.Robinson B.Sc. Records are kept of the date of separation, date of analysis and a complete list of the macrofauna recorded in each sample. The signed Laboratory Notebook is kept as a record and can be made available to clients as required.

6. Separation and analysis of the macrofauna was carried out by Marine Ecological Surveys Ltd staff, one of whom is currently the only person in UK accredited for marine macrofaunal analysis through the Natural History Museum IdQ scheme. A Reference collection is kept for uniformity of analysis, and the complete sample from each station is kept preserved in alcohol for validation and use by the client as required. Macrofauna samples are kept for 4 months after completion of analysis, or longer on request by the client.

7. The data from the Field and Laboratory Notebooks are then compiled into final data sheets for analysis of community composition. All data are double checked with two staff before entering to tables for analysis and are cross-checked with printouts from the navigational system to ensure that the positions entered into the final Report are correct.

8. All signed Field Log Books, Laboratory Records and the original extracted samples of macrofauna from each sample site are available for inspection or validation after presentation of the Report.

9. The Report is authored by Dr.R.C.Newell, Dr L.J.Seiderer, Ms.N.M.Simpson and Mr.J.E.Robinson with an evaluation of the results in relation to other surveys and the work of others. The Report is prepared with a complete list of relevant literature and is in a form that is suitable for peer review and publication as required.

Appendix Table 2. Navigational positions in OSGB 36 of research stations for benthic analysis covering the Production Licence Area 408 - Coal Pit taken on the 29th July- 1st August 2000. Also shown is the depth at which the sample was taken (metres), the volume of sediment retrieved (litres) and comments on the type of deposit. **BACK**

Station #	Navigational position (OSGB)		Depth (metres)	Volume (litres)	Type of Deposit
	Easting	Northing			
1	646741.2	412477.6	32.0	8	sand
2	645251.9	414240.8	30.0	8	sand
3	644473.7	415009.7	30.0	8	sand
4	644112.9	415434.8	28.1	8.5	sand
5	643900.7	415544.6	28.0	9	sand
6	643753.4	415745.9	29.0	8.5	sand
7	643491.2	416102.2	29.0	8	sand
8	643259.7	416239.4	27.0	8	sand & mud
9	642991.8	416483.7	29.0	8	sand
10	642767.5	416747.4	28.1	4	sand
11	642602.1	417111.2	27.0	9	sand
12	642399.9	417250.0	25.4	8	sand
13	642093.2	417509.4	25.6	1	stones & sand
14	642003.3	417756.2	24.9	6	sand
15	641742.3	418015.0	25.1	3	gravel, sand & clay
16	640759.6	419015.4	25.0	9	sand & clay
17	639248.7	420504.3	25.1	8	sand
18	640261.6	421508.2	25.2	9	coarse sand & gravel
19	641752.5	419998.3	24.5	7	sand
20	641405.2	419502.8	26.2	8	sand
21	642502.6	419107.5	27.0	9	sand
22	642013.3	418595.9	24.2	9	sand
23	643011.6	418753.1	25.0	3	sand
24	642511.9	418263.9	23.9	3	sand
25	643236.4	418508.6	23.9	6	sand & boulder
26	642747.4	418003.7	23.1	8	sand
27	643387.5	418245.1	24.0	8	sandy gravel, boulders & silt
28	642885.3	417805.4	23.0	1	sand
29	643503.8	418009.4	22.5	5	stones & sand
30	642996.4	417512.1	22.7	8	stones & sand
31	643732.4	417741.3	21.8	6	sandy gravel
32	643250.2	417260.0	23.0	3	sandy gravel & stones
33	643999.2	417489.7	21.5	9	sand & gravel
34	643496.0	417009.4	23.7	8	sand & gravel
35	644237.9	417269.7	21.0	8.5	sand & gravel
36	643739.7	416766.2	25.0	8	gravel & sand
37	644388.8	416790.6	23.0	9	sand & gravel
38	644003.1	416517.3	26.0	9	sand & fine gravel
39	644263.6	416752.7	25.9	3	gravel, stones & sand
40	644108.4	416294.9	28.2	9	sand
41	644802.5	416594.3	24.6	9	gravel & sand
42	644500.1	416100.5	27.9	8	sand & gravel
43	645002.7	416397.9	25.2	2	gravel & sand
44	644600.6	415764.1	28.2	9	sand
45	645491.1	415804.5	27.2	2	muddy sand
46	645005.6	415505.1	27.7	9	sand & gravel
47	646249.1	415250.2	30.5	8	sand & gravel
48	645738.1	414752.6	29.6	8	shelly sand
49	647753.4	413754.0	31.0	8	sand
50	649500.2	413267.9	27.5	9	gravel, stones & sand
51	649985.0	413526.9	28.0	7	cobbles, sand & gravel
52	650502.7	414026.9	26.2	8.5	Sand
53	648233.8	414026.4	30.0	8.5	muddy sand & stones
54	648499.8	415001.4	29.5	8	sand & fine gravel
55	648988.4	415752.4	27.1	9	sand & fine gravel
56	647502.7	416002.7	30.7	6	sand
57	648004.6	416510.9	27.4	8	sand

Station #	Navigational position (OSGB)		Depth (metres)	Volume (litres)	Type of Deposit
	Easting	Northing			
58	646759.4	415748.3	30.8	8	sand
59	647237.9	416292.0	30.4	8	sand
60	647752.8	416740.1	29.2	8	sand & silt
61	646499.1	416481.4	29.1	4	muddy sand
62	646996.9	416490.0	31.2	8	sand
63	647520.3	417090.8	29.2	9	sand & gravel
64	647291.7	417251.8	30.0	9	gravelly sand
65	646805.6	416746.4	31.4	9	sand & stones
66	646694.4	417000.3	29.4	6	sand & stones
67	645618.0	416313.2	28.6	8	sand & gravel
68	646007.7	416488.4	27.0	8	sandy gravel
69	646265.0	416749.7	27.3	9	gravel
70	646507.8	417247.4	27.2	8	sand
71	647012.5	417741.3	28.3	2	muddy sand & gravel
72	646749.6	417999.2	29.3	7	sandy gravel
73	646505.9	417607.2	26.2	9	muddy sand & gravel
74	646247.3	417489.9	25.4	8.5	sandy gravel
75	646285.2	417184.4	26.2	9	sand & gravel
76	645498.0	416976.5	24.4	8	sandy gravel
77	645420.4	417213.1	24.4	9	muddy sand & gravel
78	645201.7	417080.8	23.8	9	sandy, muddy, gravel
79	644900.5	417229.8	23.9	9	sandy, muddy, gravel & stones
80	645253.1	417394.1	23.9	9	sandy, muddy, gravel
81	645908.2	417739.7	24.9	9	sandy gravel & stones
82	646509.0	418232.3	25.4	9	sandy gravel & stones
83	646240.2	418510.7	22.4	8.5	muddy gravel
84	645739.5	418016.4	22.8	6.5	muddy sand & boulders
85	644994.4	417617.4	20.2	9	muddy gravel & sand
86	644698.6	417509.6	20.0	9	sand & gravel
87	644990.8	417808.1	21.4	9	gravel
88	645499.7	418263.6	24.3	9	muddy sand & gravel
89	645991.0	418771.9	22.9	9	sand & gravel
90	645758.6	419255.4	24.3	9	sand & gravel
91	644978.8	418512.5	24.3	9	sandy gravel
92	645005.2	419997.8	26.3	8	sandy gravel
93	644410.4	419398.4	26.5	9	muddy sand & gravel
94	643742.4	418736.9	26.1	9	muddy sand, clay & gravel
95	643499.3	418995.4	26.4	3	muddy sandy gravel
96	643312.6	419249.0	26.1	9	muddy sand & gravel
97	643019.3	419486.0	25.8	8	sand & stones
98	642237.5	420509.5	25.5	5	sand
99	642745.1	420993.6	26.1	8	sand
100	643508.6	421506.0	25.4	7.5	sand & gravel
101	644007.1	422265.5	25.1	9	sand
102	644764.0	422757.3	24.2	8	sand
103	645754.4	420754.3	23.4	8.5	gravel and sand
104	646238.1	421248.0	23.1	8	gravel & sand
105	646482.2	420009.8	23.7	8.5	sand & gravel
106	646749.8	419502.7	22.6	8.5	sand & gravel
107	647390.8	420016.8	21.9	8	muddy sand & gravel
108	646996.3	419261.8	23.2	9	sand & gravel
109	647484.1	419758.7	22.1	9.5	sand & gravel
110	647230.5	419114.8	22.7	9	sandy gravel
111	647742.7	419761.5	22.9	8	sandy gravel
112	647748.0	419265.0	22.2	9	sandy gravel
113	647495.5	418756.4	22.4	3.5	muddy gravel
114	647495.7	418270.2	25.7	6	muddy gravel
115	647740.5	418512.1	23..0	9	sandy gravel
116	647997.0	418754.9	24.3	9	sandy gravel
117	648249.4	418513.3	21.9	4.5	sandy gravel
118	648002.6	418263.2	22.3	8	sandy gravel

Station #	Navigational position (OSGB)		Depth (metres)	Volume (litres)	Type of Deposit
	Easting	Northing			
119	647740.7	417977.0	22.7	5	sandy gravel
120	648016.8	417766.6	24.2	8	sandy gravel
121	648244.6	417997.5	25.0	8	sandy gravel
122	648752.8	418248.7	23.1	9	sandy gravel & stones
123	648995.0	418779.4	23.4	9	sandy gravel
124	650007.0	419012.8	23.6	8	sand
125	649498.0	418493.7	23.9	9	sand & gravel
126	649013.7	417993.5	23.7	4	muddy sand, gravel & clay
127	648507.2	417483.1	27.2	8	sand
128	648748.8	417409.2	28.0	2	sand
129	649014.5	417185.2	26.8	8.5	sand
130	649265.6	416750.6	30.2	8	muddy sand
131	650269.2	417719.7	24.2	9	sandy gravel
132	650763.2	418243.7	24.5	8	sand & gravel
133	650993.2	417732.6	25.2	8	sand
134	650507.1	417248.7	24.8	8	sandy gravel
135	651276.2	417506.5	25.8	3	sand
136	650741.8	416984.7	25.5	8	sand
137	650020.2	416251.6	25.4	8.5	sand
138	650018.6	416018.5	27.5	8	sandy gravel
139	650353.0	416253.5	25.9	8.5	sand
140	650764.2	416379.8	26.8	8.5	sand
141	651112.0	416477.3	25.0	9	sand
142	651412.2	416988.2	23.4	9	gravel & sand
143	651403.5	416740.6	23.9	8.5	gravel & sand
144	651256.1	416393.1	25.3	8.5	sand
145	650995.4	416241.2	25.6	8	sand
146	650610.3	416189.1	25.5	8	sand
147	650422.0	416002.1	25.7	8	sand
148	650508.0	415809.6	26.4	8	sand
149	650264.8	415742.0	26.7	8.5	sand & gravel
150	650749.1	415768.5	26.9	8	sand
151	650764.3	415987.1	26.1	6	sand
152	651018.6	418748.2	26.9	8	sand
153	651252.9	416100.8	26.7	9	sandy gravel
154	651384.9	416250.8	25.9	8	sand
155	652006.0	416739.5	23.8	9	sand & gravel
156	652249.3	416949.3	25.1	8.5	sand
157	651505.5	415991.3	27.3	9	sand & gravel
158	651733.8	415748.6	25.7	8.5	sand
159	652263.7	416251.0	25.2	9	sand
160	652748.7	416013.6	24.0	8	sand
161	652259.2	415505.4	24.7	8	sand
162	651752.4	414990.2	25.4	8.5	sand
163	653515.0	414990.5	22.8	8.5	sand
164	653005.6	414753.4	22.6	8.5	sand
165	652491.5	413978.8	24.7	8.5	sand
166	654004.4	412507.1	24.6	9	sand
167	655002.5	413489.2	22.9	8	sand
31A	642771.9	420273.5	25	8.5	boulders & sand
31B	642769.9	420260.0	25	8	sand & gravel
31C	642771.7	420027.0	25	9	sandy gravel
33A	646942.6	421186.1	22.6	7	stones, gravel & sand
33B	646944.0	421182.8	22.4	8	gravel & sand
33C	646940.0	421187.6	22.2	2	gravel & sand
35A	650528.4	421239.7	21.9	9	sandy gravel
35B	650517.8	421235.9	22.6	8	sandy gravel
35C	650543.0	421230.0	21.6	9	gravelly sand
27A	641959.9	415973.5	27.9	7	gravelly sand
27B	641920.4	415967.2	27.9	2	gravelly sand
27C	641908.7	415948.9	27.9	8	sandy gravel & stones

Station #	Navigational position (OSGB)		Depth (metres)	Volume (litres)	Type of Deposit
	Easting	Northing			
22A	643315.2	415222.1	28.3	8.5	sand
22B	643317.8	415210.0	28.3	8	sand
22C	643324.5	415201.2	28.3	8.5	sand
36A	658022.5	404896.9	24	8	sandy gravel
36B	658027.2	404922.9	23.9	8	muddy, sandy gravel
36C	658021.0	404965.5	23.6	9	muddy, sandy gravel
37A	637977.8	416947.2	30.1	8	muddy gravel & sand
37B	637974.3	416977.1	30.2	8	muddy gravel & sand
37C	637984.0	416941.5	30.1	9	muddy sand
38A	633966.9	428976.1	26.0	3	sand
38B	633955.7	428976.5	26.1	6	sand
38C	633948.2	428991.1	26.2	1.5	sand
39A	654003.3	416953.2	24.2	8.5	sand
39B	653990.6	416943.9	24.5	8	sand
39C	654008.0	416939.4	24.5	9	sand

Appendix Table 3. Table summarising the Particle Size Distribution by wet sieving method. The sieve apertures are to BS 1377 (part 2: 1990) standards are shown in mm. The actual percentage retained by each sieve are shown for each station sampled in Production Licence Area 408- Coal Pit benthic survey carried out in July - August 2000. **BACK**

Station	**Sieve Aperture (mm)**													
	75	50	37.5	20	10	5	2	1.18	0.6	0.43	0.30	0.21	0.15	0.063
1	0.0	0.0	0.0	4.3	14.3	7.5	4.7	6.9	9.2	18.3	15.9	14.7	2.9	1.4
2	0.0	0.0	0.3	0.6	3.2	5.7	3.4	6.8	8.4	23.2	44.4	2.8	1.0	0.4
3	0.0	0.0	0.0	0.0	0.1	0.5	1.0	5.2	13.8	46.3	28.6	2.6	1.0	1.0
4	0.0	0.0	0.0	0.0	0.5	2.2	3.5	8.3	8.6	20.2	33.1	19.5	2.5	1.6
5	0.0	0.0	0.0	0.0	0.1	0.4	1.2	6.8	12.0	25.7	34.6	16.1	1.9	1.2
6	0.0	0.0	0.0	0.0	0.2	1.0	1.6	4.2	3.9	13.6	41.6	30.4	2.5	0.9
7	0.0	0.0	0.1	0.2	0.4	0.5	1.3	3.6	3.1	14.1	44.4	26.0	3.6	2.8
8	0.0	0.0	0.0	0.6	0.5	0.5	0.8	4.1	4.9	17.8	60.7	6.4	2.2	1.4
9	0.0	0.0	0.0	0.0	0.2	0.5	1.6	2.9	3.7	10.5	71.3	6.1	2.1	1.1
10	0.0	0.0	0.0	0.0	0.3	0.3	0.6	1.6	2.1	8.7	48.0	32.4	3.5	2.5
11	0.0	0.0	0.0	0.1	1.0	2.6	16.5	27.9	9.0	9.4	24.4	6.0	2.0	1.1
12	0.0	0.0	3.1	7.1	5.8	2.0	2.5	12.1	9.0	14.3	38.4	4.0	1.0	0.7
14	0.0	0.0	0.0	0.0	0.5	1.0	1.5	5.1	7.3	19.7	55.5	6.2	1.3	1.9
15	0.0	0.0	2.4	4.4	7.9	8.0	2.7	4.4	4.0	28.0	34.2	1.7	0.9	1.3
16	0.0	0.0	0.6	0.2	1.3	4.2	2.8	8.3	11.0	20.4	25.8	14.4	1.8	9.1
17	0.0	0.0	0.0	0.1	0.3	1.2	1.5	5.5	12.2	29.5	35.7	10.7	2.1	1.2
18	0.0	0.0	0.0	1.5	4.2	15.5	19.8	13.4	6.2	15.4	13.5	7.8	1.7	0.9
19	0.0	0.0	0.0	0.0	0.1	0.4	1.5	10.2	14.6	33.4	31.4	5.3	1.9	1.1
20	0.0	0.0	0.3	4.9	7.8	7.6	11.2	20.8	6.8	10.6	8.6	2.8	1.3	17.4
21	0.0	0.0	0.0	1.3	2.2	3.8	7.3	25.3	19.3	17.0	9.9	9.5	3.2	1.1
22	0.0	0.0	0.0	0.0	0.2	0.8	1.6	4.9	6.4	30.4	45.2	7.0	2.1	1.3
23	0.0	0.0	0.0	1.4	4.2	4.5	2.5	4.9	7.2	26.9	22.6	22.2	2.4	1.3
24	0.0	0.0	0.0	0.4	1.5	3.0	2.6	7.0	9.5	38.6	20.4	13.9	2.2	0.9
25	0.0	0.0	6.0	3.6	9.0	3.7	1.4	3.4	5.3	15.2	23.2	25.7	2.2	1.4
26	0.0	0.0	0.0	0.0	0.5	1.1	1.7	6.5	12.2	41.3	19.8	13.2	2.6	1.3
27	0.0	0.0	9.6	10.1	5.0	3.1	1.1	3.2	4.8	14.3	20.8	22.9	2.5	2.6
28	0.0	0.0	0.0	0.0	1.3	3.4	4.1	8.7	10.1	33.7	30.4	5.6	2.2	0.4
29	0.0	0.0	12.4	5.3	3.3	2.6	1.8	4.5	7.4	19.9	31.4	7.3	3.2	1.0
30	0.0	0.0	7.4	12.6	9.0	4.5	1.6	2.7	3.9	19.2	29.8	6.3	1.8	1.3
31	0.0	0.0	3.6	19.4	25.3	11.1	3.1	4.8	6.4	10.3	10.7	3.6	1.5	0.2
33	0.0	0.0	4.2	11.4	16.7	14.3	3.2	3.2	2.8	6.3	14.4	20.3	1.6	1.8
34	0.0	7.7	0.8	7.1	2.8	0.9	0.8	4.9	13.6	36.5	12.6	9.5	1.9	0.8
35	0.0	0.0	5.1	15.3	12.7	15.4	5.6	4.7	4.7	10.8	16.6	7.3	1.1	0.7
36	0.0	0.0	16.8	27.0	11.9	3.8	2.8	4.1	5.5	14.4	7.2	5.8	0.7	0.1
37	0.0	0.0	0.0	7.2	6.2	5.4	6.4	11.0	10.6	24.0	19.2	8.1	1.5	0.4
38	0.0	0.0	2.2	5.5	7.8	6.4	6.7	11.1	12.5	19.7	17.4	7.6	2.4	0.7
39	0.0	0.0	12.6	28.0	14.3	5.4	4.4	6.2	3.5	7.2	8.8	7.8	1.4	0.5
40	0.0	0.0	0.0	0.0	0.6	2.9	3.6	9.5	14.6	36.8	21.8	7.4	1.7	1.0
41	0.0	0.0	7.6	22.7	28.9	11.6	2.4	2.9	2.8	5.4	10.2	4.2	1.2	0.2
42	0.0	0.0	3.1	14.1	15.5	4.0	2.8	5.2	5.1	15.4	13.7	18.1	2.3	0.7
43	0.0	0.0	9.1	19.5	24.6	8.5	2.2	2.2	2.1	5.1	8.2	14.8	3.2	0.3
44	0.0	0.0	1.9	4.4	3.4	3.1	3.1	8.0	13.9	34.4	20.0	5.0	1.9	1.0
45	0.0	0.0	0.0	19.4	8.2	1.9	1.1	2.7	4.0	9.6	13.7	32.9	4.9	1.5
46	0.0	0.0	4.0	31.1	16.3	11.3	4.5	7.2	5.2	7.9	10.5	0.5	0.6	0.8
47	0.0	0.0	3.3	12.6	14.2	6.3	12.6	5.4	5.7	34.7	1.1	2.9	0.0	1.1
48	0.0	0.0	0.0	0.2	5.8	8.0	6.4	19.0	17.3	36.1	0.0	2.7	1.2	3.2
49	0.0	0.0	0.2	6.4	5.9	8.2	7.3	8.8	7.7	18.9	29.7	1.4	0.4	5.1
50	0.0	9.0	20.3	11.7	11.0	7.7	3.6	7.3	5.7	16.2	2.5	3.5	0.4	1.0
51	0.0	0.0	11.4	11.8	17.7	15.4	5.2	6.7	4.5	4.0	17.4	3.1	1.4	1.3
52	0.0	0.0	0.0	0.9	8.9	29.3	8.8	9.1	7.2	27.2	3.1	3.7	0.5	1.2
53	0.0	0.0	12.5	10.1	6.8	5.4	4.3	6.7	6.4	29.4	5.1	9.5	1.1	2.7
54	0.0	0.0	0.0	2.9	4.9	1.1	1.1	3.8	9.0	57.3	5.2	8.3	1.8	4.5
55	0.0	0.0	0.0	0.0	4.7	11.6	8.1	10.7	8.3	29.1	18.1	4.7	1.5	3.2
56	0.0	0.0	0.0	0.1	0.6	2.1	1.7	4.4	7.1	62.6	5.0	10.6	2.5	3.4
57	0.0	0.0	0.0	0.0	0.1	5.9	8.2	20.9	17.2	21.6	13.5	5.4	6.3	0.9
58	0.0	0.0	0.0	1.2	0.9	1.4	5.3	5.0	14.7	60.7	1.6	6.4	1.2	1.7
59	0.0	0.0	0.0	1.4	1.5	3.9	2.2	6.4	18.5	47.7	15.7	0.8	0.0	1.9
60	0.0	0.0	0.4	0.1	0.2	10.0	6.7	16.7	14.6	38.5	1.7	3.8	4.5	2.6
61	0.0	0.0	0.0	12.9	29.6	13.4	2.3	3.0	2.9	12.1	4.6	14.7	1.5	2.9

