

## 9 FISH AND SHELLFISH RESOURCE

### 9.1 EXISTING ENVIRONMENT

#### *Introduction*

- 9.1.1 The following section provides information on the existing environment with respect to the natural fish and natural and farmed shellfish resources of the study area and also identifies the potential impacts of the approach channel deepening, beneficial beach nourishment and the disposal of dredged material to these biological resources.

#### *Data sources*

- 9.1.2 In determining the baseline conditions, data has been used from a wide variety of sources. Much of the information comes from the commercial fisheries industry and the discussion within this section links closely with the importance and impacts to the commercial fishery, which is presented in Section 10.
- 9.1.3 A full list of data sources used to establish the existing baseline environment for the natural fish and shellfish resources is provided in Table 9.1.

**Table 9.1 Summary of sources of data used to assess the fish and shellfish resource**

<b>Data</b>	<b>Description</b>
International Council for the Exploration of the Seas (ICES) Stock Assessment Reports	Annual stock assessment reports produced by specific working groups within ICES. These reports provide information on resource status/state of key stock plus management advice. They also propose biological reference points for parameters such as fishing mortality and spawning stock biomass are provided. These data give a high-level overview of the state of key fish stocks in the study area.
Defra landings data by port	Provides a high-level, regional overview of catches within study area. Does not fully represent catches in these areas, as there is no statutory requirement under either EU or national legislation for vessels <10m length to declare their catches. Information for this sector is collected with the co-operation of the industry. It comprises log sheets and landing declarations voluntarily supplied by fishermen and assessments of landings derived from market sources and by correspondents located in the ports.
Southern Sea Fisheries District Committee Quarterly reports and consultation	The SSFDC were able to provide qualitative summaries of fisheries activities within a summary document and several quarterly reports routinely produced as part of their responsibilities. Landings data was not available but some information on the several fisheries was provided.
Poole and District Fishermens Association	Questionnaires were issued to fishermen requesting information relating to fishing activity and species targeted. PDFa also provided feedback at consultation meetings on fishing activity, stocks and distribution.
Poole Charter Skippers Association (PCSA)	Several key members of the Poole Charter Skippers Association provided a range of information during a semi-structured interview
Data from individual fishing organisations	Some information was provided by the Poole and District Sea Angling Association – Mr C. T. Holloway

**Table 9.1 (continued)**

Data	Description
Various literature sources	In order to fully assess potential impacts on natural fish and shellfish resources, information on the biology (spawning, migrations) of key species has been collated.
Previous studies	There have been few studies into finfish within the study area but a considerable amount of research has gone into the shellfish resources of the region including studies into the clams and cockles within the Harbour and the crustaceans of Poole Bay by the University of Southampton.
Epibenthic survey	Epibenthic dredge surveys carried out by the University of Swansea have provided a good overview of shellfish populations within Poole Harbour and the Swash Channel.

*Overview of fish and shellfish resource in the study area*

- 9.1.4 The following paragraphs provide an overview of fish and shellfisheries resources within the study area. Figures 9.1 and 9.2 summarise the ecology of fish and shellfish in the study area.
- 9.1.5 Poole Harbour supports a wide variety of fish and shellfish species. There are around 35 species of adult finfish recorded in the Harbour (PCSA, pers. comm.), 17 species of bivalve shellfish, and 11 species of decapod crustaceans (Dyrynda, 1985). The conditions and productivity of the Harbour is such that shellfish, eels, some demersal fish species (e.g. flounder), bass and grey mullet are found in much greater quantities within the Harbour than on the open coast.
- 9.1.6 Both natural and farmed stocks of bivalve molluscs are found within the Harbour with cockles and native and Manila clams dominating the intertidal areas and mussels, oysters and American hard shell clams in subtidal areas. Cockles are found all over Harbour.
- 9.1.7 The Harbour and Bay combined provide important nursery areas for a wide variety of fish. In terms of commercially important species, the Harbour and Bay provide nursery areas for plaice, brill, turbot, dab, sole and wrasse. The area is especially important for sandeel, black sea bream, pollack and pipefish. The CEFAS young fish surveys looked at the south and east coasts of England from Portland Bill to Flamborough Head (Rogers *et al.*, 1998). Poole Harbour was the most important area for juvenile flounder, with over 10 young fish caught per 1000m<sup>2</sup>.
- 9.1.8 The Harbour is important for bass and is a designated bass nursery area under the Bass (Specified Sea Areas) (Prohibition of Fishing) Order 1990. All waters enclosed by a line drawn 011° true from Jerry's Point, through Brownsea Castle to Salterns Pier (note that the Pier no longer exists and is incorporated into a marina) are within the nursery area. In completing the government fisheries department's long term strategy for the conservation and management of the bass fishery of England and Wales, bass nursery areas have been designated to prohibit bass fishing in nursery areas for all or part of the year. This has been implemented alongside increased landing size and gear restrictions. In Poole Harbour, fishing for bass and the use of sandeel as bait is prohibited from 1<sup>st</sup> May to 31<sup>st</sup> October. This does not apply to anglers fishing from the shore.
- 9.1.9 The Harbour is also used by migratory species, including salmon, sea trout and eels. Salmon are of conservation importance and in February 1996, the National Salmon

Management Strategy was launched by the predecessor of the Environment Agency with the following four objectives which are addressed through local Salmon Action Plans:

- Optimise the number of salmon returning to homewater fisheries
- Maintain and improve fitness and diversity of salmon stocks
- Optimise the total economic value of surplus stocks
- Ensure beneficiaries meet necessary costs.

