IDENTIFICATION OF SEABED INDICATOR SPECIES FROM TIME-SERIES AND OTHER STUDIES TO SUPPORT IMPLEMENTATION OF THE EU HABITATS AND WATER FRAMEWORK DIRECTIVES

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This report provides a starting-point review. Additions, errors and omissions should be drawn to the attention of the first author: k.hiscock@mba.ac.uk

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SUMMARY

Significant progress has been made in recent years to identify indices of pollution in the marine environment based on reviews of information in published papers and reports. The EU Water Framework Directive has provided a recent imperative to identify biological (as well as physical and chemical) data that will inform the development of measures of quality. The measures need to relate to a range of 'Pressures' so that cause and effect can be assessed. It is the matching of information sources to different Pressures (Environmental factors) which has been at the centre of the study described here.

The area included is the north-east Atlantic, predominantly estuarine and nearshore habitats.

The seabed Indicators research was undertaken as a follow-on to the review of time-series studies (Hiscock & Kimmance 2004: see http://www.marlin.ac.uk/time_series_metadata for report and interactive access to the database). During that review, it was apparent that many studies identified change in species abundance as a result of specific perturbations or environmental factors. During the course of the current work, many additional publications have been consulted including studies of gradients of effect from point-source effluents and experimental studies.

Ninety-eight papers or reports have been identified that list species which increase or decrease or that are considered intolerant or tolerant in relation to different pressures/environmental factors. The publications have been inspected and the results summarized in the report and/or included in spread sheets for each of the main Pressures identified by the Environment Agency. Those Pressures have been matched to 'Environmental factors' used in the Marine Life Information Network (*MarLIN*) programme to assess sensitivity of species to perturbation and the *MarLIN* database has been queried to provide tabulated information on intolerance and sensitivity (sensitivity = intolerance and recovery potential) for species that have been researched by *MarLIN*.

The information located in the literature has been brought together into one summary table identifying the response of 482 taxa to seven Pressures, 15 Environmental factors and a general category for industrial effluents including sewage and metals.

Whilst adding significantly to the availability of information about likely indicator species in relation to particular Pressures, few species are identified more than once or twice as responding to a particular Pressure and few Pressures have a large number of potential indicators identified. However, there is a significant amount of information available for physical disturbance, organic enrichment and hydrocarbon contamination.

A few publications are identified that have not been incorporated into the review and should be. Also, useful material has been published whilst the report was being completed and potentially important publications are known to the in the press: information should continue to be added especially to the summary table (Table 2).

Some 'Pressures' need better definition so that they relate more precisely to particular factors or so that there is clarification for increases and decreases.

The *MarLIN* database fields (and associated Web pages) should be modified to make them more relevant to the Water Framework Directive and to take advantage of information obtained in the course of undertaking the work described in this report.

Readers of the report are invited to draw attention to relevant publications not included or to information about potential indicators based on their own knowledge.

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IDENTIFICATION OF SEABED INDICATOR SPECIES FROM TIME-SERIES AND OTHER STUDIES

1. INTRODUCTION

Box 1

Glossary of terms used by OSPAR and ICES in relation to biological indicators

The terms have been developed especially in relation to ecosystem effects of fisheries.

EcoQ: Ecological Quality. EcoQ of surface waters is an overall expression of the structure and function of aquatic systems, taking account of the biological community and natural physiographic and climatic factors as well as physical and chemical conditions including those resulting from human activities.

EcoQO: Ecological Quality Objective. EcoQO is the desired level of EcoQ relative to the EcoQ reference level (the level of EcoQ where anthropogenic influence on the ecological system is minimal).

Fragile species: Sessile and slow-moving species, often characterised by rigid bodies or tubes that are particularly sensitive [*sic*] to physical damage.

Sensitive species: A species easily depleted by a human activity, and/or if affected is expected to only recover over a very long period, or not at all.

Opportunistic species: Species with early maturation, high fecundity and a high colonisation potential achieved through intrinsic long-distance dispersal and a high reproductive rate. These characteristics allow for colonising habitats of a temporary nature often created through physical disturbance.

Scavenger species (invertebrates): Opportunistic feeders that respond to chemical signals and are mobile over scales of tens of metres.

The following definition of 'intolerance' is from the *MarLIN* Web pages:

Intolerance is the susceptibility of a habitat, community or species (i.e. the components of a biotope) to damage, or death, from an external factor. Intolerance must be assessed relative to change in a specific factor.

This introduction draws attention to existing and known forthcoming information resources that can be used to identify marine indicator species. In freshwater biology, there has long been a tradition of using species composition to indicate water quality. The 'RIVPACS' programme is a commercially available methodology for identifying water quality from the organisms present in a stream (see, for instance, Sutcliffe, 1994). In marine biology, the idea that indicator species could be used to identify pollution-induced change has been discussed for many years (see, for instance, Gray & Pearson, 1982). The indicator species approach was greatly encouraged by the work of Pearson & Rosenberg (1978) on organic pollution gradients (Figure 1) but identifying a sound suite of indicator species for marine water quality in general, let-alone developing something like RIVPACS has proved difficult.

Nevertheless, significant progress has been made in recent years especially by Ángel Borja and colleagues (see, for instance Borja *et al.*, 2000; 2004) in developing the AZTI Marine Biotic Index (AMBI). Borja *et al*. (2000) identified five ecological groups related to the degree of sensitivity/tolerance to an environmental stress gradient (Figure 2) and, by analysing data from a wide range of soft-bottom benthos in a variety of locations including polluted or disturbed situations, listed a large number of species assigned with their ecological group. AMBI is also available on the Internet to enable analysis of any suitable dataset to identify degree of 'pollution'. The Marine Life Information Network (*MarLIN*) Web pages provide an assessment of intolerance and of sensitivity for species based on a review of literature. Sensitivity is assessed in relation to 24 environmental factors. A new index (the Swedish 'Species Tolerance Values' ($E5O_{0.05}$)) was made available at the

ICES Study Group on EcoQO's for Sensitive and for Opportunistic Benthos Species (SGSOBS) workshop in Copenhagen on 22-24 March 2004 (see Box 2). Appendix 1 brings together information from AMBI, *MarLIN*, an OSPAR/ICES Working Group and the Swedish 'Species Tolerance Values' in a demonstration of how information resources can be merged – but, in the time available, was only undertaken for 242 species with names that began with 'A'.

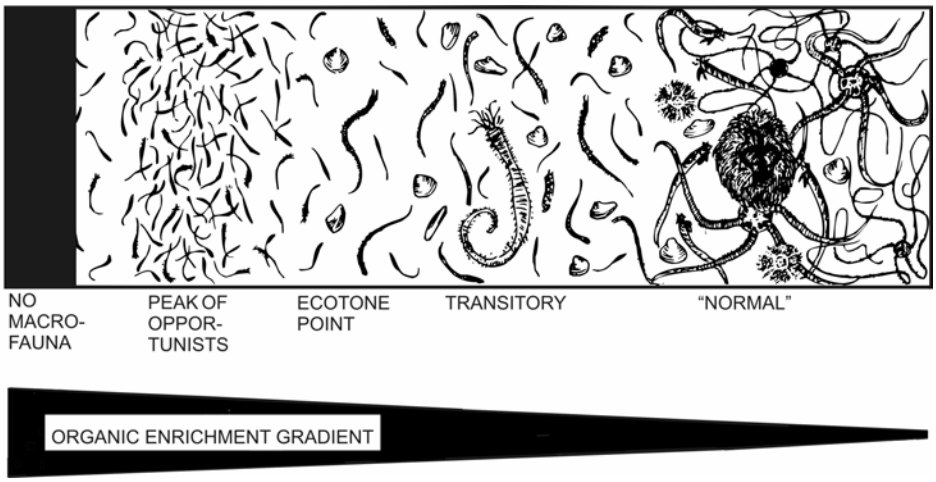

Figure 1. Diagrammatic representation of changes in abundance and species types along a generalised organic enrichment gradient (from Pearson & Rosenberg, 1978).

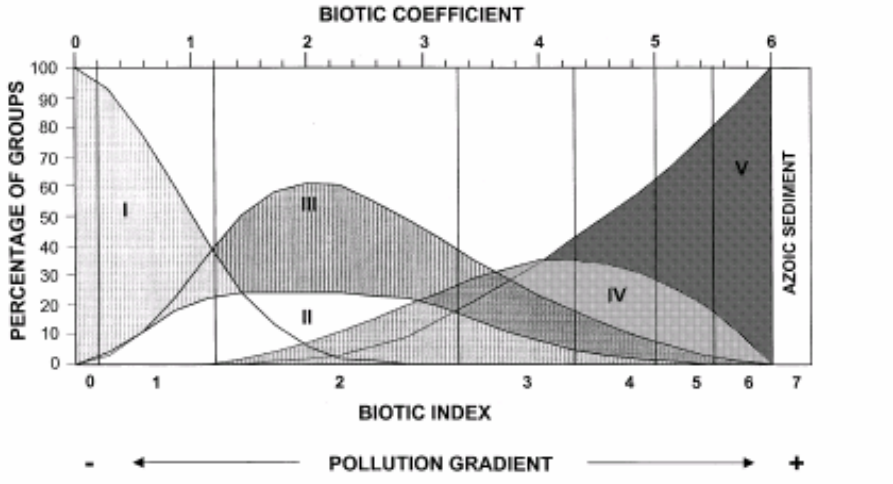

Figure 2. Theoretical model from Borja *et al.* 2000) that divides the ordination of soft-bottom macrofauna species into five ecological groups (Group I: very sensitive species; Group II: indifferent species; Group III: tolerant species; Group IV: second-order opportunistic species; Group V: first-order opportunistic species), according to their sensitivity to an increasing pollution gradient.

The study described in this report identifies potential indicator species from published literature. The basic presumption in undertaking the work is that the presence of species at a location is encouraged or discouraged by the environmental factors prevalent at that location. Those factors may be:

1. natural, resulting in the presence of a particular community and a certain species richness, and
2. unnatural (brought about by human activities), resulting in a modification of the expected natural communities.

For the purposes of identifying the 'quality' or 'health' of a community, it will be any effects of chronic (frequent or continuous) disturbance and pollution that are most important to assess. Studies are often of one-off events such as oil spills or of experimental trawling and extrapolating to likely long-term impacts or to frequent or continuous disturbance or pollution is usually difficult. However, sensitive indicators may only require single or episodic exposure; for instance to cause imposex. In the case of frequent or continuous application of a factor, *MarLIN* Biology and Sensitivity Key Information research should identify potential indicator species as 'High' Intolerance (i.e. likely to be killed by the factor). In the case of one-off events that cause long-lasting adverse effects, *MarLIN* Biology and Sensitivity Key Information research should identify potential indicator species as 'High' or 'Very High' Sensitivity (i.e. likely to be killed and unlikely to recover for in excess of respectively ten or 25 years or not at all).

However, variability in environmental conditions from day-to-day, season-to-season and year-to-year creates fluctuations in the abundance and distribution of component species in a community – resulting in what is sometimes called "dynamic stability". Such variability can result in temporary absence or low abundance of a species for natural reasons.

Furthermore, although communities are now classified within biotopes, predicting what biotope will be present under defined environmental conditions is difficult outside of extreme situations where only a few species are likely to be able to survive (for instance, extreme wave exposure, low salinity, extreme organic enrichment). Separating natural variability from change brought about by human activities is therefore often difficult. Nevertheless, several types of studies can point to those species that react to human-induced change. For instance:

1. time-series studies where an environment has been degraded or a factor changed;
2. studies of gradients of effect away from point source perturbations (especially contaminants input), and
3. studies following extreme events and pollution or disturbance.

In undertaking the review described here, we have identified from the literature examples of the above types of study in order to determine likely indicator species.

2. MARINE ENVIRONMENTAL PROTECTION INITIATIVES

There are several marine environmental protection initiatives currently being developed that require or would benefit from identification of those species that might indicate the quality of water masses or the degree of contamination or disturbance of seabed habitats.

The EC Water Framework Directive (WFD) addresses the full range of potential human impacts on aquatic systems. It includes identification of targets (subject to various qualifications) for coastal and transitional (estuarine) waters in terms of achieving "good surface water status"by 2015. "Good surface water status" is defined in terms of "good ecological status", coupled with "good surface water chemical status" and achievement of

protected area objectives which includes those of the Habitats Directive. Status is assessed in relation to type-specefic reference conditions representing the conditions to be expected in undisturbed water bodies with no or very minor anthropogenic alterations, which in consequence are to be regarded as having "High Ecological Quality". The WFD defines High Ecological Quality as "All the disturbance sensitive taxa associated with undisturbed conditions are present".

Box 2

International Council for the Exploration of the Seas (ICES) Study Group on EcoQO's for Sensitive and for Opportunistic Benthos Species (SGSOBS). Copenhagen on 22-24 March 2004.

Summarised brief for the meeting.

Continue development of EcoQ element (o) Density of sensitive species and ScoQ element (p) Density of opportunistic species to:

1. identify possible [sensitive and opportunistic] species, taking into account developments in implementing the Water Framework Directive;
2. commence development, for species identified , and on the basis of the criteria for sound EcoQOs established by ICES in 2001, of related metrics, objectives and reference levels for this EcoQO;
3. for these [the above] EcoQ elements, to consider further spatial scale requirements of sampling and the adequacy of existing monitoring activities;
4. where possible and appropriate, reconstruct the historic trajectory of the metric and determine its historic performance;
5. taking into account all potential sources of relevant information, determine what information it will be possible to collect in future to assess whether the EcoQO is being met;
6. develop draft guidelines, including monitoring protocols and assessment methods, for evaluating the status of, and compliance with, the EcoQO.

Summarised recommendations.

1. The above [reviewed in full report] information resources and any others readily available should be combined to identify tolerant, sensitive, and opportunistic species.
2. Sensitive taxa should be related to the EcoRegion and habitat type (e.g. EUNIS habitat type) in which they occur.
3. Lists of species from analysis of survey data should be presented so that rare or uncommon species are not included (may be EcoRegion dependent). Rare species cannot be used reliably to identify the presence of adverse effects.
4. The identification of key structural and functional sensitive species that are intolerant and/or sensitive to stressors needs to be given priority because of their high ecological significance.
5. Sensitive species that are normally in high abundance in a biotope are preferred over low density species as potential indicators.
6. Sensitive species that are conspicuous, easily identified, and readily observed or surveyed should be identified as "Sentinel species".

(From: http://www.ices.dk/iceswork/wgdetailace.asp?wg=SGSOBS**)**

The factors, under the Water Framework Directive, to be assessed for coastal waters and transitional waters cover:

1. **biological quality elements** (phytoplankton, macroalgae and angiosperms, benthic invertebrate fauna and, additionally in transitional waters, fish);
2. **hydromorphological elements** (tidal regime, morphological conditions);

3. **physico-chemical elements:** general conditions (temperature, oxygenation, transparency, nutrient concentrations, salinity), specific synthetic pollutants and specific non-synthetic pollutants.

The resulting classification scheme which is required to assess the status of biological elements (plants, macroinvertebrates and transitional fish) is expressed in terms of High, Good, Moderate, Poor and Bad status and is expressed numerically as an Ecological Quality Ration (EQR) which is a simple assessment of observed status versus Reference Classification schemes for each of the biological elements which is required to be in place for the commencement of monitoring in 2007 (see: www.wfduk.org).

The Oslo and Paris Commissions (OSPAR) Convention on the Protection of the Marine Environment of the north-east Atlantic has adopted an 'Ecological Quality Objectives' (EcoQO) approach in implementing Annex V of the Convention. It is probably possible to interpret the ecological quality that would result from achieving the EcoQOs as being in line with the "good ecological status" which the Water Framework Directive sets as the goal for coastal waters and transitional waters in general.

The Habitats Directive requires the maintenance of 'favourable conservation status' within Special Areas of Conservation. That requirement should be informed by a knowledge of what communities and what species richness should be present in an area against the communities that are present. Change in communities needs to be recorded and interpreted including separation of natural variability and change brought about by anthropogenic activities (over-and-above sample variability). Where possible, features assessed for the Habitats Directive will be related to the biological elements of the WFD using the same metric scales. For example, for macroinvertebrates in an intertidal mudflat, the same metrics may be used to assess favourable condition and ecological status.

The International Council for the Exploration of the Seas (ICES) has, perhaps, the longest history of working to identify benthic indicator species. Their work is now closely linked to OSPAR. The ICES Advisory Committee on Ecosystems (www.ices.dk/iceswork/ace.asp) has recommended properties of good indicators (from political to scientific) of environmental quality:

- Relatively easy to understand by non-scientists and those who will decide on their use.
- Sensitive to a manageable human activity.
- Relatively tightly linked in space and time to that activity.
- Easily and accurately measured, with a low error rate.
- Responsive primarily to human activity, with low responsiveness to other causes of change.
- Measurable over a large proportion of the area in which the indicator is likely to be used.
- Based on an existing body of time-series of data to allow a realistic setting of objectives.

The ICES 'Study Group on EcoQO's for Sensitive and for Opportunistic Benthos Species (SGSOBS)' met in Copenhagen on 22-24 March 2004 (see Box 2). That meeting provided the opportunity for one of the project team (KH) to contribute initial results from this JNCC/EA exercise and to ensure that this report takes account of most up-to-date information and approaches to identifying indicator species.

The UK Biodiversity Indicators Forum (16 June 2003) considered the value of indicator species as a part of a wide-ranging appraisal of 'indicators'.

In all of the various initiatives aimed at environmental protection, interpreting the results of biological monitoring or of sudden observed change requires an ability to separate likely natural variability or response to natural extreme events from change brought about by human activities: another area of interpretation that should be informed by the study described here. This study provides the start of an evidence base to support the setting of numerical boundaries essential to interpreting changes in biological communities when setting objectives for ecological status assessments for WFD or favourable condition assessments for Habitats. The study will also help to identify gaps in our knowledge with respect to key sensitive species and help to focus ecological research into the effects of anthropogenic pressures on the marine environment.

3. SOURCES OF INFORMATION

JNCC Time-series study. The review of time-series studies undertaken for JNCC by the Marine Biological Association (Hiscock & Kimmance 2003) identified some changes in species abundances that could be interpreted as related to changes in environmental factors including as a result of human activities.

Pollution studies. The wide range of papers describing results of studies of pollution events and of studies of gradients of effect from point source discharges were especially useful in identifying species that were affected by certain contaminants.

***MarLIN* sensitivity reviews.** The Marine Life Information Network (*MarLIN*) Biology and Sensitivity Key Information sub-programme has used a wide range of literature to identify degree of intolerance and likely recoverability of species to environmental factors. The assessments of intolerance to a factor and likely recovery are brought together into an index of sensitivity (see Hiscock & Tyler-Walters, in press). Information is held in a Microsoft Access database. Two queries were undertaken with the following interpretation.

1. **Intolerant species.** 'High' or 'Intermediate' intolerance to selected factors. Degree of intolerance will reflect recent events that have affected a community as well as events that may have taken place a year or more ago and result in absence of sensitive species as well. Intolerant species will be absent from severely affected locations.
2. **Sensitive species.** Species with a Very High or High sensitivity will be affected in the long term. Their absence may indicate an event that happened several years before the survey or that happens intermittently. Sensitive species are likely to be excluded from a community where an adverse factor is present continuously but not necessarily at a severe level.

Expert opinion. The review described here has benefited from experience of contributors in undertaking studies related to pollution and/or analysing data sets to identify species 'driving' change.

4. DATA LOGGING AND INTERPRETATION

Data logging was undertaken on a Microsoft excel spreadsheet. The information was separated into tables for the following factors:

- Diffuse nutrients
- Organic enrichment
- 'Priority substances'
- Thermal discharge
- Change in turbidity

- Change in emersion regime
- Physical removal (dredging)
- Physical disturbance (trawl fishing)
- Physical abrasion and disturbance (dredge fishing)
- Organic enrichment
- Pesticides and medicines (fish farming)
- Temperature change (climate change)

Records were identified according to:

- Habitat
- Species
- Change
- Exposure pressure
- Source reference
- Method used
- Notes

The above information was further interpreted and collated into a spreadsheet that related to activities and to the habitat types separated into European Union Nature Information System (EUNIS) types. Species identified as indicator species or that were demonstrated to change significantly in abundance in relation to change in a factor were recorded within each habitat type. A measure of 'confidence' was given depending on the number of publications in which a particular species featured.

Change in salinity was not included in the data logging exercise although one relevant paper is noted below.

5. SUMMARY OF RESULTS

5.1 Introduction

The results of the literature review are given on the Microsoft Excel spreadsheets (tabulated in Appendix 2) and are summarised, with some case studies (in boxes), below.

5.2 Results of the literature review

5.2.1 Introduction

The terms used in headings (5.2.2 to 5.2.13) below are those listed by the Environment Agency as 'Source pressure' and, after the "-" as 'Exposure pressure' with *MarLIN* equivalent or closest match factors in parenthesis. Source and Exposure pressures are human activity-based and do not include natural variability in environmental factors that might be driving change, although may be linked. It is therefore important to identify potential indicators related especially to lowered salinity and to decrease in temperature. Also, change in physical substratum and oxygen concentration (deoxygenation) might result from natural events and, if change is to be interpreted according to major drivers, such natural factors need to be acknowledged.

5.2.2 Dredging – Suspended sediment / change in physical substrate (Substratum removal)

Dredging includes activities such as aggregate extraction and pipeline burial and all species on and in the seabed, except some highly mobile species, will have a high intolerance. Degree of recoverability and therefore sensitivity depends on cessation of activity and the same sort of substratum being present after dredging. The available

literature reviewed here takes little account of recovery and results given in this report may not identify good indicator species for long-term impacts.

5.2.3 Commercial fishing including oyster, mussel and cockle dredging and trawling – Change in physical substrate, Change in habitat, Removal of fish / invertebrates (Abrasion and physical disturbance)

Abrasion and physical disturbance is likely to result from the use of mobile fishing gear that penetrates the seabed, mooring chains that scrape the seabed, propeller wash, vessels stranding and storms that disturb sediments or cause abrasion by mobilising sand, cobbles etc. There is a large body of information describing effects of mobile fishing gear (see, for instance, the volume edited by Kaiser & de Groot, 2000). Physical disturbance attracts a small range of opportunistic species such as *Capitella capitata* and *Mediomastus fragilis* (May & Pearson, 1995). Commercial fishing activites particularly impact upon bivalve molluscs and more generally lead to increases in scavenging and predatory crustaceans, gastropods and sea stars (Rumohr and Kujowski, 2000).

5.2.4 Nets, traps and pots - Removal of fish / invertebrates (Removal of this species/removal of other species)

Static fishing gear will remove target species (intolerance of target species) but may also catch non-target species and may crush or detach fragile sessile invertebrates.

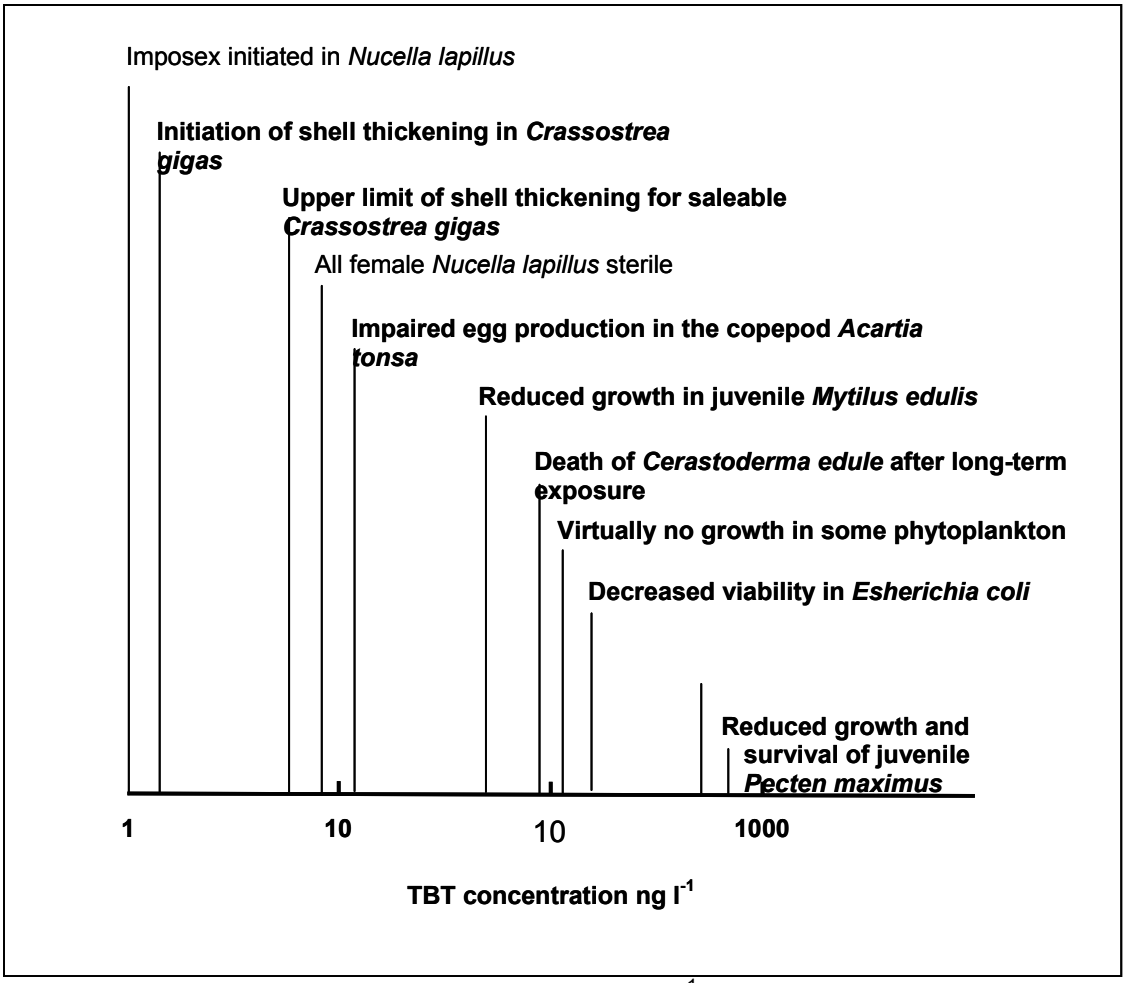

Figure 3. Sensitivity to tributyltin contamination (ng l^{-1}) of various marine organisms. The responses range from subtle effects on individuals to acute effects directly affecting populations (from Hawkins *et al*., 1994 based on Gibbs *et al.* 1991).