Station	Sieve Aperture (mm)													
	75	50	37.5	20	10	5	2	1.18	0.6	0.43	0.30	0.21	0.15	0.063
62	0.0	0.0	0.0	0.1	0.6	1.0	1.2	4.3	8.1	65.2	5.4	11.1	2.1	0.8
63	0.0	0.0	4.5	3.9	12.9	8.0	5.1	6.2	8.3	29.0	18.7	1.1	1.1	1.2
64	0.0	9.7	13.7	10.9	10.8	7.8	3.5	5.9	8.8	16.9	8.3	1.9	0.9	0.9
65	0.0	0.0	4.2	12.6	13.0	3.9	2.1	5.6	7.7	31.9	4.9	11.0	1.6	1.5
66	0.0	0.0	0.0	6.1	16.8	9.1	1.0	2.4	4.3	13.2	19.4	23.3	2.8	1.6
67	0.0	0.0	1.0	16.5	22.1	5.3	2.3	3.1	2.6	11.1	34.0	1.2	0.3	0.6
68	0.0	0.0	13.1	14.8	23.7	14.2	3.2	2.1	4.4	20.2	0.4	0.9	0.7	2.2
69	0.0	0.0	13.7	16.7	22.4	18.2	4.0	3.2	3.1	5.1	5.6	5.2	1.6	1.1
70	0.0	6.8	0.0	0.5	7.3	10.4	3.1	4.6	6.6	16.0	23.0	18.6	1.1	2.1
71	0.0	0.0	0.0	11.2	22.7	12.5	2.0	3.1	4.3	22.4	17.6	1.2	0.5	2.4
72	0.0	0.0	25.7	17.9	14.5	11.3	2.5	3.1	2.4	11.6	2.4	6.5	1.2	1.0
73	0.0	0.0	11.2	9.8	15.9	12.8	2.4	4.1	4.2	9.1	25.8	1.3	0.5	2.9
74	0.0	0.0	4.7	5.0	16.8	16.9	7.2	7.1	6.7	31.8	2.3	0.3	0.2	1.0
75	0.0	0.0	3.2	6.4	17.0	21.8	6.9	7.9	5.8	8.3	12.6	5.6	1.9	2.7
76	0.0	6.0	18.2	17.9	24.0	16.4	3.1	1.8	1.7	9.6	0.2	0.0	0.1	1.1
77	0.0	0.0	2.3	3.6	14.8	10.6	3.0	3.3	5.0	17.9	28.3	6.3	2.2	2.6
78	0.0	0.0	9.6	14.7	21.8	17.0	3.4	2.1	2.2	9.3	14.1	2.2	0.5	3.1
79	16.1	3.9	12.7	21.1	15.5	8.8	2.0	1.2	1.0	4.4	9.2	1.8	0.8	1.5
80	14.9	0.0	2.5	13.9	19.4	15.0	4.2	3.4	5.1	15.4	2.1	3.7	0.2	0.3
81	33.4	0.0	0.8	4.5	7.9	6.4	2.3	2.8	3.1	12.1	23.4	0.9	0.6	2.0
82	0.0	0.0	3.9	26.8	26.0	16.7	2.8	2.6	3.4	8.1	4.0	3.9	1.0	0.8
83	0.0	0.0	13.3	15.1	14.4	5.0	10.6	4.6	3.8	26.4	0.6	2.8	0.7	2.7
84	0.0	0.0	2.4	24.3	26.2	9.9	3.4	3.2	3.9	12.5	10.5	1.3	0.8	1.6
85	0.0	22.5	6.3	11.9	20.1	15.1	6.6	5.9	3.0	3.1	1.3	2.0	0.9	1.2
86	24.8	0.0	5.3	12.8	16.2	8.9	3.0	2.5	2.2	8.7	11.6	2.7	0.5	0.8
87	0.0	7.5	10.3	18.5	20.1	12.9	2.5	2.5	2.9	7.7	10.5	1.9	0.7	2.1
88	0.0	16.3	8.8	5.8	12.9	10.0	3.2	2.3	2.3	8.4	22.2	3.1	2.0	2.7
89	0.0	0.0	12.5	14.1	19.4	14.3	3.0	4.0	8.4	16.1	2.5	1.6	0.3	3.9
90	0.0	0.0	9.2	12.9	12.5	6.7	2.1	3.8	8.0	26.8	7.3	5.9	1.2	3.6
91	0.0	0.0	14.4	10.1	16.8	17.5	4.9	3.9	4.1	13.4	6.1	7.1	0.3	1.5
92	0.0	10.3	9.9	23.6	13.0	8.7	3.1	4.0	4.6	15.6	1.9	3.4	0.7	1.3
93	0.0	0.0	30.8	10.6	10.1	7.8	4.2	6.4	6.1	18.1	0.0	1.3	0.5	4.0
94	0.0	0.0	7.5	15.2	15.9	10.1	2.7	3.2	2.8	8.9	19.5	5.3	2.4	6.3
95	0.0	0.0	2.7	10.5	14.4	15.5	4.2	5.2	4.1	5.9	16.8	13.2	6.0	1.3
96	0.0	10.0	8.5	13.7	14.7	17.4	5.6	7.1	5.6	5.7	3.7	6.2	1.3	0.4
97	0.0	0.0	20.1	3.9	9.3	6.0	2.3	2.8	4.0	15.5	23.4	8.0	2.9	1.6
98	0.0	0.0	7.3	2.7	4.7	5.3	3.4	6.8	7.6	17.9	37.9	3.7	1.4	1.2
99	0.0	0.0	0.0	7.5	11.2	6.0	2.0	3.7	6.8	26.2	29.8	2.8	1.4	2.6
100	0.0	0.0	0.0	4.7	25.5	29.5	8.4	5.2	4.7	10.9	7.4	1.7	1.0	0.9
101	0.0	0.0	0.0	0.0	0.4	1.4	3.0	14.1	18.5	31.0	24.3	4.4	1.4	1.5
102	0.0	0.0	0.0	0.0	1.3	1.5	1.5	4.8	10.3	37.7	37.7	2.1	1.8	1.3
103	0.0	0.0	6.0	14.3	17.6	10.4	2.1	2.5	2.9	12.4	17.2	10.5	1.6	2.5
104	0.0	19.7	6.6	7.9	12.0	9.4	3.2	3.8	5.3	12.3	6.4	11.9	0.6	0.8
105	0.0	0.0	7.6	1.9	5.5	5.1	2.2	3.8	6.0	21.8	37.8	5.4	1.4	1.5
106	0.0	0.0	7.5	9.2	7.5	5.0	2.1	5.3	10.2	28.3	17.2	5.4	1.5	0.9
107	0.0	0.0	2.9	13.7	26.8	10.5	5.6	6.0	8.4	7.7	7.7	8.7	0.9	1.2
108	0.0	20.9	3.5	11.9	15.3	10.0	3.6	4.6	4.7	8.0	11.1	4.9	0.8	0.8
109	0.0	0.0	2.9	17.1	27.8	10.6	3.2	3.8	5.8	11.0	11.2	4.3	1.3	0.9
110	0.0	0.0	7.5	13.1	25.4	13.6	3.9	4.7	4.0	5.7	10.3	9.2	1.5	1.1
111	0.0	0.0	3.0	27.5	29.2	10.6	4.5	6.5	4.5	2.4	5.5	4.8	0.5	0.9
112	0.0	0.0	2.7	20.1	24.5	12.5	2.9	5.1	6.6	11.4	10.6	2.4	0.5	0.7
113	0.0	0.0	5.0	23.5	16.4	8.1	2.5	4.8	4.6	5.2	19.7	5.3	2.8	2.2
114	0.0	0.0	5.3	16.9	18.3	11.4	8.1	5.9	6.0	8.1	12.4	4.1	2.2	1.2
115	0.0	0.0	6.5	19.2	18.0	7.3	2.0	5.2	4.8	5.7	19.0	8.3	2.7	1.0
116	0.0	0.0	1.8	8.0	12.2	19.1	10.2	12.3	7.6	8.2	11.4	7.4	1.0	1.0
117	0.0	0.0	18.1	25.2	11.8	7.4	4.4	7.3	4.5	5.1	12.5	1.8	1.1	0.8
118	0.0	0.0	2.5	16.0	26.2	14.6	4.7	9.3	8.1	5.5	6.2	5.3	1.3	0.5
119	0.0	0.0	8.0	15.7	14.5	11.4	9.0	10.8	10.5	7.5	4.6	5.6	1.8	0.7
120	0.0	0.0	8.8	19.7	16.6	6.2	5.4	9.6	10.5	9.6	5.6	6.4	1.1	0.5
121	0.0	0.0	9.9	18.3	19.5	13.4	7.3	11.4	5.9	3.2	4.5	5.1	0.9	0.6
122	0.0	15.7	6.9	13.2	17.9	14.3	4.2	3.7	2.9	4.8	11.7	3.0	0.8	0.9
123	0.0	0.0	5.3	10.0	22.6	14.7	4.5	6.4	6.1	10.9	10.0	6.8	2.1	0.6
124	0.0	0.0	0.0	0.3	0.4	1.6	0.8	1.7	3.4	18.4	56.2	13.6	2.2	1.5
125	0.0	0.0	2.6	9.2	18.0	18.8	3.8	3.7	4.2	10.8	25.4	1.2	1.6	0.6
126	0.0	0.0	0.0	7.9	16.2	15.0	3.6	2.7	2.7	7.0	21.0	20.7	2.6	0.6
127	0.0	0.0	0.0	3.1	2.1	3.1	4.7	10.9	16.1	29.6	19.0	6.8	2.5	2.0

Station	Sieve Aperture (mm)													
	75	50	37.5	20	10	5	2	1.18	0.6	0.43	0.30	0.21	0.15	0.063
128	0.0	0.0	0.0	0.0	1.9	1.9	3.1	4.2	7.9	27.6	32.4	16.6	2.7	1.7
129	0.0	0.0	0.0	0.0	0.1	0.3	0.9	4.2	10.2	26.3	45.2	8.9	2.4	1.6
130	0.0	0.0	0.0	0.0	2.6	6.3	4.2	3.3	4.5	9.8	56.8	6.8	3.7	2.0
131	0.0	17.3	8.4	19.4	20.2	11.0	1.8	1.1	1.0	3.2	9.8	4.9	1.0	0.8
132	0.0	2.4	3.4	6.0	8.4	16.1	14.3	16.3	12.5	10.8	6.6	1.4	1.0	0.9
133	0.0	0.0	0.0	0.0	0.1	0.4	1.0	7.1	12.3	39.6	33.5	3.2	1.5	1.4
134	0.0	0.0	12.5	15.8	19.1	13.8	3.7	3.2	3.4	6.2	19.6	1.7	0.6	0.5
135	0.0	0.0	0.0	10.0	3.7	2.7	1.7	4.8	5.0	24.5	36.1	8.0	1.9	1.6
136	0.0	0.0	0.0	0.0	0.1	0.5	0.8	15.5	27.7	32.1	15.2	5.1	1.4	1.5
137	0.0	0.0	0.0	0.0	0.1	3.5	8.7	19.8	18.9	30.8	13.9	1.4	1.9	1.0
138	0.0	0.0	0.0	0.2	5.6	43.6	8.4	6.7	7.7	20.1	0.7	5.4	0.9	0.8
139	0.0	0.0	0.0	0.0	1.7	1.0	3.7	14.5	19.7	42.2	13.1	1.3	1.7	1.0
140	0.0	0.0	0.0	0.0	0.0	0.4	4.1	17.0	26.5	35.1	9.1	3.7	2.6	1.5
141	0.0	0.0	0.0	1.0	1.7	1.2	5.6	21.0	19.0	23.4	17.9	2.1	2.5	4.5
142	30.5	0.0	4.8	16.3	13.4	11.2	2.5	2.2	2.0	4.4	9.1	2.3	0.5	0.8
143	0.0	0.0	11.2	15.6	13.2	10.6	2.0	4.5	4.7	13.4	20.3	1.3	1.5	1.8
144	0.0	0.0	0.0	0.9	1.8	0.5	1.3	4.8	8.2	29.8	36.2	11.1	2.1	3.2
145	0.0	0.0	0.0	0.0	1.2	0.4	3.4	15.7	25.4	31.7	14.2	2.9	0.5	4.6
146	0.0	0.0	0.0	0.0	0.2	0.8	3.3	12.3	22.6	42.5	9.7	3.7	2.2	2.7
147	0.0	0.0	0.0	0.0	0.1	3.0	10.1	20.5	19.0	29.0	12.2	2.0	2.2	1.8
148	0.0	0.0	0.0	0.0	0.0	1.3	4.0	17.3	23.8	33.0	12.0	4.7	2.6	1.1
149	0.0	0.0	0.0	1.5	4.2	10.8	6.9	6.7	6.4	8.0	4.5	2.5	1.9	46.7
150	0.0	0.0	0.0	0.2	0.2	1.1	4.8	20.3	23.1	26.5	15.9	3.9	1.8	2.2
151	0.0	0.0	0.0	6.3	3.5	2.0	5.7	18.0	17.9	27.4	9.4	5.5	1.8	2.4
152	0.0	0.0	0.0	0.2	0.2	0.2	1.4	6.4	12.6	35.6	34.6	2.0	2.8	4.1
153	17.6	0.0	3.0	7.1	12.5	6.1	5.5	6.9	6.4	16.3	12.7	3.6	0.7	1.6
154	0.0	0.0	0.0	7.5	15.1	5.0	6.5	10.4	10.0	18.2	18.1	5.8	1.8	1.4
155	0.0	0.0	0.0	5.5	20.9	19.1	5.4	5.7	3.1	7.6	19.4	7.2	1.8	4.4
156	0.0	0.0	0.0	0.0	0.6	11.2	19.1	25.3	16.4	11.2	10.1	2.2	2.3	1.7
157	0.0	0.0	0.0	0.6	10.7	21.6	15.6	10.0	6.6	7.6	12.9	4.8	4.3	5.4
158	0.0	0.0	0.0	0.0	0.0	0.1	0.4	3.5	12.7	32.7	30.5	15.9	2.2	1.9
159	0.0	0.0	0.0	0.5	0.1	0.2	0.2	1.1	25.7	54.5	13.5	1.5	0.7	2.0
160	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.8	12.2	30.8	40.2	8.5	2.2	4.1
161	0.0	0.0	0.0	0.0	0.0	0.1	1.5	10.9	20.6	34.5	23.5	5.4	2.3	1.2
162	0.0	0.0	0.0	0.1	0.0	0.9	1.6	8.3	20.5	43.0	17.7	4.3	1.8	1.8
163	0.0	0.0	0.0	0.0	0.1	0.5	0.8	3.2	8.0	53.7	28.4	2.1	1.1	2.2
164	0.0	0.0	0.0	0.0	0.9	5.8	11.3	14.7	17.1	35.2	7.6	3.5	1.6	2.3
165	0.0	0.0	0.0	0.8	0.3	3.0	4.7	9.5	11.7	34.0	23.2	6.1	2.4	4.3
166	0.0	0.0	0.0	0.6	5.9	18.9	9.2	11.7	9.4	16.5	16.9	6.4	2.3	2.0
167	0.0	0.0	0.0	0.0	0.8	1.3	1.3	2.3	5.0	22.9	58.6	4.5	1.3	2.0
22A	0.0	0.0	0.7	0.3	0.2	0.6	1.3	4.0	5.9	17.0	63.5	3.5	1.2	1.7
22B	0.0	0.0	0.0	0.0	0.0	0.8	4.0	10.9	10.5	18.7	49.6	3.6	0.9	1.0
22C	0.0	0.0	0.0	0.0	0.1	0.9	2.3	4.0	4.5	12.0	68.6	5.4	0.9	1.4
27A	0.0	0.0	13.4	18.6	18.6	10.8	3.2	3.7	4.1	9.0	15.4	2.1	0.7	0.5
27B	0.0	4.4	13.4	20.4	19.3	13.3	3.8	4.1	3.3	3.9	7.0	5.7	1.0	0.3
27C	0.0	0.0	0.7	15.4	14.6	12.2	3.6	4.3	3.4	6.3	27.2	9.6	1.6	1.1
31A	0.0	0.0	0.0	7.0	19.2	11.0	5.2	7.6	7.9	17.9	14.8	7.1	1.6	0.7
31B	0.0	0.0	1.1	6.4	18.6	15.9	7.2	10.3	8.4	12.6	11.9	5.2	1.8	0.6
31C	0.0	0.0	0.3	6.2	27.5	14.3	6.1	7.8	5.9	8.9	17.5	3.7	0.9	0.8
33A	0.0	3.1	23.3	11.2	9.6	8.5	2.5	4.4	4.9	8.5	16.3	1.8	0.7	5.1
33B	7.0	3.4	19.8	13.6	11.9	7.3	2.1	3.4	5.0	8.6	16.1	0.6	0.2	0.8
33C	0.0	0.0	16.1	22.2	14.4	8.8	2.2	2.9	3.3	6.0	9.8	11.7	2.0	0.5
35A	0.0	4.5	10.6	10.5	18.3	10.9	4.0	4.1	5.8	13.1	15.6	1.6	0.2	1.0
35B	0.0	5.9	13.1	10.9	18.7	9.3	3.2	4.6	6.9	14.3	9.6	2.2	0.4	0.9
35C	0.0	2.5	2.0	7.8	11.9	13.7	7.1	9.8	9.8	14.8	12.4	5.6	1.7	0.9
36A	0.0	3.4	10.9	13.6	20.7	12.5	2.1	2.5	3.4	6.7	8.9	9.3	0.5	1.5
36B	10.6	8.2	22.5	13.1	14.6	12.3	1.8	1.6	1.9	3.0	3.6	4.6	1.1	1.0
36C	0.0	19.9	16.2	13.7	16.2	14.1	2.1	2.1	1.9	3.7	6.7	2.2	0.7	0.5
37A	0.0	3.6	5.5	6.7	12.7	11.4	4.9	6.7	6.2	12.2	23.9	2.0	0.4	3.9
37B	0.0	0.4	4.0	5.8	17.9	16.0	8.1	8.9	6.6	10.0	13.9	3.0	2.3	3.2
37C	0.0	9.0	9.0	6.1	12.9	9.6	4.6	6.0	5.3	9.5	13.6	4.9	2.9	6.7
38A	0.0	0.0	0.0	0.2	1.6	0.8	0.5	0.8	1.1	2.9	85.9	4.4	0.9	1.0
38B	0.0	0.0	0.0	3.8	1.5	0.9	0.6	0.7	0.7	2.2	83.3	4.1	0.7	1.7
38C	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.9	0.9	2.3	81.0	11.5	1.1	1.6
39A	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	3.6	27.7	47.6	15.9	2.2	2.4

Station	Sieve Aperture (mm)													
	75	50	37.5	20	10	5	2	1.18	0.6	0.43	0.30	0.21	0.15	0.063
39B	0.0	0.0	0.0	0.0	0.1	0.1	0.3	11.5	28.7	37.7	18.5	0.1	0.9	2.1
39C	0.0	0.0	0.0	0.0	0.1	0.1	0.3	11.5	28.7	37.7	18.5	0.1	0.9	2.1

Appendix Table 4. Table summarising the percentage silt (<0.063mm), sand (0.063mm-5mm) and gravel (5mm-75mm) of sediments for each station sampled in Production Licence Area 408- Coal Pit benthic survey carried out in July - August 2000. for benthic analysis covering the Princes Channel survey area in February 2002. **BACK**

Station	% silt	% sand	% gravel
1	1.4	72.5	26.1
2	0.4	89.9	9.8
3	1.0	98.5	0.5
4	1.6	95.6	2.7
5	1.2	98.3	0.5
6	0.9	97.9	1.2
7	2.8	96.1	1.1
8	1.4	96.9	1.6
9	1.1	98.2	0.7
10	2.5	96.9	0.5
11	1.1	95.3	3.7
12	0.7	81.3	18.0
14	1.9	96.7	1.4
15	1.3	76.0	22.7
16	9.1	84.5	6.3
17	1.2	97.2	1.6
18	0.9	77.9	21.2
19	1.1	98.4	0.5
20	17.4	62.0	20.6
21	1.1	91.5	7.3
22	1.3	97.6	1.1
23	1.3	88.6	10.1
24	0.9	94.2	4.9
25	1.4	76.4	22.2
26	1.3	97.1	1.6
27	2.6	69.6	27.8
28	0.4	94.9	4.7
29	1.0	75.4	23.5
30	1.3	65.2	33.5
31	0.2	40.4	59.4
33	1.8	51.7	46.5
34	0.8	79.9	19.3
35	0.7	50.7	48.6
36	0.1	40.5	59.4
37	0.4	80.8	18.8
38	0.7	77.3	22.0
39	0.5	39.3	60.2
40	1.0	95.5	3.5
41	0.2	29.1	70.7
42	0.7	62.5	36.7
43	0.3	37.9	61.7
44	1.0	86.2	12.8
45	1.5	69.0	29.5
46	0.8	36.4	62.8
47	1.1	62.4	36.5
48	3.2	82.8	14.0
49	5.1	74.1	20.8
50	1.0	39.2	59.8
51	1.3	42.3	56.4
52	1.2	59.6	39.2
53	2.7	62.5	34.8
54	4.5	86.6	8.9
55	3.2	80.4	16.4
56	3.4	93.8	2.8
57	0.9	93.0	6.1
58	1.7	94.8	3.5
59	1.9	91.3	6.8
60	2.6	86.6	10.8
61	2.9	41.2	55.9
62	0.8	97.5	1.7
63	1.2	69.5	29.3
64	0.9	46.2	52.9
65	1.5	64.8	33.8
66	1.6	66.4	32.0
67	0.6	54.5	44.9
68	2.2	31.9	65.9
69	1.1	27.9	71.1
70	2.1	72.9	25.0
71	2.4	51.3	46.4
72	1.0	29.7	69.3
73	2.9	47.4	49.8
74	1.0	55.6	43.3
75	2.7	49.0	48.4
76	1.1	16.5	82.4
77	2.6	66.0	31.4
78	3.1	33.8	63.0
79	1.5	20.4	78.1
80	0.3	34.0	65.7
81	2.0	45.1	52.9
82	0.8	25.8	73.4
83	2.7	49.5	47.8
84	1.6	35.5	62.9
85	1.2	22.9	76.0
86	0.8	31.2	68.0
87	2.1	28.7	69.2
88	2.7	43.4	53.9
89	3.9	35.8	60.3
90	3.6	55.1	41.4
91	1.5	39.7	58.8
92	1.3	33.3	65.5
93	4.0	36.7	59.4
94	6.3	45.0	48.7
95	1.3	55.6	43.1
96	0.4	35.2	64.3
97	1.6	59.0	39.4
98	1.2	78.9	20.0
99	2.6	72.6	24.7
100	0.9	39.4	59.7
101	1.5	96.6	1.9
102	1.3	95.9	2.8
103	2.5	49.1	48.3
104	0.8	43.6	55.7
105	1.5	78.3	20.1
106	0.9	70.0	29.1
107	1.2	44.9	53.9
108	0.8	37.7	61.5
109	0.9	40.6	58.5
110	1.1	39.3	59.7
111	0.9	28.7	70.3
112	0.7	39.5	59.8
113	2.2	44.9	52.9
114	1.2	46.8	52.0
115	1.0	47.8	51.2
116	1.0	57.9	41.1
117	0.8	36.7	62.5
118	0.5	40.3	59.2
119	0.7	49.7	49.6
120	0.5	48.2	51.3
121	0.6	38.3	61.1
122	0.9	31.0	68.0