9.1.10 Local Salmon Action Plans have been written for the rivers Frome and Piddle. The Environment Agency published the River Frome Salmon Action Plan in 1998 and the River Piddle Salmon Action Plan in 2003. The Action Plan Consultation Documents:

- Set a spawning target and suggest fishing effort controls for salmon stocks and fisheries;
- Identify and establish the feasibility of removing factors limiting salmon survival and production; and
- Outline a programme of works to carry out necessary remedial, improvement and development measures.

*Distribution and behaviour of finfish species of commercial or conservation importance*

#### **Salmon *Salmo salar***

9.1.11 Salmon pass through Poole Harbour in order to reach spawning grounds located along the length of the rivers Frome and Piddle. Salmon have also been recorded in the tidal reaches of the Sherford and it is likely they visit the tidal reaches of the Corfe river (Environment Agency, 2000b). Following relatively stable stock levels over the past 50 years, the 1990s have seen rod catches and egg deposition fall to low levels. Pollution, ground water extraction and man-made infrastructure are considered to have contributed to the decline. The Atlantic Salmon is listed under Annex 2 of the EC 'Habitats and Species' Directive, and also mentioned within the Biodiversity Action Plans for chalk rivers. The total number of Salmon recorded travelling up the river Frome in 2003 was 553.

#### **Sea trout *Salmo trutta***

9.1.12 Adult sea trout migrate into freshwater between March and December with peaks May-July and October-November. Sea trout spawning areas do not extend as far upstream as the salmon redds in the river Frome. The juvenile sea trout remain upstream until February when migration back to the sea begins. There is a peak in migration during mid-march, and by April the juveniles will have left the harbour.

#### **Eel *Anguilla anguilla***

9.1.13 The common eel is a catadromous species, migrating out to sea to spawn and returning into brackish and freshwaters to feed. Adults leave Poole Harbour between February and November with peak migrations occurring during autumn in conjunction with the onset of rising river discharge. Spawning grounds are in the Sargasso Sea, western Atlantic. The young elvers, or glass eels, return after an (approximately) three year journey within the Gulf Stream, entering the Harbour from March to August, with a peak influx during June and July. Unlike salmon, eels do not instinctively return to the same rivers as their parents.

- 9.1.14 Overwintering fish burrow into the mud and enter a dormant phase. Dyrinda (1987) observed eel burrows in several parts of the channel system, with the largest numbers adjacent to Goathorn Point within the Lower South Deep.

**Twaite shad *Alosa fallax* and Allis shad *Alosa alosa***

- 9.1.15 The shad is a member of the herring family, found in small numbers in shallow coastal areas and estuaries in a few locations around the UK, including certain parts of the Dorset Coast. The shads are now given considerable legal protection. It is listed in Annexes II and V of the EU Habitats and Species Directive, Appendix III of the Bern Convention, Schedule V of the Wildlife and Countryside Act (1981) and as a Priority Species in the UK Biodiversity Action Plan.
- 9.1.16 In the past they were fished in considerable numbers but have now become rare, in Poole this has been due to their migration being affected by pollution and the deterioration of their natural habitat, especially man-made obstructions blocking their river migration paths (SSFDC, 2003). For these reasons as well as over fishing, they have become rare throughout Europe and are thus also protected under Annex II and V of the EU Habitats Directive.

**Thick-lipped grey mullet *Chelon labrosus***

- 9.1.17 This species is found in coastal inshore waters of estuaries, harbours, sandy bays and are often encountered in low salinity environments and lagoons. Grey mullet migrate to deeper waters in winter and returns into estuaries and lagoons in spring/summer.

**Bass *Dicentrarchus labrax***

- 9.1.18 Adult bass tend to enter coastal waters and river mouths, estuaries and lagoons during the summer. They are found concentrated downstream within the Harbour and out into the Swash Channel especially around the Harbour entrance. Adults often move offshore during the winter to deeper waters, returning in spring and not moving very far from their coastal sites over the summer and early autumn. Results from bass tagging around Poole in 1992 found that 84% of tagged bass (average size 39.8cm western end of Poole Bay) were found within 10km of their tagging site the following year.

**Lesser sandeel *Ammodytes tobianus***

- 9.1.19 This is the most common of the sandeels, a territorial species that inhabits inshore waters over sandy sediments. They can be found in intertidal areas and within estuaries, frequently being associated with the bars and outer mouth of an estuary. They are found less frequently among offshore sandy shoals. They alternate between burying themselves within the sediment for protection and swimming in large schools in the water column. During the winter they hibernate buried in sandy sediments. Sandeels occur in large numbers at Hook Sands adjacent to the Swash Channel and at Soldier Bank in the Harbour.