5.2.5 Discharge of contaminated water / use and disposal of other chemicals – Priority substances / other synthetic / non-synthetic chemicals, heavy metals (Synthetic chemicals, Heavy metals)

The Water Framework Directive introduces a new categorisation for prioritising the assessment and control of contaminants released to the environment which is explained in more detail in the Directive and Common Implementation Strategy Guidance links to which can be found on the UK WFD website. For simplicity, contaminants have been considered under the headings of synthetic chemicals, metals and their compounds and persistent hydrocarbons.

Synthetic chemicals

A wide range of substances fall under this category. They include “Organohalogen compounds and substances”, “Organophosphorous compounds” and “Organotin compounds” at least in Annex VIII of the WFD. Establishing cause and effect in relation to what is often a cocktail of chemical in water is often difficult and the impact of Tributyl Tin

(TBT) contamination may be one of the few clear examples of effects that have not been confused with other stressors. Matthiessen *et al.* (1999) provide an account of changes in the Crouch Estuary following the prohibition of TBT use on small vessels in 1987. Whilst a definite link to TBT could not be established, the increase in number of infaunal taxa from 15 in 1987 to 40 in 1991 and 47 in 1997 (and from 29 in 1987 to 39 in 1997 for epifauna) at the most inland site suggests that it should be possible to identify taxa that are likely to have been sensitive to TBT. For infaunal species, those that were not recorded in 1987 but were present in 1991 and 1997 are listed in Table 1.

Table 1. Species present in significant (over 2 or 3 per grab or at several stations) numbers at upper estuary sites in the River Crouch in 1991 or 1997 but not 1987, and which appear to have been adversely affected by TBT. (Interpreted from Matthiesen *et al*. 1987.)

Eteone longa	*Achelia echinata*	*Corophium volutator*
Exogone spp	*Anoplodactylus pygmaeus*	*Caprella linearis*
Aphelochaeta multibranchis	Ostracods	*Hydrobia ulvae*
Tharyx killariensis	*Diastylis* sp.	*Retusa obtusa*
Melinna palmata	*Parajassa pelagica*	*Cerastoderma edule*

For epifaunal species, many occurred as single records and an increase in numbers of individuals may be a better basis for assessing improvement since TBT was banned. The number and abundance of species of molluscs, crustaceans and ascidians especially increased.

TBT has also been shown to affect various species in different ways and to have a variety of sublethal effects. Whilst sublethal effects are outside the scope of the current study, they can trigger higher order effects. Figure 3 illustrates the range of sublethal effects that can be found.

Metals and their compounds

Metals are most often addressed as 'heavy metals' although the term is rarely defined. Many metals are essential as trace elements to organisms and include aluminium, arsenic, chromium, cobalt, copper, iron, manganese, molybdenum, nickel, selenium, tin, vanadium and zinc. Non-essential heavy metals include cadmium, gold, lead, mercury and silver (Furness & Rainbow, 1990). Langston (1990) describes sublethal effects of metals especially from experimental studies and specifically effects of copper and zinc in Restronguet Creek, Cornwall.The species effects in terms of increase or decrease are described in Bryan *et al.* (1987). The paper by Rygg (1985) of the effect of copper is particularly valuable in specifying non-tolerant species in relation to a specified concentration in sediment (Box 3).

Persistent hydrocarbons

Hydrocarbons include a wide range of substances ranging in toxicity from very high (for instance, fresh petroleum) to very low (for instance, weathered crude oil).

Box 3

Tolerance of sediment species to copper. Tolerance is assessed in relation to concentrations of > 200 ppm. From Rygg (1985). * = negatively correlated with increased sediment copper concentration in experimental studies by Olsgard (1999). ¹ = Possibly *Minuspio cirrifera* in Howson & Picton (1997). [ ] = Not recorded from UK waters.

Non-tolerant (absent)	Non-tolerant but occasionally found	Moderately tolerant. Present at some stations	Highly tolerant. Common at the most copper-polluted stations
Annelida	**Annelida**	**Annelida**	**Annelida**
Glycera rouxii	*Paramphinome jeffreysii*	*Ceratocephale loveni*	*Phloe minuta*
[*Phylo norvegica*]	*Lumbrineris* spp.	*Nephtys paradoxa*	*Eteone longa*
Laonice cirrata	*Paraonis gracilis*	*Nephtys ciliata*	*Anaitides groenlandica*
Diplocirrus glaucus	*Prionospio cirrifera**¹	*Prionospio malmgreni*	*Nereimyra punctata*
Polyphysia crassa	*Spiophanes kroyeri*	*Tharyx marioni*	*Ophiodromus flexuosus*
Scalibregma inflatum	*Melinna cristata*		*Glycera alba*
Ophelina cylindricaudata	**Mollusca**	**Mollusca**	*Goniada maculata*
Ophelina norvegica	*Thyasira equalis*	*Thyasira flexuosa*	*Polydora* spp.
Ophelina modesta		*Thyasira sarsi**	*Scoloplos armiger*
Ophelina acuminata	**Echinodermata**	*Corbula gibba*	*Cirratulus cirratus**
Rhodine loveni	*Amphiura chiajei*		*Chaetozone setosa**
Rhodine gracilior	*Amphiura filiformis*		*Cossura longocirrata*
Sosane gracilis			*Capitella capitata**
Terebellides stroemi			*Heteromastus filiformis*
			Tubificoides spp.
Crustacea			
Eudorella emarginata			
Eriopisa elongata			
Calocaris macandreae			
Mollusca			
Nucula sulcata			
Ennucula tenuis			
Abra nitida			

The hydrocarbons most likely to affect water quality and be entrained into seabed habitats are from effluents that, at source, might have concentrations up to 25 ppm oil. Studies of point source discharges including refinery effluents and from oil based drilling muds have identified tolerant and intolerant species along gradients away from those point sources. Those studies that clearly identify tolerant and intolerant (possible indicator) species are included in Appendix 2. However, many studies are descriptive in nature. For instance,

work carried out on sublittoral sediments in Sullom Voe (May & Pearson, 1995) draws attention to the occurrence of species characteristic of enriched sediments in areas of enhanced hydrocarbons: *Capitella capitata*, *Thyasira flexuosa*, *Prionospio fallax*, *Chaetozone setosa* and *Abra nitida*. Conclusions from Levell *et al*. (1989) in relation to the impacts of North Sea oil platforms are shown in Box 4. Daan *et al*. (1994) also list species most abundant and least abundant near to oil platforms where oil-based drilling muds were used. Olsgard & Gray (1995) analysing results from Norwegian sector North Sea oil production platforms list 32 'most sensitive' and 10 'most tolerant' species.

Oil spills have also revealed species that are tolerant or intolerant of oiling although oil on the surface of the sea rarely affects subtidal species unless dispersed into the water column by chemicals or by strong wave action. The Braer oil spill in Shetland in 1993 provided an opportunity to identify species that increased or declined in abundance where oiling occurred. Severe weather conditions meant that oil was incorporated into sediments. Kingston *et al.* (1995) note the following:

- **Species reaching maximum abundance at contaminated sites:** *Capitella capitata*; *Chaetozone setosa*; *Phloe inornata*; *Diplocirrus glaucus*; *Paramphinome jeffreysi*; *Spiophanes kroyeri*.
- **Species with significantly lower abundances at oiled stations**: *Aonides paucibranchiata*; *Glycera lapidum*; *Lumbrineris gracilis*.

Amphipods were completely absent from the worst affected areas, consistent with other known impacts of oil spills (for instance, loss of ampheliscid amphipods after the *Amoco Cadiz* oil spill: Cabioch *et al*., 1980).

Box 4

Hydrocarbon contamination

Elevated levels of hydrocarbons in sediments may cause mortality of species and make space available to tolerant opportunistic species. Levell *et al.* (1989) catalogue some of the species whose abundance appears to be affected by hydrocarbon contamination and disturbance along gradients away from oil platforms. The following species are identified as affected:

Taxa that are present in high abundance (extremely tolerant species)

Capitella capitata (a polychaete worm)*
Phloe inornata (a polychaete worm)
'Rhaphidrilus nemasoma' (a polychaete worm)*
Ophryotrocha spp. (a polychaete worm)*

Very tolerant taxa (enhanced abundances in transitional zones along disturbance/pollution gradient)

Chaetozone setosa species complex (a polychaete worm)*
Cauleriella sp. (a polychaete worm)
Tharyx marioni (a polychaete worm)
Cirratulus cirratus (a polychaete worm)*
Heteromastus filiformis (a polychaete worm)
Capitomastus minimus (a polychaete worm)
Notomastus latericeus (a polychaete worm)
Eteone sp. (a polychaete worm)
Anaitides mucosa (a polychaete worm)
Hesionid worms such as *Nerimyra punctata* & *Ophiodromus flexuosa*
Glycerid worms such as *Glycera ?alba* & *Goniada maculata*
Polydora sp. (a polychaete worm)
Diplocirrus glaucus (a polychaete worm)
Philine scabra (a mollusc)
Thyasira flexuosa/gouldii (a mollusc)
* = also listed by Olsgard & Gray (1995) as 'most tolerant'.

5.2.6 Use and disposal of synthetic / non—synthetic chemicals (e.g. addition of medication-synthetic chemicals) - Priority substances / other synthetic / non-synthetic chemicals, heavy metals (Synthetic chemicals)

This category relates specifically to the pharmaceutical chemicals and biocides used in the aquaculture industry**.** A study being undertaken by the Scottish Association for Marine Science (SAMS) and others is investigating the effects of pharmaceutical products on benthic fauna and flora in sea lochs. In a preliminary report (SAMS, 2003), detected changes in benthos were most likely the result of natural fluctuations except that numbers of copepods collected were lower than expected in sea loch sediments. The prospect of identifying indicator species for pharmaceutical chemicals seems poor.

5.2.7 Physical structure / Physical alteration by .... engineering modification – Change in physical substrate, Oxygen concentration, Flow / flow direction, Suspended sediment / Increased turbidity (Increase/Decrease in suspended sediment)

Levels of suspended sediments vary greatly in transitional waters and less so in coastal waters. Increases in suspended sediments may occur naturally because of freshwater run-off or following storms that disturb seabed sediments. Sediments being dumped as a part of capital and maintenance dredging will also increase suspended sediment levels which might clog feeding structures and smother organisms. Turbidity may also increase as a result of algal blooms.

5.2.8 Surface water run-off, Process water discharge, Disposal of wastes - Nitrate/Phosphate (Changes in nutrients)

Increased nutrients are most likely to affect abundance of phytoplankton which may include toxic algae. The abundance of foliose benthic algae may also increase where nutrients are high. Both of these primary effects resulting from elevated nutrients will impact upon other biological elements or features (e.g. toxins produced by phytoplankton blooms or deoxygenation of sediments from coverage of algal mats) and may lead to “undesirable disturbance” to the structure and functioning of the ecosystem.

5.2.9 Abstraction of water - Salinity (Increase in salinity)

Marine species will usually survive in salinities as low as 30 with progressively more being unable to survive as salinity drops towards freshwater levels. Increased salinity (as might happen where fresh water is being abstracted upstream) is likely to result in the appearance of many species that require a higher salinity than previously existed at a location. Studies of species distributions along a salinity gradient will reveal those species likely to occur in an area after salinity has risen. Few such studies exist and the species that would indicate a rise in salinity is dependent on the salinity that existed prior to change and that after change. The most useful approach to identifying potential indicator species would be to tabulate non-rare species according to the salinity ranges in which they occur or are absent. Such an approach was used by Laffoley & Hiscock (1993).

5.2.10 (Decrease in salinity)

Decrease in salinity is not included within ‘Pressures’ but results from natural events such as prolonged rainfall. Tidal barrages and water extraction from rivers will also affect salinity in transitional waters. In situations where there is continuous input of freshwater (for instance the outfall from a hydroelectric plant), species that might survive occasional low salinity, might succumb to continuous low salinity near the surface. All marine species are ultimately intolerant of decrease in salinity and the comment for information sources is as above.

Box 5

Taxa highly tolerant of salinity changes in the Douro Estuary, Portugal where salinity ranges from 0 to 35. (Mucha *et al.*, 2004)

Hediste diversicolor	Nadiidae	*Cyathura carinata*
Streblospio benedicti	Tubificidae	*Corophium volutator*
Melina palmata	*Tubifex costatus*	*Scrobicularia plana*
Polygordius sp.	Nematoda indet.	Chironomidae indet.
Enchytraeidae indet.		Collembola indet.

Some species appear to have a very high tolerance of variable salinity. The Douro Estuary, Portugal has “dramatic” salinity fluctuations (0-35) not only seasonally but within the tidal cycle. Mucha *et al.* (2004) found only 14 taxa there – taxa that are highly tolerant of fluctuations in salinity (Box 5).

5.2.11 Process water discharge – Oxygen concentration / Organic matter (Deoxygenation)

Organic matter is included here as organic enrichment causes de-oxygenation. Annex VIII of the WFD refers to “Substances which have an unfavourable influence on the oxygen balance”. There have been many studies of the impact on benthic communities of organic enrichment causing hypoxia and many are reviewed by Diaz & Rosenberg (1995). Box 6 gives examples of species found to be resistant to moderate and severe hypoxia and species that seem to be eliminated by such conditions.

Box 6

Examples of species found to be resistant to moderate and severe hypoxia and species that seem to be eliminated by such conditions. (Species not recorded from Britain and Ireland have not been included). From Diaz & Rosenberg (1995). The number of source references for a species conclusion is given in brackets.

Species resistant to severe hypoxia	Species resistent to moderate hypoxia	Species sensitive to hypoxia
Arctica islandica (2)	*Capitella capitata* (3)	*Diastylis rathkei* (1)
Astarte borealis (2)	*Abra alba* (2)	*Nephrops norvegicus* (1)
Corbula gibba (5)	*Abra nitida* (2)	*Brissopsis lyrifera* (1)
Ophiura albida (2)	*Amphiura filiformis* (3)	*Ampharete grubei* (1)
Halicryptus spinulosus (2)	*Amphiura chiajei* (2)	*Macoma calcarea* (1)
Malacoceros fuliginosus (2)	*Streblospio benedicti* (1)	*Gammarus tirinus* (1)
Metridium senile (1)	*Mercenaria mercenaria* (1)	*Spisula solida* (1)
Phoronis mülleri (2)	*Spisula solidissima* (2)	*Crangon crangon* (1)
Ophiodromus flexuosus (1)	*Lumbrineris verilli* (1)	*Carcinus maenas* (1)
Pseudopolydora pulchra (1)	*Scoloplos armiger* (1)	*Nereis pelagica* (1)
Paraprionospio pinnata (2)	*Nereis diversicolor* (1)	
Loimia medusa (2)	*Pectinaria koreni* (1)	
Modiolus phaseolina (1)		
Nephtys hombergi (2)		
Calliactis parasitica (1)		
Streblospio benedicti (1)		
Goniadella gracilis (1)		
Mytilus edulis (1)		
Heteromastus filiformis (3)		
Arenicola marina (1)		
Magelona sp. (1)		

5.2.12 Process water discharge - Thermal range (Increase in temperature)

Increase in temperature can be a cause for concern and is related to heated effluents from power stations. Only a few papers describe impacts from such heated effluents. In the long-term, climate change and seawater temperature rise may be affect some key structural or key functional species. Such potential long-term impacts are not included here but are reviewed in Hiscock *et al*. (2004).

5.2.14 Thermal range (Decrease in temperature)

Decrease in temperature is most likely to be a natural event as a result of, for instance, a very cold winter. The most consistently useful source of information on the effects of very cold weather on marine life is the summary edited by Crisp (1964) of the impact of the 1962/63 winter on marine life in Britain.

5.3 Identification of species affected by 'Exposure pressure'

Table 2 lists taxa identified as affected by major Exposure pressures for which research literature is available. Information is summarized from the print-out of spreadsheets in Appendix 2 and from tabulated information in the report text and is included in alphabetical order of taxa. (Table 2 is included after the references.)

5.4 Species intolerance and sensitivity from *MarLIN* research

Species that are likely to be adversely affected by particular factors (which can be linked to categories of human activities and natural events) were identified by querying the *MarLIN* Biology and Sensitivity Key Information database. Results are shown in Appendix 3 and 4.

5.5 Meiobenthos

This section of the report is included to address the status of knowledge of meiobenthos as potential indicators. Because of perceived taxonomic difficulties, meiobenthos are not usually considered as practical indicators of disturbance. Also, no reliable indicators of pressures other than organic enrichment have been identified. Nevertheless, the meiofaunal taxa that favour habitats that are highly enriched with organic matter are remarkable in two respects; first they are virtually confined to a few groups of nematodes and copepods that are relatively easy to recognise at taxonomic levels above that of species, and second these same groups are of ubiquitous occurrence in such situations, at least in temperate latitudes where they have been most studied. The suite of species is small, but differs rather consistently between intertidal or shallow estuarine sites and those sites that are subtidal and more or less fully marine.

Intertidally on a wide range of sediment types incuding muds, muddy sands and sands, nematodes are found in very high densities in organic material such as decomposing macroalgae and terrestrially derived phanerogams. Decomposing wrack beds are usually dominated (worldwide) by a single species, *Rabditis marina* (Inglis & Coles, 1961; Inglis, 1966), whereas decaying marsh vegetation and sewage effluent is usually dominated by two related genera of the nematode family Monhysteridae, namely *Diplolaimella* and *Diplolaimelloides* (Lorenzen, 1969; Hopper, 1970; Hopper *et al.*, 1973, Austen *et al.*, 1989). A wide variety of environments enriched by particulate organic material are also characterised by the predominance of a limited number of copepod species. Notable among these are members of the genus *Tisbe* (Fava & Volkmann, 1975). This genus comprises a number of very closely related and morphologically similar species (Volkmann, 1979), which are often found in multispecies guilds in organically enriched habitats (Bergmans, 1979). For example, Gee *et al.* (1985) found that sediments enriched with organic detritus became dominated by a guild of five *Tisbe* species, even in situations where a *Beggiatoa* mat formed on the sediment surface, indicating at least periodic anoxia

in the overlying water as well as the sediment. Species in this genus are exceptionally large relative to other harpacticoid copepods, and quite easy to identify to genus level.

Subtidally, the nematodes that typically predominate in organically enriched sediments are not the small Monhysterids and Rhabditids, but abnormally large Oncholaimids, which as a group are also easy to identify. In situations where disturbance is not necessarily associated with organic enrichment, these species are more often members of the genus *Metoncholaimus*, in Britain particularly *M. scanicus* and *M. albidus* (Richard Warwick, personal observations). However, in organically enriched situations *Pononema* may become enormously abundant (Warwick & Robinson, 2000). Bett & Moore (1988) for example found a wet weight of 50 $g.m^{-2}$ of *P. alaeospicula* in the centre of the Garroch Head (Firth of Clyde) sewage sludge dumping ground. They also report dense populations of this species from a sublittoral sewage outfall in the Firth of Forth and surrounding the outfall of an alginates factory in Loch Creran, W. Scotland. The commoner, closely related and morphologically similar *P. vulgare* was found in dense matted aggregations often comprising millions of individuals and easily visible to the naked eye in organically enriched habitats in the Kiel and Flensberg inner fjords (Lorenzen *et al.*, 1987; Prein, 1988). The harpacticoid copepod species most commonly associated with subtidal organically enriched habitats is the large Diosaccid *Bulbamphiascus imus* (Marcotte & Coull, 1974; Keller, 1986; Moore & Pearson, 1986; Sandulli & Nicola-Guidici, 1990), to such an extent that it has come to be regarded as an indicator species of organic pollution. Marcotte & Coull (1974) found that this species was dominant near a sewage outfall in the Mediterranean in the summer, but that a species of *Tisbe* dominated in winter.

6. CONCLUSIONS

The information tabulated in appendices together with other sources of information included in this review have identified a large number of species that might respond positively (increased abundance or appearance where not previously present) or negatively (decreased abundance or loss) to certain environmental factors and human activities. In order to produce practical guidance that might assist in interpreting change, the various results have been brought together in Table 2 (presented following References). The list whilst large is not exhaustive and there are other faunal and floral groups which have been ommitted from the study.

The different terminology used in different source material was inconsistent and confusing and Appendix 5 is a read-across table that matches different terms.

Certain species or taxa occur frequently in lists of sensitive species that decline in abundance or tolerant species that thrive where significant pressures of different types occur. The taxa are ones that are likely to occur in many surveys because they are common and widespread. They include:

Various amphipods. Sensitive to physical disturnace and hydrocarbons.

Amphiura filiformis. Sensitive to physical disturbance, hydrocarbons and to organic input (increased nutrients).

Capitella capitata. Typically increases in abundance as a result of hydrocarbons and organic input.

Cardium edule. Sensitive to physical disturbance.

Chaetozone setosa. Typically increases in abundance as a result of hydrocarbons and organic input.

Echinocardium cordatum. Sensitive to physical disturbance and to organic input (increased nutrients).

Eteone longa. Typically increases as a result of organic input.

Heteromastus filiformis. Tolerant of or increased abundance in relation to heavy metals and organic input including nutrients.

Macoma balthica. Typically increases as a result of organic input.

Mya arenaria. Typically increases as a result of organic input.

Nephtys hombergii. Sensitive to physical disturbance.

Phloe minuta. Typically increases as a result of organic input.

Scalibregma inflatum. Typically increases as a result of organic input.

Scolelepis fuliginosa. Typically increases as a result of organic input.

Scoloplos armiger. Typically increases as a result of organic input.

Reviews that bring-together results from several different studies to look for consistent trends in presence or absence of species in relation to specific pressures are few. Rygg (1985) compares his observations from Norwegian fjords of effects of copper pollution with three other studies whilst Borja (2000) has used a wide range of studies but where the pressure is different from study-to-study, thus not identifying pressure-specific indicator taxa. If pressure-specific taxa exist, they would be particularly valuable in identifying reasons for decline or increase in those species at a location. Organic enrichment gradients and TBT contaminant effects do, however, have pressure-specific taxa.

The results of the study described here confirm that many of the species that have been identified as 'tolerant' of a wide range of pressures (and therefore of 'low' sensitivity to that pressure) are r-strategists – species that have a high rate of reproduction and will colonise habitats quickly. Such r-strategists may be killed by the factors resulting from pressures but have a high turn-over rate and so return rapidly. In conditions of severe impact, not even the r-strategists survive. Some K-strategists (species that have low fecundity, are slow-growing and long-lived) may be tolerant of pressures. For instance, horse mussels, *Modiolus modiolus,* have continued to thrive in the vicinity of an oily effluent in Shetland (ERT (Scotland) Ltd, 2002). However, it is usually K-strategists that constitute the majority of indicators of adverse effects from a pressure.

The identification of species as either 'r-strategists' or 'K-strategists' is simplistic and there are many species that have a reproductive strategy, growth rate and longevity that is intermediate. Those species are often 'moderately sensitive' to a factor and occur at in intermediate position along a pollution/disturbance gradient or along a time gradient to recovery following removal of a pressure. In the context of 'intermediate' species, it is difficult to better the diagram in Figure 1 although similar diagrams should be produced for other substrata especially hard substrata and for particular sampling units such as kelp holdfasts.

In concentrating on identifying species or particular taxa as indicators, this study may have missed the opportunity to look at broader indicators of pressures affecting marine life. For instance, the occurrence of large patches of intertidal green algae or epiphytes on subtidal plants may indicate eutrophication.

Table 2 produced as a part of this contract will now be used in Biology and Sensitivity Key Information reviews being produced by the *MarLIN* programme. At present, new species being researched will include reference to the conclusions of this review in the 'Additional

Information' section of sensitivity reviews. However, presentation of the *MarLIN* reviews to make them as useful as possible to personnel implementing the WFD, interpreting the results of SAC monitoring etc. requires the development of additional tools and searches, some re-structuring of the Web-site and using terminology employed for 'Pressures' in the WFD.

In interpreting the results of surveys by reference to 'indicator' species identified by the survey, it is important to take account of the natural stability or instability of the environment in which the samples were taken. The presence of disturbance-tolerant species and the absence of long-lived slow-growing species may merely indicate that the habitat is naturally unstable (through wave disturbance of sediments, scour effects during storms, low salinity events during high river flow etc.). However, in situations where measures have been taken to improve water quality or to reduce habitat disturbance, the appearance of K-strategists not previously present will be a good sign.

Climate change effects may also need to be taken into account in identifying potential indicator species. Some edge-of-range species may increase (southern species) or decrease (northern species) as temperature rises.

We are aware of several papers that have been submitted for publication that relate to human impacts on the marine environment and identify potential indicator species. We have been unsuccessful in obtaining 'in submission' papers describing changes in the Bay of Biscay and off the coast of Belgium in relation to fishing activities. We have recently (September 2004) received the CEFAS report on aggregate extraction (Boyd *et al*., 2004) which identifies many species that charcterise dredged and undredged areas. Other relevant papers such as on macroalgae and gradients of nutrient enrichment (Karez *et al*., 2004) are appearing at frequent intervals. Such papers can be used to expand or refine conclusions in this report and on *MarLIN* Web pages at some later revision.

7. RECOMMENDATIONS

1. The conclusions from this study brought together in Table 2 should be scrutinized by experienced marine ecologists and attention drawn to additional sources of information and improvements to the contents of the table.
2. Validation of the AMBI index and its categorisation of sensitivity for macroinvertebrate species (i.e. abundant and sensitive taxa which will determine status boundaries) should be further undertaken to provide a firmer evidence base to support the development of the index.
3. There should be particular effort to mobilise information from monitoring studies of fish farms: such information has been only sparsely found in available literature.
4. More effort needs to be made to identify sources of information about effects of nutrients on intertidal sediment flats: for instance, Rafaelli *et al.* (1989).
5. The work undertaken on the impacts of an acidified halogenated effluent should be incorporated (Hoare & Hiscock, 1974).
6. Information on 'Substratum removal' (Mineral extraction: aggregates) should be carefully scrutinized and conclusions about potential indicator species improved to take account of speed of recovery wherever possible.
7. A greater range of faunal and floral groups should be assessed to broaden the scope of for determining indicator species such as macroalgal, angiosperms (such as sea

grasses) and fish species to provide a similar evidence base for other biological elements considered by the Habitats and Water Framework Directives.