Station	% silt	% sand	% gravel
123	0.6	46.8	52.6
124	1.5	96.3	2.3
125	0.6	50.8	48.6
126	0.6	60.3	39.1
127	2.0	89.7	8.3
128	1.7	94.6	3.7
129	1.6	98.1	0.3
130	2.0	89.2	8.9
131	0.8	22.8	76.3
132	0.9	63.0	36.2
133	1.4	98.2	0.4
134	0.5	38.4	61.2
135	1.6	82.1	16.4
136	1.5	97.8	0.7
137	1.0	95.4	3.6
138	0.8	49.9	49.3
139	1.0	96.3	2.7
140	1.5	98.1	0.4
141	4.5	91.6	3.9
142	0.8	23.0	76.2
143	1.8	47.6	50.6
144	3.2	93.6	3.2
145	4.6	93.9	1.6
146	2.7	96.3	1.0
147	1.8	95.0	3.2
148	1.1	97.5	1.3
149	46.7	36.8	16.5
150	2.2	96.4	1.4
151	2.4	85.8	11.8
152	4.1	95.3	0.5
153	1.6	52.1	46.3
154	1.4	70.9	27.7
155	4.4	50.1	45.5
156	1.7	86.5	11.7
157	5.4	61.7	32.8
158	1.9	98.0	0.1
159	2.0	97.2	0.8
160	4.1	95.8	0.0
161	1.2	98.7	0.1
162	1.8	97.2	1.0
163	2.2	97.2	0.6
164	2.3	91.1	6.6
165	4.3	91.6	4.1
166	2.0	72.6	25.4
167	2.0	95.9	2.1
22A	1.7	96.5	1.8
22B	1.0	98.1	0.8
22C	1.4	97.6	1.0
27A	0.5	38.2	61.4
27B	0.3	28.9	70.8
27C	1.1	56.0	42.9
31A	0.7	62.1	37.2
31B	0.6	57.4	42.1
31C	0.8	50.9	48.3
33A	5.1	39.1	55.8
33B	0.8	36.1	63.1
33C	0.5	38.0	61.5
35A	1.0	44.3	54.7
35B	0.9	41.2	57.9
35C	0.9	61.2	37.9
36A	1.5	33.3	61.1
36B	1.0	17.6	81.3
36C	0.5	19.3	80.1
37A	3.9	56.3	39.8
37B	3.2	52.8	44.1
37C	6.7	46.8	46.5
38A	1.0	96.4	2.6
38B	1.7	92.1	6.2
38C	1.6	98.1	0.3
39A	2.4	97.5	0.1
39B	2.1	97.6	0.2
39C	2.1	97.6	0.2

Appendix Table 5. Table showing the species of macrofauna (>1mm) extracted from the sediments of the Production Licence Area 408 - Coal Pit during July/August 2000. The species codes used in subsequent tables are also shown. **BACK**

Species Code	Taxon
	Phylum PORIFERA
1	*Dysidea fragilis*
	Phylum CNIDARIA
13	*Eudendrium ramosum*
2	*Phialella quadrata*
12	*Calycella syringa*
15	*Filellum serpens*
14	*Lafoea dumosa*
7	*Halecium halecinum*
4	*Abietinaria abietina*
10	*Diphasia attenuata*
9	*Hydrallmania falcata*
6	*Sertularella guadichaudi*
3	*Sertularia cupressina*
5	*Sertularia distans*
17	*Nemertsia antennina*
16	*Plumularia setacea*
11	*Clytia hemisphaerica*
8	*Obelia* sp.
23	*Cerianthus lloydii*
18	*Stomphia coccinea*
24	*Sagartia troglodytes*
20	Unidet. Actinaria sp. (type 1)
21	Unidet. Actinaria sp. (type 2)
22	Unidet. Anthozoa sp.
19	*Halcampa chrysanthellum*
	Phylum TURBELLARIA
27	Unidet. Turbellarian spp.
	Phylum NEMERTEA
28	Unidet. Nemertea spp.
26	*Tubulanus superbus*
227	*Cerebratulus* sp.
	Phylum NEMATODA
29	Unidet. Nematoda spp.
	Phylum ANNELIDA
72	*Harmothoe lunulata*
229	*Harmothoe impar*
62	*Harmothoe* sp.
223	*Lagisca extenuata*
78	*Lepidonotus squamata*
59	*Pholoe inornata*
91	*Sthenelais boa*
230	*Sigalion mathildae*
225	*Eulalia viridis*
41	*Hesionura elongata*
42	*Eteone longa*
48	*Eteone picta*
76	*Eteone foliosa*
57	*Eumida sanguinea*
68	*Phyllodoce maculata*
80	*Phyllodoce lineata*
96	*Phyllodoce laminosa*
98	*Pseudomystides limbata*
56	*Pisione remota*
31	*Aricidea* sp.
55	*Chaetozone setosa*
58	*Tharyx marioni*
61	*Cirratulus filiformis*
79	*Dodecaeria concharum*
93	*Cirriformia tentaculata*
95	*Heterocirrus* sp.
81	*Nicomache lumbricalis*
83	*Euclymene lumbricoides*
226	*Maldane sarsi*
65	*Notomastus* sp.
217	*Heteromastus filiformis*
87	*Capitella* sp.
32	*Poecillochaetus serpens*
33	*Spiophanes bombyx*
44	*Laonice cirrata*
46	*Aonides paucibranchiata*
50	*Nerinides tridentata*
215	*Nerenides* sp.
51	*Spio filicornis*
89	*Prionospio* sp.
69	*Polydora* sp. (type 1)
221	*Polydora* sp. (type 2)
92	*Chaetopterus variopedatus*
47	*Magelona mirabilis*
35	*Goniada maculata*
36	*Glycera alba*
219	*Glycera* sp. (gigantea)
53	*Glycera lapidum*
67	*Glycera* sp. (juv)
94	*Glycera rouxi*
88	*Nematoneris unicornis*
63	*Marphysa bellii*
64	*Lumbrineris laterilli*
74	*Protodorvillea keferseini*
220	*Schistomeringos neglecta*
246	*Schistomeringos rudolphi*
66	*Kefersteinia cirrata*
71	*Nereis* sp. (juv)
90	*Nereis fucata*
38	*Nephtys caeca*
54	*Nephtys* sp. (juv)
30	*Ophelia borealis*
40	*Travisia forbesii*
34	*Scoloplos armiger*
77	*Orbinia sertulata*
39	*Scalibregma inflatum*
43	*Exogone hebes*
45	*Exogone naidina*
224	*Brania pusilla*
237	*Pionosyllis* sp.
73	*Syllis gracilis*
222	*Typosyllis prolifera*
75	*Eusyllis blomstrandi*
52	*Autolytus* sp. (type 1)
218	*Autolytus* sp. (type 2)
49	*Pectinaria koreni*
37	*Polycirrus caliendrum*
60	*Lanice conchilega* (juv)
84	*Ampharete acutifrons*
70	*Sabellaria spinulosa*
82	*Owenia fusiformis*
85	*Jasminiera elegans*
216	Unidet. Sabellidae
86	*Pomotoceros* sp.
97	*Hydroides norvegica*
25	Unidet. Oligochaeta sp. (type 1)
228	Unidet. Oligochaeta sp. (type 2)
	Phylum SIPUNCULA
99	*Golfingia minuta*
	Phylum CRUSTACEA
116	*Balanus crenatus*
124	*Nebalia bipes*
105	*Gastrosaccus spinifer*
100	*Pseudocuma longicornis*
101	*Iphinoe trispinosa*

Species Code	Taxon
102	*Bodotria pulchella*
108	*Bodotria scorpiodes*
107	*Diastylis rathkei*
235	*Diastylis rugosa*
125	*Tanaissus lilljeborgi*
139	*Leptognathia gracilis*
121	*Tryphosites longipes*
129	*Tmetonyx cicada*
132	*Hippomedon denticulatus*
149	*Tryphosella sarsi*
117	*Ampelisca diadema*
118	*Ampelisca tenuicornis*
145	*Iphimedia minuta*
119	*Amphilochus* (c.f. *neopolitanus*)
112	*Stenothoe marina*
232	*Liljeborgia* sp.
233	*Leucothoe incisa*
127	*Abludomelita obtusata*
150	*Maera othonis*
103	*Urothoe marina*
110	*Bathyporeia* sp.
114	*Bathyporeia guillamsoniana*
104	*Synchelidium haplocheles*
111	*Perioculoides longimanus*
131	*Phoxocephalus holbolli*
106	*Megaluropus agilis*
115	*Argissa hamatipes*
234	*Apherusa* sp.
113	*Atylus falcatus*
135	*Leptocheirus hirsutimanus*
143	*Microprotopus maculatus*
133	*Photis reinhardi*
134	*Gammaropsis* sp.
153	*Megamphopus cornutus*
126	*Corophium* sp.
138	*Siphonoecetes kroyeranus*
122	*Caprella linearis*
141	*Pariambus typicus*
130	*Eurydice spinigera*
136	*Gnathia* sp. (juv)
144	*Gnathia oxyuraea*
142	*Pontophilus trispinosa*
146	*Upogebia deltaura*
147	*Callianassa subterranea*
137	*Pagurus* sp. (juv)
128	*Galathea intermedia*
140	*Pisidia longicornis*
109	*Liocarcinus* sp. (juv)
148	*Cancer pagurus*
151	*Thia scutellata*
152	*Pinnotheres pisum*
120	Crab Zoea larvae
123	Natantia Zoea larvae
	Phylum CHELICERATA
154	*Phoxochilidium femoratum*
155	*Anoplodactylus petiolatus*
156	*Nymphon brevirostre*
231	*Pycnogonum littorale*
157	*Achelia* sp. (juv)
	Phylum MOLLUSCA
164	*Polinices polianus*
176	*Gibbula tumida*
236	*Caecum glabrum*
173	*Philine aperta*
188	*Retusa umbilicata*
178	*Pleurobranchus membranaceus*

163	*Onchidoris muricata*
242	*Ancula gibbosa*
243	*Polycera quadrilinieata*
180	*Thecacera pinnigera* (?)
162	Unidet. Opisthobranchia sp.
177	*Doto* sp.
179	*Glycymeris glycymeris* (juv)
239	*Monia patelliformis*
181	*Musculus discors*
182	*Modoilula phaseolina*
175	*Chlamys varia* (juv)
158	*Goodalia triangularis*
169	*Tridonta montagui*
159	*Mysella bidentata*
186	*Leptonidae* sp.
185	*Parvicardium scabrum*
167	*Dosinia exoleta*
184	*Mysia undata*
166	*Spisula elliptica*
187	*Spisula solida* (juv)
240	*Spisula subtruncata*
174	*Fabulina fabula*
183	*Moerella pygmaea*
160	*Abra alba*
161	*Abra nitida*
238	*Gari fervensis*
165	*Ensis ensis*
170	*Phaxas pellucidus*
241	*Mya truncata*
172	*Hiatella arctica*
168	*Thracia* sp. (juv)
171	Unidet. Bivalve sp. (juv)
	Phylum PHORONIDA
189	*Phoronida* sp.
	Phylum BRYOZOA
190	*Vesicularia spinosa*
191	*Eucratea loricata*
192	*Electra pilosa*
193	*Alcyonidium diaphanum*
244	*Pseudoaclcyonidium* sp.
194	Unidet. Bryozoan sp.
195	*Flustra foliacea*
196	*Scrupocellaria scruposa*
197	*Crisia denticulata*
198	*Bugula flaellata*
	Phylum ECHINODERMATA
199	*Echinocardium cordatum*
200	*Echinocyamus pusilus*
203	Unidet. Echinoidea sp. (juv)
201	*Ophuiura affinis*
202	*Amphipholis squamata*
208	*Ophiothrix fragilis*
204	*Amphiura* sp.
205	*Asterias rubens*
207	Unidet. Asteroidea sp. (juv)
206	*Leptosynapta inhaerens*
	Phylum CHORDATA
209	*Molgula occulta*
210	*Ascidiella scabra*
245	*Dendrodoa grossularia*
211	*Branchiostoma lanceolatum*
212	*Hyperoplus lanceolatus*
213	*Callionymus lyra*
214	*Solea solea*

Total number of taxa = 246

Appendix Table 6. Table summarising the diversity and abundance of the macrofauna (>1mm) extracted from the sediments in and adjacent to Production Licence Area 408 - Coal Pit in July/August 2000. The species identification codes are shown in parentheses and are followed by the number of individuals per Hamon Grab expressed per $0.1m^2$ of sediment surface. Also shown are the total number of individuals (abundance) and species (diversity) recorded at each sampling station. Colonial species have been assigned a score of 1 where recorded in low abundance and a score of 10 where found in high densities. **BACK**

Station #	Identification code & number per Hamon Grab sample ($0.1m^2$)	No. of Species	No. of Individuals
1	(2)1;(3)1;(28)3;(29)2;(30)95;(31)17;(32)6;(33)12;(34)14;(35)1;(36)1;(37)1;(38)5;(39)1;(40)1;(41)7;(42)8;(43)4;(44)3;(45)5;(46)1;(47)2;(48)1;(49)1;(50)1;(51)1;(100)18;(101)4;(102)3;(103)4;(104)1;(114)3;(159)1;(160)1;(190)1;(191)1;(200)1;(201)5	38	238
2	(2)1;(3)1;(4)1;(5)1;(6)1;(28)3;(30)25;(31)3;(32)2;(33)6;(34)10;(35)1;(37)1;(38)11;(39)2;(42)3;(43)2;(44)11;(47)3;(48)3;(49)1;(50)6;(51)2;(52)1;(54)1;(55)1;(56)1;(57)1;(58)2;(59)1;(60)2;(100)18;(101)10;(103)7;(104)1;(105)1;(106)2;(107)2;(108)1;(109)1;(110)4;(111)1;(112)2;(190)1;(191)1;(192)1;(201)1;(202)1;(203)84;(204)1	50	250
3	(2)1;(4)1;(27)1;(29)2;(30)15;(32)2;(34)1;(38)6;(41)5;(43)1;(50)5;(52)1;(53)1;(100)1;(101)2;(103)1;(190)1;(212)1	18	48
4	(2)1;(8)1;(28)1;(29)1;(30)86;(31)1;(33)2;(34)1;(37)5;(38)10;(41)1;(48)4;(51)6;(100)14;(101)3;(102)1;(103)7;(104)1;(111)2;(113)1;(114)9;(115)1;(155)1;(190)1;(191)1;(192)1;(193)1;(194)1;(201)1;(212)2;(213)1	31	169
5	(2)1;(29)1;(30)25;(32)1;(34)3;(38)11;(41)2;(43)1;(51)2;(59)1;(100)1;(101)1;(102)1;(103)11;(110)5;(191)1;(213)1	17	69
6	(4)1;(8)1;(30)47;(32)1;(33)9;(34)4;(38)15;(42)1;(44)1;(47)2;(48)3;(50)1;(51)3;(52)2;(55)2;(61)1;(100)5;(101)1;(103)5;(106)1;(107)1;(110)22;(114)3;(190)1;(201)1;(212)2	26	136
7	(4)1;(28)2;(30)10;(31)11;(33)9;(34)3;(38)17;(42)3;(44)1;(47)11;(48)2;(50)1;(51)1;(57)2;(61)1;(100)21;(101)2;(103)13;(106)3;(107)1;(110)37;(111)3;(114)4;(115)1;(161)1;(162)1;(190)1;(201)3;(203)8;(212)2	30	176
8	(4)1;(8)1;(9)1;(30)8;(31)9;(33)5;(38)13;(42)2;(44)1;(47)4;(50)1;(51)1;(55)3;(57)1;(62)1;(100)1;(103)1;(106)1;(107)1;(109)1;(110)18;(111)1;(116)2;(163)1;(164)1;(190)1;(192)1;(201)1;(212)1	29	84
9	(29)2;(30)12;(31)3;(32)2;(33)11;(34)1;(38)16;(42)1;(44)3;(47)13;(50)4;(51)4;(63)1;(100)3;(103)2;(106)3;(110)16;(111)2;(114)2;(163)2;(195)1;(212)1	22	105
10	(2)1;(4)1;(8)1;(12)1;(30)14;(33)3;(34)7;(38)8;(42)1;(47)3;(50)3;(51)2;(60)1;(100)1;(103)2;(105)1;(106)2;(110)6;(111)1;(114)2;(191)1;(192)1;(195)1;(203)15	24	79
11	(2)1;(4)1;(8)1;(10)1;(12)1;(29)2;(30)185;(33)2;(34)3;(35)1;(37)5;(38)4;(39)5;(41)12;(43)2;(44)4;(51)11;(52)1;(53)1;(55)2;(60)2;(100)15;(101)7;(103)1;(106)12;(107)2;(109)1;(110)9;(113)4;(114)1;(117)1;(161)1;(190)1;(191)1;(192)1;(193)1;(195)1;(199)1;(203)2	39	309
12	(4)1;(8)1;(9)1;(30)54;(31)8;(33)3;(34)7;(37)2;(38)8;(41)1;(42)2;(47)1;(50)2;(51)1;(54)1;(59)1;(64)1;(100)1;(103)1;(110)1;(160)1;(161)1;(164)1;(191)1;(192)1;(193)1;(195)1;(212)6;(214)1	29	112
13	(2)1;(4)1;(9)1;(28)1;(29)2;(30)12;(31)2;(33)6;(34)2;(38)3;(39)3;(42)2;(48)1;(57)1;(59)1;(100)1;(106)3;(110)2;(114)5;(116)12;(165)1;(191)1;(192)1;(193)1;(195)1;(201)1;(203)3	27	71
14	(2)1;(4)1;(30)28;(31)4;(33)7;(34)1;(38)8;(39)1;(43)1;(44)2;(47)1;(50)2;(51)5;(54)4;(55)1;(65)1;(66)1;(100)6;(103)1;(104)1;(106)3;(107)1;(110)8;(113)1;(114)2;(161)1	26	93
15	(8)1;(28)1;(29)2;(30)35;(33)4;(34)4;(35)1;(37)3;(38)3;(39)1;(40)1;(41)2;(42)3;(44)2;(46)1;(48)1;(49)1;(50)1;(51)1;(57)1;(100)2;(106)1;(110)4;(113)1;(118)1;(119)1;(191)1;(192)1;(195)1;(203)1	30	83
16	(2)1;(4)1;(8)1;(29)2;(30)29;(31)1;(32)1;(33)3;(34)5;(37)3;(38)2;(40)2;(42)1;(50)1;(51)2;(54)1;(58)1;(100)2;(103)1;(106)1;(107)1;(110)1;(114)1;(123)2;(160)1;(191)1;(195)1;(196)1;(212)1	29	71
17	(2)1;(4)1;(30)7;(31)1;(34)1;(37)1;(38)6;(40)1;(42)1;(44)1;(50)1;(51)1;(55)1;(100)3;(101)1;(105)1;(110)1;(114)1;(192)1	19	32
18	(2)1;(4)1;(8)1;(29)6;(30)71;(32)2;(33)6;(34)4;(36)1;(37)6;(38)3;(39)4;(40)1;(41)2;(42)1;(43)1;(48)1;(51)2;(54)2;(57)2;(58)1;(100)10;(101)8;(103)1;(106)1;(107)1;(110)2;(113)1;(160)1;(190)1;(191)1;(195)1;(201)1;(212)15	34	163