8. The exercise undertaken at the ICES Workshop (for species beginning with 'A') to bring-together results of various studies that have produced indices should be completed but using only common/widespread species from the AMBI work and adding information from the current study.
9. The *MarLIN* database should be interrogated to identify biotopes that are registered as high or very high sensitivity to factors where these relate to Habitats Directive water related features or WFD biological elements and classification tools.
10. A series of diagrammatic representations of the 'health' of communities in different habitats in relation to a gradient of 'pressure' should be developed as a training aid. The diagrams will be similar in style to those produced by Pearson & Rosenberg (1978).
11. Further research should be undertaken to identify species and biotopes affected by natural variability and extremes to provide a context to change brought about by human activities and to provide additional supporting evidence where misclassifications occur from assessment schemes being developed for Habitats Directive and WFD.
12. More clarity is needed in the application of Pressures and *MarLIN* factors of "Suspended sediment" and "Turbidity" as the two are closely linked and any impacts are difficult to disentangle between the two categories. [for the moment, 'Decreased turbidity' (Warwick *et al.*, 1991) has not been included in Table 2].
13. *MarLIN* Biology and Sensitivity Key Information research should be undertaken on (potential) indicator species to ensure that information for interpretation of change is available.
14. Using the information collated in the current exercise and existing research on the *MarLIN* database, produce "Reduced abundance may be due to:" and "Increased abundance may be due to:" on the *MarLIN* database and Web pages (cross-references to recommendation in 9.1 of SGSOBS report).
15. Keep the *MarLIN* database and Web pages up-to-date as new literature and interpretation of existing information becomes available.
16. There should be greater integration of initiatives to improve consistency of approach to the assessment of sensitivity of species and reduce confusion in terminology. The MarLIN website should be further developed to provide a consistent glosssary of terms for relating pressures and impacts on the marine environment as well as helping to validate classification schemes used for regulatory monitoring and EU Directives.

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Table 2. Species likely to respond to exposure pressures (environmental factors) and that might be identified as indicator species. Sources of information are:

1. Table 1 (Post-TBT Crouch Estuary infauna: Matthiessen *et al.*, 1999)

2. Box 3 (Tolerance of sediment species to copper: Rygg, 1985) (Not including species not listed in Howson & Picton 1997)

3. Box 5 (Salinity variation: Mucha *et al.*, 2004)

4. Appendix 2 (Results of the literature review.) (Some references are identified precisely but for those indicated [4], the reader will need to refer to Appendix 2)

5. (Redundant)

6. Hardy *et al*. , 1993

10. Newell,1985

14. Bamber, 1984

[18] Moore, 1991

[22] Veale *et al*., 2000

[26] Southern Sciences, 1992

7. Desgarrado Periera *et al.,* 1997

11. Meire *et al.*, 1994

[15] Hall *et al*., 1990

[19] Cowie *et al*., 2000

[23] Kaiser *et al*., 2000

[27] Hauton *et al.*, 2003

8. Gray, 1976

12. Warwick *et al.*, 1991

[16] Ferns, 2000

[20] Shaeder, 1986

[24] Bradshaw *et al*., 2002

[28] Hall-Spencer & Moore, 2000

9. Newell *et al*., 1984

13. Barnett & Watson, 1986

[17] Beukema, 1995

[21] Devon Wildlife Trust ,1994

[25] Eleftheriou & Robertson, 1992

[29] MacDonald *et al*.,1996

[30] Eno *et al*., 2001

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31. Read, 1987

[35] Bagge, 1969

[39] Pearson, 1975

[43] Henriksson, 1969

[47] Desprez, 2000

[51] Kenny & Rees, 1994

[32] Shillabeer & Tapp, 1990

[36] Eagle, 1973

[40] Rosenberg, 1972

[44] Leppakoski, 1975

[48] Boyd *et al*., 2003

[52] Kenny & Rees, 1996

[33] Bustos-Baez & Frid, 2003

[37] Rees *et al.*, 1992

[41] Dybern, 1972

[45] Beyer, 1968

[49] Shelton & Rolfe, 1972

[53] Millner et al., 1977

[34] Anger, 1975

[38] Hall *et al.*, 1997

[42] Halcrow *et al*., 1973

[46] Diaz & Rosenberg, 1995

[50] Van Moorsel, 1994

[54] van Delfsen et al., 2000

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[55] Hyslop *et al*., 1997
[56] Johnson & Frid, 1995
[57]Bergman & Hup, 1992
[58] Lindeboom & De Groot, 1998
[59] Rumohr & Kujawski, 2000
[60] Craeymeersch *et al*., 2000
[61] Kaiser *et al*., 1998
[62] Kaiser & Spencer, 1996
[63] Atkinson, 1989
[64] Ball *et al*., 2000
[65] Tuck *et al*., 1998
[66] Brown *et al*., 1987
[67] Pearson & Black, 2001
[68] Mattson & Linden, 1983
[69] Black *et al*., 1997
[70] Collier & Pinn, 1998
[71] Grant & Briggs, 1998
[72] Thain *et al*., 1997
[73] Spencer *et al*., 1997
[74] Spencer *et al*., 1998
[75] Beukema, 1989
[76] Beukema, 1991
[77] Pearson et al., 1985
[78] Crump et al., 1998

[79] Dicks & Levell, 1989
[80] Moore, 1998
[81] Nikitik & Robinson, 2003
[82] Olsgard & Gray, 1995
[83] Gray et al., 1990
[84] Kingston, 1987
[85] Kingston *et al*., 1995
[86] Davies *et al*., 1984
[87] Levell *et al*., 1989
[88] Rutt *et al*., 1998
[89] Gomez gasteira & Dauvon, 2000
[90] Oug *et al*., 1998
[91] Daan *et al*., 1994
[92] Dixon, 1987
[93] Bryan *et al*., 1987
[94]
[95] Olsgard, 1999
[96] Dauvin, 1998
[97] Bamber, 1989
[98] Leppakoski, 1977
[99] Rosenberg, 1977
[100] Warwick, 2001

HI = High Intolerance; HS = High Sensitivity; VHS – Very High Sensitivity (*MarLIN* research: Appendix 3 & 4. Benchmarks (intensity of factor) explained in Appendix 6).
-- = likely to be absent in the habitat as a result of the factor.
- = likely to be present in lower numbers than expected in the habitat as a result of the factor.
++ = likely to be present in much higher abundance than expected in the habitat as a result of the factor.
+ = likely to be present or present in higher abundance than expected in the habitat as a result of the factor.
T = Tolerant (Bryan *et al.*, 1987; Diaz & Rosenberg, 1995; Olsgard, 1999; Rygg, 1985; Desgarrado Pereira *et al.*, 1997; Meire *et al.*, 1994)
I = Intermediate (Diaz & Rosenberg, 1995; Meire *et al*., 1994)
S = Sensitive (Diaz & Rosenberg, 1995)

Tox = Toxic (chaemotherapeutants)

Under “Nitrate/Phosphate” / “Changes in nutrients”, organic enrichment in relation to mariculture is marked *.

Some reviews include information on a species from more than one source: the number of sources for a species against each factor/pressure are given in ( ).

Species	EA 'Exposure pressure'														Industrial effluents (gen.) incl. sewage & metals	Habitat(s)	Notes
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances		Nitrate / Phosphate	Salinity		Oxygen concentration	Thermal range/heat					
	Equivalent *MarLIN* environmental factor																
	Substratum loss	Smothering	Increased suspended sediment	Decreased suspended sediment	Increased turbidity	Physical disturbance [* = dredging - fishery]	Synthetic chemicals [Tox =chemotherap.]	Heavy metals	Hydrocarbons	Changes in nutrients [* =. Org. enrich. mari.]	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature			
Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	**Habitat(s)**	**Notes**
Abra alba	+[49]	+[4]				-[18*] 27	HI		+[88] 92 -	-[33*] I[46*]			I[4(2)]			+[9]	A2.2 Litt. sands & muddy sands; A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds; A4.6 Biogenic structs over sublitt. sed. Various (Diaz & Rosen.)	Intermediate to organic enrichment [45]
Abra nitida	-	-[99]				-[20*]		--[2]		-[40*]			I[46 (2)]				A2.3 Litt. mudsA4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	
Abra prismatica									-[82 83]								A4.2 Sublitt. sands & muddy sands	
Abra sp.						-[64*]				+[37*]							A4.2 Sublitt. sands & muddy sands	
Abra tenuis						-[20*]											A2.3 Litt. muds; A4.4 Sublitt. combi.	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
						26*											seds	
Achelia echinata							--[1]											[1] = TBT
Aequipecten opercularis						-[22*]											A4.1 Sub. cob., grav., cse snd	
Ahnfeltia plicata							HI		HI									
Alaria esculenta											HI			HI				
Alcyonium digitatum	-[49]					-[21* 22* 23]							HI				A3.6 Circalitt. rk mod. exp. wave act.; A4.1 Sub. cob., grav., cse snd	
Alentia gelatinosa						-[27*]											A4.6 Biogenic structs over sublitt. sed.	
Alkmaria romijni	VHS	HS				HS												
Ampelisca brevicornis						-60*			--[80]								A2.2 Litt. Sands & muddy sands; A4.2 Sublitt. sands & muddy sands	
Ampelisca spinipes		+[4]															A4.2 Sub. Sands & muddy sands	
Ampelisca spp.						--[62*]			--[96 89 83 88]								A4.2 Sublitt. sands & muddy sands	
Ampharete grubei	+[49]					-[73] 26* +[73]				+[33*]			S[46]				A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. sands & muddy sands; A4.4 Sublitt. combi. Seds; Various (Diaz & Rosen.)	In some papers as *A. acutifrons*
Ampharete sp.										+[37* 39*]							[4]A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Amphianthus dohrnii	VHS					HI; HS												
Amphipholis squamata	-[47 48]																A4.1 Sub. cob., grav., cse snd	
Amphipoda	-[51 52]								--[85]	-[45]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds; A.4.1 Sub. cob., grav., cse snd	
Amphiura chiajei						-[64*]		-[2]	HI	-[45*] (2) 68*		HI	I[4(2)]				A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds; Various (Diaz & Rosen.)	[2] = Copper

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Amphiura filiformis		-[97]				-[58*] [59*] +[24*]	HI	-[2]	HI –[82] [92] [90] [91] [83]	-[33*] [40*] [67*] +[77]	HI		I[4(3)]				A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	[2] = Copper Intermediate to organic enrichment [45]
Amphiura sp.										+[39*]							A4.3 Sublitt. muds	
Amythasides macroglossum									-[82]								A4.2 Sublitt. sands & muddy sands	
Anaitides groenlandica								T[2]		+[35*] [40*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[2] = Copper
Anaitides sp.										+[75]								
Anoplodactylus pygmaeus							--[1]											[1] = TBT
Antedon bifida		HI				HI	HI		HI		HI	HI						
Aonides paucibranchiata									-[82] [85]								A4.2 Sublitt. sands & muddy sands	
Aphelochaeta marioni							--[1] HI	-[93]								+[10]	A2.3 Litt. muds; A4.3 Sublitt muds	[1] = TBT
Aphelochaeta multibranchis							--[1]											[1] = TBT
Aphelochaeta sp.		+[4]															A4.2 Sub. Snds & muddy snds	
Aphrodita aculeata						-[61*] [22*]					HI	HI					A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. Sands & muddy sands	
Aphrodite sp.																T[7]	A2.3 Litt. muds	
Apistobranchus paucibranchiata										+[67*] -[77]	*						A4.3 Sublitt. muds	
Arctica islandica	-[50]	-[99]				-[59*] [60*]	HI						T[46] (2)	HS	NR		A4.2 Sublitt sands & muddy sands; Various (Diaz & Rosen.) A4.1 Sub. cob., grav., cse snd; A4.3 Sublitt. muds	
Arenicola marina							HS Tox [72]			+[31*] [75]			T[46]				A2.2 Litt. sands & muddy sands; A2.3 Littoral muds; A4.3 Sublitt. muds Various (Diaz & Rosen.)	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Aricidea wassi									-[82]								A4.2 Sublitt. sands & muddy sands	
Armandia cirrhosa	VHS										HI; VHS							
Ascidiella scabra						HI												Rapid colonizer
Ascophyllum nodosum	HS	HI; HS				HI; HS	HS											
Astarte borealis													T[46] (2)				Various (Diaz & Rosen.)	
Asterias rubens	-[49]					-[57*] +[24*]			HS		HS		HS	HS			A4.2 Sublitt. sands & muddy sands; A4.1 Sub. cob., grav., cse snd	
Atrina fragilis	VHS	HS				HI VHS								HS				
Atylus swammerdami						+[60*]											A4.2 Sublitt. sands & muddy sands	
Audouinella purpurea																--[6]	A1.3 Litt. rock shelt. wave act.	
Axinella dissimilis	HS	HS	HS			HS					HI; HS		HS	HS				
Balanus crenatus	-[51 52]	HI					HI						HI	HI			Sub. cob., grav., cse snd	
Balanus improvisus																T[f]	A2.3 Litt muds (on stones?)	
Bangia atropurpurea																--[6]	A1.3 Litt. rock shelt. wave act.	
Bathyporeia elegans						-[15*]											A2.2 Litt sands & muddy sands	
Bathyporeia pelagica		-[55]					HI		HI	HI	HI		HI				A2.2 Litt. sands & muddy sands	
Bathyporeia pilosa						-[16*]											A2.2 Litt. sands & muddy sands	
Bathyporeia sp.									-[80]								A2.2 Litt. sands & muddy sands	
Botryllus schlosseri		HI	HI															
Brada villosa								--[2]									A4.3 Sublitt. muds	
Bradyidius armatus										+[45*]							A4.3 Sublitt. muds	
Branchiostoma lanceolatum	-[47]																A4.1 Sub. cob., grav., cse snd	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Brissopsis lyrifera						-[64*]	HI			+[40*]			HI S[46]				A4.3 Sublitt. muds; Various (Diaz & Rosen.)	
Buccinum undatum						-[23*] 65* +[24*] 59*											A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Bugula turbinata		HI					HI		HI									
Caecum armoricum	VHS					HI; HS												
Callianassa subterranea						-[58*]	HI		HI -[91]		HI						A4.2 Sublitt. sands & muddy sands	
Calliostoma zizyphinum						+*[24]											A4.1 Sub. cob., grav., cse snd	
Callithamnion sepositum																--[6]	A1.3 Litt. rock shelt. wave act.	
Calocaris macandreae								--[2]										[2] = Copper
Campanularidae						-[24*]											A4.1 Sub. cob., grav., cse snd	
Cancer pagurus		HI				+[22*] -[25*]	HI		HI								A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. sands & muddy sands	
Capitella capitata							Tox[69]	T[2] -[95]	+[82 83 85 84 86 87]	+[8*] 31* 32* 33* 34* 35* 36* 39* 40* 41* 42* 43* 44* 66* 67* 68*			I[46 (3)]			T[7] +[8]	A2.3 Littoral muds; A4.2 Sub. Sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	[2] = Copper;
Capitella sp.									+[80]								A2.2 Litt. sands & muddy sands	
Capitelloides giardi																+[9]	A4.3 Sublitt. mud	
Capitomastus minimus						-[64*]				+[32*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Capitomastus sp.										+[39*]							A4.3 Sublitt. muds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Caprella linearis							--[1]											[1] = TBT
Carcinus maenas							HI; Tox[71]		HI				S[46]			T[/]	A2.3 Litt. muds; Various (Diaz & Rosen.)	
Caryophyllia smithii						-[21*]											A3.6 Circalitt. rk mod. exp. wave act.	
Caulleriella killariensis						-[74]											A4.2 Sublitt. sands & muddy sands	
Caulleriella sp.								--[93]	+[86 88]	+[67*]						T[/]	A2.3 Litt. muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Caulleriella zetlandica						+[65*] 58*								+[14]			A2.2 Litt . sands & muddy sands; A4.3 Sublitt. muds	
Ceramium rubrum																--[6]	A1.3 Litt. rock shelt. wave act.	
Ceramium shuttleworthianum																--[6]	A1.3 Litt. rock shelt. wave act.	
Ceramium tenuissimum																--[6]	A1.3 Litt. rock shelt. wave act.	
Ceramium virgatum							HI		HI									
Cerastoderma edule						-[16*] 18* 26* 74 +[20*]	-[1]	--[93]	-88				HI	--[14]		T[/]; -[8]	A2.2 Litt. sands & muddy sands; A2.3 Litt. muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds; A4.4 Sublitt. combi. seds	[1] = TBT
Cerastoderma glaucum	HS	HI; HS			-[12]					HS			HS					
Ceratocephale loveni								+[2]										[2] = Copper
Cerianthus llodii						-[27*]											A4.6 Biogenic structs over sublitt. sed.	
Chaetopterus variopedatus						-[27*]											A4.6 Biogenic structs over sublitt. sed.	
Chaetozone gibber									+[80 81 88]								A2.2 Litt. sands & muddy sands; A4.2 Sublitt. sands & muddy sands	
Chaetozone setosa		+[97]				-[64*] +[65*] 58* +[73]		T[2] -[95]	+[82 89 83 85 87]	+[32*] 40* +67*							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[2] = Copper

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Chaetozone sp.									+[86]								A4.2 Sublitt. sands & muddy sands	
Chironomidae indet.											T[3]	T[3]						
Chondrus crispus							HI											
Chthamalus montagui												HI	HI		HI			
Chthamalus sp.									-[78]									
Chthamalus stellatus												HI	HI		HI			
Cingula vitrea						-[58*]											A4.2 Sublitt. sands & muddy sands	
Ciona intestinalis						HI												
Cirratulidae					-[12]					+[32*, 37* 67*]							A4.2 Sublitt. sands & muddy sands ; A4.3 Sublitt. muds	
Cirratulus cirratus		HI					HI	T[2]	+[82]								A4.2 Sublitt. sands & muddy sands	[2] = Copper
Cirriformia sp.						-[20*]											A2.3 Litt. muds	
Cirriformia tentaculata								-[93]		+[32*]						+[9]	A2.3 Litt. muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Clausinella fasciata						-[22*]											A4.1 Sub. cob., grav., cse snd	
Clavelina lepadiformis		HI				HI												
Clavopsella navis	VHS	HS	HS			HI; HS												
Clitellio arenaria										+[31*]							A2.3 Littoral muds	
Collembola indet.											T[3]	T[3]						
Conopeum reticulum		HI							HI									
Corbula gibba						-[64* 65*]		+[2]		+[35* 39* 41*]			T[46] (5)				A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	[2] = Copper
Corophium arenarium					-[12]	-[16*]											A2.2 Litt. sands & muddy sands	
Corophium crassicorne						-[15*]											A2.2 Litt. sands & muddy sands	
Corophium sp.																T[7]	A2.3 Litt. muds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Corophium volutator		HI			-[12]		HI; -[1] Tox 70	HI; T[93] -- 100	HI	HI; +[8]* 31* 41*	T[3]	T[3]	HI			+[9]	A2.3 Littoral muds; A4.3 Sublitt. muds	[1] = TBT;
Corystes cassivelaunus						-[29]* +[59]*											A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Cossura longocirrata								T[2] 95									A4.3 Sublitt. muds	
Cossura sp.										+[67]*							A4.3 Sublitt. muds	
Crangon allmanni	-[53]																A4.1 Sub. cob., grav., cse snd	
Crangon crangon	-[53]									-[77]			S[46]			+[10]	A4.3 Sublitt. mids; Various (Diaz & Rosen.);A4.1 Sub. cob., grav., cse snd	
Crangonidae										-[45]*							A4.3 Sublitt. muds	
Crepidula fornicata							HI											
Crisia sp.						-[24]*											A4.1 Sub. cob., grav., cse snd	
Crustacea								--[2]									A4.3 Sublitt. muds	
Ctenodrilus sp.									+[84]								A4.2 Sublitt. sands & muddy sands	
Cumacea										-[45]*							A4.3 Sublitt. muds	
Cyathura carinata					-[12]			-- 100			T[3]	T[3]					A2.3 Litt. muds	
Cylichna cylindracea						-[64]*											A4.3 Sublitt. muds	
Cylichna cylindrica						-[58]*			-[91]								A4.2 Sublitt. sands & muddy sands	
Delesseria sanguinea							HI		HI				HI			--[6]	A1.3 Litt. rock shelt. wave act.	
Diastylis bradyi										-[32]*							[4]A4.2 Sublitt. sands & muddy sands	
Diastylis rathkei													S[46]				Various (Diaz & Rosen.)	
Diastylis sp.							--[1]											[1] = TBT
Diplocirrus glaucus						-[64]*		--[2]		+[67]*							A4.3 Sublitt. muds	[2] = Copper
Donax vittatus	-[54]																A4.2 Sub. Snds & muddy snds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Dosinia exoleta	-[50]					-[27*]											4.1 Sub. cob., grav., cse snd; A4.6 Biogenic structs over sublitt. sed.	
Dosinia lupinus						-[64*]											A4.3 Sublitt. muds	
Echinocardium cordatum	-[54]					HI; -[25*] 57* 58* 64* 29* +[59*]	HI		HI; -[91]	HI; -[68*] 40* 77			HI				A4.2 Sub. Sands & muddy sands; A4.3 Sublitt. muds	
Echinocardium flavescens									-[82]								A4.2 Sub. Sands & muddy sands	
Echinocyamus pusillus	-[47]					-[59*]			-[82]								A4.2 Sublitt. sands & muddy sands; A4.1 Sub. Cob., grav., cse snd	
Echinodermata								--[2]									A4.3 Sublitt. muds	
Echinus esculentus						-[23*]	HI	HI	HI								A4.1 Sub. cob., grav., cse snd	
Eclysippe vanelli									-[82]								A4.2 Sublitt. sands & muddy sands	
Edwardsia ivelli	HS	HS				HI; HS												
Edwardsia sp.									-[82]								A4.2 Sub. sands & muddy sands	
Electra pilosa		HI																
Elminius modestus									-[79]							T[f]	A2.3 Litt. muds (on stones?)	
Enchytraeidae							--[1]				T[3]	T[3]						[1] = TBT
Enipo kinbergi						-[58*]											A4.2 Sublitt. sands & muddy sands	
Ennucula tenuis								--[2]										[2] = Copper
Ensis arcuatus						-*[27]											A4.6 Biogenic structs over sublitt. sed.	
Ensis ensis						-*[25]											A4.2 Sublitt. sands & muddy sands	
Ensis siliqua									-[88]								A4.2 Sublitt. sands & muddy sands	
Ensis spp.	-[50]					HI; -[29*]	HI		HI								A4.2 Sublitt. sands & muddy sands; A4.1 Sub. cob., grav., cse snd	
Enteromorpha spp.		HI							+[78]								A1.2 Litt. Rk mod. Exp waves	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Eriopisa elongata						-[4]		--[2]									A4.2 Sublitt. sands & muddy sands	[2] = Copper
Eteone longa						-[26*]	--[1]	T[2] 95		+ [31*] 35* 36* 39* 41* 42* 75							A2.3 Littoral muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds ; A4.4 Sublitt. combi. seds	[1] = TBT, [2] = copper;
Euclymene lumbricoides						+[73]											A4.2 Sublitt. sands & muddy sands	
Eudorella emarginata								--[2]										[2] = Copper
Eulalia sp.										+[39*] 76							A4.3 Sublitt. muds	
Eumida sp.										-[67*]								
Eunicella verrucosa	VHS					-[21*]						HI; VHS	HI; VHS				A3.6 Circalitt. rk mod. exp. wave act.	
Eurydice pulchra		HI					HI			HI			HI					
Exogone naidina							--[1]											[1] = TBT
Exogone sp.							--[1]											[1] = TBT
Fabricia sabella								+[100]									A.2.3 Littoral muds	
Fabulina fabula		+[4]				-[57*]	HI			-[32*]							A4.2 Sublitt. sands & muddy sands	
Flustra foliacea							HI					HI						
Fucus ceranoides		HI								HI								
Fucus distichus		HI												HI				
Fucus serratus		HI					HI									--[6]	A1.3 Litt. rock shelt. wave act.	
Fucus spiralis		HI							HI					NR				
Fucus vesiculosus		HI																
Funiculina quadrangularis	HS					HI -[29*]											A4.3 Sublitt. muds	
Furcellaria lumbricalis						M	HI		HI									
Galathea intermedia						+*[24]											A4.1 Sub. cob., grav., cse snd	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Gammarus insensibilis	HS				HS		HI; HS		HI; HS									
Gammarus salinus									HI									
Gammarus tigrinus													S[46]				Various (Diaz & Rosen.)	
Gari fervensis	-[50]																A4.1 Sub. cob., grav., cse snd	
Gattyana cirrosa									-[91]								A4.2 Sublitt. sands & muddy sands	
Giffordia granulosa																--[6]	A1.3 Litt. rock shelt. wave act.	
Glycera alba								T[2] 95		+[40*] -[67*]							A4.3 Sublitt. muds	[2] = Copper
Glycera lapidum									-[85]	-[4]							A4.2 Sublitt. sands & muddy sands	
Glycera rouxii								--[2]										[2] = Copper
Glycera spp.	-[47]																A4.1 Sub. cob., grav., cse snd	
Glycinde nordmanni		+[97]							-[91]	-[4]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Glycymeris glycymeris						-[23*]											A4.1 Sub. cob., grav., cse snd	
Gobius cobitis								HI										
Gobius couchi								HI										
Golfingia vulgaris									-[82]								A4.2 Sublitt. sands & muddy sands	
Goniada maculata	+[49]	-[97]						T[2]	+[86]	+[35*] -[33*]							A.2.2 Littoral muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt.muds A4.1 Sub. cob., grav., cse snd	[2] = Copper
Halichondria panicea		HI																
Harmothoe ljungmani	-[47]																A4.1 Sub. cob., grav., cse snd	
Harmothoe sp.								--[95]		+[76]							A4.3 Sublitt. muds	
Harpinia antennaria						-[64*]			-[82 92 91]								A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Harpinia sp.									--[81 88]								A4.2 Sublitt. sands & muddy sands	
Haustorius arenarius	-[4]	-[55]							-[80]								A2.2 Litt sands & muddy sands	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Hediste diversicolor							HI Tox [70 71]	T[93]		+ [8* 31* 44*]	T[3]	T[3]				T[7]	A.2.3 Littoral muds; A4.3 Sublitt. muds	
Henricia oculata														HI				
Hesionidae										+[45*]							A4.3 Sublitt. muds	
Hessionura elongata	+[48]																A4.1 Sub. cob., grav., cse snd	
Heteromastus filiformis		+[97]				+[4] (2) -[73 74] -[17*]		T[2] 95		+[35*, 37* 40* 75 76]			T[46] (3)				A2.2 Litt. sands & muddy sands; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	[2] = Copper
Himanthalia elongata		HI									HI							
Hippolytidae										-[45*]							A4.3 Sublitt. muds	
Hyale prevostii									HI									
Hyas coarctatus						+[59*] -[22*]											A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. sands & muddy sands	
Hydrobia ulvae						-[16*] 18	-[1] Tox [71]	--[93]		+[31*]						T[7]	A2.2 Litt sands & muddy sands; A.2.3 Littoral muds	[1] = TBT
Iphinoe trispinosa		+[4]															A4.2 Sub. Snds & muddy snds	
Isaeidae									-[81]								A4.2 Sublitt.sands & muddy sands	
Jassa falcata									HI; VHS				HI					
Jassa marmorata									+[83]								A4.2 Sublitt. sands & muddy sands;	
Jassa pusilla																T[7]	A2.3 Litt. muds	
Labidoplax sp.										+[39*]							A4.3 Sublitt. muds	
Lacuna vincta						HI												
Lafoea dumosa						-[24*]											A4.1 Sub. cob., grav., cse snd	
Lagis koreni						-[62*]											A4.2 Sublitt.sands & muddy sands	
Laminaria digitata																--[6]	A1.3 Litt. rock shelt. wave act.	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Laminaria hyperborea														HI				
Laminaria saccharina		HI									HI					--[6]	A1.3 Litt. rock shelt. wave act.	
Lanice conchilega		+[56] +[4]				-[57*] +[73]	HI			+[39*] -[67*]					HI		A4.2 Sub. sands & muddy sands; A4.3 Sublitt. muds	
Laonice cirrata								--[2]										
Leptognathia brevirostris										+[67*]							A4.3 Sublitt. muds	
Leptopsammia pruvoti	VHS	HI; VHS	HS			HI; VHS					VHS		HS	HS				
Leptosynapta bergensis		+[97]															A4.3 Sublitt. muds	
Leptosynapta inhaerens						-[58*]											A4.2 Sublitt. sands & muddy sands	
Levinsenia gracilis										+[37*] (2)							A4.2 Sublitt. sands & muddy sands	
Limaria hians						-[28*]											A4.6 Biogenic structs over sublitt. sed.	
Limaria loscombi						-[24*]											A4.1 Sub. cob., grav., cse snd	
Limatula subauriculata									-[82]								A4.2 Sublitt. sands & muddy sands	
Liocarcinus depurator						HI							HI					
Liocarcinus holsatus						+[59*]											A4.2 Sublitt. sands & muddy sands	
Liocarcinus sp.						-[22*] 27											A4.1 Sub. cob., grav., cse snd; A4.6 Biogenic structs over sublitt. sed.	
Lithophyllum incrustans	HS						HI; HS		HI									
Lithothamnion corallioides	VHS	HI; VHS	HI; VHS			HI; VHS					HI; VHS							
Lithothamnion glaciale	VHS	HI; VHS	HS		HS	HI; VHS				HS				HS				
Littorina littorea		HI					Tox [71]		HI									
Lumbrineris gracilis	-[48]	+[97]					Tox		-[85]								A4.1 Sub. cob., grav., cse snd; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Lumbrineris sp(p).								--[2] 94		+[37*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[2] = Copper
Luniata montagui									+[82]								A4.2 Sublitt. sands & muddy sands	
Lutraria angustior						-[27*]											A4.6 Biogenic structs over sublitt. sed.	
Macandrevia cranium									-[82]								A4.2 Sublitt. sands & muddy sands	
Macoma balthica						-[18*]	HI --[1]	HI --[93]	HI	+[8*] 31* 35* 43* 44* 75 76						-[8]; +[10]	A2.2 Litt. sands & muddy sands; A2.3 Littoral muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[1] = TBT;
Macoma calcarea													S[46]				Various (Diaz & Rosen.)	
Macropodia rostrata						+[24*]											A4.1 Sub. cob., grav., cse snd	
Macropodia sp.						-[22*]											A4.1 Sub. cob., grav., cse snd	
Magelona mirabilis							HI		HI									
Magelona pappillicornis						-[57*]											A4.2 Sublitt. Sands & muddy sands	
Magelona sp.		+[4]								-[67*]							A4.2 Sublitt. Sands & muddy sands	
Malacoceros fuliginosus									-[82]	+[67*]			T[46] (2)				A4.2 Sublitt. Sands & muddy sands; A4.3 Sublitt. muds; Various (Diaz & Rosen.)	
Maldanidae										+[37*]							A4.2 Sublitt. sands & muddy sands	
Manayunkia aestuarina						-[19*] 26*		+[100]		+[31*]							A2.3 Litt. muds; A4.4 Sublitt. combi. seds	
Marphysa bellii	-[48]																A4.1 Sub. cob., grav., cse snd	
Marphysa sanguinea	-[48]																A4.1 Sub. cob., grav., cse snd	
Mastocarpus stellatus																--[6]	A1.3 Litt. rock shelt. wave act.	
Mediomastus fragilis						+[58*]				+[31*]							A.2.3 Littoral muds; A4.3 Sublitt. muds	
Melarhaphe neritoides									+[78]								A1.2 Litt. Rk mod. Exp waves	
Melinna cristata								-[2]										[2] = Copper

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Melinna palmata					-[12]	+[73] -[26*]	--[1]	--[93]		+[67*]	T[3]	T[3]					A2.3 Litt. muds; A4.3 Sublitt. muds; A4.4 Sublitt. combi. seds	[1] = TBT
Membranoptera alata																--[6]	A1.3 Litt. rock shelt. wave act.	
Mercenaria mercenaria						-[20*]											A2.3 Litt. muds	
Metridium senile						-[65*]							T[46]				A4.3 Sublitt. muds; Various (Diaz & Rosen.)	
Micropthalmus sczelkowii										+[68*]							A4.3 Sublitt. muds	
Microspio sp.										+[67*]							A4.3 Sublitt. muds	
Modiolus modiolus	HS -[51 52]	HS				HI; HS -[24*]	HS					HI; HS		HS			A4.1 Sub. cob., grav., cse snd	
Modiolus phaseolina													T[46]				Various (Diaz & Rosen.)	
Molgula manhattensis						HI												
Montacuta ferruginosa									-[91]								A4.2 Sublitt. sands & muddy sands	
Montacuta substriata									-[82 83]								A4.2 Sublitt. sands & muddy sands	
Morchellium argus		HI																
Mugga wahlbergi										-[67*]								
Musculus discors		HI																
Mya arenaria		-[99]			-[12]	-[17*] 26*			HI	+[31*] 35* 43*						-[8]	A2.2 Litt. sands & muddy sands; A2.3 Littoral muds; Sublitt. sands & muddy sands; A4.3 Sublitt. muds; A4.4 Sublitt. combi. seds	
Mya truncata						-[27*]				+[41*]							A4.3 Sublitt. muds; A4.6 Biogenic structs over sublitt. sed.	
Myriochele oculata									-[82]	+[37*]							A4.2 Sublitt. sands & muddy sands	
Mysella bidentata		+[4] -[97]				-[64*] -58* +[73]			-[82 91]	+[37*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Mytilus edulis		-[99]						--[93]		+[32*] +[41*]			T[46]			-[8];	A2.3 Litt. muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	
Nadiidae											T[3]	T[3]						
Nais communis										+[31*]							A2.3 Littoral muds	
Nematoda indet.											T[3]	T[3]						
Nematostella vectensis	VH					HI; VH												
Nemertea		+[4]							+[4]								A4.2 Sub. Snds & muddy snds; A4.3 Sublitt. muds	
Nemertesia sp.						-[21*]											A3.6 Circalitt. rk mod. exp. wave act.	Likely to recolonise rapidly
Nemertina sp.						-[27*]			+[82]								A4.6 Biogenic structs over sublitt. sed.	
Neocrania anomala		HI																
Neomysis integer											HI							
Neopentadactyla mixta	HS	HI	HS			HS					HI; HS			HS				
Nephrops norvegicus						-[63]							HI S[46]				A4.3 Sublitt. muds; Various (Diaz & Rosen.)	
Nephtys ciliata								+[2]		+[44*]							A4.3 Sublitt. muds	[2] = Copper
Nephtys cirrosa	+[47 49]					-[15* 65 58]											A2.2 Litt. sands & muddy sands; A4.3 Sublitt. muds; A4.1 Sub. cob., grav., cse snd	
Nephtys hombergii		-[97]				-[16* 20* 26* 73 74]	--[1]	T[100 93]	HI -[91]	+[31*] -[32* 33*]			T[46 (2)]			T[7] +[9; 10]	A2.2 Litt. sands & muddy sands; A2.3 Litt. muds; A4..2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds; A4.4 Sublitt. combi. Seds; Various (Diaz & Rosen.)	[1] = TBT
Nephtys incisa										+[37*]							A4.2 Sublitt. sands & muddy sands	
Nephtys paradoxa								+[2]										[2] = Copper

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Nephtys sp.						-[61*]											A4.2 Sublitt. Sands & muddy sands	
Nepthys longosetosa									-[82]								A4.2 Sublitt. sands & muddy sands	
Neptunea antiqua						+[24*]											A4.1 Sub. cob., grav., cse snd	
Nereimyra punctata								T[2] 95	+[90]								A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[2] = Copper
Nereis diversicolor					-[12]	-[19*]				+[75 76]			I[46]			+[9]	A2.3 Litt. muds; A4.3 Sublitt.muds; Various (Diaz & Rosen.)	
Nereis pelagica													S[46]				Various (Diaz & Rosen.)	
Notomastus latericeus	-[47]								+[87]								A4.2 Sublitt. sands & muddy sands; Sub. cob., grav., cse snd	
Notomastus sp.		+[4]															A4.2 Sub. Snds & muddy snds	
Nucella lapillus	HS						HI; HS			HI; HS								
Nucula hanleyi	+[49]																A4.1 Sub. cob., grav., cse snd	
Nucula nitidosa		+[4]				-[59*] 65* 58*				+[33*] -[68*] 77			NR				A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Nucula sulcata								--[2]									A4.3 Sublitt. muds	[2] = Copper
Nucula tenuis						-[59*] 64*		--[2]									A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Obelia longissima														HI				
Oligochaeta									+[81]	+[32*]						T[f]	A2.3 Litt. Muds; A4.2 Sublitt. sands & muddy sands	
Ophelia bicornis	+[4(2)]																Sub. cob., grav., cse snd	
Ophelina acuminata						+[4]		--[2]		+[31*]							A4.2 Sublitt. sands & muddy sands	[2] = Copper
Ophelina acuminata						+[58*]				+[37*]							A2.3 Littoral muds; A4.2 Sublitt. sands & muddy sands	]„
Ophelina cylindricaudata								--[2]										[2] = Copper
Ophelina modesta								--[2]										[2] = Copper

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Ophelina norvegica								--[2]										[2] = Copper
Ophelina sp.										-[67]*								
Ophiocomina nigra						+[23*24]											A4.1 Sub. cob., grav., cse snd	
Ophiodromus flexuosus								T[2]		+[35*40*]			T[46]				A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	
Ophiopholis aculeata						-[24*]											A4.1 Sub. cob., grav., cse snd	
Ophiothrix fragilis	-[49]	HI				-[24*]			HI				HI				A4.1 Sub. cob., grav., cse snd	
Ophryotrocha sp.									+[82 84 89]	+[4 38* 67*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Ophiura affinis								-[95]	+[83 82] -								A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Ophiura albida	-[53] +[49]					+[23* 24 59*]				-[40* 67*]			T[46] (2)				A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.) A4.1 Sub. cob., grav., cse snd	
Ophiura ophiura						-[59*]											A4.2 Sublitt. sands & muddy sands	
Ophiura sp.		+[4]				+[58*]				-[45*]							A4.3 Sublitt. muds; A4.2 Sub. Sands & muddy sands	
Ophiura texturata										-[40*]							A4.3 Sublitt. muds	
Osilinus lineatus		HI											HI		HI			
Ostracoda							--[1]											[1] = TBT
Ostrea edulis	VHS	HI; VHS				HS	HI; VHS	HS -[93]					HS		HS			
Owenia fusiformis	M	+[4]							-[82 91]	-[67*]							A4.2 Sublitt. Sands & muddy sands	
Pachycerianthus multiplicatus						-[29*]											A4.3 Sublitt. muds	
Pagurus bernhardus	-[53]					+[61*]											A4.2 Sublitt. sands & muddy sands; A4.1 Sub. cob., grav., cse snd	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Pagurus sp.						+[22*]											A4.1 Sub. cob., grav., cse snd	
Palmaria palmata							HI		HI									
Paludinella litorina		HI; HS				HI; VHS												
Pandalidae										-[45*]							A4.3 Sublitt. muds	
Pandalina brevirostris						+[24*]											A4.1 Sub. cob., grav., cse snd	
Parajassa pelagica							--[1]											[1] = TBT
Paramphinome jeffreysii								-[2]	+[82]								A4.2 Sublitt. sands & muddy sands	[2] = Copper
Paranais littoralis										+[31*]							A2.3 Littoral muds	]
Paranais sp.						-[19*]											A2.3 Litt. muds	
Paraonis gracilis								-[2]										[2] = Copper
Patella sp.									+[78 79]								A1.2 Litt. Rk mod. Exp waves	
Patella ulyssiponensis		HI					HI		HI									
Patella vulgata		HI					HI		HI									
Pectinaria koreni								-[95]					I[46] (2)				A4.3 Sublitt. muds; Various (Diaz & Rosen.)	
Pectinaria sp.						-[58*]											A4.2 Sublitt. sands & muddy sands	
Peloscolex benedeni										+ [8* 35* 39* 41* 42*]							[4]A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt.muds	
Pelvetia canaliculata		HI							HI									
Pentapora fascialis						HI -[21* 29 30]					HI						A3.6 Circalitt. rk mod. exp. wave act.	
Perugia caeca										-[67*]								
Petricola pholadiformis					--[14]									--[14]			A2.2 Litt. sands & muddy sands	
Phascolion strombii									-[82]								A4.2 Sublitt. sands & muddy sands	
Phaxas pellucidus						-[59* 64*]				-[77]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Philine aperta										+[40*]							A4.3 Sublitt. muds	
Phloe inornata									+[83 85 87]	+[67*]							A4.2 Sublitt. sands & muddy sands	
Phloe minuta		-[97]					--[1]	T[2] 95	+[84 91] -	+[32* 35* 37* 39* 40* 45*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[1] = TBT [2] = Copper
Pholas dactylus							HI											
Phoronis mulleri													T[46] (2)				Various (Diaz & Rosen.)	
Phoronis sp.						+[58*]											A4.2 Sublitt. sands & muddy sands	
Photis longicaudata									-[88]								A4.2 Sublitt.sands & muddy sands	
Phyllodoce groenlandica									+[90]								A4.2 Sublitt. sands & muddy sands	
Phyllodoce maculata																+[9]	A4.3 Sublitt. muds	
Phyllodoce sp.	+[47]					-[26*]				+[39*]							A4.3 Sublitt. muds A4.1 Sub. cob., grav., cse snd	
Phymatolithon calcareum	VHS	HI; VHS	HI; VHS			HI; VHS -*[28]								M			A4.6 Biogenic structs over sublitt. sed.	
Pisidia longicornis	-[48 49]					HI			-[88]			HI					A4.1 Sub. cob., grav., cse snd	
Pista cristata																	A4.2 Sublitt. sands & muddy sands	
Plumaria elegans																--[6]	A1.3 Litt. rock shelt. wave act.	
Podoceropsis nitida									-[82]								A4.2 Sublitt. sands & muddy sands	
Poecilochaetus serpens		+[4]															A4.2 Sublitt. sands & muddy sands	
Polychaeta indet.						+[21*]											A3.6 Circalitt. rk mod. exp. wave act.	
Polycirrus medusa	-[47]																A4.1 Sub. cob., grav., cse snd	
Polycirrus plumosus										-[67*]								
Polycirrus sp.		+[4]							-[82]								A4.2 Sublitt. sands & muddy sands	
Polydora benedeni																+[8]	A4.3 Sublitt. muds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Polydora caulleryi								T[95]									A4.3 Sublitt. muds	
Polydora ciliata									+[87]	+[8*] 35* 41*						+[8]	A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Polydora polybranchiata																+[9]	A4.3 Sublitt. muds	
Polydora sp.								T[2]		-[32*] +[39*]						T[7]	A2.3 Litt. muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[2] = Copper
Polygordius lacteus						-[27*]											A4.6 Biogenic structs over sublitt. sed.	
Polygordius sp.											T[3]	T[3]						
Polyphysia crassa								--[2]		+[40*] 77							A4.3 Sublitt. muds	[2] = Copper
Polysiphonia urceolata																--[6]	A1.3 Litt. rock shelt. wave act.	
Pomatoceros triqueter	-[48 49] +[47]	HI										HI					Sub. cob., grav., cse snd	
Pomatoschistus microps								HI										
Pomatoschistus minutus								HI										
Porifera indet. (encr.)						+[21*]											A3.6 Circalitt. rk mod. exp. wave act.	
Porphyra umbilicalis									+[78]								A1.2 Litt. Rk mod. Exp waves	
Portlandia phillippiana									-[82]								A4.2 Sublitt. sands & muddy sands	
Potamopyrgus jenkensii							Tox 71										A4.3 Sublitt. muds	
Praxillura sp.										+[39*]							A4.3 Sublitt. muds	
Prionospio cerrifera								--[2] 95		+[35*]							A4.2 Sublitt. sands & muddy sands	
Prionospio cirrifera								--[2; 4]									A4.3 Sublitt. muds	[2] = Copper
Prionospio fallax										+[67*]								A4.3 Sublitt. muds
Prionospio malmgreni								+[2]										[2] = Copper
Prionospio sp.										+[37*] +[39*]						T[7]	A2.3 Litt. muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Protanthea simplex		HI				HI								HI				
Protodorvillia kefersteini									+[90]	+[67*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Protodorvillia sp.										+[39*]							A4.3 Sublitt. muds	
Psammechinus miliaris	-[49 53]	HI				HI +[59*]	HI		HI								A4.2 Sublitt. sands & muddy sands; A4.1 Sub. cob., grav., cse snd	
Psammodrillus balanoglossoides									+[80]								A2.2 Litt. sands & muddy sands	
Pseudocuma longicornis						+[60*]			-[88]								A4.2 Sublitt. sands & muddy sands	
Pseudopolydora paucibranchiata								-[95]	+[84]	+[67*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Pseudopolydora pulchra													T[46]				Various (Diaz & Rosen.)	
Ptilota plumosa																--[6]	A1.3 Litt. rock shelt. wave act.	
Pygospio elegans						+[73] -[16* 18]				+[8*] 31* 35* 42* 98						+[9]	A2.2 Litt. sands & muddy sands; A2.3 Littoral muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	]
Pygospio sp.								+[100] 93									A2.3 Littoral muds	
Raricirrus berylii									+[82]								A4.2 Sublitt. sands & muddy sands	
Retusa obtusa							-[1]											[1] = TBT
Rhaphidrilus sp.									+[82]								A4.2 Sublitt. sands & muddy sands	
Rhodine gracilior								--[2]										[2] = Copper
Rhodine loveni								--[2]										[2] = Copper
Rhodothamniella floridula		HI					HI		HI			HI						
Sabellaria spinulosa	-[48 51 52]															T[7]	A2.3 Litt. muds; Sub. cob., grav., cse snd	
Scalibregma inflatum		+[4]						--[2]		+[32*] 33* 67* 40*							[4]A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[2] = Copper

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Scolelepis fuliginosa										+[31*] 35(2)* 39*40* 42*66* 68*							A2.3 Littoral muds; Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Scolelepis tridentata						-[64*]											A4.3 Sublitt. muds	
Scolelepsis squamata		-[55]								+[31*]							A2.2 Litt. Sands & muddy sands, A2.3 Littoral muds	
Scoloplos armiger		+[4] -[99]				-[16*] 58* 65* 73		++[2]	+[87] -[82] 83 86	+[35*] 36* 43* 44* 75 76			I[46]				A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Various (Diaz & Rosen.)	[2] = Copper
Scoloplos sp.										+[4]*							A4.3 Sublitt. muds	
Scoloplos squamata										+[67]*							A2.3 Littoral muds	
Scrobicularia plana					-[12]			T[93]			T[3]	T[3]				T[/]	A2.3 Littoral muds	
Scrupocellaria sp.						-[24*]											A4.1 Sub. cob., grav., cse snd	
Semibalanus balanoides									-[78 79]								A1.2 Litt. rk mod. exp waves	
Serpulidae indet.						-[24*]											A4.1 Sub. cob., grav., cse snd	
Sertularella sp.						-[24*]											A4.1 Sub. cob., grav., cse snd	
Sosane gracilis								--[2]										
Sphaeodorum gracilis		+[97]															A4.3 Sublitt. muds	
Sphaeodorum sp.										+[39*]							A4.3 Sublitt. muds	
Sphaerosyllis tetralix										+[67]*								
Spio armata		+[4]															A4.2 Sub. Snds & muddy snds	
Spio decorata										+[67]*							A4.3 Sublitt. muds	
Spio filicornis	+[48] [54]	+[4]				+[58]* -[15*]				+[31*] -[32*]							A2.2 Littt. sands & muddy sands; A2.3 Littoral muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Sub. cob., grav., cse snd;	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Spionidae					-[12]					+[45*]							A4.3 Sublitt. muds	
Spiophanes bombyx	+[47 48 54]	+[4]				-[57*] +[58*]			-[82]	-[32*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds Sub. cob., grav., cse snd	
Spiophanes kroyeri								T[95] --[2] [94]									A2.3 Sublitt. muds	[2] = Copper
Spiophanes sp.									+[84]	+[39*]							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	
Spiratella retroversa									-[82]								A4.2 Sublitt. sands & muddy sands	
Spirorbinidae indet.						-[24*]											A4.1 Sub. cob., grav., cse snd	
Spisula elliptica									-[82]								A4.2 Sublitt. sands & muddy sands	
Spisula solida						-[59*]							VHS[46]				A4.2 Sublitt. sands & muddy sands; Various (Diaz & Rosen.)	
Spisula subtruncata		+[4] -[99]															A4.2 Sub. sands & muddy sands; A4.3 Sublitt. muds	
Stenothoe marina																T[7]	A2.3 Litt. muds	
Sthenelais limicola									-[82 83]								A4.2 Sub. sands & muddy sands	
Streblospio benedicti											T[3]	T[3]	T[46]				Various (Diaz & Rosen.)	
Streblospio shrubsoli						-[19*]				+[8*]						+[8]	A2.3 Litt. muds; A4.3 Sublitt. muds	
Streblospio sp.								+[100]									A2.3 Littoral muds	
Syllis sp.	-[47]					-[26*]											A4.1 Sub. cob., grav., cse snd; A4.4 Sublitt. combi. seds	
Synelmis klatti										-[67*]								
Telimya ferruginosa						-[58*]											A4.2 Sublitt. sands & muddy sands	
Tellina crassa	-[50]																Sub. cob., grav., cse snd	
Tellina pygmaea	+[47]																Sub. cob., grav., cse snd	
Tellina spp.	-[4]																A4.2 Sub. sands & muddy asnds	

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Tellina tenuis														+[13]		-[8]	A2.2 Litt. sands & muddy sands; A4.3 Sublitt. muds	
Tenellia adspersa	VHS	VHS																
Terebellides stroemi						-[65]*		--[2]		-[40]*							A4.3 Sublitt. muds	[2] = Copper
Tetrastemma sp.						-[16]*											A2.2 Litt. sands & muddy sands	
Tharyx killariensis							--											[1] = TBT
Tharyx marioni						-[26]*		+[2]									A4.4 Sublitt. combi. seds	[2] = Copper
Tharyx sp.																T[7]	A2.3 Litt. muds	
Thracia phaseolina										+[31]*							[4]A2.3 Littoral muds	
Thracia sp.							--[1]											[1] = TBT
Thyasira equalis								-[2]										[2] = Copper
Thyasira ferruginea										+[67]*							A4.3 Sublitt. muds	
Thyasira flexuosa						-[58]* 64		+[2]		+[35]*							A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt. muds	[2] = Copper
Thyasira gouldi	VHS					VHS				VHS				VHS				
Thyasira sarsi								+[2] -[95]	-[82 85]								A4.3 Sublitt. muds	[2] = Copper
Thyasira sp.									+[84]	+[39]* 40*							A4.3 Sublitt. muds (2)	
Trachythyone elongata						-[58]*											A4.2 Sublitt. sands & muddy sands	
Truncatella subcylindrica	HS	HS				VHS	VHS											
Tubifex costatus											T[3]	T[3]						
Tubificoides amplivisatus										+[31]*				+[14]			A2.2 Litt. sands & muddy sands; A2.3 Littoral muds	
Tubificoides benedini						+[31]* 73 -[19]* 26*	--[1]									+[9 10]	A2.3 Litt. muds; A4.3 Sublitt muds; A4.4 Sublitt. combi. seds	[1] = TBT

Species	Sub. loss	Smother.	Incr. sus.	Decr. sus.	Incr. turb.	Phys. dist.	Syn. chem.	Heavy met.	Hydrocarb.	Nutrients	Incr. salin.	Decr. salin.	Deoxy.	Incr. temp.	Decr. temp	Ind. eff.gen	Habitat(s)	Notes
Tubificoides sp(p).					-[12]			T[2] +[100]		+[32*] 38*		T[3]	T[3]				A2.3 Littoral muds; A4.2 Sublitt. sands & muddy sands; A4.3 Sublitt.muds	[2] = Copper
Unciola planipes									-[82]								A4.2 Sublitt. sands & muddy sands	
Upogebia sp.						-[58*]											A4.2 Sublitt. sands & muddy sands	
Urothoe brevicornis						+[60*]											A4.2 Sublitt. sands & muddy sands	
Urothoe poseidonis						+[60*]			-[80]								A2.2 Litt. sands & muddy sands; A4.2 Sublitt. sands & muddy sands	
Urothoe sp.		-[55]				-[62*]											A2.2 Litt. sands & muddy sands; A4.2 Sublitt. sands & muddy sands	
Urticina felina						-[22*]											A4.1 Sub. cob., grav., cse snd	
Venerupis rhomboides	-[50]					-[27*]				+[31*]							A2.3 Littoral muds A4.1 Sub. cob., grav., cse snd; A4.6 Biogenic structs over sublitt. sed.	Also known as *Tapes rhomboides*
Venerupis senegalensis																-[8]	A4.3 Sublitt. muds	[8] as *V. pullastra*
Virgularia mirabilis						-[29 63]											A4.3 Sublitt. muds	
Zostera marina	VHS	VHS			VHS					VHS								
Zostera noltii	HS	HS																

APPENDIX 1. ABBREVIATED LIST OF SPECIES (BEGINNING WITH 'A') IDENTIFIED AS 'INTOLERANT OF' AND 'SENSITIVE TO' STRESSORS AS A PART OF THE ICES SGSOBS WORKSHOP.