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
19	(2)1;(4)1;(10)1;(29)1;(30)6;(38)7;(51)3;(55)1;(100)1;(101)1;(103)1;(110)2;(114)1;(120)1;(121)1;(122)1;(192)1;(195)1;(196)1;(201)1	20	34
20	(2)1;(4)1;(29)9;(30)24;(32)1;(37)7;(38)5;(39)1;(41)8;(42)1;(43)1;(46)2;(48)3;(51)4;(53)1;(56)68;(67)3;(100)17;(101)5;(104)1;(106)4;(107)1;(110)2;(113)1;(114)1;(123)1;(124)1;(163)2;(165)1;(191)1;(192)1;(195)1;(212)9	33	189
21	(9)1;(12)1;(29)1;(30)53;(32)1;(34)2;(37)4;(38)6;(41)6;(43)5;(44)1;(45)3;(46)4;(48)2;(51)2;(52)3;(56)21;(62)1;(65)1;(100)18;(101)1;(105)2;(106)1;(166)1;(192)1;(212)3	26	145
22	(4)1;(29)2;(30)19;(33)14;(34)5;(37)5;(38)7;(39)1;(41)2;(42)2;(44)1;(50)1;(51)8;(52)2;(54)7;(55)1;(56)1;(59)1;(100)14;(101)1;(106)5;(109)1;(110)11;(125)1;(167)1;(192)1;(195)1;(200)1	28	117
23	(8)1;(28)1;(29)3;(30)34;(31)1;(33)9;(34)5;(37)3;(38)5;(39)1;(41)1;(43)3;(44)1;(51)4;(56)1;(60)1;(100)5;(106)1;(110)2;(114)1;(155)1;(192)1;(193)1;(203)1	24	87
24	(4)1;(9)1;(12)1;(29)5;(30)12;(31)1;(33)1;(35)1;(37)1;(38)3;(41)1;(42)1;(43)1;(44)1;(50)1;(51)2;(54)2;(100)14;(101)2;(105)2;(106)8;(107)1;(109)1;(110)1;(111)1;(191)1;(192)1;(195)1	28	69
25	(4)1;(12)1;(13)1;(28)3;(29)3;(30)90;(32)2;(33)17;(34)5;(37)3;(38)6;(41)1;(42)6;(43)5;(44)5;(46)1;(48)4;(49)1;(54)3;(59)2;(61)1;(68)9;(100)9;(101)7;(102)1;(104)1;(106)7;(110)16;(112)1;(114)17;(116)11;(126)2;(155)1;(164)1;(191)1;(192)1;(195)1;(203)1	38	248
26	(8)1;(12)1;(19)1;(28)2;(29)2;(30)31;(33)5;(34)1;(37)1;(38)4;(42)1;(48)1;(50)1;(51)7;(54)3;(55)1;(56)10;(67)1;(100)2;(104)1;(106)3;(110)3;(114)1;(192)1;(212)2	25	87
27	(2)1;(4)1;(9)1;(27)1;(28)3;(29)7;(30)67;(31)1;(32)2;(33)11;(34)1;(37)3;(38)6;(39)2;(41)2;(42)5;(43)1;(44)2;(48)1;(51)3;(52)1;(59)1;(62)1;(63)1;(66)1;(68)1;(69)1;(70)1;(71)1;(100)9;(101)1;(104)1;(106)1;(107)1;(110)31;(111)2;(114)15;(116)11;(120)1;(189)3;(190)1;(193)1;(203)1	43	209
28	(4)1;(9)1;(30)19;(33)1;(37)5;(38)3;(41)1;(42)1;(43)4;(44)1;(46)1;(51)1;(52)1;(54)2;(55)1;(65)1;(68)1;(100)7;(101)2;(106)5;(108)1;(109)1;(110)4;(111)1;(114)2;(168)1;(191)1;(192)1;(201)1	29	72
29	(4)1;(14)1;(28)2;(29)2;(30)9;(32)2;(33)13;(34)8;(35)1;(37)3;(38)2;(39)4;(41)1;(42)8;(43)3;(44)5;(47)2;(48)2;(49)1;(51)1;(52)2;(54)4;(56)1;(57)1;(63)1;(68)2;(72)1;(100)10;(101)5;(102)1;(103)2;(104)1;(106)1;(110)7;(114)15;(116)2;(168)4;(191)1;(195)1;(212)1	40	134
30	(2)1;(4)1;(6)1;(10)1;(12)1;(13)1;(15)1;(19)1;(20)1;(28)1;(29)7;(30)29;(31)1;(32)2;(33)21;(34)1;(37)3;(38)3;(39)1;(43)5;(50)1;(51)2;(52)4;(54)1;(57)1;(59)2;(60)1;(62)2;(63)2;(66)2;(68)4;(72)1;(73)4;(100)10;(101)1;(103)1;(106)4;(110)15;(111)1;(113)2;(114)3;(116)128;(119)1;(122)21;(127)12;(128)1;(155)2;(163)7;(168)2;(190)1;(191)1;(192)1;(193)1;(205)1;(212)1	55	327
31	(4)1;(19)1;(29)2;(30)102;(32)3;(33)6;(34)2;(37)13;(38)1;(43)4;(48)2;(51)1;(53)5;(54)1;(66)1;(70)1;(71)1;(74)5;(100)13;(104)3;(106)3;(107)1;(110)1;(111)1;(112)1;(113)4;(114)3;(192)1;(200)1;(212)1	30	185
32	(2)1;(4)1;(15)1;(20)1;(29)6;(30)34;(33)3;(37)2;(39)2;(43)3;(45)1;(46)1;(48)1;(51)1;(52)2;(53)1;(54)1;(56)7;(68)1;(70)1;(100)5;(101)1;(102)1;(104)1;(106)3;(110)1;(111)1;(114)2;(116)10;(122)1;(129)1;(168)1;(192)1;(193)1	34	101
33	(4)1;(8)1;(9)1;(19)1;(28)3;(29)5;(30)112;(32)1;(33)46;(34)3;(37)3;(38)5;(41)1;(42)7;(43)11;(44)5;(47)1;(48)3;(50)3;(51)2;(52)3;(54)11;(55)3;(57)1;(68)1;(71)1;(100)19;(103)1;(106)9;(110)40;(111)3;(114)6;(122)2;(192)1;(196)1;(203)5	36	322
34	(2)1;(4)1;(15)1;(28)1;(29)2;(30)20;(32)2;(33)3;(34)1;(35)2;(37)2;(38)6;(41)1;(43)4;(44)4;(45)1;(50)1;(51)2;(54)1;(56)13;(70)1;(75)2;(76)1;(77)1;(100)1;(106)1;(122)1;(130)1;(165)1;(191)1;(200)1;(212)6	32	87
35	(2)1;(4)1;(10)1;(21)1;(28)3;(29)4;(30)63;(32)2;(33)7;(34)3;(37)2;(38)4;(39)2;(43)5;(44)2;(45)1;(51)9;(52)3;(54)4;(60)1;(65)2;(68)1;(100)5;(102)2;(104)1;(110)18;(165)1;(168)1;(192)1;(201)1;(212)2	31	154
36	(2)1;(4)1;(6)1;(28)4;(29)8;(30)105;(32)3;(33)13;(37)14;(38)2;(42)1;(43)23;(44)4;(45)1;(46)3;(48)1;(50)1;(51)1;(52)1;(53)1;(55)1;(57)1;(65)1;(66)1;(67)2;(70)1;(77)1;(100)10;(103)1;(106)4;(110)7;(113)1;(114)2;(122)1;(160)1;(191)1;(196)1;(200)1;(201)1;(210)1;(212)1	41	230

Station #	Identification code & number per Hamon Grab sample ($0.1m^2$)	No. of Species	No. of Individuals
37	(4)1;(28)1;(30)109;(33)4;(35)1;(37)1;(38)7;(41)3;(43)5;(44)2;(48)3;(51)9;(52)1;(54)4;(65)2;(66)1;(100)6;(103)1;(105)1;(106)1;(110)1;(111)1;(113)1;(114)3;(193)1;(212)1	26	171
38	(2)1;(4)1;(12)1;(15)1;(21)1;(28)4;(29)7;(30)242;(32)3;(33)17;(34)4;(37)7;(38)4;(39)2;(41)2;(42)4;(43)12;(44)1;(46)2;(48)2;(51)3;(53)1;(54)4;(56)12;(60)1;(65)2;(66)5;(67)4;(68)1;(71)1;(74)5;(75)2;(100)11;(101)1;(102)1;(103)2;(104)1;(106)1;(110)3;(111)1;(114)1;(131)1;(132)1;(135)1;(160)1;(168)1;(191)1;(193)1;(212)3	49	391
39	(2)1;(4)1;(6)1;(15)1;(28)1;(30)31;(33)7;(34)1;(36)1;(37)4;(38)2;(39)1;(42)1;(47)1;(52)1;(60)2;(71)1;(100)1;(101)1;(106)1;(110)3;(114)4;(116)1;(163)1;(192)1;(193)1	26	72
40	(2)1;(4)1;(9)1;(17)1;(28)2;(29)1;(30)25;(31)1;(32)1;(33)8;(34)3;(37)3;(38)10;(43)2;(44)2;(46)1;(51)6;(54)4;(70)1;(74)1;(103)4;(114)1;(168)1;(190)1;(192)1;(199)1;(212)4	27	88
41	(4)1;(19)1;(28)5;(29)7;(30)127;(31)1;(32)11;(33)25;(34)2;(35)4;(37)4;(39)5;(42)25;(43)13;(44)2;(45)1;(46)4;(49)32;(52)1;(53)1;(54)2;(57)1;(59)3;(60)3;(61)2;(66)2;(68)15;(71)3;(74)1;(75)2;(78)1;(100)11;(101)2;(103)1;(104)1;(110)1;(111)3;(112)1;(116)62;(117)4;(118)2;(124)1;(131)6;(133)2;(134)1;(165)1;(191)1;(192)1;(193)1;(201)6;(203)1	51	416
42	(2)1;(4)1;(15)1;(28)5;(29)10;(30)124;(31)2;(32)1;(33)37;(34)4;(38)9;(39)2;(42)2;(43)12;(44)2;(46)1;(47)1;(52)2;(53)1;(54)3;(67)1;(68)1;(100)3;(101)1;(102)1;(106)3;(110)15;(111)2;(113)1;(114)4;(165)1;(166)1;(168)2;(169)1;(192)1;(201)1;(203)3;(212)2	38	265
43	(15)1;(28)3;(29)4;(30)19;(31)1;(32)1;(33)79;(34)3;(35)1;(36)1;(37)1;(39)1;(42)8;(43)3;(44)5;(47)3;(48)2;(49)19;(57)1;(59)1;(60)5;(61)1;(62)1;(66)1;(68)6;(100)6;(101)1;(103)1;(106)3;(111)2;(113)1;(119)3;(136)1;(170)1;(201)3;(203)2	36	195
44	(2)1;(4)1;(28)2;(29)6;(30)41;(32)2;(33)8;(34)1;(37)10;(38)7;(41)6;(42)2;(43)15;(44)4;(46)1;(48)2;(49)1;(51)13;(52)1;(54)4;(56)2;(61)1;(67)2;(100)10;(101)1;(102)3;(103)1;(104)3;(106)5;(110)9;(113)1;(114)3;(120)2;(168)1;(190)1;(191)1;(192)1;(196)1;(203)2;(212)1	40	179
45	(4)1;(28)2;(29)5;(30)4;(31)1;(32)22;(33)28;(35)1;(37)3;(38)2;(39)5;(42)13;(44)13;(47)2;(48)3;(49)106;(51)1;(57)2;(59)4;(60)3;(64)1;(65)2;(66)1;(68)97;(72)1;(79)2;(80)1;(100)1;(104)1;(110)1;(114)2;(116)189;(118)1;(120)2;(137)1;(155)2;(159)4;(161)3;(170)3;(171)1;(172)1;(189)3;(190)1;(191)1;(192)1;(193)1;(199)1;(201)5;(203)3	49	554
46	(2)1;(4)1;(9)1;(12)1;(19)1;(28)7;(29)40;(30)26;(33)30;(34)14;(37)6;(39)6;(41)1;(42)35;(43)8;(44)2;(46)6;(48)5;(49)25;(52)3;(54)4;(56)13;(57)1;(59)4;(60)3;(63)1;(66)2;(67)1;(70)1;(71)4;(74)1;(79)1;(100)8;(101)1;(103)2;(106)1;(107)1;(110)5;(111)1;(114)20;(116)3;(120)1;(131)1;(137)1;(160)1;(161)2;(165)3;(170)2;(190)1;(191)1;(192)1;(193)1;(195)1;(201)1	54	314
47	(2)1;(8)1;(9)1;(13)1;(28)10;(29)6;(30)88;(31)21;(33)17;(34)11;(37)1;(38)7;(42)11;(43)3;(44)14;(46)1;(47)5;(48)3;(49)26;(51)1;(54)4;(56)1;(57)1;(58)1;(59)1;(63)1;(66)1;(67)1;(74)1;(75)1;(81)1;(100)3;(101)7;(106)1;(107)1;(110)37;(113)1;(114)20;(116)2;(125)1;(161)1;(191)1;(193)1;(201)5;(203)2	45	326
48	(2)1;(4)1;(28)2;(29)3;(30)72;(31)4;(32)2;(33)13;(34)2;(37)3;(38)1;(39)1;(41)2;(42)2;(43)2;(44)2;(46)2;(47)1;(48)3;(49)1;(54)1;(56)2;(59)1;(100)9;(101)1;(102)1;(103)2;(106)1;(114)2;(165)1;(166)1;(191)1;(192)1;(201)1	34	145
49	(2)1;(4)1;(13)1;(28)5;(29)1;(30)26;(31)7;(32)8;(33)32;(34)15;(37)1;(38)9;(42)3;(43)2;(44)4;(46)2;(47)4;(49)23;(50)1;(51)2;(54)4;(57)2;(66)2;(68)2;(72)1;(100)4;(101)4;(102)2;(103)1;(105)1;(110)8;(114)6;(126)1;(167)2;(168)3;(190)1;(191)1;(195)1;(196)1;(201)2	40	197
50	(12)1;(19)1;(28)2;(29)11;(30)40;(32)1;(33)13;(34)4;(35)3;(37)2;(38)3;(42)3;(43)16;(46)4;(48)4;(49)5;(51)5;(52)5;(54)3;(56)9;(57)1;(66)3;(67)1;(71)1;(72)1;(74)1;(81)1;(100)13;(101)3;(103)65;(107)3;(109)1;(110)5;(113)2;(114)11;(160)1;(161)2;(168)1;(201)7	39	258
51	(2)1;(6)1;(28)8;(29)13;(30)72;(32)5;(33)7;(34)2;(35)5;(37)3;(39)1;(42)1;(43)6;(44)1;(46)1;(47)1;(48)3;(49)44;(52)2;(54)1;(57)1;(59)4;(60)1;(61)3;(63)3;(65)2;(66)1;(71)1;(72)1;(74)9;(75)1;(81)2;(100)4;(103)3;(104)1;(106)1;(107)1;(110)2;(111)2;(114)1;(121)1;(131)1;(159)4;(166)1;(168)3;(201)7	46	239

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
52	(2)1;(4)1;(28)8;(29)25;(30)79;(31)2;(32)3;(33)25;(34)2;(37)2;(38)1;(41)10;(43)28;(44)1;(46)5;(47)1;(48)3;(49)8;(51)1;(52)10;(54)3;(56)7;(61)2;(66)1;(67)1;(71)1;(74)5;(75)1;(77)1;(81)1;(100)2;(103)1;(107)1;(110)11;(114)11;(165)1;(168)1;(173)1;(206)1;(212)3	40	272
53	(2)1;(4)1;(15)1;(18)1;(28)3;(29)7;(30)37;(31)4;(32)9;(33)28;(37)1;(38)4;(39)1;(40)1;(41)1;(42)7;(44)6;(47)6;(48)1;(49)9;(50)1;(54)5;(57)1;(59)3;(60)1;(63)4;(66)4;(67)2;(72)1;(100)7;(101)7;(102)1;(104)1;(105)1;(110)6;(111)3;(113)1;(114)23;(122)1;(159)2;(163)1;(165)2;(169)1;(170)1;(191)1;(193)1;(195)1;(197)1;(201)4	49	217
54	(2)1;(9)1;(28)5;(29)12;(30)27;(32)5;(33)9;(34)4;(35)1;(38)3;(39)8;(41)3;(42)3;(43)6;(44)2;(46)4;(49)2;(51)1;(54)3;(56)6;(59)1;(62)1;(66)2;(77)1;(100)3;(101)1;(102)3;(103)1;(106)1;(110)1;(114)1;(116)1;(191)1;(195)1;(196)1;(201)1	36	127
55	(2)1;(4)1;(12)1;(28)6;(29)6;(30)40;(31)1;(32)5;(33)9;(34)9;(37)1;(38)3;(39)4;(41)26;(42)3;(43)16;(44)2;(46)1;(48)2;(49)59;(51)6;(52)3;(54)1;(56)2;(60)2;(63)2;(65)1;(71)2;(72)1;(77)3;(100)6;(103)2;(104)1;(107)1;(109)1;(114)3;(160)2;(161)1;(165)2;(168)2;(191)1;(195)1;(201)4;(203)2	44	248
56	(4)1;(7)1;(10)1;(12)1;(15)1;(28)3;(29)4;(30)5;(31)4;(32)6;(33)22;(34)4;(38)4;(41)2;(42)2;(44)10;(46)1;(47)2;(49)6;(50)2;(51)1;(54)5;(56)5;(57)1;(66)1;(100)1;(101)2;(103)4;(114)1;(190)1;(191)1;(192)1;(195)1;(201)1;(203)1	35	109
57	(2)1;(4)1;(12)1;(28)7;(29)10;(30)9;(31)1;(33)2;(38)1;(41)4;(42)1;(43)20;(44)4;(45)2;(46)5;(48)4;(49)1;(50)2;(51)1;(52)1;(54)3;(56)92;(67)2;(74)1;(100)1;(101)4;(103)1;(107)1;(111)1;(165)1;(166)1;(191)1;(200)1;(201)1;(211)1	35	190
58	(2)1;(4)1;(9)1;(15)1;(28)4;(29)6;(30)27;(32)30;(33)10;(34)10;(38)8;(39)2;(41)1;(42)1;(43)1;(44)9;(47)10;(49)25;(50)1;(51)4;(54)8;(55)1;(57)2;(59)3;(100)9;(101)7;(103)2;(104)2;(106)2;(107)1;(114)8;(115)1;(121)1;(131)1;(138)1;(165)1;(166)1;(168)1;(174)1;(190)1;(191)1;(201)7;(203)3;(210)1	44	219
59	(2)1;(10)1;(28)5;(29)3;(30)23;(31)8;(32)6;(33)14;(34)9;(37)1;(38)7;(39)1;(41)2;(42)1;(43)1;(44)2;(48)1;(49)16;(52)4;(54)9;(56)5;(59)2;(62)2;(66)1;(67)1;(100)2;(101)2;(103)2;(106)1;(110)4;(111)1;(161)3;(170)2;(190)1;(191)1;(192)1;(201)4;(203)3;(212)1	39	154
60	(4)1;(7)1;(9)1;(15)1;(19)1;(28)2;(30)3;(32)1;(33)6;(34)2;(38)10;(39)2;(42)1;(49)6;(50)2;(54)4;(67)1;(101)4;(103)5;(107)1;(110)1;(113)1;(114)3;(156)1;(161)1;(168)1;(190)1;(191)1;(195)1;(199)1	30	67
61	(4)1;(15)1;(28)3;(29)4;(30)3;(31)1;(32)20;(33)12;(34)7;(38)1;(39)7;(42)13;(44)14;(48)4;(49)44;(59)7;(60)1;(61)1;(63)1;(66)1;(68)1;(71)2;(80)1;(100)1;(101)2;(106)1;(107)1;(110)4;(111)2;(114)1;(116)31;(121)1;(165)2;(170)2;(190)1;(191)1;(192)1;(195)1;(201)6;(210)4	40	212
62	(2)1;(4)1;(9)1;(19)1;(28)4;(30)6;(31)4;(32)4;(33)18;(34)5;(35)2;(38)10;(42)3;(44)3;(47)5;(49)11;(50)2;(52)1;(54)3;(101)5;(103)1;(104)1;(106)3;(107)2;(110)1;(111)2;(114)7;(138)1;(160)1;(163)1;(168)1;(170)2;(191)1;(192)1;(193)1;(199)1;(201)7;(203)5	38	129
63	(2)1;(4)1;(19)1;(28)7;(29)9;(30)64;(31)4;(32)2;(33)11;(34)9;(38)6;(41)2;(42)2;(43)10;(44)2;(46)2;(49)1;(54)2;(56)2;(61)1;(63)3;(66)3;(74)1;(79)1;(100)2;(110)3;(114)2;(139)1;(160)1;(191)1;(192)1;(200)2;(201)1;(210)1;(212)1	35	163
64	(1)1;(2)1;(4)1;(9)1;(28)1;(29)7;(30)72;(32)3;(33)7;(34)2;(35)2;(36)1;(37)1;(38)4;(41)3;(43)13;(44)2;(46)4;(47)1;(48)1;(49)6;(51)1;(52)2;(54)1;(56)1;(63)1;(67)1;(71)1;(74)2;(75)1;(100)2;(103)5;(106)1;(114)5;(117)1;(129)1;(140)1;(160)1;(163)2;(167)1;(193)1;(200)1;(201)1;(212)1	44	169
65	(2)1;(19)1;(28)4;(29)4;(30)53;(31)9;(32)7;(33)15;(34)2;(37)4;(38)2;(41)5;(42)2;(43)3;(44)6;(49)2;(52)2;(54)4;(59)2;(66)4;(71)1;(75)1;(81)1;(100)6;(103)1;(106)1;(107)1;(110)3;(111)2;(113)1;(114)4;(115)1;(165)2;(190)1;(191)1;(192)1;(193)1;(200)1;(201)3;(210)1;(212)1	41	167
66	(2)1;(4)1;(15)1;(28)3;(29)3;(30)63;(31)2;(32)22;(33)95;(34)13;(37)3;(38)2;(39)7;(42)7;(44)6;(47)1;(48)5;(49)7;(51)3;(52)3;(53)1;(54)3;(55)1;(58)1;(59)4;(60)1;(62)1;(65)1;(67)1;(79)4;(100)3;(101)1;(102)1;(106)1;(109)1;(110)1;(111)1;(114)8;(135)2;(138)1;(160)1;(161)1;(165)3;(168)2;(191)1;(193)1;(201)1;(203)1	48	297