(Copenhagen 22-24 March 2004): see http://www.ices.dk/iceswork/wgdetailace.asp?wg=SGSOBS). Only species that have several sources of information are included here.

Four sources of information have been used:

- AZTI Marine Biotic Index. Group I ('Sensitive' species) are listed and are for a range of stressors.
- *MarLIN* database: Intolerance (I) and Sensitivity (S) ranks are given. vh = Very High (Sensitivity); h = High (Intolerance/Sensitivity); i = Intermediate (Intolerance); m= Moderate (Sensitivity)
- ACE Working Group report. F = Fragile (=Intolerant); S = Sensitive in relation to mechanical disturbance from fisheries.
- Swedish 'Species Tolerance Values' (ES50 $_{0.05}$ – Expected number of Species among 50 individuals – 5% of the population selected as the 'most tolerant' species). Species included are those with an index above 10 or species listed in other sources.

Only species beginning with 'A' are listed here to provide a demonstation.

SPECIES	AMBI ecological group	Nitrates/ Phosphates	Organic matter	Oxygen	Heavy metals	Synthetic chemicals	Hydrocrabons	Salinity	Mechanical disturbance	Removal of substratum	Smothering	Swedish tolerance values ES50 $_{0.05}$
Abra alba					I=i	I=h S=m		I=i	I=i F			4
Acanthocardia echinata	I								F, S			
Acidostoma obesum	I											13.20
Acrocnida brachiata	I								F			
Acteon tornatalis									F			
Aglaophamus malmgreni												11.5
Ahnfeltia plicata		i				I=h S=m,	I=h S=m,		I=i		I=I	
Alaria esculenta		I=i			I=i	I=i		I=h S=m	I=i		I=I	
Alcyonidium diaphanum									F			
Alcyonium digitatum	I			I=h S=M m		I=i		I=i	I=i F		I=i	
Alkmaria romijni									I=i S=h,		I=i S=h	

Alvania abyssicola	I											14.40
Amaeana trilobata	I											15.40
Amhipholis brachiata									F			
Ampharete lindstroemi												11.6
Ampelisca brevicornis	I											12.50
Ampelisca diadema	I											10.70
Ampelisca macrocephala	I											11.60
Ampelisca tenuicornis	I											13.00
Ampharete grubei	I								F			6.80
Ampharete falcata												12.3
Amphianthus dohrnii				I=i				I=i	I=h S=h,			
Amphictene auricoma	I											11.50
Amphilepis norvegica	I											14.70
Amphiura chiajei	I						I=h S=m	I=h S=m,	F			10.60
Amphiura filiformis	I				I=i	I=h S=m	I=h S=M	I=h S=M				9.50
Ampicteis gunneri									F			12
Amythasides macroglossus	I								F			11.00
Anomia ephippium	I								F			
Antedon bifida				I=i	I=i	I=h S=m	I=h S=m	I=h S=m	F I=h S=m		I=h S=M	
Aora gracilis	I											13.70
Aphelochaeta marioni		I=i				I=h S=m			I=i			
Aphrodita aculeata	I							I=h S=m	F I=i			10.6
Apistobranchus tenuis	I											14.40
Apistobranchus tullbergi	I								F			
Aporrhais pespelicani	I								F			8.9
Apseudes spinosus												12.6
Arctica islandica						I=h S=m	I=i	I=i	F, S, I=i S=M		I=i S=m	7.5
Arenicola marina	I	I=i				I=h S=m	I=i		I=i			5.80
Argissa hamatipes												12.5
Armandia cirrhosa	I						S=vh	I=h	S=m I=i			10.40
Armina loveni	I								S			
Artacama proboscidea												11.6
Ascidiella scabra						I=i		I=i	I=h			
Ascophyllum nodosum		I=i				I=i S=h			I=h S=h,		I=h S=h	
Asterias rubens	I			I=h S=m	I=i	I=i	S=m, I=h	S=m, I=h	F I=i			7.90

Astropecten irregularis	I								F			10.30
Atrina fragilis		S=m			S=m				I= h S=vh		I= i S=h	
Atylus vedlomensis	I											14.00
Autonoe longipes	I											
Axinella dissimilis				I=i S=h				I=h S=h	F I=i S=H		I=i S=h	

* Rosenberg, Blomqvist, Nilsson, Cederwall & Dimming (submitted). Marine quality assessment by use of benthic species-abundance distribution; a proposed new protocol within the EC Water Framework Directive. *Marine Pollution Bulletin*.

APPENDIX 2. INTERPRETATION OF RESEARCH DISPLAYED ON SPREAD SHEET PRINT-OUTS.

("Conf" = Confidence and is the number of sources found that identify a species as affected by the named factor). Shaded rows indicate species for which increase is suggested in one source and decrease (intolerance) in another.

1. ORGANIC ENRICHMENT

A. Organic enrichment

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.3	Litt. Muds	*Clitellio arenaris*	Annelida: Oligochaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Nais communis*	Annelida: Oligochaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Paranais littoralis*	Annelida: Oligochaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Tubificoides amplivisatus*	Annelida: Oligochaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Tubificoides benedeni*	Annelida: Oligochaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Arenicola marina*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Capitella capitata*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Eteone longa*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Hediste diversicolor*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Manayunkia aestuarina*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Mediomastus fragilis*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Nephtys hombergii*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Ophelina acuminata*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Pygospio elegans*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Scolepsis fulginosa*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Scolepsis squamata*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Spio filicornis*	Annelida: Polychaeta	increase	1	Read (1987)
A2.3	Litt. Muds	*Corophium volutator*	Crustacea: Eumalacostraca	increase	1	Read (1987)
A2.3	Litt. Muds	*Hydrobia ulvae*	Mollusca: Gastropoda	increase	1	Read (1987)
A2.3	Litt. Muds	*Macoma balthica*	Mollusca: Pelecypoda	increase	1	Read (1987)
A2.3	Litt. Muds	*Mya arenaria*	Mollusca: Pelecypoda	increase	1	Read (1987)
A2.3	Litt. Muds	*Thracia phaseolina*	Mollusca: Pelecypoda	increase	1	Read (1987)
A2.3	Litt. Muds	*Venerupis rhombiodes*	Mollusca: Pelecypoda	increase	1	Read (1987)
A4.2	Sublitt. sands & muddy sands	*Oligochaeta*	Annelida: Oligochaeta	increase	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Peloscolex benedeni*	Annelida: Oligochaeta	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Tubificoides sp.*	Annelida: Oligochaeta	increase	1	Shillabeer & Tapp (1990)

A4.2	Sublitt. sands & muddy sands	*Ampharete grubei* (as *acutifrons*)	Annelida: Polychaeta	increase	1	Bustos-Baez & Frid (2003)
A4.2	Sublitt. sands & muddy sands	*Ampharete sp.*	Annelida: Polychaeta	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Anaitides groenlandica*	Annelida: Polychaeta	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Capitella capitata*	Annelida: Polychaeta	increase	5	Bustos-Baez & Frid (2003); Anger (1975); Shillabeer & Tapp (1990); Bagge (1969); Eagle (1973)
A4.2	Sublitt. sands & muddy sands	*Capitomastus minimus*	Annelida: Polychaeta	increase	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Chaetozone setosa*	Annelida: Polychaeta	increase	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Cirratulidae*	Annelida: Polychaeta	increase	2	Shillabeer & Tapp (1990); Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Cirriformia tentaculata*	Annelida: Polychaeta	increase	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Eteone longa*	Annelida: Polychaeta	increase	2	Bagge (1969); Eagle (1973)
A4.2	Sublitt. sands & muddy sands	*Goniada maculata*	Annelida: Polychaeta	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Heteromastus filiformis*	Annelida: Polychaeta	increase	2	Rees *et al*. (1992); Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Levinsenia gracilis*	Annelida: Polychaeta	increase	2	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Lumbrineris sp.*	Annelida: Polychaeta	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Maldanid sp.*	Annelida: Polychaeta	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Myriochele oculata*	Annelida: Polychaeta	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Nephtys incisa*	Annelida: Polychaeta	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Ophelina acuminata*	Annelida: Polychaeta	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Ophiodromus flexuosus*	Annelida: Polychaeta	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Pholoe minuta*	Annelida: Polychaeta	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Polydora ciliata*	Annelida: Polychaeta	increase	2	Shillabeer & Tapp (1990); Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Pronospio cerrifera*	Annelida: Polychaeta	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Pronospio sp.*	Annelida: Polychaeta	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Pygospio elegans*	Annelida: Polychaeta	increase	1	Anger (1975)
A4.2	Sublitt. sands & muddy sands	*Scalibregma inflatum*	Annelida: Polychaeta	increase	1	Bustos-Baez & Frid (2003)
A4.2	Sublitt. sands & muddy sands	*Scolepsis fulginosa*	Annelida: Polychaeta	increase	2	Shillabeer & Tapp (1990); Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	increase	2	Bagge (1969); Eagle (1973)
A4.2	Sublitt. sands & muddy sands	*Abra sp.*	Mollusca: Pelecypoda	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Corbula gibba*	Mollusca: Pelecypoda	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Macoma balthica*	Mollusca: Pelecypoda	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Mya arenaria*	Mollusca: Pelecypoda	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Mysella bidentata*	Mollusca: Pelecypoda	increase	1	Rees *et al*. (1992)
A4.2	Sublitt. sands & muddy sands	*Mytilus edulis*	Mollusca: Pelecypoda	increase	1	Shillabeer & Tapp (1990)

A4.2	Sublitt. sands & muddy sands	*Nucula nitidosa*	Mollusca: Pelecypoda	increase	1	Bustos-Baez & Frid (2003)
A4.2	Sublitt. sands & muddy sands	*Thyasira flexuosa*	Mollusca: Pelecypoda	increase	1	Bagge (1969)
A4.2	Sublitt. sands & muddy sands	*Goniada maculata*	Annelida: Polychaeta	decrease	1	Bustos-Baez & Frid (2003)
A4.2	Sublitt. sands & muddy sands	*Nephtys hombergii*	Annelida: Polychaeta	decrease	2	Bustos-Baez & Frid (2003); Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Abra alba*	Mollusca: Pelecypoda	decrease	1	Bustos-Baez & Frid (2003)
A4.2	Sublitt. sands & muddy sands	*Amphiura filiformis*	Echinodermata: Ophiuroidea	decrease	1	Bustos-Baez & Frid (2003)
A4.2	Sublitt. sands & muddy sands	*Spiophanes bombyx*	Annelida: Polychaeta	decrease	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Spio filicornis*	Annelida: Polychaeta	decrease	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Polydora sp.*	Annelida: Polychaeta	decrease	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Diastylis bradyi*	Crustacea: Cumacea	decrease	1	Shillabeer & Tapp (1990)
A4.2	Sublitt. sands & muddy sands	*Fabulina fabula*	Mollusca: Pelecypoda	decrease	1	Shillabeer & Tapp (1990)
A4.3	Sublitt. muds	*Tubificoides sp.*	Annelida: Oligochaeta	increase	1	Hall *et al*. (1997)
A4.3	Sublitt. muds	*Ampharete sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Aniatidea groenlandica*	Annelida: Polychaeta	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Capitella capitata*	Annelida: Polychaeta	increase	7	Pearson (1975); Rosenberg (1972); Dybern (1972); Gray (1976); Halcrow *et al*. (1973); Henriksson (1969); Leppakoski (1975)
A4.3	Sublitt. muds	*Capitomastus sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Chaetozone setosa*	Annelida: Polychaeta	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Eteone longa*	Annelida: Polychaeta	increase	3	Pearson (1975); Hall *et al*. (1997); Dybern (1972)
A4.3	Sublitt. muds	*Eulalia sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Glycera alba*	Annelida: Polychaeta	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Hediste diversicolor*	Annelida: Polychaeta	increase	2	Gray (1976); Henriksson (1969)
A4.3	Sublitt. muds	*Hesionidae*	Annelida: Polychaeta	increase	1	Beyer (1968)
A4.3	Sublitt. muds	*Heteromastus filiformis*	Annelida: Polychaeta	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Lanice conchilega*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Nephtys ciliata*	Annelida: Polychaeta	increase	1	Leppakoski (1975)
A4.3	Sublitt. muds	*Ophiodromus flexuosus*	Annelida: Polychaeta	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Ophryotrocha sp.*	Annelida: Polychaeta	increase	2	Hall *et al*. (1997)
A4.3	Sublitt. muds	*Pelescolux benedeni*	Annelida: Polychaeta	increase	4	Pearson (1975); Dybern (1972); Gray (1976); Halcrow *et al*. (1973)
A4.3	Sublitt. muds	*Pholoe minuta*	Annelida: Polychaeta	increase	3	Pearson (1975); Beyer (1968);

						Rosenberg (1972)
A4.3	Sublitt. muds	*Phyllodoce sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Polydora ciliata*	Annelida: Polychaeta	increase	2	Dybern (1972); Gray (1976)
A4.3	Sublitt. muds	*Polydora sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Polyphysia crassa*	Annelida: Polychaeta	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Praxillura sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Prionospio sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Protodorvillea sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Pygospio elegans*	Annelida: Polychaeta	increase	3	Gray (1976); Halcrow *et al*. (1973); Leppakoski (1973)
A4.3	Sublitt. muds	*Scalibregma inflatum*	Annelida: Polychaeta	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Scolepsis fulginosa*	Annelida: Polychaeta	increase	3	Pearson (1975); Rosenberg (1972); Halcrow *et al*. (1973)
A4.3	Sublitt. muds	*Scoloplos armiger*	Annelida: Polychaeta	increase	2	Henriksson (1969); Leppakoski (1975)
A4.3	Sublitt. muds	*Sphaerodorum sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Spionidae*	Annelida: Polychaeta	increase	1	Beyer (1968)
A4.3	Sublitt. muds	*Spiophanes sp.*	Annelida: Polychaeta	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Strebliospio shrubsoli*	Annelida: Polychaeta	increase	1	Gray (1976)
A4.3	Sublitt. muds	*Beggiatoa sp.*	Bacteria	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Bradyidius armatus*	Crustacea: Copepoda	increase	1	Beyer (1968)
A4.3	Sublitt. muds	*Corophium volutator*	Crustacea: Eumalacostraca	increase	2	Dybern (1972); Gray (1976)
A4.3	Sublitt. muds	*Bryssopsis lyrifera*	Echinodermata: Echinoidea	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Labidoplax sp.*	Echinodermata: Holothuroidea	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Amphiura sp.*	Echinodermata: Ophiuroidea	increase	1	Pearson (1975)
A4.3	Sublitt. muds	*Philine aperta*	Mollusca: Gastropoda	increase	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Corbula gibba*	Mollusca: Pelecypoda	increase	2	Pearson (1975); Dybern (1972)
A4.3	Sublitt. muds	*Macoma balthica*	Mollusca: Pelecypoda	increase	3	Gray (1976); Henriksson (1969); Leppakoski (1975)
A4.3	Sublitt. muds	*Mya arenaria*	Mollusca: Pelecypoda	increase	1	Henriksson (1969)
A4.3	Sublitt. muds	*Mya truncata*	Mollusca: Pelecypoda	increase	1	Dybern (1972)
A4.3	Sublitt. muds	*Mytilus edulis*	Mollusca: Pelecypoda	increase	1	Dybern (1972)
A4.3	Sublitt. muds	*Nudibranchia*	Mollusca: Nudibranchia	increase	1	Beyer (1968)
A4.3	Sublitt. muds	*Thyasira sp.*	Mollusca: Pelecypoda	increase	2	Pearson (1975); Rosenberg (1972)
A4.3	Sublitt. muds	*Terebellides stroemi*	Annelida: Polychaeta	decrease	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Amphipoda*	Crustacea: Eumalacostraca	decrease	1	Beyer (1968)

A4.3	Sublitt. muds	*Crangonidae*	Crustacea: Eumalacostraca	decrease	1	Beyer (1968)
A4.3	Sublitt. muds	*Cumucea*	Crustacea: Cumacea	decrease	1	Beyer (1968)
A4.3	Sublitt. muds	*Hippolytidae*	Crustacea: Eumalacostraca	decrease	1	Beyer (1968)
A4.3	Sublitt. muds	*Pandalidae*	Crustacea: Eumalacostraca	decrease	1	Beyer (1968)
A4.3	Sublitt. muds	*Echinocardium cordatum*	Echinodermata: Echinoidea	decrease	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Amphiura filiformis*	Echinodermata: Ophiuroidea	decrease	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Ophiura albida*	Echinodermata: Ophiuroidea	decrease	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Ophiura sp.*	Echinodermata: Ophiuroidea	decrease	1	Beyer (1968)
A4.3	Sublitt. muds	*Ophiura texturata*	Echinodermata: Ophiuroidea	decrease	1	Rosenberg (1972)
A4.3	Sublitt. muds	*Abra nitida*	Mollusca: Pelecypoda	decrease	1	Rosenberg (1972)

B. Hypoxia

Habitat	Species	Phylum: Class	Change	Conf	Sources
Various	*Arctica islandica*	Mollusca: Pelecypoda	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Astarte borealis*	Mollusca: Pelecypoda	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Corbula gibbula*	Mollusca: Pelecypoda	tolerant	5	Diaz & Rosenberg 1995 and references therein
Various	*Ophiura albida*	Echinodermata: Ophiuroidea	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Halicryptus spinulosus*	Priapula: Priapulidae	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Malacoceros fuliginosus*	Annelida: Polychaeta	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Metridium senile*	Cnidaria: Hexacorallia	tolerant	1	Diaz & Rosenberg 1995 and references therein
Various	*Phoronis mulleri*	Phoronida: Phoronidae	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Ophiodromus flexuosus*	Annelida: Polychaeta	tolerant	1	Diaz & Rosenberg 1995 and references therein
Various	*Pseudopolydora pulchra*	Annelida: Polychaeta	tolerant	1	Diaz & Rosenberg 1995 and references therein
Various	*Modiolus phaseolina*	Mollusca: Pelecypoda	tolerant	1	Diaz & Rosenberg 1995 and references therein
Various	*Nephtys hombergi*	Annelida: Polychaeta	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Streblospio benedicti*	Annelida: Polychaeta	tolerant	1	Diaz & Rosenberg 1995 and references therein
Various	*Mytilus edulis*	Mollusca: Pelecypoda	tolerant	1	Diaz & Rosenberg 1995 and references therein
Various	*Heteromastus filiformis*	Annelida: Polychaeta	tolerant	3	Diaz & Rosenberg 1995 and references therein
Various	*Arenicola marina*	Annelida: Polychaeta	tolerant	1	Diaz & Rosenberg 1995 and references therein
Various	*Saduria entomon*	Crustacea: Isopoda	tolerant	2	Diaz & Rosenberg 1995 and references therein
Various	*Capitella capitata*	Annelida: Polychaeta	intermed	3	Diaz & Rosenberg 1995 and references therein
Various	*Abra alba*	Mollusca: Pelecypoda	intermed	2	Diaz & Rosenberg 1995 and references therein
Various	*Abra nitida*	Mollusca: Pelecypoda	intermed	2	Diaz & Rosenberg 1995 and references therein
Various	*Amphiura filiformis*	Echinodermata: Ophiuroidea	intermed	3	Diaz & Rosenberg 1995 and references therein
Various	*A. chiajei*	Echinodermata: Ophiuroidea	intermed	2	Diaz & Rosenberg 1995 and references therein

Various	*Scoloplos armiger*	Annelida: Polychaeta	intermed	1	Diaz & Rosenberg 1995 and references therein
Various	*Asychis elongata*	Annelida: Polychaeta	intermed	1	Diaz & Rosenberg 1995 and references therein
Various	*Nereis diversicolor*	Annelida: Polychaeta	intermed	1	Diaz & Rosenberg 1995 and references therein
Various	*Pectinaria koreni*	Annelida: Polychaeta	intermed	2	Diaz & Rosenberg 1995 and references therein
Various	*Diastylis rathkei*	Crustacea: Cumacea	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Nephrops norvegicus*	Crustacea: Eumalocostraca	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Brissopsis lyrifera*	Echinodermata: Echinodea	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Ampharete grubei*	Annelida: Polychaeta	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Macoma calcarea*	Mollusca: Pelecypoda	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Gammarus tigrinus*	Crustacea: Eumalocostraca	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Spisula solida*	Mollusca: Pelecypoda	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Crangon crangon*	Crustacea: Eumalocostraca	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Carcinus maenas*	Crustacea: Eumalocostraca	sensitive	1	Diaz & Rosenberg 1995 and references therein
Various	*Nereis pelagica*	Annelida: Polychaeta	sensitive	1	Diaz & Rosenberg 1995 and references therein

2. DREDGING AND DUMPING

A. Mineral extraction: aggregates

EUNIS	Habitat	Taxon	Phylum: Class	Change	Conf	Sources
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Branchiostoma lanceolatum*	Chordata: Cephalochordata	decrease	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Amphipholis squamata*	Echinodermata: Ophiuroidea	decrease	2	Desprez (2000); Boyd *et al*. (2003)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Echinocyamus pusillus*	Echinodermata: Echinoidea	decrease	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Polycirrus medusa*	Annelida: Polychaeta	decrease	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Notomastus latericeus*	Annelida: Polychaeta	decrease	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Syllis spp.*	Annelida: Polychaeta	decrease	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Harmathoe ljungmani*	Annelida: Polychaeta	decrease	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Glycera spp.*	Annelida: Polychaeta	decrease	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Pomatoceros triqueter*	Annelida: Polychaeta	decrease	2	Boyd *et al*. (2003); Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Dosinia exoleta*	Mollusca: Pelecypoda	decrease	1	Van Moorsel (1994)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ensis sp(p).*	Mollusca: Pelecypoda	decrease	1	Van Moorsel (1994)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Arctica islandica*	Mollusca: Pelecypoda	decrease	1	Van Moorsel (1994)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Gari fervenis*	Mollusca: Pelecypoda	decrease	1	Van Moorsel (1994)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Tellina crassa*	Mollusca: Pelecypoda	decrease	1	Van Moorsel (1994)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Pisidia longicornis*	Crustacea: Eumalacostraca	decrease	2	Boyd *et al*. (2003); Shelton & Rolfe (1972)

A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Lumbrineris gracilis*	Annelida: Polychaeta	decrease	1	Boyd *et al*. (2003)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Marphysa bellii*	Annelida: Polychaeta	decrease	1	Boyd *et al*. (2003)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Marphysa sanguinea*	Annelida: Polychaeta	decrease	1	Boyd *et al*. (2003)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Sabellaria spinulosa*	Annelida: Polychaeta	decrease	2	Boyd *et al*. (2003); Kenny & Rees (1994, 1996)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Venerupis rhombiodes*	Mollusca: Pelecypoda	decrease	1	Van Moorsel (1994)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Balanus crenatus*	Crustacea: Maxillopoda	decrease	1	Kenny & Rees (1994; 1996)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Amphipoda sp.*	Crustacea: Eumalacostraca	decrease	1	Kenny & Rees (1994; 1996)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Modiolus modiolus*	Mollusca: Pelecypoda	decrease	1	Kenny & Rees (1994; 1996)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Alcyonium digitatum*	Cnidaria: Octocorallia	decrease	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Balanus balanoides*	Crustacea: Maxillopoda	decrease	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Asterias rubens*	Echinodermata: Asteroidea	decrease	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophiothrix fragilis*	Echinodermata: Ophiuroidea	decrease	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Psammechinus miliaris*	Echinodermata: Echinoidea	decrease	2	Shelton & Rolfe (1972); Millner & Dickson (1977)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophiura albida*	Echinodermata: Ophiuroidea	decrease	1	Millner & Dickson (1977)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Crangon crangon*	Crustacea: Eumalacostraca	decrease	1	Millner & Dickson (1977)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Crangon allmanni*	Crustacea: Eumalacostraca	decrease	1	Millner & Dickson (1977)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Pagurus bernhardus*	Crustacea: Eumalacostraca	decrease	1	Millner & Dickson (1977)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophelia borealis*	Annelida: Polychaeta	increase	2	Desprez (2000); Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Nephtys cirrosa*	Annelida: Polychaeta	increase	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Spiophanes bombyx*	Annelida: Polychaeta	increase	2	Desprez (2000); Boyd *et al*. (2003)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Tellina pygmaea*	Mollusca: Pelecypoda	increase	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Pomatoceros triqueter*	Annelida: Polychaeta	increase	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Phyllodoce sp.*	Annelida: Polychaeta	increase	1	Desprez (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Hessionura elongata*	Annelida: Polychaeta	increase	1	Boyd *et al*. (2003)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Spio filicornis*	Annelida: Polychaeta	increase	1	Boyd *et al*. (2003)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophiura albida*	Echinodermata: Ophiuroidea	increase	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Nucula hanleyi*	Mollusca: Pelecypoda	increase	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Abra alba*	Mollusca: Pelecypoda	increase	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Nephtys cirrosa*	Annelida: Polychaeta	increase	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Goniada maculata*	Annelida: Polychaeta	increase	1	Shelton & Rolfe (1972)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ampharete acutifrons*	Annelida: Polychaeta	increase	1	Shelton & Rolfe (1972)
A4.2	Sublitt. sands & muddy sands	*Echinocardium cordatum*	Echinodermata: Echinoidea	decrease	1	van Dalfsen *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Donax vittatus*	Mollusca: Pelecypoda	decrease	1	van Dalfsen *et al*. (2000)

A4.2	Sublitt. sands & muddy sands	*Tellina sp(p).*	Mollusca: Pelecypoda	decrease	1	van Dalfsen *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Spio filicornis*	Annelida: Polychaeta	increase	1	van Dalfsen *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Spiophanes bombyx*	Annelida: Polychaeta	increase	1	van Dalfsen *et al*. (2000)

B. Maintenance dredging and spoil dumping

EUNIS	Habitat	Taxon	Phylum: Class	Change	Conf	Sources
A4.2	Sublitt. sands & muddy sands	*Fabulina fabula*	Mollusca: Pelecypoda	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Spiophanes bombyx*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Notomastus sp.*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Nucula nitidosa*	Mollusca: Pelecypoda	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Abra alba*	Mollusca: Pelecypoda	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Aphelochaeta sp.*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Iphinoe trispinosa*	Crustacea: Cumacea	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Magelona sp.*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Mysella bidentata*	Mollusca: Pelecypoda	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Ampelisca spinipes*	Crustacea: Eumalacostraca	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Lanice conchilega*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Nemertea*	Nemertea	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Ophiura sp.*	Echinodermata: Echinoidea	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Owenia fusiformis*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Poecilochaetus serpens*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Polycirrus sp.*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Scalibregma inflatum*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Spio armata*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Spio filicornis*	Annelida: Polychaeta	increase	1	Warwick, pers comm.
A4.2	Sublitt. sands & muddy sands	*Spisula subtruncata*	Mollusca: Pelecypoda	increase	1	Warwick, pers comm.
A4.3	Sublitt. muds	*Abra nitida*	Mollusca: Pelecypoda	decrease	1	Rosenberg (1977)
A4.3	Sublitt. muds	*Spisula subtruncata*	Mollusca: Pelecypoda	decrease	1	Rosenberg (1977)
A4.3	Sublitt. muds	*Arctica islandica*	Mollusca: Pelecypoda	decrease	1	Rosenberg (1977)
A4.3	Sublitt. muds	*Mya arenaria*	Mollusca: Pelecypoda	decrease	1	Rosenberg (1977)
A4.3	Sublitt. muds	*Mytilus edulis*	Mollusca: Pelecypoda	decrease	1	Rosenberg (1977)

C. Industrial waste dumping (colliery waste and fly ash)

EUNIS	Habitat	Taxon	Phylum: Class	Change	Confidence	Sources
A2.2	Litt. sands & muddy sands	*Scolepsis squamata*	Annelida: Polychaeta	decrease	1	Hyslop *et al*. (1997)
A2.2	Litt. sands & muddy sands	*Urothoe sp.*	Crustacea: Eumalocostraca	decrease	1	Hyslop *et al*. (1997)
A2.2	Litt. sands & muddy sands	*Bathyporeia pelagica*	Crustacea: Eumalocostraca	decrease	1	Hyslop *et al*. (1997)
A2.2	Litt. sands & muddy sands	*Haustorius arenarius*	Crustacea: Eumalocostraca	decrease	1	Hyslop *et al*. (1997)
A4.2	Sublitt. sands & muddy sands	*Lanice conchilega*	Annelida: Polychaeta	increase	1	Johnson & Frid (1995)
A4.3	Sublitt. muds	*Chaetozone setosa*	Annelida: Polychaeta	increase	1	Bamber (1989)
A4.3	Sublitt. muds	*Glycinde nordmanni*	Annelida: Polychaeta	increase	1	Bamber (1989)
A4.3	Sublitt. muds	*Heteromastus filiformis*	Annelida: Polychaeta	increase	1	Bamber (1989)
A4.3	Sublitt. muds	*Leptosynapta bergensis*	Annelida: Polychaeta	increase	1	Bamber (1989)
A4.3	Sublitt. muds	*Lumbrineris gracilis*	Annelida: Polychaeta	increase	1	Bamber (1989)
A4.3	Sublitt. muds	*Scolepsis armiger*	Annelida: Polychaeta	increase	1	Bamber (1989)
A4.3	Sublitt. muds	*Sphaeodorum gracilis*	Annelida: Polychaeta	increase	1	Bamber (1989)
A4.3	Sublitt. muds	*Goniada maculata*	Annelida: Polychaeta	decrease	1	Bamber (1989)
A4.3	Sublitt. muds	*Nephtys hombergii*	Annelida: Polychaeta	decrease	1	Bamber (1989)
A4.3	Sublitt. muds	*Pholoe minuta*	Annelida: Polychaeta	decrease	1	Bamber (1989)
A4.3	Sublitt. muds	*Amphiura filiformis*	Echinodermata: Ophiuroidea	decrease	1	Bamber (1989)
A4.3	Sublitt. muds	*Mysella bidentata*	Mollusca: Pelecypoda	decrease	1	Bamber (1989)

7. COMMERCIAL FISHING

A. Trawling

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A4.2	Sublitt. sands & muddy sands	*Echinocardium cordatum*	Echinodermata: Echinoidea	decrease	3	Bergman & Hup (1992); Lindeboom & de Groot (1998); MacDonald *et al*. (1996)
A4.2	Sublitt. sands & muddy sands	*Amphiura filiformis*	Echinodermata: Ophiuroidea	decrease	2	Rumohr & Kujawski (2000); Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Arctica islandica*	Mollusca: Pelecypoda	decrease	2	Rumohr & Kujawski (2000); Craeymeersch *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Aphrodita aculeata*	Annelida: Polychaeta	decrease	1	Kaiser *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Nephtys spp.*	Annelida: Polychaeta	decrease	1	Kaiser *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Lanice conchilega*	Annelida: Polychaeta	decrease	1	Bergman & Hup (1992)

A4.2	Sublitt. sands & muddy sands	*Spiophanes bombyx*	Annelida: Polychaeta	decrease	1	Bergman & Hup (1992)
A4.2	Sublitt. sands & muddy sands	*Magelona pappillicornis*	Annelida: Polychaeta	decrease	1	Bergman & Hup (1992)
A4.2	Sublitt. sands & muddy sands	*Pectinaria spp.*	Annelida: Polychaeta	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Enipo kinbergi*	Annelida: Polychaeta	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Lagis Koreni*	Annelida: Polychaeta	decrease	1	Kaiser & Spencer (1996)
A4.2	Sublitt. sands & muddy sands	*Urothoe spp.*	Crustacea: Eumalacostraca	decrease	1	Kaiser & Spencer (1996)
A4.2	Sublitt. sands & muddy sands	*Ampelisca brevicornis*	Crustacea: Eumalacostraca	decrease	1	Craemeersch *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Ampelisca spp.*	Crustacea: Eumalacostraca	decrease	1	Kaiser & Spencer (1996)
A4.2	Sublitt. sands & muddy sands	*Callianassa subterranea*	Crustacea: Eumalacostraca	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Upogebia spp.*	Crustacea: Eumalacostraca	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Corystes cassivelaunus*	Crustacea: Eumalacostraca	decrease	1	MacDonald *et al*. (1996)
A4.2	Sublitt. sands & muddy sands	*Asterias rubens*	Echinodermata: Asteroidea	decrease	1	Bergman & Hup (1992)
A4.2	Sublitt. sands & muddy sands	*Echinocyamus pusillus*	Echinodermata: Echinoidea	decrease	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Trachythyone elongata*	Echinodermata: Holothuriodae	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Leptosynapta inhaerens*	Echinodermata: Holothuriodae	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Ophiura ophiura*	Echinodermata: Ophiuroidea	decrease	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Cylichna cylindracea*	Mollusca: Gastropoda	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Cingula vitrea*	Mollusca: Gastropoda	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Ensis spp.*	Mollusca: Gastropoda	decrease	1	MacDonald *et al*. (1996)
A4.2	Sublitt. sands & muddy sands	*Spisula solida*	Mollusca: Pelecypoda	decrease	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Nucula tenuis*	Mollusca: Pelecypoda	decrease	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Phaxas pellucidus*	Mollusca: Pelecypoda	decrease	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Nucula nitidosa*	Mollusca: Pelecypoda	decrease	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Fabulina (Tellina) fabula*	Mollusca: Pelecypoda	decrease	1	Bergman & Hup (1992)
A4.2	Sublitt. sands & muddy sands	*Telimya ferruginosa*	Mollusca: Pelecypoda	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Mysella bidentata*	Mollusca: Pelecypoda	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Thyasira flexuosa*	Mollusca: Pelecypoda	decrease	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Ophelina accuminata*	Annelida: Polychaeta	increase	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Spiophanes bombyx*	Annelida: Polychaeta	increase	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Spio filicornis*	Annelida: Polychaeta	increase	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Urothoe brevicornis*	Crustacea: Amphipoda	increase	1	Craeymeersch *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Urothoe poseidonis*	Crustacea: Amphipoda	increase	1	Craeymeersch *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Liocarcinus holsatus*	Crustacea: Eumalacostraca	increase	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Hyas coarctatus*	Crustacea: Eumalacostraca	increase	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Corystes cassivelaunus*	Crustacea: Eumalacostraca	increase	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Atylus swammerdami*	Crustacea: Eumalacostraca	increase	1	Craeymeersch *et al*. (2000)

A4.2	Sublitt. sands & muddy sands	*Pagurus bernhardus*	Crustacea: Eumalacostraca	increase	1	Kaiser *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Pseudocuma longicornis*	Crustacea: Malacostraca	increase	1	Craeymeersch *et al*. (2000)
A4.2	Sublitt. sands & muddy sands	*Psammechinus miliaris*	Echinodermata: Echinoidea	increase	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Echinocardium cordatum*	Echinodermata: Echinoidea	increase	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Ophiura albida*	Echinodermata: Ophiuroidea	increase	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Ophiura spp. Juveniles*	Echinodermata: Ophiuroidea	increase	1	Lindeboom & de Groot (1998)
A4.2	Sublitt. sands & muddy sands	*Buccinum undatum*	Mollusca: Gastropoda	increase	1	Rumohr & Kujawski (2000)
A4.2	Sublitt. sands & muddy sands	*Phoronis spp.*	Pseudocoelomata: Phoronida	increase	1	Lindeboom & de Groot (1998)
A4.3	Sublitt. muds	*Virgularia mirabilis*	Cnidaria: Octocorallia	decrease	2	MacDonald *et al*. (1996); Atkinson (1989)
A4.3	Sublitt. muds	*Corbula gibba*	Mollusca: Pelecypoda	decrease	2	Ball *et al*. (2000); Tuck *et al*. (1998)
A4.3	Sublitt. muds	*Nucula nitidosa*	Mollusca: Pelecypoda	decrease	2	Tuck *et al*. (1998); Lindeboom & de Groot (1998)
A4.3	Sublitt. muds	*Scoloplos armiger*	Annelida: Polychaeta	decrease	2	Tuck *et al*. (1998); Lindeboom & de Groot (1998)
A4.3	Sublitt. muds	*Nephtys cirrosa*	Annelida: Polychaeta	decrease	2	Tuck *et al*. (1998); Lindeboom & de Groot (1998)
A4.3	Sublitt. muds	*Scolelepis tridentata*	Annelida: Polychaeta	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Diplocirrus glaucus*	Annelida: Polychaeta	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Chaetozone setosa*	Annelida: Polychaeta	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Capitomastus minimus*	Annelida: Polychaeta	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Terebellides stroemi*	Annelida: Polychaeta	decrease	1	Tuck *et al*. (1998)
A4.3	Sublitt. muds	*Metridium senile*	Cnidaria: Hexacorallia	decrease	1	Tuck *et al*. (1998)
A4.3	Sublitt. muds	*Pachycerianthus multiplicatus*	Cnidaria: Hexacorallia	decrease	1	MacDonald *et al*. (1996)
A4.3	Sublitt. muds	*Funiculina quadrangularis*	Cnidaria: Octocorallia	decrease	1	MacDonald *et al*. (1996)
A4.3	Sublitt. muds	*Harpinia antennaria*	Crustacea: Amphipoda	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Nephrops norvegicus*	Crustacea: Eumalacostraca	decrease	1	Atkinson (1989)
A4.3	Sublitt. muds	*Brissopsis lyrifera*	Echinodermata: Echinoidea	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Echinocardium cordatum*	Echinodermata: Echinoidea	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Amphiura chiajei*	Echinodermata: Ophuroidea	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Buccinum undatum*	Mollusca: Gastropoda	decrease	1	Tuck *et al*. (1998)
A4.3	Sublitt. muds	*Dosinia lupinus*	Mollusca: Pelecypoda	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Thyasira flexuosa*	Mollusca: Pelecypoda	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Mysella bidentata*	Mollusca: Pelecypoda	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Abra spp.*	Mollusca: Pelecypoda	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Nucula tenuis*	Mollusca: Pelecypoda	decrease	1	Ball *et al*. (2000)

A4.3	Sublitt. muds	*Phaxas pellucidus*	Mollusca: Pelecypoda	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Clichna cylindracea*	Mollusca: Pelecypoda	decrease	1	Ball *et al*. (2000)
A4.3	Sublitt. muds	*Chaetozone setosa*	Annelida: polychaeta	increase	2	Tuck *et al*. (1998); Lindeboom & de Groot (1998)
A4.3	Sublitt. muds	*Caulleriella zetlandica*	Annelida: polychaeta	increase	2	Tuck *et al*. (1998); Lindeboom & de Groot (1998)
A4.3	Sublitt. muds	*Mediomastus fragilis*	Annelida: polychaeta	increase	1	Lindeboom & de Groot (1998)

B Dredging

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.2	Litt. sands & muddy sands	*Spio flicornis*	Annelida: Polychaeta	decrease	1	Hall *et al*. (1990)
A2.2	Litt. sands & muddy sands	*Nephtys cirrosa*	Annelida: Polychaeta	decrease	1	Hall *et al*. (1990)
A2.2	Litt. sands & muddy sands	*Nephtys hombergii*	Annelida: Polychaeta	decrease	1	Ferns (2000)
A2.2	Litt. sands & muddy sands	*Heteromastus filiformis*	Annelida: Polychaeta	decrease	1	Beukema (1995)
A2.2	Litt. sands & muddy sands	*Pygospio elegans*	Annelida: Polychaeta	decrease	2	Ferns (2000); Moore (1991)
A2.2	Litt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	decrease	1	Ferns (2000)
A2.2	Litt. sands & muddy sands	*Corophium arenarium*	Crustacea: Eumalacostraca	decrease	1	Ferns (2000)
A2.2	Litt. sands & muddy sands	*Corophium crassicorne*	Crustacea: Eumalacostraca	decrease	1	Hall *et al*. (1990)
A2.2	Litt. sands & muddy sands	*Bathyporeia elegans*	Crustacea: Eumalacostraca	decrease	1	Hall *et al*. (1990)
A2.2	Litt. sands & muddy sands	*Bathyporeia pilosa*	Crustacea: Eumalacostraca	decrease	1	Ferns (2000)
A2.2	Litt. sands & muddy sands	*Hydrobia ulvae*	Mollusca: Gastropoda	decrease	2	Ferns (2000); Moore (1991)
A2.2	Litt. sands & muddy sands	*Cerastoderma edule*	Mollusca: Pelecypoda	decrease	2	Ferns (2000); Moore (1991)
A2.2	Litt. sands & muddy sands	*Macoma balthica*	Mollusca: Pelecypoda	decrease	1	Moore (1991)
A2.2	Litt. sands & muddy sands	*Abra alba*	Mollusca: Pelecypoda	decrease	1	Moore (1991)
A2.2	Litt. sands & muddy sands	*Mya arenaria*	Mollusca: Pelecypoda	decrease	1	Beukema (1995)
A2.2	Litt. sands & muddy sands	*Tetrastemma* sp.	Nemertinea: Enopla	decrease	1	Ferns (2000)
A2.3	Litt. muds	*Paranais* sp.	Annelida: Oligochaeta	decrease	1	Cowie *et al*. (2000)
A2.3	Litt. muds	*Tubificoides benedii*	Annelida: Oligochaeta	decrease	1	Cowie *et al*. (2000)
A2.3	Litt. muds	*Streblospio shrubsolii*	Annelida: Polychaeta	decrease	1	Cowie *et al*. (2000)
A2.3	Litt. muds	*Nereis diversicolor*	Annelida: Polychaeta	decrease	1	Cowie *et al*. (2000)
A2.3	Litt. muds	*Nephtys hombergii*	Annelida: Polychaeta	decrease	1	Sheader (1986)
A2.3	Litt. muds	*Cirriformia* sp.	Annelida: Polychaeta	decrease	1	Sheader (1986)
A2.3	Litt. muds	*Manayunkia aestuarina*	Annelida: Polychaeta	decrease	1	Cowie *et al*. (2000)
A2.3	Litt. muds	*Mercenaria mercenaria*	Mollusca: Pelecypoda	decrease	1	Sheader (1986)

A2.3	Litt. muds	*Abra tenuis*	Mollusca: Pelecypoda	decrease	1	Sheader (1986)
A2.3	Litt. muds	*Abra nitida*	Mollusca: Pelecypoda	decrease	1	Sheader (1986)
A2.3	Litt. muds	*Cerastoderma edule*	Mollusca: Pelecypoda	increase	1	Sheader (1986)

A3.6	Circalitt. rock m. exp. wave action/tidal streams	*Eunicella verrucosa*	Cnidaria: Octocorallia	decrease	1	Devon Wildlife Trust (1994)
A3.6	Circalitt. rock m. exp. wave action/tidal streams	*Pentapora foliacea*	Bryozoa: Gymnolaemata	decrease	1	Devon Wildlife Trust (1994)
A3.6	Circalitt. rock m. exp. wave action/tidal streams	*Alcyonium digitatum*	Cnidaria: Octocorallia	decrease	1	Devon Wildlife Trust (1994)
A3.6	Circalitt. rock m. exp. wave action/tidal streams	*Caryophyllia smithii*	Cnidaria: Hexacorallia	decrease	1	Devon Wildlife Trust (1994)
A3.6	Circalitt. rock m. exp. wave action/tidal streams	*Nemertesia* sp.	Cnidaria: Leptolida	decrease	1	Devon Wildlife Trust (1994)

A3.6	Circalitt. rock m. exp. wave action/tidal streams	Polychaeta indet.	Annelida: Polychaeta	increase	1	Devon Wildlife Trust (1994)
A3.6	Circalitt. rock m. exp. wave action/tidal streams	Porifera indet. (encrusting)	Porifera	increase	1	Devon Wildlife Trust (1994)

A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Alcyonium digitatum*	Cnidaria: Octocorallia	decrease	2	Veale *et al*. (2000); Kaiser *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	Serpulidae indet.	Annelida: Polychaeta	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	Spirorbidae indet.	Annelida: Polychaeta	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Aphrodite aculeata*	Annelida: Polychaeta	decrease	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Urticina felina*	Cnidaria: Hexacorallia	decrease	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Lafoea dumosa*	Cnidaria: Hydrozoa	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Sertularella sp.*	Cnidaria: Hydrozoa	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Campanularidae*	Cnidaria: Hydrozoa	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Liocarcinus sp.*	Crustacea: Eumalacostraca	decrease	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Hyas coarctatus*	Crustacea: Eumalacostraca	decrease	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Macropodia sp.*	Crustacea: Eumalacostraca	decrease	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Echinus esculentis*	Echinodermata: Echiniodea	decrease	1	Kaiser *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophiothrix fragilis*	Echinodermata: Ophiuroidea	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophiopholis aculeata*	Echinodermata: Ophiuroidea	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Crisia sp.*	Ectoprocta: Gymnolaemata	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Scrupocellaria sp.*	Ectoprocta: Gymnolaemata	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Buccinum undatum*	Mollusca: Gastropoda	decrease	1	Kaiser *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Modiolus modiolus*	Mollusca: Pelecypoda	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Liminaria loscombi*	Mollusca: Pelecypoda	decrease	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Aequipecten opercularis*	Mollusca: Pelecypoda	decrease	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Clausinela fasciata*	Mollusca: Pelecypoda	decrease	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Glycymeris*	Mollusca: Pelecypoda	decrease	1	Kaiser *et al*. (2000)

		glycymeris				
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophiocomina nigra*	Echinodermata: Ophiuroidea	increase	2	Bradshaw *et al*. (2002); Kaiser *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Ophiura albida*	Echinodermata: Ophiuroidea	increase	2	Bradshaw *et al*. (2002); Kaiser *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Amphiura filiformis*	Echinodermata: Ophiuroidea	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Pandalina brevirostris*	Crustacea: Eumalacostraca	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Cancer pagurus*	Crustacea: Eumalacostraca	increase	1	Veale *et al*. (2000)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Galathea intermedia*	Crustacea: Eumalacostraca	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Macropodia rostrata*	Crustacea: Eumalacostraca	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Pagurus* C34	Crustacea: Eumalacostraca	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Asterias rubens*	Echinodermata: Asteroidea	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Buccinum undatum*	Mollusca: Gastropoda	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Neptunea antiqua*	Mollusca: Gastropoda	increase	1	Bradshaw *et al*. (2002)
A4.1	Sublitt. mobile cobbles, gravels & coarse sands	*Calliostoma zizyphinum*	Mollusca: Gastropoda	increase	1	Bradshaw *et al*. (2002)

A4.2	Sublitt. sands & muddy sands	*Echinocardium cordatum*	Echinodermata: Echinoidea	decrease	1	Eleftheriou & Robertson (1992)
A4.2	Sublitt. sands & muddy sands	*Cancer pagurus*	Crustacea: Eumalacostraca	decrease	1	Eleftheriou & Robertson (1992)
A4.2	Sublitt. sands & muddy sands	*Ensis ensis*	Mollusca: Pelecypoda	decrease	1	Eleftheriou & Robertson (1992)

A4.4	Sublitt. combination sediments	*Melinna palmata*	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Tharynx marioni*	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Nephtys hombergii*	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Manayunkia aestuarina*	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Phyllodociid sp.*	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Ampharete grubei* (as *acutifrons*)	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Syllid sp.*	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Eteone longa*	Annelida: Polychaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Tubificoides benedeni*	Annelida: Oligochaeta	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Cerastoderma edule*	Mollusca: Pelecypoda	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Abra tenuis*	Mollusca: Pelecypoda	decrease	1	Southern Science (1992)
A4.4	Sublitt. combination sediments	*Mya arenaria*	Mollusca: Pelecypoda	decrease	1	Southern Science (1992)

A4.6	Biogenic structures over sublittoral sedi.	*Alentia gelatinosa*	Annelida: Polychaeta	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Chaetopterus variopedatus*	Annelida: Polychaeta	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Polygordius lacteus*	Annelida: Polychaeta	decrease	1	Hauton *et al*. (2003)

A4.6	Biogenic structures over sublittoral sedi.	*Cerianthus Lloydii*	Cnidaria: Hexacorallia	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Liocarcinus sp.*	Crustacea: Eumalacostraca	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Limaria hans*	Mollusca: Pelecypoda	decrease	1	Hall-Spencer & Moore (2000)
A4.6	Biogenic structures over sublittoral sedi.	*Abra abra*	Mollusca: Pelecypoda	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Ensis arcuatus*	Mollusca: Pelecypoda	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Dosinia eseolata*	Mollusca: Pelecypoda	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Venerupis rhomboides*	Mollusca: Pelecypoda	decrease	1	Hauton *et al*. (2003) (as *Tapes*)
A4.6	Biogenic structures over sublittoral sedi.	*Lutraria angustior*	Mollusca: Pelecypoda	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Mya truncata*	Mollusca: Pelecypoda	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Nemertina sp.*	Nemertinea: Enopla	decrease	1	Hauton *et al*. (2003)
A4.6	Biogenic structures over sublittoral sedi.	*Phymatolithon calcareum*	Rhodophycota: Rhodophyceae	decrease	1	Hall-Spencer & Moore (2000)

C. Pots/traps

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A3.6	Circalitt. rock m. exp. wave action/tidal streams	*Pentapora foliacea*	Bryozoa: Gymnolaemata	decrease	1	MacDonald *et al*. (1996); Eno *et al*. (2001)

D. Mariculture

i. Organic enrichment

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A4.3	Sublitt. muds	*Capitella capitata*	Annelida: Polychaeta	increase	3	Brown *et al*. (1987); Pearson & Black (2001); Mattson & Linden (1983)
A4.3	Sublitt. muds	*Scolepsis fulginosa*	Annelida: Polychaeta	increase	2	Brown *et al*. (1987); Mattson & Linden (1983)
A4.3	Sublitt. muds	*Apistobranchus paucibranchiata*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Cauleriella* spp.	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Chaetozone setosa*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Cirratulidae*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Cossura* sp.	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Diplocirrus glaucus*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Malacoceros fulginosus*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Malococeros fuliginosus*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Melinna palmata*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Micropthalmus sczelkowii*	Annelida: Polychaeta	increase	1	Mattson & Linden (1983)
A4.3	Sublitt. muds	*Microspio* sp.	Annelida: Polychaeta	increase	1	Pearson & Black (2001)

A4.3	Sublitt. muds	*Ophryotrocha* sp.	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Pholoe inornata*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Pronospio fallax*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Protodorvillea kefersteini*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Pseudopolydora paucibranchiata*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Scalibregma inflatum*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Scoloplos sp.*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Sphaerosyllis tetralix*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Spio decorata*	Annelida: Polychaeta	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Leptognathia brevirostris*	Crustacea: Taniadacea	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Abra abra*	Mollusca: Pelecypoda	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Thyasira ferruginea*	Mollusca: Pelecypoda	increase	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Eumida sp.*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Glycera alba*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Lanice conchilega*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Magelonia sp.*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Mugga wahlbergi*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Ophelina sp.*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Owenia fusiformis*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Perugia caeca*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Polycirrus plumosus*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Synelmis klatti*	Annelida: Polychaeta	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Echinocardium cordatum*	Echinodermata: Echinoidea	decrease	1	Mattson & Linden (1983)
A4.3	Sublitt. muds	*Nucula nitidosa*	Echinodermata: Echinoidea	decrease	1	Mattson & Linden (1983)
A4.3	Sublitt. muds	*Amphiura chiajei*	Echinodermata: Ophiuroidea	decrease	1	Mattson & Linden (1983)
A4.3	Sublitt. muds	*Amphiura filiformis*	Echinodermata: Ophiuroidea	decrease	1	Pearson & Black (2001)
A4.3	Sublitt. muds	*Ophiura albida*	Echinodermata: Ophiuroidea	decrease	1	Mattson & Linden (1983)

ii. Chemotherapeutants

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A4.3	Sublitt. muds	*Hediste diversicolor*	Annelida: Polychaeta	toxic	2	Collier & Pinn (1998); Grant &
A4.3	Sublitt. muds	*Arenicoloa marina*	Annelida: Polychaeta	toxic	1	Thain *et al*. (1997)
A4.3	Sublitt. muds	*Capitella capitata*	Annelida: Polychaeta	toxic	1	Black *et al*. (1997)
A4.3	Sublitt. muds	*Corophium volutator*	Annelida: Polychaeta	toxic	1	Collier & Pinn (1998)
A4.3	Sublitt. muds	*Carcinus maenas*	Crustacea: Eumalacostraca	toxic	1	Grant & Briggs (1998)