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
67	(2)1;(4)1;(13)1;(28)13;(29)18;(30)20;(31)4;(32)31;(33)107;(34)13;(35)3;(36)2;(37)1;(38)2;(39)8;(42)21;(44)7;(46)3;(47)3;(48)9;(49)105;(52)2;(54)2;(57)1;(59)19;(60)5;(64)3;(65)1;(66)1;(68)3;(70)1;(78)1;(79)4;(81)1;(82)2;(100)3;(101)1;(103)1;(109)1;(110)2;(111)2;(116)48;(119)2;(124)1;(127)3;(128)1;(131)1;(141)2;(155)1;(156)1;(160)1;(163)4;(165)3;(192)1;(193)1;(195)1;(200)1;(201)1;(203)1;(204)3;(210)1	61	507
68	(2)1;(4)1;(9)1;(13)1;(27)1;(28)4;(29)34;(30)161;(32)6;(33)96;(34)5;(35)3;(37)1;(38)3;(39)6;(42)45;(43)4;(44)2;(46)2;(48)6;(49)110;(50)1;(52)1;(54)2;(55)1;(57)7;(59)11;(60)3;(63)3;(65)3;(66)3;(67)2;(68)5;(74)4;(75)1;(100)3;(101)2;(103)1;(116)1;(117)1;(121)1;(127)1;(131)2;(136)1;(155)3;(163)7;(165)4;(168)1;(175)1;(190)1;(191)1;(193)1;(201)10;(204)1;(209)2	55	585
69	(4)1;(28)7;(29)22;(30)184;(32)3;(33)10;(34)8;(37)2;(39)1;(42)4;(43)8;(44)7;(46)4;(48)3;(49)37;(51)2;(52)2;(53)1;(54)1;(59)6;(60)5;(63)2;(65)12;(66)7;(67)3;(69)1;(71)6;(75)1;(79)1;(100)14;(101)1;(104)1;(106)1;(107)2;(109)1;(113)3;(117)2;(165)2;(166)1;(191)1;(201)6	41	386
70	(2)1;(4)1;(28)2;(29)16;(30)250;(32)8;(33)33;(34)7;(35)3;(37)2;(38)3;(39)13;(42)4;(43)3;(46)2;(48)1;(49)7;(50)1;(51)5;(52)1;(53)2;(54)3;(57)1;(60)1;(65)3;(66)2;(68)1;(72)1;(79)2;(100)6;(101)3;(109)1;(110)1;(113)2;(134)4;(141)1;(159)1;(191)1;(201)24	39	423
71	(2)1;(4)1;(10)1;(12)1;(15)1;(18)1;(27)1;(28)1;(29)10;(30)18;(32)24;(33)18;(34)4;(35)4;(37)2;(39)10;(42)10;(43)1;(44)5;(46)2;(47)2;(48)3;(49)70;(50)1;(52)2;(53)1;(57)5;(59)33;(60)2;(61)3;(62)8;(63)1;(65)15;(66)1;(67)2;(68)5;(69)1;(70)1;(71)2;(75)2;(78)2;(79)1;(81)3;(83)1;(84)9;(85)1;(101)2;(103)1;(109)4;(112)1;(113)1;(116)8;(118)2;(131)2;(133)7;(137)1;(141)1;(155)3;(159)8;(160)2;(161)4;(163)28;(165)3;(167)1;(168)2;(176)2;(177)4;(178)2;(191)1;(192)1;(193)1;(199)1;(200)1;(201)13;(204)3;(210)3	76	406
72	(1)1;(2)1;(4)1;(10)1;(28)7;(29)14;(30)39;(31)1;(32)12;(33)36;(34)3;(37)1;(38)3;(39)2;(42)14;(43)3;(44)3;(46)2;(47)1;(48)12;(49)24;(52)2;(53)1;(55)2;(59)23;(60)1;(61)4;(62)3;(65)26;(66)6;(67)3;(68)7;(70)9;(74)3;(75)1;(78)2;(84)6;(85)1;(86)4;(100)1;(103)8;(104)1;(109)2;(110)1;(111)1;(116)20;(117)3;(133)1;(134)2;(136)1;(137)2;(141)2;(155)2;(156)1;(160)1;(163)2;(165)1;(167)1;(170)1;(175)1;(179)1;(191)1;(192)1;(193)1;(195)1;(196)1;(201)15;(203)1;(204)2;(210)2	70	366
73	(4)1;(9)1;(12)1;(15)1;(27)1;(28)12;(29)24;(30)67;(32)17;(33)29;(34)7;(35)1;(39)40;(42)29;(43)6;(44)13;(46)1;(47)2;(48)10;(49)100;(54)3;(57)2;(59)14;(60)2;(62)1;(65)12;(66)2;(67)5;(68)2;(71)1;(72)1;(74)1;(78)1;(79)1;(84)1;(100)6;(101)8;(106)1;(107)2;(108)1;(112)1;(117)1;(118)3;(131)1;(134)1;(135)1;(160)1;(163)3;(165)2;(168)2;(170)1;(171)1;(191)1;(192)1;(193)1;(200)1;(201)20;(203)1;(204)1;(206)1	60	475
74	(2)1;(4)1;(9)1;(27)1;(28)4;(29)10;(30)24;(32)5;(33)38;(39)3;(42)6;(43)3;(44)5;(48)2;(49)5;(51)7;(52)1;(53)1;(54)1;(57)2;(59)4;(60)2;(62)1;(63)2;(65)8;(66)1;(67)4;(68)2;(71)2;(74)9;(78)1;(84)3;(85)2;(100)1;(101)2;(103)1;(106)1;(109)1;(117)1;(163)1;(190)1;(191)1;(201)8;(203)2	44	182
75	(2)1;(4)1;(9)1;(13)1;(28)4;(29)16;(30)54;(32)5;(33)6;(34)8;(35)2;(37)3;(39)11;(41)1;(42)8;(43)5;(44)2;(46)1;(49)1;(50)1;(51)13;(52)1;(54)1;(56)2;(59)3;(65)6;(66)2;(67)2;(68)3;(71)4;(74)1;(100)4;(101)3;(106)1;(110)3;(114)1;(117)1;(124)1;(127)2;(134)3;(190)1;(191)1;(193)1;(201)9	44	201
76	(4)1;(6)1;(27)1;(28)3;(29)18;(30)137;(32)6;(33)24;(34)6;(35)1;(36)3;(37)4;(39)4;(42)5;(43)6;(44)3;(46)3;(48)3;(49)12;(51)6;(52)2;(53)2;(57)2;(59)1;(60)6;(61)1;(65)13;(66)6;(67)13;(68)18;(71)2;(74)8;(86)1;(100)3;(107)2;(116)88;(118)2;(119)1;(121)1;(163)1;(165)1;(190)1;(191)1;(192)1;(193)1;(195)1;(200)1;(201)7	48	434
77	(1)1;(2)1;(4)1;(19)2;(28)7;(29)13;(30)217;(33)41;(34)12;(35)2;(37)1;(38)2;(39)2;(43)4;(44)4;(46)1;(49)3;(51)1;(52)2;(54)11;(59)1;(61)1;(65)8;(68)1;(74)5;(110)14;(111)1;(114)40;(116)1;(135)1;(142)1;(163)2;(189)1;(190)1;(191)1;(193)1;(201)1	37	409

Station #	Identification code & number per Hamon Grab sample (0.1m^2)	No. of Species	No. of Individuals
78	(2)1;(4)1;(10)1;(19)5;(28)5;(29)13;(30)73;(32)5;(33)40;(34)3;(37)2;(39)3;(41)1;(42)5;(43)4;(44)1;(48)3;(49)10;(50)3;(51)1;(52)2;(54)5;(57)1;(59)2;(60)5;(61)1;(66)10;(68)2;(71)2;(74)1;(103)1;(106)1;(110)5;(111)2;(119)1;(121)1;(129)2;(131)1;(141)1;(155)1;(163)3;(165)1;(191)1;(192)1;(193)1;(201)3;(203)1;(210)4	48	242
79	(1)1;(2)1;(4)1;(10)1;(19)1;(28)13;(29)26;(30)67;(32)7;(33)33;(34)3;(35)3;(37)2;(39)2;(42)18;(43)19;(44)1;(45)1;(46)2;(48)1;(49)6;(51)1;(52)1;(54)1;(57)3;(58)2;(59)9;(60)1;(61)1;(62)1;(65)17;(66)7;(67)1;(68)286;(71)18;(74)13;(75)2;(79)2;(84)1;(100)1;(101)2;(103)1;(106)1;(110)1;(111)1;(116)135;(124)2;(133)3;(134)1;(137)1;(155)1;(165)1;(168)1;(189)2;(192)1;(193)1;(201)4;(203)1;(206)1;(210)2	60	740
80	(2)1;(4)1;(15)1;(19)9;(28)9;(29)41;(30)53;(33)16;(34)3;(37)1;(38)1;(39)1;(41)1;(42)2;(43)5;(44)1;(46)5;(48)2;(51)3;(52)1;(54)1;(55)1;(57)1;(59)4;(61)2;(62)1;(65)9;(67)6;(74)72;(87)1;(88)1;(105)1;(110)6;(116)43;(165)1;(166)1;(192)1;(193)1;(200)1;(206)4;(209)1	41	316
81	(2)1;(4)1;(19)1;(28)7;(29)7;(30)196;(32)1;(33)17;(34)5;(35)1;(37)2;(38)2;(39)1;(42)2;(43)6;(44)1;(46)1;(48)1;(50)1;(51)2;(54)2;(59)2;(62)2;(63)1;(65)19;(66)8;(67)3;(71)11;(74)4;(79)1;(82)1;(100)1;(102)1;(103)1;(110)30;(114)8;(116)2;(193)1;(195)1;(201)2;(212)1	41	358
82	(2)1;(4)1;(7)1;(8)1;(9)1;(15)1;(26)1;(28)15;(29)29;(30)7;(32)13;(33)29;(34)3;(35)3;(37)6;(38)1;(39)18;(41)2;(42)38;(43)5;(44)3;(46)8;(47)1;(48)1;(49)49;(51)2;(52)1;(54)2;(57)3;(59)62;(60)8;(61)2;(62)2;(63)3;(65)55;(66)10;(67)8;(68)8;(69)2;(70)23;(71)8;(74)4;(75)1;(84)149;(85)9;(86)3;(89)1;(99)1;(107)1;(109)4;(112)1;(114)1;(116)55;(117)8;(118)2;(119)2;(124)1;(128)3;(133)7;(137)1;(141)3;(155)3;(159)2;(160)2;(161)1;(163)20;(172)1;(177)1;(178)3;(180)4;(191)1;(192)1;(193)1;(201)39;(203)1;(204)1;(205)1;(206)2;(210)27	79	805
83	(4)1;(15)1;(20)1;(23)4;(27)5;(28)16;(29)24;(30)6;(32)7;(33)15;(34)3;(35)3;(37)11;(39)2;(42)7;(43)2;(44)2;(46)4;(48)13;(49)21;(51)1;(52)1;(53)6;(56)2;(57)5;(59)32;(60)9;(61)2;(62)5;(63)2;(65)33;(66)2;(67)10;(70)3;(71)12;(73)1;(74)10;(78)2;(84)15;(85)1;(100)2;(101)1;(102)1;(103)3;(107)2;(109)8;(110)1;(116)57;(117)2;(118)1;(119)1;(124)1;(127)1;(133)6;(134)1;(136)4;(137)4;(143)2;(144)2;(163)8;(168)3;(177)3;(189)1;(191)1;(192)1;(193)1;(196)1;(200)1;(201)25;(205)1;(210)5	71	453
84	(1)1;(2)1;(4)1;(9)1;(10)1;(19)2;(23)1;(27)2;(28)1;(29)5;(30)7;(32)10;(33)10;(34)2;(37)4;(38)5;(42)4;(43)1;(44)5;(46)2;(49)13;(51)3;(52)2;(54)1;(55)1;(57)7;(59)23;(60)3;(61)2;(62)7;(63)2;(64)1;(65)10;(66)2;(67)1;(68)155;(71)2;(72)1;(73)2;(74)1;(75)3;(78)2;(90)1;(109)2;(112)1;(116)1172;(118)1;(133)1;(134)6;(136)1;(137)2;(141)1;(145)1;(154)1;(163)23;(168)6;(177)2;(190)1;(191)1;(192)1;(193)1;(195)1;(201)18;(203)1;(204)3;(205)1	66	1559
85	(2)1;(4)1;(8)1;(11)1;(28)6;(29)13;(30)127;(31)1;(32)18;(33)50;(34)2;(35)2;(36)2;(37)5;(38)1;(39)1;(41)13;(42)26;(43)22;(44)12;(46)3;(47)1;(48)6;(49)23;(50)1;(51)10;(52)1;(54)3;(57)2;(59)3;(60)7;(61)4;(65)6;(67)4;(68)3;(69)1;(70)5;(71)4;(74)3;(78)1;(79)1;(84)2;(85)5;(90)1;(100)2;(101)4;(116)11;(118)5;(131)2;(134)3;(136)1;(141)1;(155)1;(163)2;(165)4;(166)1;(167)2;(180)1;(189)2;(190)1;(191)1;(192)1;(193)1;(201)10;(204)1;(206)2;(210)1	67	465
86	(2)1;(4)1;(19)2;(28)6;(29)16;(30)142;(32)1;(33)13;(35)1;(37)4;(38)1;(39)1;(42)9;(43)9;(44)4;(48)2;(51)3;(52)2;(54)6;(59)2;(61)2;(64)1;(65)24;(66)1;(67)5;(70)1;(71)4;(73)1;(74)15;(103)3;(110)7;(114)2;(116)31;(117)1;(193)1;(200)1;(211)1	37	327
87	(2)1;(4)1;(10)1;(28)15;(29)34;(30)2;(35)3;(37)2;(41)6;(42)1;(43)13;(44)4;(46)13;(50)1;(53)4;(54)1;(55)1;(56)5;(57)1;(60)1;(61)2;(62)1;(65)2;(66)1;(67)14;(71)5;(74)10;(84)2;(85)2;(116)230;(119)2;(124)1;(127)1;(132)1;(134)1;(139)1;(162)1;(163)8;(191)1;(192)1;(193)1;(195)1;(201)21;(206)1;(210)1	45	422
88	(2)1;(4)1;(10)1;(15)1;(27)1;(28)8;(29)8;(30)2;(32)11;(33)16;(34)1;(35)3;(37)2;(39)9;(42)14;(43)3;(44)6;(46)1;(48)6;(49)19;(51)1;(52)1;(54)3;(57)4;(59)51;(60)6;(61)1;(62)4;(63)1;(64)2;(65)18;(67)1;(68)14;(71)2;(72)2;(74)1;(75)1;(78)3;(84)1;(91)1;(99)1;(103)6;(109)7;(111)1;(112)1;(115)1;(116)169;(117)1;(118)3;(119)2;(127)1;(136)6;(137)8;(144)1;(146)1;(159)2;(161)1;(163)14;(165)2;(168)4;(171)1;(178)1;(181)1;(191)1;(192)1;(193)1;(195)1;(198)1;(201)10;(203)1;(207)1;(208)1;(210)17	73	502

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
89	(6)1;(28)2;(29)22;(30)40;(33)11;(35)2;(41)7;(42)2;(43)40;(44)5;(46)6;(48)14;(51)3;(52)12;(53)2;(54)3;(56)41;(61)1;(65)1;(66)1;(67)5;(71)1;(74)3;(131)1;(209)1;(212)1	26	228
90	(1)1;(2)1;(4)1;(6)1;(8)1;(9)1;(10)1;(13)1;(15)1;(28)5;(29)4;(30)27;(32)2;(33)9;(34)2;(35)4;(37)3;(38)2;(41)2;(43)13;(46)4;(49)2;(51)1;(52)3;(54)3;(55)1;(56)1;(57)1;(59)1;(60)4;(61)1;(62)1;(63)2;(65)3;(67)1;(71)2;(74)1;(100)4;(103)32;(106)2;(114)11;(116)1;(159)1;(160)1;(161)1;(171)2;(182)2;(193)1;(195)1;(201)3	50	176
91	(4)1;(16)1;(28)6;(29)16;(30)63;(31)1;(32)2;(33)19;(35)2;(37)3;(39)1;(41)3;(42)3;(43)14;(44)1;(45)1;(46)9;(48)2;(49)7;(50)3;(52)4;(54)3;(55)1;(56)2;(59)4;(60)1;(61)3;(62)2;(63)2;(65)19;(66)7;(67)8;(71)6;(74)17;(100)4;(101)1;(102)1;(103)44;(104)3;(110)2;(111)1;(113)1;(114)6;(116)6;(117)1;(124)1;(131)2;(161)1;(165)2;(191)1;(192)1;(193)1;(200)1;(201)5;(206)1;(211)1;(212)1	57	325
92	(4)1;(9)1;(10)1;(12)1;(13)1;(28)2;(29)9;(30)50;(32)4;(33)12;(35)1;(37)5;(39)4;(41)2;(42)5;(43)2;(44)2;(48)5;(49)7;(54)3;(56)1;(57)1;(59)12;(61)1;(62)1;(65)25;(66)1;(67)3;(68)13;(71)3;(72)3;(74)4;(78)1;(85)1;(92)1;(100)1;(103)48;(108)1;(116)244;(117)1;(131)1;(140)1;(141)2;(159)27;(163)3;(164)1;(178)1;(192)1;(193)1;(195)1;(201)5;(206)1;(210)1	53	530
93	(4)1;(9)1;(19)1;(28)3;(29)10;(30)42;(32)2;(33)3;(34)2;(35)1;(37)3;(39)3;(41)2;(42)1;(43)2;(46)2;(56)17;(59)4;(60)1;(61)1;(62)1;(63)1;(65)1;(67)5;(70)1;(71)1;(72)3;(74)1;(75)2;(99)1;(101)1;(103)17;(147)1;(159)2;(171)1;(179)1;(189)1;(191)1;(193)1	39	145
94	(4)1;(9)1;(28)2;(29)7;(30)82;(32)6;(33)17;(35)1;(38)1;(39)2;(42)4;(43)2;(49)1;(50)2;(51)2;(54)4;(59)8;(61)1;(62)2;(63)1;(65)2;(68)10;(69)1;(71)2;(90)1;(114)23;(116)45;(136)1;(146)1;(147)2;(159)2;(163)8;(167)1;(191)1;(192)1;(193)1	36	249
95	(4)1;(28)3;(29)12;(30)74;(32)3;(33)37;(34)10;(35)1;(37)1;(42)10;(43)5;(44)3;(46)1;(48)1;(49)8;(52)2;(54)2;(55)3;(56)2;(57)3;(59)5;(60)4;(62)1;(65)8;(67)1;(68)12;(74)2;(75)2;(93)1;(103)3;(108)1;(111)1;(114)2;(116)202;(127)1;(131)2;(140)1;(148)1;(163)1;(168)2;(191)1;(192)1;(193)1;(201)1;(206)1	45	440
96	(4)1;(28)6;(29)20;(30)13;(31)1;(32)2;(33)2;(34)18;(35)1;(36)1;(39)5;(41)10;(42)4;(43)6;(44)2;(48)8;(49)11;(52)1;(56)6;(59)15;(60)2;(61)1;(65)22;(66)1;(67)7;(70)1;(71)1;(74)28;(100)3;(107)1;(110)3;(111)2;(116)27;(137)1;(149)1;(163)1;(167)1;(168)5;(190)1;(192)1;(193)1;(195)1;(206)1;(210)1;(211)1	45	248
97	(1)1;(2)1;(4)1;(19)1;(28)8;(29)2;(30)36;(31)1;(32)1;(33)20;(34)3;(38)1;(39)1;(40)1;(42)4;(44)1;(51)1;(54)10;(55)4;(59)1;(60)1;(65)2;(66)4;(68)1;(100)4;(101)2;(103)2;(106)2;(108)1;(110)8;(111)3;(114)6;(116)9;(138)1;(141)1;(161)1;(165)1;(168)1;(190)1;(191)1;(210)1	41	152
98	(4)1;(13)1;(28)2;(29)1;(30)58;(32)1;(33)22;(37)2;(38)4;(42)2;(43)2;(44)3;(46)1;(47)1;(51)2;(52)2;(55)3;(57)1;(67)1;(106)1;(110)13;(114)7;(116)7;(191)1;(193)1;(195)1;(212)2	27	143
99	(2)1;(4)1;(15)1;(27)1;(28)2;(29)2;(30)34;(31)7;(33)9;(34)4;(38)6;(41)4;(42)1;(43)2;(48)3;(49)1;(51)3;(54)3;(57)1;(59)1;(60)3;(65)1;(66)1;(100)7;(103)1;(106)2;(110)8;(113)1;(114)2;(118)1;(168)1;(191)1;(192)1;(201)5;(212)1	35	123
100	(2)1;(4)1;(8)1;(19)1;(28)10;(29)33;(30)56;(32)2;(33)5;(34)2;(35)3;(37)1;(41)2;(43)80;(44)8;(45)1;(46)6;(47)1;(48)5;(49)29;(52)13;(54)1;(56)24;(59)2;(60)2;(61)1;(63)1;(64)1;(65)12;(66)1;(67)12;(68)1;(69)2;(71)1;(74)5;(81)1;(84)1;(100)3;(101)5;(103)2;(110)2;(118)1;(135)1;(149)1;(160)1;(165)1;(168)1;(170)1;(201)2;(209)1;(211)1;(212)1	52	353
101	(2)1;(29)8;(30)15;(33)1;(34)3;(38)3;(41)5;(43)13;(44)5;(46)1;(51)3;(52)3;(54)4;(56)3;(57)1;(100)2;(105)1;(106)1;(114)1;(165)1;(183)1;(200)1	22	77
102	(2)1;(28)4;(29)3;(30)9;(33)9;(34)3;(38)6;(39)1;(41)1;(42)1;(43)2;(44)1;(46)1;(49)2;(51)7;(54)10;(65)1;(68)1;(74)1;(100)4;(101)1;(103)1;(106)2;(110)3;(111)2;(116)1;(139)2;(168)1;(169)1;(190)1;(192)1;(201)5	32	89

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
103	(2)1;(4)1;(28)7;(29)22;(30)118;(32)1;(33)38;(34)9;(35)3;(37)5;(38)1;(39)6;(41)1;(42)13;(43)27;(44)5;(46)2;(48)3;(49)1;(51)1;(52)3;(54)8;(59)2;(60)2;(61)1;(65)3;(67)2;(68)1;(71)3;(74)2;(101)4;(106)1;(107)1;(110)13;(111)2;(114)3;(116)176;(136)1;(165)1;(168)3;(189)1;(191)1;(192)1;(200)1;(201)2;(210)1	46	504
104	(2)1;(4)1;(28)5;(29)22;(30)70;(31)1;(32)1;(33)19;(34)4;(35)4;(37)6;(39)1;(40)2;(41)7;(42)3;(43)80;(44)3;(46)2;(48)3;(49)1;(51)3;(52)2;(54)6;(60)3;(63)1;(66)1;(67)5;(68)2;(71)1;(106)1;(107)1;(114)1;(160)3;(168)2;(169)1;(191)1;(206)1;(209)3	38	274
105	(2)1;(28)4;(29)2;(30)37;(31)1;(33)15;(34)3;(37)1;(38)3;(40)1;(43)7;(44)2;(46)1;(48)1;(51)8;(52)1;(54)5;(57)1;(65)1;(107)1;(109)1;(110)2;(132)1;(149)1;(165)1;(168)1;(190)1;(191)1;(200)2;(212)1	30	108
106	(4)1;(9)1;(28)5;(29)29;(30)12;(33)1;(34)1;(35)2;(37)2;(41)5;(42)4;(43)48;(44)8;(46)6;(48)2;(49)1;(51)5;(52)7;(54)7;(55)3;(56)4;(60)1;(63)2;(65)1;(66)2;(74)2;(109)1;(110)2;(114)1;(139)1;(157)1;(163)1;(165)1;(166)1;(168)1;(191)1;(193)1;(200)4;(201)1	39	179
107	(1)1;(2)1;(4)1;(19)1;(28)11;(29)65;(30)74;(32)1;(33)7;(34)3;(35)8;(36)2;(37)1;(41)2;(42)1;(43)37;(44)3;(46)7;(48)5;(49)37;(50)1;(51)1;(52)2;(54)4;(56)26;(59)3;(61)1;(62)1;(63)3;(65)3;(67)7;(68)2;(70)1;(71)4;(74)14;(100)1;(101)1;(103)2;(105)1;(109)1;(110)1;(116)4;(131)12;(134)1;(140)1;(160)2;(168)4;(169)1;(171)1;(201)1;(209)5;(211)3	52	383
108	(4)1;(19)1;(28)19;(29)163;(30)88;(32)3;(34)3;(35)15;(36)1;(37)2;(41)3;(42)22;(43)35;(44)4;(46)7;(48)1;(49)10;(51)1;(52)2;(54)2;(56)13;(59)4;(60)1;(65)2;(66)2;(67)15;(70)1;(71)4;(72)4;(74)15;(100)2;(103)2;(110)2;(116)7;(119)1;(131)3;(135)1;(165)3;(168)7;(191)1;(192)1;(201)4;(210)1	43	479
109	(2)1;(4)1;(9)1;(11)1;(28)4;(29)23;(30)174;(31)2;(32)4;(33)20;(34)11;(35)1;(37)1;(38)1;(39)1;(41)3;(42)16;(43)19;(44)5;(46)2;(47)2;(48)6;(49)135;(50)1;(51)1;(52)3;(54)2;(57)4;(59)2;(60)6;(61)2;(62)1;(63)1;(65)3;(66)6;(68)3;(71)5;(74)15;(84)1;(100)1;(107)1;(114)1;(116)169;(131)3;(168)2;(190)1;(191)1;(192)1;(193)1;(201)2	50	673
110	(4)1;(6)1;(19)1;(28)7;(29)34;(30)84;(32)5;(33)28;(34)2;(35)3;(38)2;(39)2;(42)11;(43)2;(44)9;(46)1;(48)4;(49)45;(53)1;(57)3;(59)17;(60)6;(61)4;(63)2;(65)50;(66)1;(67)1;(68)6;(71)7;(72)2;(74)7;(84)5;(94)1;(103)5;(116)13;(117)1;(131)3;(137)2;(140)1;(144)2;(160)2;(163)7;(165)1;(171)1;(191)1;(193)1;(201)2;(210)1	48	398
111	(4)1;(15)1;(28)8;(29)49;(30)91;(32)1;(33)6;(35)8;(37)1;(41)2;(42)1;(43)12;(44)5;(46)5;(48)3;(49)20;(52)5;(53)1;(54)2;(56)5;(57)1;(59)1;(61)1;(62)1;(63)3;(65)4;(67)3;(70)1;(71)2;(74)17;(75)4;(108)1;(109)1;(110)2;(111)1;(114)4;(124)1;(133)1;(165)1;(168)1;(191)1;(193)1;(201)2;(206)2	44	284
112	(4)1;(15)1;(19)1;(28)7;(29)69;(30)42;(33)22;(35)12;(36)1;(37)4;(38)1;(41)5;(42)4;(43)77;(44)3;(46)10;(48)3;(49)17;(50)1;(51)2;(52)10;(54)1;(56)13;(57)1;(59)2;(61)2;(63)2;(65)8;(67)9;(69)1;(71)5;(74)8;(75)2;(80)1;(100)4;(101)1;(108)1;(110)2;(111)1;(114)8;(124)1;(131)3;(150)1;(165)5;(168)1;(182)1;(191)1;(201)3;(210)1	49	382
113	(4)1;(11)1;(28)4;(29)14;(30)14;(32)10;(33)11;(34)3;(35)4;(37)4;(38)1;(39)9;(41)1;(42)20;(43)2;(44)2;(47)1;(48)2;(49)29;(51)8;(53)1;(55)1;(57)17;(59)19;(60)14;(61)1;(62)2;(64)1;(65)24;(66)3;(68)26;(70)5;(71)6;(74)1;(75)1;(81)1;(84)18;(95)1;(99)1;(109)1;(116)343;(118)1;(128)1;(134)1;(136)1;(140)2;(141)1;(144)1;(146)4;(159)2;(161)2;(163)8;(167)2;(168)5;(169)1;(185)2;(186)5;(189)1;(191)1;(192)1;(193)1;(195)1;(201) 2;(203)3;(210)3	65	680
114	(4)1;(13)1;(15)1;(19)1;(27)2;(28)4;(29)21;(30)23;(32)5;(33)33;(34)1;(35)14;(36)1;(39)3;(41)1;(42)19;(43)4;(44)7;(46)2;(47)1;(48)4;(49)182;(50)1;(54)1;(57)2;(59)7;(60)2;(62)3;(63)5;(65)7;(66)2;(67)4;(68)2;(70)3;(71)1;(74)2;(75)2;(84)2;(100)2;(103)26;(106)1;(109)1;(110)2;(116)1;(117)1;(118)3;(124)1;(131)1;(134)1;(135)1;(141)1;(155)1;(159)19;(163)7;(165)2;(166)1;(168)2;(170)1;(184)1;(192)1;(193)1;(201)7;(203)1	63	463

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
115	(9)1;(13)1;(27)1;(28)3;(29)38;(30)77;(32)13;(33)18;(34)3;(35)3;(37)6;(38)1;(39)11;(42)23;(43)1;(44)2;(46)2;(47)1;(48)6;(49)61;(57)15;(59)52;(60)5;(62)5;(63)2;(64)1;(65)5;(66)2;(67)1;(68)74;(70)3;(71)3;(72)2;(74)3;(84)19;(85)1;(95)1;(99)1;(103)3;(104)1;(109)6;(110)1;(111)1;(116)414;(117)2;(127)1;(128)4;(131)1;(133)1;(134)1;(136)2;(141)3;(144)5;(155)1;(157)1;(161)4;(163)30;(167)1;(185)1;(190)1;(191)1;(193)1;(195)1;(201)34;(203)1;(205)1;(206)3;(207)1;(210)5	69	1000
116	(2)1;(4)1;(15)1;(28)7;(29)31;(30)112;(31)1;(32)7;(33)4;(34)2;(35)2;(37)1;(38)1;(39)1;(41)4;(42)1;(43)8;(44)1;(46)2;(47)2;(48)5;(49)16;(50)1;(51)2;(52)2;(54)1;(55)1;(56)7;(59)5;(60)4;(62)1;(65)4;(67)5;(68)1;(71)2;(73)1;(74)12;(100)5;(101)2;(110)1;(118)1;(129)2;(131)1;(133)1;(135)1;(191)1;(192)1;(200)3;(201)4;(210)2	50	285
117	(4)1;(28)7;(29)11;(30)95;(32)5;(33)2;(34)2;(41)6;(42)1;(43)16;(44)3;(48)1;(49)7;(51)2;(52)1;(54)2;(55)1;(60)3;(61)1;(65)2;(67)1;(70)1;(74)8;(100)1;(103)1;(110)2;(111)1;(116)12;(136)1;(165)1;(190)1;(191)1;(192)1;(193)1;(201)2	35	204
118	(4)1;(13)1;(19)1;(23)1;(27)1;(28)1;(29)31;(30)80;(32)3;(33)3;(35)6;(36)1;(37)2;(41)2;(42)4;(43)1;(44)3;(48)5;(49)8;(52)3;(56)1;(59)3;(61)3;(62)1;(63)2;(65)14;(66)12;(67)5;(68)3;(70)1;(71)4;(74)2;(100)4;(101)2;(103)2;(109)2;(110)1;(111)1;(112)1;(116)82;(128)1;(129)1;(134)1;(140)1;(141)2;(144)1;(163)1;(191)1;(192)1;(193)1;(195)1;(201)1;(205)2;(206)1	54	320
119	(1)1;(4)1;(13)1;(17)1;(19)1;(23)1;(28)9;(29)65;(30)19;(35)7;(37)2;(41)5;(42)9;(43)22;(46)10;(48)3;(49)14;(52)2;(56)9;(59)3;(62)1;(63)3;(65)5;(66)2;(67)2;(68)1;(71)4;(74)5;(75)1;(77)1;(103)14;(109)1;(116)5;(131)2;(160)1;(191)1;(192)1;(193)1;(195)1;(200)2;(201)2;(204)1	42	242
120	(1)1;(2)1;(4)1;(9)1;(19)1;(28)5;(29)17;(30)3;(32)1;(33)2;(34)1;(35)2;(37)1;(39)9;(41)5;(42)2;(43)3;(44)3;(46)2;(48)3;(49)88;(52)9;(53)1;(54)1;(56)7;(59)4;(60)1;(61)1;(62)1;(63)2;(67)5;(71)1;(74)16;(75)2;(78)1;(100)3;(102)1;(103)8;(110)2;(111)1;(116)2;(117)1;(129)2;(131)1;(135)1;(137)1;(142)1;(161)2;(168)1;(169)1;(171)1;(175)1;(177)2;(192)1;(193)1;(201)6;(210)10;(211)1	58	255
121	(4)1;(10)1;(15)1;(27)3;(28)14;(29)55;(30)2;(32)1;(33)5;(34)2;(35)1;(41)2;(42)5;(43)2;(44)2;(46)2;(49)63;(51)3;(54)1;(56)2;(57)1;(59)2;(61)1;(64)2;(65)14;(66)1;(67)9;(69)1;(71)8;(74)15;(94)1;(96)1;(101)1;(141)1;(161)1;(191)1;(193)1;(206)2	38	231
122	(2)1;(4)1;(9)1;(28)3;(29)27;(30)54;(32)1;(33)26;(34)8;(35)2;(37)3;(38)1;(39)1;(42)6;(43)18;(44)2;(46)3;(47)1;(48)1;(49)16;(52)3;(54)5;(57)5;(59)4;(60)27;(61)3;(63)2;(66)5;(67)4;(68)4;(74)15;(75)3;(100)3;(101)1;(107)2;(110)1;(116)39;(127)1;(129)1;(131)3;(163)1;(165)1;(189)1;(190)1;(192)1;(193)1;(200)1;(201)4;(210)1	49	319
123	(1)1;(4)1;(15)1;(28)7;(29)39;(30)74;(31)1;(32)2;(33)9;(34)6;(35)1;(37)1;(38)2;(41)1;(42)1;(43)22;(44)1;(46)4;(47)1;(49)17;(51)2;(52)2;(53)1;(54)5;(55)3;(60)1;(61)1;(65)4;(71)2;(74)1;(75)1;(82)1;(99)1;(100)7;(101)1;(109)1;(110)3;(111)1;(113)1;(139)1;(159)1;(165)1;(168)1;(190)1;(191)1;(192)1;(193)1;(201)2;(206)3;(209)1	50	245
124	(2)1;(28)2;(29)3;(30)11;(33)9;(34)7;(38)2;(40)1;(41)2;(42)3;(48)3;(49)18;(51)6;(52)1;(54)11;(61)1;(110)7;(111)1;(114)2;(119)1;(129)1;(161)1;(191)1	23	95
125	(28)23;(29)55;(30)23;(33)8;(34)4;(35)5;(36)1;(37)1;(41)4;(42)5;(43)9;(44)3;(46)4;(47)1;(48)1;(49)69;(52)4;(55)1;(59)4;(60)9;(65)3;(67)4;(71)2;(72)1;(74)3;(75)1;(84)2;(100)1;(103)1;(117)1;(129)1;(165)1;(168)1;(191)1;(201)1;(206)1;(211)1	37	260
126	(4)1;(28)3;(29)7;(30)16;(32)1;(33)12;(34)4;(37)1;(39)6;(42)2;(44)2;(49)37;(51)1;(54)4;(57)1;(59)8;(60)4;(61)2;(63)1;(65)1;(66)1;(67)1;(71)1;(79)1;(97)1;(100)1;(102)1;(110)2;(111)1;(192)1;(193)1;(203)1	32	127
127	(2)1;(28)11;(29)23;(30)18;(32)4;(33)5;(35)1;(38)7;(40)2;(41)23;(42)1;(43)28;(44)2;(45)1;(46)2;(47)2;(48)4;(49)5;(50)4;(51)3;(52)12;(54)7;(56)9;(60)1;(77)1;(100)3;(103)1;(105)1;(106)1;(107)1;(110)2;(111)1;(114)1;(138)1;(160)2;(165)1;(168)1;(191)1;(201)4	39	198
128	(4)1;(28)1;(29)4;(30)2;(33)4;(38)2;(43)1;(44)1;(47)1;(48)1;(49)5;(54)4;(59)2;(100)2;(103)1;(106)1;(110)1;(111)1;(165)1	19	36

Station #	Identification code & number per Hamon Grab sample (0.1m^2)	No. of Species	No. of Individuals
129	(2)1;(4)1;(28)8;(29)5;(30)14;(31)1;(33)9;(34)1;(38)14;(42)1;(44)1;(47)8;(49)3;(51)4;(54)5;(55)1;(56)1;(68)1;(71)1;(100)3;(102)1;(103)2;(110)8;(111)1;(114)4;(160)1;(167)1;(190)1;(191)1;(201)1;(203)8	31	112
130	(4)1;(28)1;(30)1;(32)7;(33)1;(34)1;(42)2;(47)2;(49)18;(54)16;(55)1;(57)2;(66)1;(68)2;(100)1;(101)1;(103)2;(110)10;(114)3;(160)1;(165)3;(175)1;(190)1;(191)1;(193)1	25	81
131	(2)1;(4)1;(28)12;(29)17;(30)89;(31)4;(32)3;(33)22;(34)3;(35)1;(38)3;(42)5;(43)25;(44)3;(45)1;(46)1;(48)1;(49)16;(50)1;(51)1;(54)7;(67)1;(68)3;(71)4;(90)1;(110)2;(114)9;(117)1;(165)2	29	240
132	(2)1;(4)1;(28)14;(29)28;(30)11;(32)3;(35)28;(39)1;(42)1;(43)5;(44)7;(46)8;(47)1;(49)4;(53)2;(56)58;(62)1;(65)1;(67)13;(74)20;(100)5;(101)1;(104)1;(107)1;(109)1;(110)1;(165)2;(190)1;(192)1;(201)5;(210)1;(211)1	32	229
133	(4)1;(9)1;(29)1;(30)16;(32)2;(33)9;(34)3;(35)1;(38)4;(41)1;(43)13;(44)1;(47)1;(49)5;(51)5;(52)1;(54)8;(64)1;(66)1;(67)1;(68)1;(100)1;(106)1;(161)1;(163)1;(164)1;(165)4;(166)2;(167)1;(170)1;(187)1;(192)1;(200)1;(201)1	34	94
134	(2)1;(4)1;(15)1;(28)22;(29)23;(30)93;(31)2;(32)4;(33)23;(34)5;(35)5;(37)3;(39)3;(41)2;(42)5;(43)20;(44)4;(46)1;(48)1;(49)53;(52)2;(54)5;(55)1;(59)2;(60)1;(61)3;(63)1;(65)2;(66)2;(67)1;(68)3;(71)5;(74)4;(75)2;(90)1;(100)3;(101)2;(106)1;(110)4;(111)1;(113)1;(114)4;(116)4;(142)1;(160)1;(192)1;(193)1;(201)3;(211)1	49	335
135	(4)1;(11)1;(28)1;(29)1;(30)11;(31)1;(33)9;(38)1;(42)1;(43)1;(44)1;(49)1;(51)1;(54)3;(66)2;(68)1;(110)1;(114)1;(169)1;(192)1	20	41
136	(2)1;(28)5;(29)9;(30)4;(32)1;(33)1;(35)4;(37)1;(38)5;(41)3;(43)5;(44)3;(49)4;(51)1;(54)5;(56)27;(59)1;(100)2;(106)2;(110)1;(114)2;(120)1;(132)1;(151)1;(160)3;(161)1;(168)12;(169)1;(200)4;(201)1;(210)1;(212)2	32	115
137	(2)1;(4)1;(9)1;(28)9;(29)6;(30)26;(32)1;(33)3;(34)3;(37)2;(38)6;(41)4;(42)2;(43)7;(46)1;(48)1;(49)6;(56)11;(65)1;(67)1;(68)1;(77)1;(100)5;(101)1;(106)3;(107)1;(111)1;(142)1;(160)1;(165)1;(168)2;(191)1;(200)1	33	113
138	(24)2;(27)3;(28)12;(29)34;(30)2;(32)2;(33)4;(34)2;(35)9;(41)3;(42)5;(43)9;(44)3;(46)3;(49)138;(54)1;(56)4;(59)4;(60)1;(61)1;(64)1;(65)2;(66)1;(72)2;(74)10;(75)2;(100)1;(101)1;(102)2;(105)1;(110)1;(113)1;(161)2;(165)2;(170)2;(201)2;(210)1	37	276
139	(2)1;(28)4;(29)14;(30)8;(32)1;(33)18;(34)4;(35)1;(37)2;(38)4;(41)10;(43)18;(44)3;(46)3;(49)7;(51)4;(52)3;(54)10;(56)7;(57)3;(60)1;(65)1;(67)1;(100)13;(101)1;(102)1;(104)1;(131)1;(139)1;(160)1;(164)1;(165)1;(168)4;(191)1;(192)1;(200)1;(203)3;(210)1;(212)1;(213)1	40	162
140	(2)1;(28)3;(29)5;(30)2;(32)2;(34)1;(35)18;(38)3;(41)1;(42)1;(43)1;(44)14;(49)2;(50)1;(51)5;(54)3;(56)34;(76)1;(100)3;(109)1;(139)2;(160)1;(165)1;(168)1;(185)1;(199)1;(200)5;(210)1	28	115
141	(2)1;(28)9;(29)20;(30)8;(34)5;(35)12;(37)1;(38)2;(41)2;(43)8;(44)5;(46)4;(49)2;(52)1;(56)31;(64)1;(65)2;(74)1;(77)4;(80)1;(100)2;(106)1;(156)1;(160)1;(165)1;(168)9;(185)4;(190)1;(200)3;(201)3;(212)1	31	147
142	(2)1;(4)1;(28)23;(29)34;(30)213;(31)8;(32)2;(33)29;(34)3;(35)3;(37)3;(39)1;(40)2;(41)3;(42)8;(43)39;(44)2;(45)1;(46)4;(48)4;(49)20;(53)1;(54)3;(59)1;(60)2;(65)3;(71)1;(75)1;(76)1;(104)1;(110)12;(114)28;(160)1;(191)1;(203)1;(206)1;(210)1	37	463
143	(4)1;(28)9;(29)10;(30)82;(32)2;(33)23;(34)9;(37)1;(38)5;(41)4;(42)1;(43)27;(44)1;(45)1;(46)4;(48)4;(49)1;(51)4;(52)6;(54)7;(56)1;(77)1;(100)1;(106)2;(110)6;(111)1;(114)2;(161)1;(201)2	29	219
144	(2)1;(22)2;(28)3;(30)23;(31)2;(33)7;(34)2;(40)1;(43)5;(44)1;(45)1;(48)2;(49)6;(51)6;(52)1;(54)5;(59)1;(72)1;(100)1;(106)3;(110)6;(114)2;(139)2;(160)1;(165)2;(187)1	26	88
145	(2)1;(28)8;(29)37;(30)3;(32)1;(33)1;(34)2;(35)22;(41)4;(43)8;(50)2;(51)4;(53)1;(54)2;(56)48;(64)1;(66)1;(67)1;(106)1;(139)3;(160)1;(165)1;(168)6;(169)2;(183)1;(187)1;(191)1;(192)1;(199)1;(200)5;(210)2;(212)2	32	175
146	(2)1;(28)11;(29)12;(30)17;(32)1;(33)3;(34)1;(35)24;(37)2;(38)1;(41)8;(43)9;(44)5;(50)4;(51)4;(52)1;(54)7;(56)38;(100)1;(104)1;(106)1;(111)2;(120)1;(160)1;(165)1;(168)1;(190)1;(191)1;(200)2;(201)2	30	164