A4.3	Sublitt. muds	*Hydrobia ulvae*	Mollusca: Gastropoda	toxic	1	Grant & Briggs (1998)
A4.3	Sublitt. muds	*Littorina littorea*	Mollusca: Gastropoda	toxic	1	Grant & Briggs (1998)
A4.3	Sublitt. muds	*Potamopyrgus jenkinsii*	Mollusca: Gastropoda	toxic	1	Grant & Briggs (1998)

iii. Disturbance from cultivation and harvesting

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.2	Sublitt. sands & muddy sands	*Tubificoides benedeni*	Annelida: Oligochaeta	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Ampharete acutfrons*	Annelida: Polychaeta	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Chaetozone setosa*	Annelida: Polychaeta	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Euclymene lumbricoides*	Annelida: Polychaeta	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Heteromastus filiformis*	Annelida: Polychaeta	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Lanice conchilega*	Annelida: Polychaeta	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Melinna palmata*	Annelida: Polychaeta	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Pygyspio elegans*	Annelida: Polychaeta	increase	1	Spencer *et al*. (1998)
A2.2	Sublitt. sands & muddy sands	*Mysella bidentata*	Mollusca: Pelecypoda	increase	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Nephtys hombergii*	Annelida: Polychaeta	decrease	2	Spencer *et al*. (1997); Spencer *et al*. (1998)
A2.2	Sublitt. sands & muddy sands	*Ampharete acutfrons*	Annelida: Polychaeta	decrease	1	Spencer *et al*. (1998)
A2.2	Sublitt. sands & muddy sands	*Caulleriella killariensis*	Annelida: Polychaeta	decrease	1	Spencer *et al*. (1998)
A2.2	Sublitt. sands & muddy sands	*Heteromastus filiformis*	Annelida: Polychaeta	decrease	1	Spencer *et al*. (1998)
A2.2	Sublitt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	decrease	1	Spencer *et al*. (1997)
A2.2	Sublitt. sands & muddy sands	*Cerastoderma edule*	Mollusca: Pelecypoda	decrease	1	Spencer *et al*. (1998)

4. DIFFUSE NUTRIENTS

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.2	Litt. sands & muddy sands	*Anaitides spp.*	Annelida: Polychaeta	increase	1	Beukema (1989)
A2.2	Litt. sands & muddy sands	*Arenicola marina*	Annelida: Polychaeta	increase	1	Beukema (1989)
A2.2	Litt. sands & muddy sands	*Eteone longa*	Annelida: Polychaeta	increase	1	Beukema (1989)
A2.2	Litt. sands & muddy sands	*Eteone spp.*	Annelida: Polychaeta	increase	1	Beukema (1991)
A2.2	Litt. sands & muddy sands	*Harmathoe spp.*	Annelida: Polychaeta	increase	1	Beukema (1991)
A2.2	Litt. sands & muddy sands	*Heteromastus filiformis*	Annelida: Polychaeta	increase	2	Beukema (1989); Beukema (1991)
A2.2	Litt. sands & muddy sands	*Nereis diversicolor*	Annelida: Polychaeta	increase	2	Beukema (1989); Beukema (1991)
A2.2	Litt. sands & muddy sands	*Pectinaria auricoma*	Annelida: Polychaeta	increase	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Polyphysia crassa*	Annelida: Polychaeta	increase	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Scoleptis foliosa*	Annelida: Polychaeta	increase	1	Beukema (1989)

A2.2	Litt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	increase	2	Beukema (1989); Beukema (1991)
A2.2	Litt. sands & muddy sands	*Amphiura filiformis*	Echinodermata: Ophiuroidea	increase	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Macoma balthica*	Mollusca: Pelecypoda	increase	2	Beukema (1989); Beukema (1991)
A2.2	Litt. sands & muddy sands	*Crangon crangon*	Crustacea: Maxillopoda	decrease	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Echinocardium chordatum*	Echinoderamta: Echinoidea	decrease	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Aporrhais pes-pelecani*	Mollusca: Gastropoda	decrease	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Arctica islandica*	Mollusca: Pelecypoda	decrease	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Nucula nidita*	Mollusca: Pelecypoda	decrease	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Phaxas pellucidus*	Mollusca: Pelecypoda	decrease	1	Pearson *et al*. (1985)
A2.2	Litt. sands & muddy sands	*Turritella communis*	Mollusca: Gastropoda	decrease	1	Pearson *et al*. (1985)

5. POINT SOURCE HAZARDOUS SUBSTANCES

A. Hydrocarbons

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A1.2	Litt. rock m. exp. wave action/tidal streams	*Melarhaphe neritoides*	Mollusca: Gastropoda	increase	1	Crump *et al*. (1998)
A1.2	Litt. rock m. exp. wave action/tidal streams	*Enteromorpha sp*	Chlorophycota: Ulvophyceae	increase	1	Crump *et al*. (1998)
A1.2	Litt. rock m. exp. wave action/tidal streams	*Porphyra umbilicalis*	Rhodophycota: Rhodophyceae	increase	1	Crump *et al*. (1998)
A1.2	Litt. rock m. exp. wave action/tidal streams	*Patella sp.*	Mollusca: Gastropoda	decrease	2	Crump *et al*. (1998); Dicks & Levell (1989)
A1.2	Litt. rock m. exp. wave action/tidal streams	*Chthamalus sp*	Crustacea: Maxillopoda	decrease	1	Crump *et al*. (1998)
A1.2	Litt. rock m. exp. wave action/tidal streams	*Elminius modestus*	Crustacea: Maxillopoda	decrease	1	Dicks & Levell (1989)
A1.2	Litt. rock m. exp. wave action/tidal streams	*Semibalanus balanoides*	Crustacea: Maxillopoda	decrease	2	Crump *et al*. (1998); Dicks & Levell (1989)
A2.2	Litt. sands & muddy sands	*Ampelisca brevicornis*	Crustacea: Eumalocostraca	absent	1	Moore (1998)
A2.2	Litt. sands & muddy sands	*Bathyporeia spp.*	Crustacea: Eumalocostraca	decrease	1	Moore (1998)
A2.2	Litt. sands & muddy sands	*Haustorius arenarius*	Crustacea: Eumalocostraca	decrease	1	Moore (1998)
A2.2	Litt. sands & muddy sands	*Urothoe poseidonis*	Crustacea: Eumalocostraca	decrease	1	Moore (1998)
A2.2	Litt. sands & muddy sands	*Capitella sp*	Annelida: Polychaeta	increase	1	Moore (1998)
A2.2	Litt. sands & muddy sands	*Chaetozone gibber*	Annelida: Polychaeta	increase	1	Moore (1998)
A2.2	Litt. sands & muddy sands	*Psammodrillus balanoglossoides*	Annelida: Polychaeta	increase	1	Moore (1998)
A4.2	Sublitt. sands & muddy sands	*Oligochaetes*	Annelida: Oligochaeta	increase	1	Niktik & Robinson (2003)
A4.2	Sublitt. sands & muddy sands	*Capitella capitata*	Annelida: Polychaeta	increase	6	Olsgard & Gray (1995); Gray *et al*. (1990); Kingston *et al*.

						(1995); Kingston (1987); Davies *et al*. (1984); Levell *et al*. (1989)
A4.2	Sublitt. sands & muddy sands	*Caulleriella sp.*	Annelida: Polychaeta	increase	2	Davies *et al*. (1984); Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Chaetozone gibber*	Annelida: Polychaeta	increase	2	Niktik & Robinson (2003); Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Chaetozone setosa*	Annelida: Polychaeta	increase	5	Olsgard & Gray (1995); Gomez Gesteira & Dauvin (2000); Gray *et al*. (1990); Kingston *et al*. (1995); Levell *et al*. (1989)
A4.2	Sublitt. sands & muddy sands	*Chaetozone sp.*	Annelida: Polychaeta	increase	1	Davies *et al*. (1984)
A4.2	Sublitt. sands & muddy sands	*Cirratulus cirratus*	Annelida: Polychaeta	increase	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Ctenodrilus sp.*	Annelida: Polychaeta	increase	1	Kingston (1987)
A4.2	Sublitt. sands & muddy sands	*Goniada maculata*	Annelida: Polychaeta	increase	1	Davies *et al*. (1984)
A4.2	Sublitt. sands & muddy sands	*Luniata montagui*	Annelida: Polychaeta	increase	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Nereimyra punctata*	Annelida: Polychaeta	increase	1	Oug *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Notomastus laterceus*	Annelida: Polychaeta	increase	1	Levell *et al*. (1989)
A4.2	Sublitt. sands & muddy sands	*Ophryotrocha sp.*	Annelida: Polychaeta	increase	3	Olsgard & Gray (1995); Gomez Gesteira & Dauvin (2000); Kingston (1987)
A4.2	Sublitt. sands & muddy sands	*Paramphinome jeffreysii*	Annelida: Polychaeta	increase	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Polydora ciliata*	Annelida: Polychaeta	increase	1	Levell *et al*. (1989)
A4.2	Sublitt. sands & muddy sands	*Pholoe inornata*	Annelida: Polychaeta	increase	3	Gray *et al*. (1990); Kingston *et al*. (1995); Levell *et al*. (1989)
A4.2	Sublitt. sands & muddy sands	*Pholoe minuta*	Annelida: Polychaeta	increase	1	Kingston (1987)
A4.2	Sublitt. sands & muddy sands	*Phyllodoce groenlandica*	Annelida: Polychaeta	increase	1	Oug *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Protodorvillea kefersteini*	Annelida: Polychaeta	increase	1	Oug *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Pseudopolydora paucibranchia*	Annelida: Polychaeta	increase	1	Kingston (1987)
A4.2	Sublitt. sands & muddy sands	*Raricirrus berylii*	Annelida: Polychaeta	increase	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Rhaphidrilus sp.*	Annelida: Polychaeta	increase	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	increase	1	Levell *et al*. (1989)
A4.2	Sublitt. sands & muddy sands	*Spiophanes sp.*	Annelida: Polychaeta	increase	1	Kingston (1987)
A4.2	Sublitt. sands & muddy sands	*Jassa marmorata*	Crustacea: Eumalacostraca	increase	1	Gray *et al*. (1990)
A4.2	Sublitt. sands & muddy sands	*Ophiura affinis*	Echinodermata: Ophiuroidea	increase	1	Gray *et al*. (1990)
A4.2	Sublitt. sands & muddy sands	*Abra alba*	Mollusca: Pelecypoda	increase	1	Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Thyasira sarsi*	Mollusca: Pelecypoda	increase	2	Olsgard & Gray (1995); Kingston *et al*. (1995)
A4.2	Sublitt. sands & muddy sands	*Thyasira sp.*	Mollusca: Pelecypoda	increase	1	Kingston (1987)

A4.2	Sublitt. sands & muddy sands	*Nemertini spp.*	Nemertini	increase	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Amythasides macroglossum*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Aonides paucibranchiata*	Annelida: Polychaeta	decrease	2	Olsgard & Gray (1995); Kingston *et al*. (1995)
A4.2	Sublitt. sands & muddy sands	*Aricidea wassi*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Eclysippe vanelli*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Gattyana cirrosa*	Annelida: Polychaeta	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Glycera lapidum*	Annelida: Polychaeta	decrease	1	Kingston *et al* (1995)
A4.2	Sublitt. sands & muddy sands	*Glycinde nordmanni*	Annelida: Polychaeta	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Lumbrineris gracilis*	Annelida: Polychaeta	decrease	1	Kingston *et al* (1995)
A4.2	Sublitt. sands & muddy sands	*Malacoceros fuliginosus*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Myriochele oculata*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Nephtys hombergii*	Annelida: Polychaeta	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Nephtys longosetosa*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Owenia fusiformis*	Annelida: Polychaeta	decrease	2	Olsgard & Gray (1995); Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Pholoe minuta*	Annelida: Polychaeta	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Pista cristata*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Polycirrus spp.*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	decrease	3	Olsgard & Gray (1995); Gray *et al*. (1990); Davies *et al*. (1984)
A4.2	Sublitt. sands & muddy sands	*Spiophanes bombyx*	Annelida: Polychaeta	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Sthenelais limicola*	Annelida: Polychaeta	decrease	2	Olsgard & Gray (1995); Gray *et al*. (1990)
A4.2	Sublitt. sands & muddy sands	*Edwarsia sp.*	Cnidaria: Hexacorallia	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Ampelisca sp.*	Crustacea: Eumalocostraca	absent	4	Dauvin (1998); Gomez Geseira & Dauvin (2000); Gray *et al*. (1990); Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Amphipoda*	Crustacea: Eumalocostraca	absent	1	Kingston *et al* (1995)
A4.2	Sublitt. sands & muddy sands	*Callianassa subterranea*	Crustacea: Eumalocostraca	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Harpinia antennaria*	Crustacea: Eumalocostraca	decrease	3	Olsgard & Gray (1995); Dixon (1987); Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Harpinia sp.*	Crustacea: Eumalocostraca	absent	2	Niktik & Robinson (2003); Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Isaeidae sp.*	Crustacea: Eumalocostraca	decrease	1	Niktik & Robinson (2003)
A4.2	Sublitt. sands & muddy sands	*Photis longicaudata*	Crustacea: Eumalocostraca	decrease	1	Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Podoceropsis nitida*	Crustacea: Eumalocostraca	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Pseudocuma longicornis*	Crustacea: Eumalocostraca	decrease	1	Rutt *et al*. (1998)

A4.2	Sublitt. sands & muddy sands	*Tmetonyx cicada*	Crustacea: Eumalocostraca	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Unciola planipes*	Crustacea: Eumalocostraca	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Echinocardium cordatum*	Echinodermata: Echinoidea	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Echinocardium flavescens*	Echinodermata: Echinoidea	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Echinocyamus pusillus*	Echinodermata: Echinoidea	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Amphiura filiformis*	Echinodermata: Ophiuroidea	decrease	5	Olsgard & Gray (1995); Dixon (1987); Gray *et al*. (1990); Daan *et al*. (1994); Oug *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Ophiura affinis*	Echinodermata: Ophiuroidea	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Cylichna cilindracea*	Mollusca: Gastropoda	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Spiratella retroversa*	Mollusca: Gastropoda	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Abra alba*	Mollusca: Pelecypoda	decrease	1	Dixon (1987)
A4.2	Sublitt. sands & muddy sands	*Abra prismatica*	Mollusca: Pelecypoda	decrease	2	Olsgard & Gray (1995); Gray *et al*. (1990)
A4.2	Sublitt. sands & muddy sands	*Cerastoderma edule*	Mollusca: Pelecypoda	decrease	1	Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Ensis siliqua*	Mollusca: Pelecypoda	decrease	1	Rutt *et al*. (1998)
A4.2	Sublitt. sands & muddy sands	*Limatula subauriculata*	Mollusca: Pelecypoda	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Macandrevia cranium*	Mollusca: Pelecypoda	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Montacuta ferruginosa*	Mollusca: Pelecypoda	decrease	1	Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Montacuta substriata*	Mollusca: Pelecypoda	decrease	1	Olsgard & Gray (1995); Gray *et al*. (1990)
A4.2	Sublitt. sands & muddy sands	*Mysella bidentata*	Mollusca: Pelecypoda	decrease	2	Olsgard & Gray (1995); Daan *et al*. (1994)
A4.2	Sublitt. sands & muddy sands	*Spisula elliptica*	Mollusca: Pelecypoda	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Goldfingia vulgaris*	Sipuncula	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Phascolion strombii*	Sipuncula	decrease	1	Olsgard & Gray (1995)
A4.2	Sublitt. sands & muddy sands	*Portlandia phillippiana*		decrease	1	Olsgard & Gray (1995)

B. Metals

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.3	Litt. muds	*Tubificoides sp.*	Annelida: Oligochaeta	increase	1	Warwick (2001)
A2.3	Litt. muds	*Fabricia sabella*	Annelida: Polychaeta	increase	1	Warwick (2001)
A2.3	Litt. muds	*Hediste diversicolor*	Annelida: Polychaeta	tolerant	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Manayunkia aestuarina*	Annelida: Polychaeta	increase	1	Warwick (2001)
A2.3	Litt. muds	*Nephtys hombergii*	Annelida: Polychaeta	tolerant	2	Warwick (2001); Bryan *et al*. (1987)

A2.3	Litt. muds	*Pygospio sp.*	Annelida: Polychaeta	increase	2	Warwick (2001); Bryan *et al*. (1987)
A2.3	Litt. muds	*Streblospio sp.*	Annelida: Polychaeta	increase	1	Warwick (2001)
A2.3	Litt. muds	*Corophium volutator*	Crustacea: Eumalocostraca	tolerant	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Scrobicularia plana*	Mollusca: Pelecypoda	tolerant	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Aphelochaeta marioni*	Annelida: Polychaeta	decrease	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Caulleriella sp.*	Annelida: Polychaeta	absent	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Cirriformia tentaculata*	Annelida: Polychaeta	decrease	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Melinna palmata*	Annelida: Polychaeta	absent	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Corophium volutator*	Crustacea: Eumalocostraca	absent	1	Warwick (2001)
A2.3	Litt. muds	*Cyathura carinata*	Crustacea: Eumalocostraca	absent	1	Warwick (2001)
A2.3	Litt. muds	*Hydrobia ulvae*	Mollusca: Gastropoda	absent	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Cerastoderma edule*	Mollusca: Pelecypoda	absent	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Macoma balthica*	Mollusca: Pelecypoda	absent	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Mytilus edulis*	Mollusca: Pelecypoda	absent	1	Bryan *et al*. (1987)
A2.3	Litt. muds	*Ostrea edulis*	Mollusca: Pelecypoda	decrease	1	Bryan *et al*. (1987)
A4.3	Sublitt. muds	*Tubificoides sp.*	Annelida: Oligochaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Anaitides groenlandica*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Capitella capitata*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Chaetozone setosa*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Cirratulus cirratus*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Cossura longocirrata*	Annelida: Polychaeta	tolerant	2	Rygg (1985); Olsgard (1999)
A4.3	Sublitt. muds	*Eteone longa*	Annelida: Polychaeta	tolerant	2	Rygg (1985); Olsgard (1999)
A4.3	Sublitt. muds	*Glycera alba*	Annelida: Polychaeta	tolerant	2	Rygg (1985); Olsgard (1999)
A4.3	Sublitt. muds	*Goniada maculata*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Heteromastus filiformis*	Annelida: Polychaeta	tolerant	2	Rygg (1985); Olsgard (1999)
A4.3	Sublitt. muds	*Nereimya punctata*	Annelida: Polychaeta	tolerant	1	Olsgard (1999)
A4.3	Sublitt. muds	*Ophiodromus flexuosus*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Pholoe minuta*	Annelida: Polychaeta	tolerant	2	Rygg (1985); Olsgard (1999)
A4.3	Sublitt. muds	*Polydora caulleryi*	Annelida: Polychaeta	tolerant	1	Olsgard (1999)
A4.3	Sublitt. muds	*Polydora sp.*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Scoloplos armiger*	Annelida: Polychaeta	tolerant	1	Rygg (1985)
A4.3	Sublitt. muds	*Spiophanes kroyeri*	Annelida: Polychaeta	tolerant	1	Olsgard (1999)
A4.3	Sublitt. muds	*Brada villosa*	Annelida: Polychaeta	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Capitella capitata*	Annelida: Polychaeta	decrease	1	Olsgard (1999)
A4.3	Sublitt. muds	*Chaetozone setosa*	Annelida: Polychaeta	decrease	1	Olsgard (1999)

A4.3	Sublitt. muds	*Harmathoe sp.*	Annelida: Polychaeta	decrease	1	Olsgard (1999)
A4.3	Sublitt. muds	*Laonice cirrata*	Annelida: Polychaeta	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Lumbrineris sp.*	Annelida: Polychaeta	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Pectinaria koreni*	Annelida: Polychaeta	decrease	1	Olsgard (1999)
A4.3	Sublitt. muds	*Prionospio cirrifera*	Annelida: Polychaeta	absent	2	Rygg (1985); Olsgard (1999)
A4.3	Sublitt. muds	*Pseudopolydora paucibranchiata*	Annelida: Polychaeta	decrease	1	Olsgard (1999)
A4.3	Sublitt. muds	*Spiophanes kroeyeri*	Annelida: Polychaeta	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Terebellides stroemi*	Annelida: Polychaeta	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Crustacea*	Crustacea	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Echinodermata*	Echinodermata	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Ophiura affinis*	Echinodermata: Ophiuroidea	decrease	1	Olsgard (1999)
A4.3	Sublitt. muds	*Abra nitida*	Mollusca: Pelecypoda	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Nucula sulcata*	Mollusca: Pelecypoda	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Nucula tenuis*	Mollusca: Pelecypoda	absent	1	Rygg (1985)
A4.3	Sublitt. muds	*Thyasira sarsi*	Mollusca: Pelecypoda	decrease	1	Olsgard (1999)

C. Industrial effluents – general (including sewage and heavy metals)

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A1.3	Litt. rock shelt. from wave action/tidal streams	*Audouinella purpurea*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Bangia atropurpurea*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Callithamnion sepositum*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Ceramium rubrum*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Ceramium shuttleworthianum*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Ceramium tenuissimum*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Delesseria sanguinea*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Mastocarpus stellatus*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Membranoptera alata*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Plumaria elegans*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Polysiphonia arceolata*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Ptilota plumosa*	Rhodophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Fucus serratus*	Phaeophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Giffordia granulosa*	Phaeophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Laminaria digitata*	Phaeophyta	absent	1	Hardy *et al*. (1993)
A1.3	Litt. rock shelt. from wave action/tidal streams	*Laminaria saccharina*	Phaeophyta	absent	1	Hardy *et al*. (1993)

A2.3	Litt. muds	*Oligochaeta*	Annelida: Oligochaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Aphrodita sp.*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Capitella capitata*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Caulleriella sp.*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Hediste diversicolor*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Nephtys hombergii*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Polydora sp.*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Prionospio sp.*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Sabellaria spinulosa*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Tharyx sp.*	Annelida: Polychaeta	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Carcinus maenas*	Crustacea: Eumalocostraca	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Corophium sp.*	Crustacea: Eumalocostraca	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Jassa pusilla*	Crustacea: Eumalocostraca	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Stenathoe marina*	Crustacea: Eumalocostraca	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Balanus improvisus*	Crustacea: Maxillopoda	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Elminius modestus*	Crustacea: Maxillopoda	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Hydrobia ulvae*	Mollusca: Gastropoda	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Cerastoderma edule*	Mollusca: Pelecypoda	tolerant	1	Desgarrado Pereira *et al*. (1997)
A2.3	Litt. muds	*Scrobicularia plana*	Mollusca: Pelecypoda	tolerant	1	Desgarrado Pereira *et al*. (1997)

A4.3	Sublitt. muds	*Capitella capitata*	Annelida: Polychaeta	increase	1	Gray (1976)
A4.3	Sublitt. muds	*Polydora benedeni*	Annelida: Polychaeta	increase	1	Gray (1976)
A4.3	Sublitt. muds	*Polydora ciliata*	Annelida: Polychaeta	increase	1	Gray (1976)
A4.3	Sublitt. muds	*Nereis diversicolor*	Annelida: Polychaeta	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Nephtys hombergi*	Annelida: Polychaeta	increase	2	Newell *et al*. (1984); Newell (1985)
A4.3	Sublitt. muds	*Phyllodoce maculata*	Annelida: Polychaeta	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Cirriforma tentaculata*	Annelida: Polychaeta	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Pygospio elegans*	Annelida: Polychaeta	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Polydora polybranchia*	Annelida: Polychaeta	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Capitelloides giardi*	Annelida: Polychaeta	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Tubificoides benedeni*	Annelida: Oligochaeta	increase	2	Newell *et al*. (1984); Newell (1985)
A4.3	Sublitt. muds	*Corophium volutator*	Crustacea: Eumalocostraca	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Macoma balthica*	Mollusca: Pelecypoda	increase	1	Newell (1985)
A4.3	Sublitt. muds	*Abra abra*	Mollusca: Pelecypoda	increase	1	Newell *et al*. (1984)
A4.3	Sublitt. muds	*Crangon crangon*	Crustacea: Eumalocostraca	increase	1	Newell (1985)

A4.3	Sublitt. muds	*Aphelochaeta marioni*	Annelida: Polychaeta	increase	1	Newell (1985)
A4.3	Sublitt. muds	*Streblospio shrubsolii*	Annelida: Polychaeta	increase	1	Gray (1976)
A4.3	Sublitt. muds	*Cerastoderma edule*	Mollusca: Pelecypoda	decrease	1	Gray (1976)
A4.3	Sublitt. muds	*Macoma balthica*	Mollusca: Pelecypoda	decrease	1	Gray (1976)
A4.3	Sublitt. muds	*Mya arenaria*	Mollusca: Pelecypoda	decrease	1	Gray (1976)
A4.3	Sublitt. muds	*Mytilus edulis*	Mollusca: Pelecypoda	decrease	1	Gray (1976)
A4.3	Sublitt. muds	*Tellina tenuis*	Mollusca: Pelecypoda	decrease	1	Gray (1976)
A4.3	Sublitt. muds	*Venerupis pallustra*	Mollusca: Pelecypoda	decrease	1	Gray (1976)

6. PHYSICAL MODIFICATIONS

A. Emersion regime

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.2	Litt. sands & muddy sands	*Hydrobia ulvae*	Mollusca: Gastropoda	tolerant	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Littorina littorea*	Mollusca: Gastropoda	tolerant	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Nereis diversicolor*	Annelida: Polychaeta	tolerant	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Pygospio elegans*	Annalida: Polychaeta	tolerant	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Ostrea edulis*	Mollusca: Pelecypoda	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Arenicola marina*	Annelida: Polychaeta	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Cerastoderma edule*	Mollusca: Pelecypoda	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Macoma balthica*	Mollusca: Pelecypoda	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Mytilus edulis*	Mollusca: Pelecypoda	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Diadumene uncta*	Cnidaria: Hexacorallia	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Heteromastus filiformis*	Annelida: Polychaeta	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Malacoceros fulginosus*	Annelida: Polychaeta	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Nephtys hombergii*	Annelida: Polychaeta	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Sagartia troglodytes*	Cnidaria: Hexacorallia	intermed	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Scoloplos armiger*	Annelida: Polychaeta	sensitive	1	Meire *et al*. (1994)
A2.2	Litt. sands & muddy sands	*Aphelochaeta marioni*	Annelida: Polychaeta	sensitive	1	Meire *et al*. (1994)

B. Decreased turbidity

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.3	Litt. muds	*Corophium volutator*	Crustacea: Eumalacostraca	increase	1	Warwick *et al*. (1991)
A2.3	Litt. muds	*Cyathura carinata*	Crustacea: Eumalacostraca	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Scrobicularia plana*	Mollusca: Pelecypoda	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Cerastoderma edule*	Mollusca: Pelecypoda	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Melinna palmata*	Annelida: Polychaeta	increase		Warwick *et al*. (1991)

A2.3	Litt. muds	*Corophium arenarium*	Crustacea: Eumalacostraca	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Mya arenaria*	Mollusca: Pelecypoda	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Tubificids*	Annelida: Oligochaeta	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Cirritulids*	Annelida: Polychaeta	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Spionids*	Annelida: Polychaeta	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Capatellids*	Annelida: Polychaeta	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Orbiniids*	Annelida: Polychaeta	increase		Warwick *et al*. (1991)
A2.3	Litt. muds	*Nereis diversicolor*	Annelida: Polychaeta	increase		Warwick *et al*. (1991)

7. THERMAL EFFLUENT

EUNIS	Habitat	Species	Phylum: Class	Change	Conf	Sources
A2.2	Litt. sands & muddy sands	*Tellina tenuis*	Mollusca: Pelecypoda	increase	1	Barnett & Watson (1986)
A2.2	Litt. sands & muddy sands	Cerastoderma edule	Mollusca: Pelecypoda	absent	1	Bamber (1984)
A2.2	Litt. sands & muddy sands	Petricola pholadiformis	Mollusca: Pelecypoda	absent	1	Bamber (1984)
A2.2	Litt. sands & muddy sands	Tubificoides amplitastus	Annelida: Oligochaeta	increase	1	Bamber (1984)
A2.2	Litt. sands & muddy sands	Cauleriella zetlandica	Annelida: Polychaeta	increase	1	Bamber (1984)

APPENDIX 3. IDENTIFICATION OF SPECIES RECORDED ON THE *MARLIN* DATABASE AS 'HIGH' (H) OR 'INTERMEDIATE' (I) INTOLERANCE TO SELECTED ENVIRONMENTAL FACTORS.