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
147	(2)1;(28)7;(29)22;(32)1;(34)1;(35)19;(37)1;(41)4;(43)10;(44)5;(46)5;(48)2;(49)2;(51)11;(52)3;(54)1;(56)54;(60)1;(65)1;(67)4;(68)1;(83)1;(100)9;(113)1;(114)1;(120)1;(160)2;(168)1;(183)1;(195)1;(200)2;(201)1;(212)1	33	178
148	(4)1;(22)1;(28)9;(29)6;(30)5;(32)5;(33)1;(34)2;(35)1;(41)4;(43)11;(46)6;(50)1;(51)1;(53)1;(54)2;(56)15;(67)1;(68)1;(72)1;(100)6;(110)2;(111)1;(168)1;(191)1;(201)1	26	87
149	(2)1;(4)1;(13)1;(28)13;(29)15;(32)15;(33)3;(34)1;(36)1;(38)1;(39)4;(42)24;(43)6;(44)12;(46)9;(47)3;(48)5;(49)104;(54)2;(56)13;(57)1;(59)1;(60)1;(65)6;(66)1;(67)4;(68)6;(71)2;(74)8;(100)4;(101)4;(107)2;(110)1;(137)2;(142)1;(152)1;(161)2;(165)1;(168)2;(169)1;(170)1;(171)1;(183)1;(187)1;(191)1;(199)1;(201)1;(210)1	48	293
150	(4)1;(28)6;(29)4;(30)9;(32)1;(33)4;(34)3;(37)2;(38)3;(41)3;(43)13;(44)2;(46)1;(49)2;(51)2;(54)3;(56)15;(57)1;(67)1;(74)1;(100)2;(110)1;(160)2;(168)3;(183)2;(191)1;(192)1;(199)2;(201)3;(212)1	30	95
151	(2)1;(4)1;(28)7;(29)25;(30)13;(32)8;(33)1;(34)4;(35)4;(38)2;(39)1;(41)18;(42)2;(43)23;(44)4;(46)11;(48)3;(49)3;(50)1;(51)2;(52)2;(54)2;(56)22;(67)4;(77)3;(100)11;(104)1;(110)1;(113)1;(139)1;(158)1;(168)4;(169)1;(183)1;(191)1;(192)1;(200)5;(201)2;(203)1;(210)1	40	200
152	(2)1;(9)1;(19)1;(28)6;(29)2;(30)29;(32)2;(33)9;(34)4;(36)1;(38)10;(41)5;(42)1;(43)3;(44)4;(47)2;(49)5;(50)2;(51)8;(52)2;(54)6;(67)1;(100)2;(104)1;(110)7;(111)1;(114)2;(161)1;(167)1;(168)4;(190)1;(191)1;(192)1;(196)1;(199)1;(200)2;(201)3;(203)7	38	141
153	(2)1;(4)1;(28)25;(29)45;(30)36;(31)1;(32)6;(33)12;(34)3;(35)22;(36)1;(37)2;(38)1;(41)11;(42)1;(43)20;(44)1;(46)4;(47)1;(48)3;(49)31;(50)2;(51)3;(52)5;(54)6;(56)15;(59)1;(63)1;(65)3;(66)1;(67)1;(71)4;(74)14;(75)1;(77)1;(100)9;(101)1;(103)1;(104)1;(106)1;(110)2;(111)1;(114)2;(139)1;(165)1;(168)4;(170)1;(191)1;(192)1;(200)3;(201)7;(203)1	52	324
154	(28)13;(29)18;(30)38;(31)1;(32)1;(33)9;(34)3;(35)2;(37)3;(38)2;(41)4;(43)14;(44)2;(46)3;(48)2;(49)14;(51)1;(56)2;(64)1;(74)1;(100)5;(102)1;(104)1;(105)1;(106)6;(110)3;(165)1;(166)1;(167)1;(191)1;(192)1;(200)1;(201)1;(211)2;(212)3	35	163
155	(2)1;(4)1;(27)1;(28)11;(29)35;(30)48;(31)1;(32)2;(33)22;(34)11;(35)7;(36)1;(37)1;(38)1;(39)3;(41)13;(42)1;(43)27;(44)6;(46)1;(48)6;(49)58;(51)3;(52)2;(54)3;(56)13;(57)3;(59)1;(60)1;(61)2;(62)1;(64)1;(65)3;(66)4;(67)1;(71)2;(74)4;(75)1;(100)10;(101)4;(103)1;(106)4;(107)1;(110)8;(111)1;(114)4;(139)1;(160)1;(166)1;(168)1;(190)1;(191)1;(192)1;(201)9;(203)6	55	358
156	(28)27;(29)41;(30)8;(32)7;(35)18;(38)1;(41)38;(42)2;(43)30;(44)3;(46)15;(47)1;(48)4;(49)11;(55)2;(56)40;(60)1;(65)4;(71)1;(74)13;(75)1;(77)1;(100)16;(101)1;(102)1;(106)1;(107)1;(114)1;(120)1;(129)1;(165)2;(169)1;(191)1;(201)11;(212)1	35	308
157	(2)1;(4)1;(9)1;(23)1;(28)28;(29)71;(30)3;(32)14;(33)6;(34)1;(35)29;(36)3;(38)1;(39)16;(41)8;(42)12;(43)2;(44)6;(46)4;(47)8;(48)40;(49)158;(51)1;(52)3;(54)1;(56)10;(57)2;(59)7;(60)3;(64)1;(65)9;(66)2;(67)11;(68)4;(71)4;(74)11;(84)4;(100)33;(101)7;(106)8;(107)3;(111)1;(113)1;(118)1;(120)1;(124)1;(127)2;(132)1;(161)2;(165)1;(166)1;(167)1;(168)2;(188)1;(190)1;(191)1;(192)1;(195)1;(196)1;(201)35;(203)1	61	595
158	(2)1;(4)1;(9)1;(28)9;(29)6;(30)7;(31)1;(33)6;(34)4;(38)11;(39)1;(41)1;(42)1;(49)3;(51)1;(54)2;(100)1;(103)1;(107)1;(110)13;(114)2;(131)1;(134)1;(139)1;(161)1;(168)1;(191)1;(193)1;(199)1;(201)1	30	83
159	(4)1;(28)15;(29)1;(30)8;(31)1;(32)1;(33)18;(47)3;(49)2;(51)1;(54)15;(101)1;(103)7;(110)6;(114)3;(191)1;(199)1	17	85
160	(2)1;(4)1;(9)1;(28)6;(29)3;(30)4;(33)9;(38)6;(41)1;(42)1;(49)2;(54)7;(56)2;(61)1;(67)2;(100)2;(103)3;(105)1;(106)1;(110)4;(111)1;(114)1;(190)1;(191)1;(195)1;(196)1;(201)3;(210)1	28	68
161	(2)1;(4)1;(28)6;(29)9;(30)11;(32)1;(33)2;(34)1;(38)1;(41)5;(42)1;(43)6;(46)1;(51)1;(52)2;(54)6;(56)3;(100)2;(104)1;(105)2;(110)2;(111)1;(168)1;(190)1;(191)1;(200)2;(201)3	27	74
162	(2)1;(9)1;(15)1;(28)7;(30)7;(32)1;(33)5;(34)4;(37)1;(38)3;(42)2;(43)4;(46)2;(51)3;(54)4;(67)3;(77)3;(100)2;(110)3;(111)1;(113)1;(114)1;(161)1;(168)2;(191)1;(192)1;(195)1;(196)1;(197)1;(199)1;(200)1;(201)2;(203)1;(212)1	34	74

Station #	Identification code & number per Hamon Grab sample (0.1m²)	No. of Species	No. of Individuals
163	(2)1;(4)1;(12)1;(25)1;(30)5;(33)5;(38)4;(51)4;(54)6;(65)1;(72)1;(100)1;(105)2;(109)1;(110)1;(136)1;(200)1;(201)2	18	39
164	(2)1;(4)1;(29)12;(35)15;(37)1;(38)1;(41)3;(43)5;(44)2;(50)1;(52)1;(54)1;(56)39;(67)4;(74)1;(75)2;(100)1;(111)1;(113)1;(139)1;(141)1;(153)1;(183)1;(192)1;(200)1;(212)1	26	100
165	(2)1;(28)8;(30)10;(33)6;(34)2;(35)1;(37)2;(38)3;(40)1;(41)2;(43)5;(48)1;(50)1;(51)5;(52)1;(54)5;(55)1;(100)5;(105)1;(106)1;(110)4;(114)2;(139)1;(166)1;(168)1;(191)1;(201)2;(212)4	28	78
166	(2)1;(4)1;(28)5;(29)4;(30)80;(32)5;(33)7;(34)4;(35)3;(37)3;(38)1;(41)12;(42)1;(43)25;(44)2;(46)2;(48)3;(51)7;(52)6;(54)2;(56)2;(61)1;(66)1;(67)4;(71)2;(74)1;(77)2;(98)1;(100)3;(110)2;(111)1;(168)2;(185)1;(191)1;(193)1;(200)1;(212)6	37	206
167	(28)9;(29)1;(30)15;(33)7;(34)1;(38)8;(44)2;(48)1;(51)5;(53)1;(54)8;(60)1;(77)1;(103)2;(109)1;(110)9;(114)4;(137)1;(166)1;(167)1;(203)2;(212)1	22	82
22A	(28)3;(29)2;(30)8;(31)1;(33)5;(38)16;(50)2;(58)1;(100)12;(101)1;(103)7;(104)3;(106)2;(108)1;(110)13;(199)1;(212)1	17	79
22B	(3)1;(28)2;(30)9;(31)2;(33)3;(34)1;(38)9;(41)3;(44)2;(45)1;(100)12;(103)3;(104)1;(106)4;(108)1;(110)3;(191)1;(192)1	18	59
22C	(28)3;(29)1;(30)15;(33)12;(34)5;(38)14;(42)4;(44)3;(47)1;(50)6;(58)2;(100)6;(101)1;(103)11;(106)2;(108)1;(110)22;(160)1;(212)3	19	113
27A	(2)1;(19)1;(28)1;(30)40;(31)3;(32)2;(33)14;(34)3;(38)3;(41)3;(43)13;(44)2;(46)2;(48)2;(53)1;(54)2;(56)1;(59)1;(63)1;(66)1;(100)23;(101)1;(103)3;(106)2;(108)2;(110)5;(113)1;(114)2;(134)1;(190)1;(193)1;(232)1	32	140
27B	(4)1;(28)4;(29)8;(30)5;(32)1;(33)24;(34)7;(37)5;(39)1;(42)11;(43)3;(49)4;(53)1;(55)1;(57)2;(59)4;(62)2;(65)1;(68)3;(70)1;(75)1;(103)3;(116)11;(117)1;(119)2;(127)2;(133)1;(135)1;(140)1;(153)1;(155)1;(156)1;(157)1;(163)7;(165)1;(177)1;(180)1;(190)1;(191)10;(192)1;(193)1;(196)1;(199)1;(209)1;(241)1	45	143
27C	(2)1;(4)1;(9)1;(12)1;(29)27;(30)28;(32)3;(33)8;(34)1;(35)2;(36)2;(37)2;(38)1;(39)1;(41)1;(42)4;(43)19;(44)1;(46)1;(48)1;(49)3;(52)2;(53)1;(58)3;(59)5;(62)3;(63)2;(65)3;(68)25;(70)2;(72)1;(74)1;(100)16;(101)1;(103)8;(104)1;(106)2;(108)1;(109)1;(110)4;(111)1;(116)298;(117)2;(119)1;(124)1;(127)1;(131)4;(135)1;(146)1;(155)1;(159)1;(163)22;(190)1;(191)1;(193)1;(201)2;(224)1;(226)1	58	532
31A	(4)1;(28)2;(29)8;(30)81;(31)1;(33)8;(34)7;(37)2;(38)3;(41)1;(43)4;(44)4;(46)2;(50)1;(56)2;(57)1;(68)2;(100)8;(106)2;(108)3;(111)1;(114)4;(191)1;(192)1;(197)1;(200)1;(235)2	27	154
31B	(2)1;(4)1;(30)160;(31)1;(32)3;(33)7;(34)9;(37)6;(38)4;(39)7;(41)9;(42)5;(43)19;(44)2;(46)4;(48)4;(52)2;(53)1;(54)1;(55)1;(56)12;(57)5;(59)1;(60)1;(65)4;(67)11;(71)2;(74)6;(100)18;(101)2;(106)2;(108)2;(109)1;(111)1;(114)3;(131)1;(163)3;(212)3;(238)1	39	326
31C	(4)1;(11)1;(30)205;(31)1;(32)4;(33)40;(34)9;(37)3;(39)8;(41)2;(42)21;(43)18;(44)3;(46)1;(47)2;(48)6;(49)3;(50)3;(54)2;(55)1;(56)20;(58)1;(66)5;(67)4;(74)1;(81)5;(87)3;(90)2;(100)45;(101)4;(103)1;(104)3;(105)1;(106)7;(108)3;(110)48;(113)2;(114)21;(195)1;(219)1;(221)2;(225)2;(246)1	43	517
33A	(4)1;(6)1;(18)1;(20)1;(28)2;(29)14;(30)88;(32)2;(33)14;(34)2;(35)1;(37)3;(38)1;(39)1;(41)2;(42)2;(43)20;(46)5;(48)1;(49)4;(50)1;(52)1;(53)3;(57)1;(58)1;(62)1;(63)4;(65)1;(67)1;(74)1;(75)1;(90)2;(100)8;(101)1;(110)2;(113)1;(114)2;(159)1;(167)1;(168)1;(191)1;(192)1;(199)1;(201)2;(211)1	45	207
33B	(9)1;(29)43;(30)157;(31)1;(32)2;(33)6;(34)5;(35)3;(37)2;(38)6;(42)1;(43)28;(44)1;(45)1;(46)1;(48)2;(49)2;(50)2;(52)4;(55)2;(63)7;(65)2;(66)4;(67)1;(70)1;(74)3;(83)1;(100)12;(101)1;(106)2;(113)1;(114)6;(159)3;(163)1;(165)1;(168)4;(191)1;(193)1;(200)4;(201)2;(226)2	41	330
33C	(4)1;(28)2;(30)20;(33)2;(37)1;(43)12;(48)1;(60)1;(62)2;(63)2;(66)1;(73)1;(110)1;(116)20;(175)1;(177)2;(193)1;(195)1;(222)1	19	73
35A	(19)2;(28)11;(29)24;(30)56;(33)10;(34)3;(35)1;(37)3;(38)2;(40)2;(41)4;(42)6;(43)56;(44)1;(46)1;(48)1;(49)1;(52)9;(54)1;(55)3;(57)1;(58)1;(64)2;(67)8;(68)1;(74)1;(87)4;(159)3;(200)2;(206)1;(217)1;(225)1;(227)3;(228)24	34	250
35B	(4)1;(28)2;(29)13;(30)11;(32)1;(33)1;(34)4;(37)4;(38)1;(41)2;(42)4;(43)35;(44)3;(45)1;(46)1;(48)2;(49)1;(52)1;(53)2;(55)3;(56)8;(65)3;(67)3;(74)2;(90)1;(101)1;(113)1;(164)1;(200)1;(212)1;(240)1	31	116

Station #	Identification code & number per Hamon Grab sample (0.1m^2)	No. of Species	No. of Individuals
35C	(4)1;(11)1;(19)1;(28)6;(29)35;(30)34;(31)1;(32)4;(33)8;(34)8;(35)3;(37)2;(38)4;(39)1;(41)1;(42)3;(43)44;(44)1;(45)1;(46)5;(48)2;(49)15;(52)3;(53)3;(55)1;(56)8;(58)6;(59)3;(63)2;(65)12;(66)3;(67)5;(74)16;(75)1;(87)1;(90)3;(98)2;(100)7;(101)4;(104)1;(106)9;(109)2;(110)1;(111)1;(116)6;(131)1;(139)1;(160)1;(163)3;(165)2;(168)2;(190)1;(193)1;(197)1;(200)3;(201)2;(243)1	57	300
36A	(6)1;(19)3;(20)1;(28)5;(30)14;(33)6;(35)9;(36)2;(37)2;(45)1;(46)7;(48)4;(51)5;(52)2;(53)6;(57)3;(59)7;(63)1;(65)37;(67)4;(70)5;(71)4;(74)13;(81)1;(85)1;(86)1;(89)2;(90)1;(99)1;(103)12;(109)3;(113)15;(117)2;(136)2;(144)1;(159)6;(191)1;(192)1;(193)1;(201)8;(215)1;(216)1;(217)1;(218)1;(232)3;(236)2	46	210
36B	(6)1;(16)1;(27)1;(28)6;(30)20;(33)3;(35)10;(36)1;(37)1;(48)3;(53)6;(54)1;(57)2;(58)1;(59)6;(61)1;(65)36;(70)2;(74)12;(86)1;(87)1;(89)2;(90)3;(103)2;(113)4;(117)2;(118)2;(124)1;(135)1;(136)1;(146)2;(159)1;(165)2;(167)1;(189)1;(192)1;(193)1;(200)5;(201)2;(217)3;(219)1;(220)2;(232)1;(236)2	44	159
36C	(6)1;(8)1;(19)1;(28)6;(29)15;(30)25;(32)1;(33)21;(35)4;(37)4;(38)1;(39)2;(42)1;(44)3;(45)3;(48)10;(49)2;(53)6;(57)2;(58)4;(59)39;(60)1;(62)2;(65)10;(66)1;(67)1;(68)3;(69)2;(70)31;(74)7;(84)6;(85)1;(87)1;(89)3;(90)1;(103)1;(104)1;(108)2;(112)1;(113)8;(117)2;(118)5;(124)2;(132)1;(134)1;(136)2;(141)1;(144)1;(159)1;(160)1;(165)1;(189)2;(191)1;(192)1;(193)1;(198)1;(200)1;(201)35;(220)2;(221)1;(222)1;(232)2;(233)1;(234)2;(236)4;(242)1	66	309
37A	(4)1;(9)1;(15)1;(28)6;(29)5;(30)1;(32)3;(33)1;(37)6;(38)1;(39)7;(42)1;(43)3;(44)1;(45)1;(46)1;(48)1;(50)1;(51)2;(52)1;(53)3;(57)5;(58)2;(59)28;(61)2;(62)5;(63)1;(64)2;(65)11;(66)2;(68)1;(72)1;(74)8;(75)1;(85)1;(89)1;(90)3;(99)5;(100)3;(103)9;(109)3;(113)1;(117)4;(118)2;(119)1;(136)4;(140)4;(144)1;(146)2;(159)2;(163)1;(168)4;(191)1;(192)1;(193)1;(201)2;(202)1;(216)2;(221)2;(224)1	60	179
37B	(4)1;(9)1;(15)1;(19)1;(27)1;(28)5;(29)9;(32)2;(33)2;(35)6;(36)1;(37)1;(38)2;(39)2;(41)1;(42)1;(45)3;(46)1;(48)2;(53)10;(57)3;(58)6;(59)8;(62)1;(63)1;(64)2;(65)19;(67)2;(71)1;(74)2;(81)2;(83)1;(85)1;(90)10;(103)8;(110)2;(117)6;(118)1;(134)1;(135)2;(136)1;(140)1;(144)1;(146)3;(167)1;(190)1;(191)1;(193)1;(195)1;(216)2;(220)4;(232)3;(242)1	53	153
37C	(2)1;(4)1;(9)1;(20)2;(27)1;(28)7;(29)3;(33)2;(34)1;(35)1;(37)7;(38)2;(39)14;(42)1;(43)4;(46)2;(47)1;(48)8;(52)1;(53)6;(57)6;(58)4;(59)21;(61)2;(62)6;(64)4;(65)11;(70)1;(72)1;(74)3;(81)2;(85)2;(90)2;(95)1;(99)5;(100)1;(103)2;(107)1;(109)2;(113)2;(117)5;(118)1;(128)1;(140)5;(144)2;(146)1;(155)3;(159)8;(163)2;(182)1;(183)1;(185)2;(189)4;(191)1;(193)1;(195)1;(200)1;(201)11;(202)1;(206)1;(209)1;(216)4;(221)6;(229)1;(231)1;(242)1	66	212
38A	(4)1;(28)2;(29)9;(30)6;(33)3;(34)3;(38)12;(41)1;(42)2;(43)2;(44)6;(47)41;(50)3;(53)1;(58)2;(100)6;(101)2;(106)2;(110)18;(111)2;(112)1;(114)7;(159)1;(191)1;(199)1	25	135
38B	(2)1;(28)1;(29)7;(30)3;(33)2;(34)3;(35)1;(38)15;(42)4;(43)3;(44)4;(47)59;(48)1;(50)2;(52)1;(55)1;(58)1;(59)1;(100)5;(104)1;(106)3;(110)25;(114)23;(164)1;(183)1;(190)1	26	170
38C	(30)2;(33)2;(37)1;(38)7;(42)2;(44)1;(47)30;(48)3;(50)1;(52)1;(55)2;(100)3;(104)1;(110)9;(111)1;(114)8	16	74
39A	(30)3;(31)1;(33)3;(38)23;(39)4;(41)3;(42)1;(46)2;(54)2;(58)1;(59)1;(62)1;(69)1;(100)1;(103)12;(106)1;(108)3;(110)12;(113)1;(114)2;(117)1;(134)2;(140)4;(150)1;(160)1;(199)1;(201)5;(202)2;(212)1;(233)1;(238)1	31	98
39B	(4)1;(28)4;(29)2;(30)8;(33)9;(34)1;(38)13;(44)2;(58)2;(59)2;(64)1;(68)1;(72)1;(74)1;(100)1;(103)7;(106)5;(107)1;(110)5;(114)5;(124)1;(140)1;(159)2;(162)1;(192)1;(199)1;(201)1;(202)1;(230)1	29	82
39C	(30)6;(33)12;(34)1;(38)12;(44)2;(47)1;(50)3;(52)1;(59)1;(60)1;(66)1;(103)9;(106)1;(110)5;(111)1;(114)6;(164)1;(177)1;(201)1;(202)1;(212)1	21	68
MEAN		**38.85**	**237.56**
STANDARD DEVIATION		**13.08**	**185.25**

Appendix Table 7. Table summarising the biomass of macrofauna (>1mm) extracted from the sediment in and adjacent to Production Licence Area 408 - Coal Pit during July/August 2000. Data have been calculated from a blotted wet weight using conversion factors as outlined in Eleftheriou & Basford (1989). The values are expressed as grams Ash Free Dry Weight (AFDW) per $0.1m^2$ Hamon Grab sample. **BACK**

Station #	Polychaeta g AFDW	Mollusca g AFDW	Crustacea g AFDW	Miscellania g AFDW	Echinodermata g AFDW	Total g AFDW
1	0.0899	0.0009	0.0045	0.0016	0.004	0.1009
2	0.2093	0	0.0045	0.0098	0.0224	0.246
3	0.1457	0	0.0023	0.1581	0	0.3061
4	0.0837	0	0.0135	0.3038	0.0008	0.4018
5	0.1333	0	0.0135	0.0016	0	0.1484
6	0.0713	0	0.0113	0.31	0.0008	0.3934
7	0.1426	0.0017	0.0135	0.4805	0.0008	0.6391
8	0.0868	0.0009	0.0023	0.062	0.0008	0.1528
9	0.093	0.0034	0.0045	0.0775	0	0.1784
10	0.0403	0	0.0045	0.2201	0.0008	0.2657
11	0.1054	0.0009	0.0023	0.1178	0.5488	0.7752
12	0.0992	0.0017	0.0023	0.9982	0	1.1014
13	0.0202	0.0009	0.0023	0.0434	0.0008	0.0676
14	0.0558	0.0017	0.0045	0.0016	0	0.0636
15	0.0217	0	0.0023	0.0016	0.0008	0.0264
16	0.1085	0.0009	0.0023	0.1395	0	0.2512
17	0.0434	0	0.0023	0.0031	0	0.0488
18	0.0713	0.0009	0.0045	2.666	0.0008	2.7435
19	0.0388	0	0.0045	0.0016	0.0008	0.0457
20	0.0496	0.0009	0.0023	2.3994	0	2.4522
21	0.0992	0.0255	0.0023	0.7719	0	0.8989
22	0.1271	0.0009	0.0045	0.0016	0.0008	0.1349
23	0.0403	0	0.0023	0.3007	0.0008	0.3441
24	0.0527	0	0.0045	0.0016	0	0.0588
25	0.0775	0.0009	0.0405	0.0093	0.0008	0.129
26	0.0465	0	0.0023	0.2232	0	0.272
27	0.0713	0	0.0225	0.0465	0.0008	0.1411
28	0.0558	0.0009	0.0135	0.0016	0.0008	0.0726
29	0.0713	0.0009	0.0023	0.1209	0	0.1954
30	0.0279	0.0068	0.9495	0.6851	0.8512	2.5205
31	0.1054	0	0.0023	0.1209	0.0008	0.2294
32	0.0248	0.0009	0.0338	0.1519	0	0.2114
33	0.1054	0	0.0113	0.0031	0.0008	0.1206
34	0.062	0.0009	0.0045	1.4353	0.0016	1.5043
35	0.0682	0.0034	0.0023	0.1922	0.0008	0.2669
36	0.0713	0.0009	0.0045	0.1612	0.0008	0.2387
37	0.0837	0	0.0045	0.1116	0	0.1998
38	0.1581	0.0009	0.0023	0.3348	0	0.4961
39	0.0403	0.0068	0.0315	0.0062	0	0.0848
40	0.0837	0.0034	0.0023	0.5208	0.0312	0.6414
41	0.0961	0.0009	2.142	0.0062	0.0008	2.246
42	0.1209	0.0017	0.0023	0.2604	0.0008	0.3861
43	0.0868	0.0009	0.0023	0.0016	0.0008	0.0924
44	0.1085	0.0009	0.0045	0.155	0.0008	0.2697
45	0.3038	0.0068	3.348	0.0465	0.9104	4.6155
46	0.1147	0.0102	0.0045	0.0341	0.0008	0.1643
47	0.155	0.0085	0.018	0.0016	0.0008	0.1839
48	0.1147	0.6375	0.0023	0.0016	0.0008	0.7569
49	0.155	0.5066	0.0135	0.0341	0.0008	0.71
50	0.0837	0.0017	0.0315	0.0403	0.0008	0.158
51	0.1333	0.0119	0.0045	0.0016	0.0008	0.1521
52	0.0682	0.0009	0.0068	1.6337	0.0008	1.7104
53	0.0651	0.0238	0.0023	0.248	0.0008	0.34
54	0.1498	0	0.0045	0.0031	0.0008	0.1582
55	0.1581	0.0527	0.0045	0.0031	0.0008	0.2192
56	0.0868	0	0.0023	0.124	0.0008	0.2139
57	0.0899	0.0009	0.0045	0.0155	0.0008	0.1116
58	0.1054	0.0187	0.0023	0.0372	0.0008	0.1644
59	0.1209	0.0009	0.0023	0.3255	0.0008	0.4504
60	0.0775	0.017	0.0023	0.0341	0.4624	0.5933
61	0.0992	0.0034	0.0855	0.0078	0.0008	0.1967
62	0.1736	0.0017	0.0045	0.0062	0.432	0.618
63	0.1395	0.0017	0.0045	0.4681	0.0048	0.6186

Station #	Polychaeta g AFDW	Mollusca g AFDW	Crustacea g AFDW	Miscellania g AFDW	Echinodermata g AFDW	Total g AFDW
64	0.0682	0.0077	0.0135	0.8773	0.0008	0.9675
65	0.0899	0.0009	0.0023	0.2666	0.0008	0.3605
66	0.1395	0.0017	0.0023	0.0651	0.0008	0.2094
67	0.3875	0.0034	0.4725	0.6727	0.0104	1.5465
68	0.3937	0.0034	0.0023	0.324	0.0064	0.7298
69	0.0713	0.0017	0.0135	0.0016	0.0008	0.0889
70	0.2418	0.0009	0.0023	0.0016	0.0008	0.2474
71	0.3906	0.0952	0.0135	1.1005	0.0016	1.6014
72	0.2635	0.0136	0.1305	0.2976	0.0144	0.7196
73	0.5487	0.0017	0.0045	0.0124	0.0016	0.5689
74	0.1116	0.0034	0.0023	0.0016	0.0008	0.1197
75	0.0713	0	0.0045	0.0016	0.0008	0.0782
76	0.093	0.0009	1.638	0.0124	0.0008	1.7451
77	0.1395	0.0009	0.0135	0.434	0.0008	0.5887
78	0.0698	0.0017	0.0023	0.1116	0.0008	0.1862
79	0.2542	0.0544	4.761	0.031	0.0064	5.107
80	0.1395	0.0051	0.3555	0.0372	0.0048	0.5421
81	0.1798	0	0.0135	0.1612	0.0008	0.3553
82	0.3999	0.0357	0.1989	0.5177	0.08	1.2322
83	0.1643	0.0187	0.7605	0.2666	0.0176	1.2277
84	0.2387	0.068	24.9885	0.4681	0.0048	25.7681
85	0.2418	0.0323	0.162	0.0155	0.0016	0.4532
86	0.4712	0	0.783	0.0062	0.0016	1.262
87	0.0527	0.0009	4.9253	0.1302	0.0008	5.1099
88	0.3906	0.0391	2.7855	1.6926	0.0008	4.9086
89	0.0558	0	0.0023	0.4123	0	0.4704
90	0.4929	0.0017	0.027	0.3875	0.0008	0.9099
91	0.1798	0.0051	0.072	0.1643	0.0008	0.422
92	0.3379	0.0034	2.5155	0.1798	0.0008	3.0374
93	0.0868	0.0009	0.0315	0.0093	0	0.1285
94	0.2015	0.0289	0.6795	0.1736	0	1.0835
95	0.1426	0.0357	5.3685	0.0155	0.0016	5.5639
96	0.062	0.0119	0.0765	0.0093	0.0096	0.1693
97	0.0806	0.0017	0.0675	0.0062	0	0.156
98	0.0496	0	0.0495	0.7533	0.8524	1.7048
99	0.1271	0.0009	0.009	0.1488	0.0008	0.2866
100	0.0682	0.0017	0.0045	0.3627	0.0008	0.4379
101	0.651	0.0102	0.009	0.0016	0.0008	0.6726
102	0.1054	0.0017	0.0045	0.0031	0.0032	0.1179
103	0.1085	0.7242	1.0395	0.0093	0.0008	1.8823
104	0.2728	0.0009	0.0045	0.0031	0.0016	0.2829
105	0.1457	0.0009	0.0045	0.1023	0.0032	0.2566
106	0.0465	0.6018	0.0045	0.2976	0.0064	0.9568
107	0.0961	0.0009	0.009	0.093	0.0008	0.1998
108	0.093	0.0204	0.0135	0.031	0.0008	0.1587
109	0.1736	0.0017	2.421	0.1643	0.0008	2.7614
110	0.4619	0.0272	0.045	0.4092	0.0016	0.9449
111	0.0837	0.0009	0.0045	0.0016	0.0032	0.0939
112	0.1705	0.0051	0.0045	0.0124	0.0008	0.1933
113	0.2821	0.8568	5.9535	0.217	0.0008	7.3102
114	0.341	0.2839	0.045	0.4526	0.0008	1.1233
115	0.3813	0.625	9.8865	1.3299	0.0016	12.2243
116	0.0806	0	0.0023	0.0031	0.0008	0.0868
117	0.0558	0.0009	0.0045	0.0016	0.0032	0.066
118	0.1736	0.0051	0.63	0.2759	0.0544	1.139
119	0.0744	0.0017	0.0135	0.3937	0.0016	0.4849
120	0.0837	0.0102	0.009	0.1674	0.0008	0.2711
121	0.1426	0.0051	0.0023	0.0062	0.0112	0.1674
122	0.1736	0.0009	0.396	0.0806	0.0016	0.6527
123	0.0837	0.0034	0.0045	0.0093	0.0336	0.1345
124	0.2294	0.0009	0.0045	0.0031	0	0.2379
125	0.0527	0.0017	0.0023	0.0155	0.0016	0.0738
126	0.186	0	0.0045	0.0093	0.0008	0.2006
127	0.3782	0.0017	0.0045	0.0093	0.0008	0.3945
128	0.0186	0.0009	0.0045	0.0016	0.0008	0.0264
129	0.1023	0.1891	0.0045	0.0031	0.0008	0.2998
130	0.0961	0.0034	0.0045	0.0403	0	0.1443
131	0.0899	0.0017	0.0135	0.0062	0	0.1113

Station #	Polychaeta g AFDW	Mollusca g AFDW	Crustacea g AFDW	Miscellania g AFDW	Echinodermata g AFDW	Total g AFDW
132	0.0279	1.0455	0.0045	0.0264	0.0008	1.1051
133	0.0992	0.0187	0.0023	0.0016	0.0008	0.1226
134	0.062	0.0009	0.0315	0.031	0.0008	0.1262
135	0.0217	0.0009	0.0023	0.0093	0	0.0342
136	0.031	0.0034	0.18	0.2418	0.0008	0.457
137	0.1302	0.0017	0.0045	0.0093	0.0008	0.1465
138	0.093	0.0153	0.0045	0.0217	0.0008	0.1353
139	0.0837	0.0051	0.0045	0.3813	0.0016	0.4762
140	0.0372	0.5185	0.0023	0.0016	0.2336	0.7932
141	0.0465	0.0051	0.0023	0.4588	0.0064	0.5191
142	0.1116	0.0068	0.0023	0.0093	0.0016	0.1316
143	0.1054	0.0034	0.0045	0.0062	0.0008	0.1203
144	0.062	0.493	0.0068	0.0062	0	0.568
145	0.0372	0.2669	0.0023	0.4526	1.9936	2.7526
146	0.0868	0.0009	0.0023	0.0186	0.0008	0.1094
147	0.0217	0.0102	0.0023	0.8525	0.0032	0.8899
148	0.0403	0.0009	0.0023	0.0186	0.0008	0.0629
149	0.1395	0.8313	0.0135	0.0124	1.0704	2.0671
150	0.0682	0.2652	0.0023	0.1178	4.8016	5.2551
151	0.0558	0.0009	0.0135	0.0155	0.0032	0.0889
152	0.1302	0.0017	0.0023	0.0016	0.4496	0.5854
153	0.1054	0.017	0.0023	0.0155	0.0032	0.1434
154	0.0899	0.2193	0.0023	1.1129	0.0008	1.4252
155	0.1643	0.0102	0.009	0.0062	0.0008	0.1905
156	0.4991	0.0034	0.0045	0.5177	0.0008	1.0255
157	0.3069	0.0255	0.009	0.0589	0.0008	0.4011
158	0.0744	0.0034	0.0045	0.0124	0.2096	0.3043
159	0.1178	0.0034	0.0135	0.0093	2.0416	2.1856
160	0.0651	0	0.009	0.0093	0.0008	0.0842
161	0.0434	0.0009	0.0045	0.0016	0.0016	0.052
162	0.0434	0.0009	0.0023	0.155	3.3472	3.5488
163	0.1023	0	0.0045	0.0016	0.0032	0.1116
164	0.031	0.0009	0.0023	0.4433	0.0016	0.4791
165	0.0961	0.153	0.0045	1.8972	0.0008	2.1516
166	0.062	0.0009	0.0023	1.8135	0.0008	1.8795
167	0.124	0.5542	0.009	0.3162	0.0008	1.0042
22A	0.0837	0	0.018	0.1054	0.4544	0.6615
22B	0.0589	0	0.0046	0.0016	0	0.0651
22C	0.124	0.0009	0.009	0.3658	0	0.4997
27A	0.062	0	0.009	0.0465	0	0.1175
27B	0.0589	0.0306	0.1575	2.2568	0.0008	2.5046
27C	0.1085	0.0323	7.587	0.3348	0.0008	8.0634
31A	0.0961	0	0.0045	0.0031	0.0008	0.1045
31B	0.1364	0.0051	0.0045	0.6572	0	0.8032
31C	0.1674	0.0051	0.018	0.0031	0	0.1936
33A	0.1581	0.0009	0.0023	0.1364	0.0008	0.2985
33B	0.6169	0.0102	0.009	0.0062	0.0008	0.6431
33C	0.0155	0.0009	0.5355	0.0186	0	0.5705
35A	0.0868	0.0009	0	0.0016	0.0032	0.0925
35B	0.0589	0.085	0.0023	0.9827	0.0008	1.1297
35C	0.2418	0.0153	0.0135	0.0031	0.0016	0.2753
36A	0.2263	0.0009	0.018	0.0558	0.0008	0.3018
36B	0.7456	0.0102	0.0225	0.0093	0.0016	0.7892
36C	0.1674	0.0034	0.0113	0.0186	0.0024	0.2031
37A	0.9641	0.018	0.693	0.0651	0.0008	1.741
37B	1.0013	0.0009	1.377	0.0713	0.008	2.4585
37C	0.5394	0.0018	0.0225	0.8742	0.0016	1.4395
38A	0.0589	0.0009	0.0045	0.0016	0.024	0.0899
38B	0.0682	0.0018	0.0225	0.0062	0	0.0987
38C	0.031	0	0.009	0	0	0.04
39A	0.1023	0.0009	0.0315	0.0806	0.5952	0.8105
39B	0.1674	0.0009	0.018	0.0016	2.3664	2.5543
39C	0.0806	0.0051	0.0225	0.155	0.0008	0.264
Mean	**0.1472**	**0.0514**	**0.4611**	**0.2586**	**0.1140**	**1.0124**
SD	**0.1508**	**0.1627**	**2.1485**	**0.4429**	**0.5101**	**2.3276**

Appendix Table 8. Table summarising the number of species, the number of individuals, biomass (g AFDW) and mean body size of individual (g AFDW) for benthic invertebrates recorded per 0.1m^2 Hamon Grab sample from Production Licence Area 408, during July - August 2000. The blotted wet weight biomass values were converted to Ash Free Dry Weight (AFDW) according to the conversion factors of Eleftheriou & Basford (1989). Mean body size has been calculated from **B / N**. **BACK**

Station #	No. of Species (S)	No. of Individuals (N)	Total Biomass (B) AFDW (g)	Mean Size (g) per Individual
1	38	238	0.1009	0.00042
2	50	250	0.2460	0.00098
3	18	48	0.3061	0.00638
4	31	169	0.4018	0.00238
5	17	69	0.1484	0.00215
6	26	136	0.3934	0.00289
7	30	176	0.6391	0.00363
8	29	84	0.1528	0.00182
9	22	105	0.1784	0.00170
10	24	79	0.2657	0.00336
11	39	309	0.7752	0.00251
12	29	112	1.1014	0.00983
13	27	71	0.0676	0.00095
14	26	93	0.0636	0.00068
15	30	83	0.0264	0.00032
16	29	71	0.2512	0.00354
17	19	32	0.0488	0.00153
18	34	163	2.7435	0.01683
19	20	34	0.0457	0.00134
20	33	189	2.4522	0.01297
21	26	145	0.8989	0.00620
22	28	117	0.1349	0.00115
23	24	87	0.3441	0.00396
24	28	69	0.0588	0.00085
25	38	248	0.1290	0.00052
26	25	87	0.2720	0.00313
27	43	209	0.1411	0.00068
28	29	72	0.0726	0.00101
29	40	134	0.1954	0.00146
30	55	327	2.5205	0.00771
31	30	185	0.2294	0.00124
32	34	101	0.2114	0.00209
33	36	322	0.1206	0.00037
34	32	87	1.5043	0.01729
35	31	154	0.2669	0.00173
36	41	230	0.2387	0.00104
37	26	171	0.1998	0.00117
38	49	391	0.4961	0.00127
39	26	72	0.0848	0.00118
40	27	88	0.6414	0.00729
41	51	416	2.2460	0.00540
42	38	265	0.3861	0.00146
43	36	195	0.0924	0.00047
44	40	179	0.2697	0.00151
45	49	554	4.6155	0.00833
46	54	314	0.1643	0.00052
47	45	326	0.1839	0.00056
48	34	145	0.7569	0.00522
49	40	197	0.7100	0.00360
50	39	258	0.1580	0.00061
51	46	239	0.1521	0.00064
52	40	272	1.7104	0.00629
53	49	217	0.3400	0.00157
54	36	127	0.1582	0.00125
55	44	248	0.2192	0.00088
56	35	109	0.2139	0.00196
57	35	190	0.1116	0.00059
58	44	219	0.1644	0.00075

Station #	No. of Species (S)	No. of Individuals (N)	Total Biomass (B) AFDW (g)	Mean Size (g) per Individual
59	39	154	0.4504	0.00292
60	30	67	0.5933	0.00886
61	40	212	0.1967	0.00093
62	38	129	0.6180	0.00479
63	35	163	0.6186	0.00380
64	44	169	0.9675	0.00572
65	41	167	0.3605	0.00216
66	48	297	0.2094	0.00071
67	61	507	1.5465	0.00305
68	55	585	0.7298	0.00125
69	41	386	0.0889	0.00023
70	39	423	0.2474	0.00058
71	76	406	1.6014	0.00394
72	70	366	0.7196	0.00197
73	60	475	0.5689	0.00120
74	44	182	0.1197	0.00066
75	44	201	0.0782	0.00039
76	48	434	1.7451	0.00402
77	37	409	0.5887	0.00144
78	48	242	0.1862	0.00077
79	60	740	5.1070	0.00690
80	41	316	0.5421	0.00172
81	41	358	0.3553	0.00099
82	79	805	1.2322	0.00153
83	71	453	1.2277	0.00271
84	66	1559	25.7681	0.01653
85	67	465	0.4532	0.00097
86	37	327	1.2620	0.00386
87	45	422	5.1099	0.01211
88	73	502	4.9086	0.00978
89	26	228	0.4704	0.00206
90	50	176	0.9099	0.00517
91	57	325	0.4220	0.00130
92	53	530	3.0374	0.00573
93	39	145	0.1285	0.00089
94	36	249	1.0835	0.00435
95	45	440	5.5639	0.01265
96	45	248	0.1693	0.00068
97	41	152	0.1560	0.00103
98	27	143	1.7048	0.01192
99	35	123	0.2866	0.00233
100	52	353	0.4379	0.00124
101	22	77	0.6726	0.00874
102	32	89	0.1179	0.00132
103	46	504	1.8823	0.00373
104	38	274	0.2829	0.00103
105	30	108	0.2566	0.00238
106	39	179	0.9568	0.00535
107	52	383	0.1998	0.00052
108	43	479	0.1587	0.00033
109	50	673	2.7614	0.00410
110	48	398	0.9449	0.00237
111	44	284	0.0939	0.00033
112	49	382	0.1933	0.00051
113	65	680	7.3102	0.01075
114	63	463	1.1233	0.00243
115	69	1000	12.2243	0.01222
116	50	285	0.0868	0.00030
117	35	204	0.0660	0.00032
118	54	320	1.1390	0.00356
119	42	242	0.4849	0.00200
120	58	255	0.2711	0.00106
121	38	231	0.1674	0.00072
122	49	319	0.6527	0.00205
123	50	245	0.1345	0.00055
124	23	95	0.2379	0.00250
125	37	260	0.0738	0.00028

Station #	No. of Species (S)	No. of Individuals (N)	Total Biomass (B) AFDW (g)	Mean Size (g) per Individual
126	32	127	0.2006	0.00158
127	39	198	0.3945	0.00199
128	19	36	0.0264	0.00073
129	31	112	0.2998	0.00268
130	25	81	0.1443	0.00178
131	29	240	0.1113	0.00046
132	32	229	1.1051	0.00483
133	34	94	0.1226	0.00130
134	49	335	0.1262	0.00038
135	20	41	0.0342	0.00083
136	32	115	0.4570	0.00397
137	33	113	0.1465	0.00130
138	37	276	0.1353	0.00049
139	40	162	0.4762	0.00294
140	28	115	0.7932	0.00690
141	31	147	0.5191	0.00353
142	37	463	0.1316	0.00028
143	29	219	0.1203	0.00055
144	26	88	0.5680	0.00645
145	32	175	2.7526	0.01573
146	30	164	0.1094	0.00067
147	33	178	0.8899	0.00500
148	26	87	0.0629	0.00072
149	48	293	2.0671	0.00705
150	30	95	5.2551	0.05532
151	40	200	0.0889	0.00044
152	38	141	0.5854	0.00415
153	52	324	0.1434	0.00044
154	35	163	1.4252	0.00874
155	55	358	0.1905	0.00053
156	35	308	1.0255	0.00333
157	61	595	0.4011	0.00067
158	30	83	0.3043	0.00367
159	17	85	2.1856	0.02571
160	28	68	0.0842	0.00124
161	27	74	0.0520	0.00070
162	34	74	3.5488	0.04796
163	18	39	0.1116	0.00286
164	26	100	0.4791	0.00479
165	28	78	2.1516	0.02758
166	37	206	1.8795	0.00912
167	22	82	1.0042	0.01225
22A	17	79	0.6615	0.00837
22B	18	59	0.0651	0.00110
22C	19	113	0.4997	0.00442
27A	32	140	0.1175	0.00084
27B	45	143	2.5046	0.01751
27C	58	532	8.0634	0.01516
31A	27	154	0.1045	0.00068
31B	39	326	0.8032	0.00246
31C	43	517	0.1936	0.00037
33A	45	207	0.2985	0.00144
33B	41	330	0.6431	0.00195
33C	19	73	0.5705	0.00782
35A	34	250	0.0925	0.00037
35B	31	116	1.1297	0.00974
35C	57	300	0.2753	0.00092
36A	46	210	0.3018	0.00144
36B	44	159	0.7892	0.00496
36C	66	309	0.2031	0.00066
37A	60	179	1.7410	0.00973
37B	53	153	2.4585	0.01607
37C	66	212	1.4395	0.00679
38A	25	135	0.0899	0.00067
38B	26	170	0.0987	0.00058
38C	16	74	0.0400	0.00054
39A	31	98	0.8105	0.00827

Station #	No. of Species (S)	No. of Individuals (N)	Total Biomass (B) AFDW (g)	Mean Size (g) per Individual
39B	29	82	2.5543	0.03115
39C	21	68	0.2640	0.00388
Mean **SD**	**38.85** **13.08**	**237.56** **185.25**	**1.0124** **2.3337**	**0.00435** **0.00693**

Appendix Table 9. Table showing the mean biomass g AFDW for various distance categories along four transects sampled during July/August 2000 in and adjacent to Production Licence Area 408 - Coal Pit. Values for transects 1,3 & 4 are pooled. For stations included in each of the four transects refer to Figure 16. **BACK**

Transect	Distance Category m	Mean Biomass g AFDW	
		Transect 2 (Dredged)	Transects 1, 3 & 4 (Abandoned)
North-West	4000	0.37875	0.902808
	2000	1.682733	0.619225
	1500	0.66595	0.305
	1000	2.6895	0.4448
	500	13.4979	0.808125
	100	0.79375	2.55485
Dredged / Abandoned		0.233713	1.004081
South-East	100	0.467	0.231367
	500	0.52185	1.080017
	1000	0.16275	0.686317
	2000	0.1887	0.5514
	4000	0.6735	0.918911
Control		1.276306	1.276306