'Intolerance' is the susceptibility of a habitat, community or species (i.e. the components of a biotope) to damage, or death, from an external factor. Intolerance must be assessed relative to change in a specific factor.

The environmental factors selected are those that are likely to affect environmental 'quality'. Factors such as 'Substratum loss' or 'Selective extraction of this species' are not included as intolerance is always high. Information on the *MarLIN* Biology and Sensitivity Key Information database is derived from literature sources and interpreted according to benchmarks. The output from the database has been edited to delete results with a 'low' confidence (reflecting little literature available and included in a field in the *MarLIN* database). The approach developed in the *MarLIN* programme is described in Hiscock & Tyler-Walters (in press).

Nearest equivalents to 'Exposure Pressure' concepts being developed by the Environment Agency are indicated.

	EA 'Exposure pressure'													
	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate*	Salinity		Oxygen concentratio	Thermal range/heat		
	Equivalent *MarLIN* environmental factor													
Species	Smothering	Increased suspended	Decreased susp. sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Abra alba					I	H	I				I			I
Ahnfeltia plicata	I	I		I	I	H		H	I					
Alaria esculenta	I	I			I	I	I		I	H			H	
Alcyonium digitatum	I				I	I				I		H		
Alkmaria romijni	I				I									
Amphianthus dohrnii					H					I		I	I	
Amphiura chiajei								H			H			I
Amphiura filiformis						H	I	H		H				
Antedon bifida	H				H	H	I	H		H	H	I	I	
Aphelochaeta marioni					I	H			I					
Aphrodita aculeata					I					H	H			

	EA 'Exposure pressure'												
	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate*	Salinity		Oxygen concentratio	Thermal range/heat	
	Equivalent *MarLIN* environmental factor												
Species	Smothering	Increased suspended	Decreased susp. sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Arctica islandica	I				I	H	I	I			I			
Arenicola marina					I	H		I	I				I	
Armandia cirrhosa					I					H				
Ascidiella scabra					H	I					I			
Ascophyllum nodosum	H				H	I			I					
Asterias rubens					I	I	I	H		H		H	H	
Atrina fragilis	I				H								I	
Axinella dissimilis	I	I			I					H		I	I	
Balanus crenatus	H				I	H	I		I			H	H	
Bathyporeia pelagica	I					H	I	H	H	H		H		
Botryllus schlosseri	H	H			I					I		I		
Brissopsis lyrifera					I	H		I				H	I	I
Bugula turbinata	H	I			I	H		H			I			I
Caecum armoricum					H									
Callianassa subterranea						H	I	H		H				
Cancer pagurus	H				I	H		H					I	
Capitella capitata	I				I						I			
Carcinus maenas						H		H						
Ceramium virgatum	I	I			I	H		H						
Cerastoderma edule	I				I	I	I	I	I			H	I	
Cerastoderma glaucum	H				I				I			H		
Chondrus crispus	I	I				H			I					
Chorda filum	I				I				I					
Chthamalus montagui	I			I	I	I			I		H	H		H
Chthamalus stellatus	I				I	I			I		H	H		H
Ciona intestinalis	I				H								I	
Cirratulus cirratus	H				I	H								

	EA 'Exposure pressure'												
	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate*	Salinity		Oxygen concentratio	Thermal range/heat	
	Equivalent *MarLIN* environmental factor												
Species	Smothering	Increased suspended	Decreased susp. sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Cladophora rupestris	I					I		I						
Clavelina lepadiformis	H	I			H								I	
Clavopsella navis	I	I			H									
Conopeum reticulum	H				I	I		H						
Corallina officinalis	I	I				I				I			I	
Corbula gibba	I				I		I					I		
Cordylophora caspia					I					I				
Corophium volutator	H	I			I	H	H	H	H			H		
Crepidula fornicata					I	H	I	I				I		I
Delesseria sanguinea	I				I	H		H				H		
Dipturus batis					I								I	I
Echinocardium cordatum					H	H	I	H	H	I		H	I	
Echinus esculentus	I				I	H	H	H		I		I	I	
Edwardsia ivelli	I				H									
Electra pilosa	H				I	I		I			I			
Ensis spp.					H	H	I	H	I	I		I	I	
Enteromorpha intestinalis	H	I			H	I		H						
Eunicella verrucosa	I				I						H	H		
Eurydice pulchra	H					H	I	I	H		I	H		
Fabulina fabula					I	H	I	I	I		I	I		
Flustra foliacea					I	H					H			
Fucus ceranoides	H				I				H	I				
Fucus distichus	H				I								H	
Fucus serratus	H				I	H		I	I					
Fucus spiralis	H				I		I	H	I	I				
Fucus vesiculosus	H				I	I			I					
Funiculina quadrangularis					H				I			I	I	I

	EA 'Exposure pressure'												
	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate*	Salinity		Oxygen concentratio	Thermal range/heat	
	Equivalent *MarLIN* environmental factor												
Species	Smothering	Increased suspended	Decreased susp. sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Furcellaria lumbricalis	I	I			I	H		H	I					
Gammarus insensibilis				I	I	H		H						
Gammarus salinus	I							H						I
Gobius cobitis	I					I	H	I					I	
Gobius couchi	I					I	H	I					I	
Halichondria bowerbanki	I				I					I		I		
Halichondria panicea	H				I							I		
Halidrys siliquosa	I			I	I	I								
Hediste diversicolor					I	H	I	I				I	I	
Helcion pellucidum	I	I		I	I	I			I	I		I	I	
Henricia oculata	I									I		I	H	
Himanthalia elongata	H	H			I			I	I	H			I	
Hippocampus hippocampus					I									
Hyale prevostii					I	I	I	H	I			H	I	
Hydrobia ulvae	I							I				I	I	
Jassa falcata	I				I	I	I	H				H	I	
Lacuna vincta	I				H			I				I	I	
Laminaria digitata	I	I		I	I	I	I			I			I	
Laminaria hyperborea				I	I		I		I	I			H	
Laminaria saccharina	H				I		I		I	H			I	
Lanice conchilega					I	H	I	I	I		I	I		H
Leptopsammia pruvoti	H	I			H					H		I	I	
Liocarcinus depurator					H		I			I		H	I	
Lithophyllum incrustans					I	H		H			I			
Lithothamnion corallioides	H	H		I	H					H			I	
Lithothamnion glaciale	H	I		I	H				I				I	

	EA 'Exposure pressure'												
	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate*	Salinity		Oxygen concentratio	Thermal range/heat	
	Equivalent *MarLIN* environmental factor												
Species	Smothering	Increased suspended	Decreased susp. sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Littorina littorea	H	I			I		I	H						
Macoma balthica					I	H	H	H						
Magelona mirabilis					I	H		H	I		I			
Metridium senile					I									
Modiolus modiolus	I				H	I					H		I	
Molgula manhattensis					H						I			
Morchellium argus	H				I					I				I
Musculus discors	H				I	I					I	I		
Mya arenaria	I	I			I	I	I	H	I					
Mytilus edulis	I				I	I	I	I	I					
Nematostella vectensis	I				H				I			I	I	
Nemertesia ramosa	I				I							I		
Neocrania anomala	H				I								I	
Neomysis integer						I	I	I		H			I	I
Neopentadactyla mixta		H			I					H			I	
Nephrops norvegicus					I		I				I	H		
Nephtys hombergii					I	I	I	H						
Nucella lapillus						H		I	H		I	I	I	
Nucula nitidosa	I				I						I			
Obelia longissima	I	I			I	I	I				I		H	
Ophiothrix fragilis	H				I			H	I			H	I	
Osilinus lineatus	H	I						I				H		H
Ostrea edulis	H				I	H	I					I		I
Palinurus elephas												I	I	
Palmaria palmata	I				I	H	I	H	I	I			I	
Paludinella litorina	H	I			H								I	
Patella ulyssiponensis	H					H		H						

	EA 'Exposure pressure'												
	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate*	Salinity		Oxygen concentratio	Thermal range/heat	
	Equivalent *MarLIN* environmental factor												
Species	Smothering	Increased suspended	Decreased susp. sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Patella vulgata	H					H	I	H				I		
Pecten maximus	I				I	I	I							
Pelvetia canaliculata	H				I			H	I					
Pentapora fascialis	I	I			H					H		I	I	
Philine aperta					I									
Pholas dactylus					I	H	I			I			I	
Phymatolithon calcareum	H	H		I	H								I	
Pisidia longicornis					H	I	I	I		I	H	I		I
Polydora ciliata					I		I	I						
Pomatoceros triqueter	H				I						H			I
Pomatoschistus microps	I					I	H	I					I	
Pomatoschistus minutus	I					I	H	I					I	
Protanthea simplex	H				H					I		I	H	
Psammechinus miliaris	H				H	H	I	H		I		I		
Rhodothamniella floridula	H	I		I	I	H		H	I		H			

APPENDIX 4. IDENTIFICATION OF SPECIES RECORDED ON THE *MARLIN* DATABASE AS 'VERY HIGH' (VH), 'HIGH' (H) OR 'MODERATE' (M) SENSITIVITY TO SELECTED ENVIRONMENTAL FACTORS.

'Sensitivity' is dependent on the intolerance of a species or habitat to damage from an external factor and the time taken for its subsequent recovery. For example, a very sensitive species or habitat is one that is very adversely affected by an external factor arising from human activities or natural events (killed/destroyed, 'high' intolerance) and is expected to recover over a very long period of time, i.e. >10 or up to 25 years ('low'; recoverability). Intolerance and hence sensitivity must be assessed relative to change in a specific factor.

The environmental factors selected are those that are likely to affect environmental 'quality'. Information on the *MarLIN* Biology and Sensitivity Key Information database is derived from literature sources and interpreted according to benchmarks. The output from the database has been edited to delete results with a low confidence (reflecting little literature available). The approach developed in the *MarLIN* programme is described in Hiscock & Tyler-Walters (in press).

Nearest equivalents to 'Exposure Pressure' concepts being developed by the Environment Agency are indicated.

	EA 'Exposure pressure'													
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances	Nitrate / Phosphate	Salinity	Oxygen concentration	Thermal range/heat				
	Equivalent *MarLIN* environmental factor													
Species	Substratum loss	Smothering	Increased suspended sediment	Decreased suspended sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Abra alba	M						M								
Ahnfeltia plicata	M						M		M						
Alaria esculenta	M										M			M	
Alcyonium digitatum	M												M		
Alkmaria romijni	VH	H				H									
Amphianthus dohrnii	VH					H									
Amphiura chiajei	M								M			M			M
Amphiura filiformis	M						M		M		M				
Antedon bifida	M	M				M	M		M		M	M			
Aphelochaeta marioni	M						M								

	EA 'Exposure pressure'														
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate	Salinity		Oxygen concentration	Thermal range/heat	
	Equivalent *MarLIN* environmental factor													
Species	**Substratum loss**	**Smothering**	**Increased suspended sediment**	**Decreased suspended sediment**	**Increased turbidity**	**Physical disturbance**	**Synthetic chemicals**	**Heavy metals**	**Hydrocarbons**	**Changes in nutrients**	**Increased salinity**	**Decreased Salinity**	**Deoxygenation**	**Increased temperature**	**Decreased temperature**
Aphrodita aculeata	M										M	M			
Arctica islandica	H	M				M								H	NR
Arenicola marina	M						M								
Armandia cirrhosa	VH					M					VH				
Ascophyllum nodosum	H	H				H	H								
Asterias rubens	M								M		M		M	M	
Atrina fragilis	VH	H				VH		M		M				H	
Axinella dissimilis	H	H	H			H					H		H	H	
Balanus crenatus	M	M					M						M	M	
Bathyporeia pelagica							M	M	M	M	M		M		
Botryllus schlosseri	M	M	M												
Brissopsis lyrifera	M						M						M		
Bugula turbinata	M	M					M		M						
Caecum armoricum	VH					H									
Callianassa subterranea	M						M		M		M				
Cancer pagurus	M						M								
Carcinus maenas									M						
Cerastoderma edule	M												M		
Cerastoderma glaucum	H	H				M				H			H		
Chondrus crispus	M						M								
Chorda filum	M														
Chthamalus montagui	M				M		M					M	M		H
Chthamalus stellatus	M						M					M	M		H
Ciona intestinalis	M					M									
Cirratulus cirratus	M	M					M								
Clavelina lepadiformis	M	M				M									

	EA 'Exposure pressure'													
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate	Salinity		Oxygen concentration	Thermal range/heat	
	Equivalent *MarLIN* environmental factor													
Species	Substratum loss	Smothering	Increased suspended sediment	Decreased suspended sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Clavopsella navis	VH	H	H			H									
Corallina officinalis	M														
Corbula gibba	M														
Cordylophora caspia	M														
Corophium volutator	M	M						M	M						
Crangon crangon															
Crepidula fornicata	M						M								
Delesseria sanguinea	M						M		M				M		
Dipturus batis						M								M	M
Echinocardium cordatum	M					M	M		M	M			M		
Echinus esculentus	M						M	M	M						
Edwardsia ivelli	H	H	M			H					M		M	M	
Electra pilosa															
Ensis spp.	M					M	M		M						
Eunicella verrucosa	VH	M				M						VH	VH		
Eurydice pulchra		M						M	M	M			M		
Fabulina fabula	M						M		M						
Flustra foliacea	M						M					M			
Fucus ceranoides	M	M				M				M	M				
Fucus distichus	M	M												M	
Fucus serratus	M	M					M								
Fucus spiralis	M	M							M					NR	
Fucus vesiculosus	M	M													
Funiculina quadrangularis	H					M							M	M	M
Furcellaria lumbricalis	M	M	M			M	M		M	M					
Gammarus insensibilis	H				H	M	H		H						

	EA 'Exposure pressure'													
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate	Salinity		Oxygen concentration	Thermal range/heat	
	Equivalent *MarLIN* environmental factor													
Species	Substratum loss	Smothering	Increased suspended sediment	Decreased suspended sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Gammarus salinus									M						
Gobius cobitis								M							
Gobius couchi								M							
Halichondria bowerbanki	M														
Halichondria panicea	M	M													
Halidrys siliquosa	M														
Hediste diversicolor	M						M	M							
Henricia oculata	M										M		M	M	
Himanthalia elongata	M	M	M								M				
Hippocampus hippocampus	M					M									M
Hyale prevostii	M								M				M		
Hydrobia ulvae	M														
Jassa falcata	M	M					M	M	VH				M	M	
Lacuna vincta	M					M									
Laminaria digitata	M														
Laminaria hyperborea	M				M	M				M	M			M	
Laminaria saccharina	M	M									M				
Lanice conchilega	M						M			M					M
Leptopsammia pruvoti	VH	VH	H			VH					VH		H	H	
Liocarcinus depurator						M							M		
Lithophyllum incrustans	H						H		M						
Lithothamnion corallioides	VH	VH	VH		M	VH					VH			M	
Lithothamnion glaciale	VH	VH	H		H	VH				H				H	
Littorina littorea	M	M							M						
Macoma balthica	M						M	M	M						

	EA 'Exposure pressure'													
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate	Salinity		Oxygen concentration	Thermal range/heat	
	Equivalent *MarLIN* environmental factor													
Species	Substratum loss	Smothering	Increased suspended sediment	Decreased suspended sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Magelona mirabilis	M						M		M						
Metridium senile	M														
Modiolus modiolus	H	H				H	H					H		H	
Molgula manhattensis															
Morchellium argus	M	M													
Mya arenaria	M								M						
Mytilus edulis	M														
Nematostella vectensis	VH					VH									
Nemertesia ramosa	M														
Neocrania anomala	M	M													
Neomysis integer															
Neopentadactyla mixta	H	M	H			H					H		M	H	
Nephrops norvegicus	M							M					M		
Nephtys hombergii									M						
Nucella lapillus	H						H			H					
Nucula nitidosa	M												NR		
Obelia longissima															
Ophiothrix fragilis	M	M							M				M		
Osilinus lineatus	M	M											M		M
Ostrea edulis	VH	VH				H	VH	H					H		H
Owenia fusiformis	M														
Palmaria palmata	M						M		M						
Paludinella litorina	H	H	M			VH					M			M	
Patella ulyssiponensis	M	M					M		M			M			
Patella vulgata	M	M					M		M						
Pecten maximus	M														

	EA 'Exposure pressure'													
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances			Nitrate / Phosphate	Salinity		Oxygen concentration	Thermal range/heat	
	Equivalent *MarLIN* environmental factor													
Species	Substratum loss	Smothering	Increased suspended sediment	Decreased suspended sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Pelvetia canaliculata	M	M				M			M	M					
Pentapora fascialis	M	M				M					M				
Philine aperta	M														
Pholas dactylus	M						M								
Phymatolithon calcareum	VH	VH	VH		M	VH								M	
Pisidia longicornis						M						M			
Polydora ciliata	M														
Pomatoceros triqueter	M	M										M			
Pomatoschistus microps								M							
Pomatoschistus minutus								M							
Protanthea simplex	M	M				M								M	
Psammechinus miliaris	M	M				M	M		M					M	
Rhodothamniella floridula	M	M					M		M			M			
Sabellaria alveolata	M														
Sabellaria spinulosa	M														
Saccorhiza polyschides	M										M				
Semibalanus balanoides	M						M		M						
Serpula vermicularis	M	M				M					M	M			
Spio filicornis	M						M								
Spiophanes bombyx	M						M								
Spisula solida	M												VH		
Talitrus saltator							M								
Tenellia adspersa	VH	VH				M									
Thyasira gouldi	VH					VH				VH	M		M	VH	
Truncatella subcylindrica	H	H				VH	VH				M			M	
Umbonula littoralis	M										M				

	EA 'Exposure pressure'												
	[None]	[None]	Suspended sediment	Increased turbidity	[None]	Priority substances	Nitrate / Phosphate	Salinity	Oxygen concentration	Thermal range/heat			
	Equivalent *MarLIN* environmental factor												
Species	Substratum loss	Smothering	Increased suspended sediment	Decreased suspended sediment	Increased turbidity	Physical disturbance	Synthetic chemicals	Heavy metals	Hydrocarbons	Changes in nutrients	Increased salinity	Decreased Salinity	Deoxygenation	Increased temperature	Decreased temperature
Urticina felina	M					M	M								
Venerupis senegalensis	M						M	M							
Virgularia mirabilis	M					M					M		M	M	
Zostera marina	VH	VH	M		VH	M	M			VH					
Zostera noltii	H	H													

APPENDIX 5. TERMS USED AND THEIR APPROXIMATE EQUIVALENTS FROM DIFFERENT PARTS OF THE REPORT.

All of the EA 'Exposure pressure' are included except 'Removal of fish/invertebrates' and 'Non-native species'. [ ] = equivalent term but not researched.

Environmental factor (*MarLIN*) terms	**EA 'Exposure Pressure**	**Used in Appendix 1 (from SGSOBS workshop)**	**Used in Appendix 2 (terms commonly employed in the literature)**
Smothering	[none]	Smothering	Waste dumping
Increase in suspended sediment	Suspended sediment	[none]	[none]
Increase in turbidity	Increased turbidity	[none]	[none]
Abrasion & physical disturbance	[Change in physical substrate - Change in habitat]	Mechanical disturbance	- Commercial fishing - Pots/traps - Disturbance from cultivation
Substratum loss	[- Change in physical substrate - Change in habitat]	Removal of substratum	- Mineral extraction (aggregates) - Dredging
[Increase/decrease in water flow rate]	[Flow / flow direction]	[none]	[none]
Synthetic compound contamination	Priority substances	Synthetic chemicals	- Chemotherapeutants - Industrial effluents
Heavy metal contamination	Priority substances	Heavy metals	- Metals - Industrial effluents
Hydrocarbon contamination	Priority substances	Hydrocarbons	Hydrocarbons
Changes in nutrient levels	Nitrate / phosphate	Nitrates/phosphates	Diffuse nutrients
Increase in salinity	Salinity	Salinity	[none]
Decrease in salinity	Salinity	Salinity	[none]
Deoxygenation	Oxygen concentration	Oxygen	Hypoxia
[none]	Organic matter	Organic matter	- Organic enrichment - Mariculture (organic enrichment)
Increase in temperature	Thermal range / heat	[none]	Thermal
Decrease in temperature	Thermal range / heat	[none]	Thermal
[Increase/decrease in emergence]	[none]	[none]	Emersion regime

Appendix 5. Summary of *MarLIN* 'benchmarks' used to indicate likely intolerance of a species to a factor. For a detailed description of the *MarLIN* approach to identifying intolerance, recoverability and sensitivity, refer to www.marlin.ac.uk and reports accessible from that Web site.

Benchmarks for Intolerance Assessment	
Intolerance and recoverability ranks for species are indicative. Ranks are assessed against the same intensity of change in environmental factor or 'benchmark'. The following table standardises the magnitude of each factor in order for effects to be normalised across species. (Sensitivity is identified according to degree of intolerance and recoverability potential)	
Physical factors	
	The level of effect against which intolerance is rated.
Substratum loss	All of substratum occupied by the species or biotope under consideration is removed. A single event is assumed for intolerance assessment. Once the activity or event has stopped (or between regular events) suitable substratum remains or is deposited. Species or community recovery assumes that the substratum within the habitat preferences of the original species or community is present.
Smothering	All of the population of a species or an area of a biotope is smothered by sediment, similar to the existing substratum, to a depth of 5 cm above the substratum for one month. NB Spoil that differs from the existing sediments (e.g. in grain size, or porosity), and impermeable materials (e.g. concrete, oil, or tar) are likely to have a greater effect.
Changes in suspended sediment.	An arbitrary short term, acute change in background suspended sediment concentration e.g., a change of 100mg/l for 1 month. The resultant light attenuation effects are addressed under turbidity, and the effects of rapid settling out of suspended sediment are addressed under smothering.
Desiccation	1). A normally subtidal, demersal or pelagic species including intertidal migratory or under-boulder species is continuously exposed to air and sunshine for 1 hour. 2). A normally intertidal species or community is exposed to a change in desiccation equivalent to a change in position of one vertical biological zone on the shore, e.g., from upper eulittoral to the mid eulittoral or from sublittoral fringe to lower eulittoral.
Changes in emergence	A 1 hour change in the time covered or not covered by the sea for a period of 1 year.
Changes in water flow rate	A change of two categories in water flow rate for one year (based on the Marine Nature Conservation Review scale) for 1 year. For example from moderately strong (1-3 knots) to very weak (negligible).

Changes in temperature	1) A short term, acute change in temperature; e.g., a 5 ° C change in the temperature range for 3 consecutive days. This definition includes 'short term' thermal discharges. 2) A long term, chronic change in temperature; e.g. a 2 ° C change in the temperature range for a year. This definition includes 'long term' thermal discharges. For intertidal species or communities, the range of temperatures includes the air temperature regime for that species or communities.
Changes in turbidity	1) A short term, acute change; e.g., two categories of the water clarity scale (see www.marlin.ac.uk) for one month, i.e. from medium to extreme turbidity. 2) A long term, chronic change; e.g., one category of the water clarity scale (see www.marlin.ac.uk) for one year, i.e. from low to medium turbidity.
Changes in wave exposure	A change of two ranks on the wave exposure scale (based on the Marine Nature Conservation Review scale) e.g., from Exposed to Extremely exposed for a period of 1 year.
Noise	Underwater noise levels e.g., the regular passing of a 30 metre trawler at 100 metres or a working cutter-suction transfer dredge at 100 metres for 1 month during important feeding or breeding periods. Atmospheric noise levels e.g., the regular passing of a Boeing 737 passenger jet 300 metres overhead for 1 month during important feeding or breeding periods.
Visual presence	The continuous presence for one month of moving objects not naturally found in the marine environment (e.g., boats, machinery, and humans) within the visual envelope of the species or community under consideration.
Physical disturbance or abrasion	This factor includes mechanical interference, crushing, physical blows against, or rubbing and erosion of the organism or habitat of interest. Force equivalent to a standard scallop dredge landing on or being dragged across the organism. A single event is assumed for assessment. Where trampling is relevant, the evidence and trampling intensity will be reported in the rationale.
Displace-ment	Removal of the organism from the substratum and displacement from its original position onto a suitable substratum.

<table>
<tr><td colspan="2">Chemical factors</td></tr>
<tr><td></td><td>The level of effect against which intolerance is rated.</td></tr>
<tr><td>Changes in levels of synthetic chemicals

Changes in levels of heavy metals

Changes in levels of hydro-carbons

Changes in levels of radionuclides

Changes in levels of nutrients</td><td>Intolerance is assessed against the available evidence for the effects of contaminants on the species (or closely related species at low confidence) or community of interest. For example:
• evidence of mass mortality of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as high intolerance;
• evidence of reduced abundance, or extent of a population of the species or community of interest (either short or long term) in response to a contaminant will be ranked as intermediate intolerance;
• evidence of sub-lethal effects or reduced reproductive potential of a population of the species or community of interest will be assessed as low intolerance.

The evidence used is stated in the rationale. Where the assessment can be based on a known activity then this is stated. The tolerance to contaminants of species of interest will be included in the rationale when available, together with relevant supporting material.</td></tr>
<tr><td>Changes in salinity</td><td>1) A short term, acute change; e.g., a change of two categories from the MNCR salinity scale for one week; for instance, from full to reduced.
2) A long term, chronic change; e.g., a change of one category from the MNCR salinity scale for one year; for instance, from reduced to low.</td></tr>
<tr><td>Changes in oxygenation</td><td>Exposure to a dissolved oxygen concentration of 2 mg/l for 1 week.</td></tr>
</table>