**Sole *Solea solea***

- 9.1.20 Based on the most recent estimate of Spawning Stock Biomass (SSB) and fishing mortality, ICES classifies the stock as being inside safe biological limits within the English

Channel. Fishing mortality in 2002 was within the level of fishing considered safe for long term stock conservation. Recent recruitment has been strong.

- 9.1.21 Adult sole migrate from offshore areas into nearshore and estuarine areas in spring (March-May) in order to spawn. Following spawning, many of these adults migrate offshore once again to offshore feeding grounds. Juvenile sole grow quickly over the summer and autumn period, moving seaward near the end of the year with reducing water temperature. The sheltered estuarine sediments of Poole Harbour are typical nursery areas for juvenile sole.

### **Flounder *Platichthys flesus***

- 9.1.22 The flounder is common to all British Coasts, being found inshore down to 50m. It is common in estuaries and is tolerant of varying salinities, sometimes moving into rivers. The flounder tends to remain inactive and buried in sediment during the day, emerging to forage during the night and often moving with the tide. It is the most widespread of the flatfish within Poole harbour. Flounder migrate to deeper spawning grounds from February onwards for breeding.

### **Plaice *Pleuronectes platessa***

- 9.1.23 Based on the most recent estimate of the biomass ICES classifies the eastern English Channel stock as being outside safe biological limits. The Spawning Stock Biomass in 2003 has been estimated to be just below precautionary levels and has fluctuated near this level since 1992. Fishing mortality has also been above sustainable levels since the early 1980s. Recent recruitment has been approximately average.
- 9.1.24 Young plaice live inshore for the first 3-4 years of their life before they move into deeper water. Commercial sized plaice are generally caught in water depths of 10-50m. Young plaice are common throughout the Harbour (Rogers *et al.*, 1998).

### **Skates and rays**

- 9.1.25 The thornback ray *Raja clavata*, found in Poole Bay, is one of the most abundant rajids in the north-eastern Atlantic and Mediterranean, and is an important component of mixed demersal trawl fisheries. It is also taken by set nets and targeted by recreational anglers. There is evidence of a decline in catch rates in NW European waters. A minimum landing size exists in certain inshore areas of the UK.
- 9.1.26 Numerous tagging experiments have been carried out on skates and rays. All have shown that species movement occurs over a small distance, mainly from offshore areas to inshore areas in spring, but none have shown any extensive movement or large-scale seasonal migration of this species.

### *Distribution and behaviour of shellfish species of commercial or conservation importance*

#### **Cockle *Cerastoderma edule***

- 9.1.27 The cockle is widely distributed and often very abundant around the estuaries and sandy bays of coastal Britain. Population densities of 10,000 per m<sup>2</sup> have been recorded. Wild cockles occur throughout most of the Harbour, with the exception of parts of the extreme

upper Wareham Channel and south-western areas of the Harbour. Particularly dense areas of cockles occur within Lychett Bay and Holes Bay and in recent times the north-east part of the Harbour has been heavily fished for cockles. Cockles are also farmed on leased beds.

- 9.1.28 Cockles are suspension feeders inhabiting the surface of sediments, burrowing to a depth of no more than 5 cm. They can be found in clean sand, muddy sand, mud or muddy gravel from the middle to lower intertidal, sometimes subtidally.
- 9.1.29 Settlement and subsequent recruitment has a significant impact on the dynamics of *Cerastoderma edule* populations. Factors such as climatic variation, interspecific predation, smothering by sediment, adult population density, sediment erosion and strong currents all can contribute to poor recruitment at a particular site.
- 9.1.30 Cockles are most sensitive to substratum loss, and are also moderately intolerant of other changes to the physical regime of their environment. However they demonstrate a high rate of recoverability as defined by Hiscock *et al.* (1999). Saying this, recruitment is sporadic and recoverability through recruitment rather than movement from other areas may be poor in years of low recruitment.

#### **European oyster *Ostrea edulis***

- 9.1.31 The native European oyster is associated with highly productive estuaries and shallow coastal waters living subtidally on firm sediments or rock. It is also artificially laid on leased areas of the seabed. It is found around many parts of the Britain. The nearby Solent supports one of the major populations found around England.
- 9.1.32 Recent dredge surveys by the University of Swansea (Dyrynda, 2003) found *Ostrea edulis* within many sections of the Middle Ship Channel, the North Channel, southern Holes Bay, at the Harbour entrance and within the South Deep and Blood Alley. The highest biomass was found in samples from the mid Wareham Channel and upper Wych Channel. The highest concentrations of dead shells were found in the Middle Ship Channel, mid Wareham Channel and upper Swash Channel, but this may not reflect the distribution of live specimens. Oysters are also farmed on leased beds.

#### **Native clams *Mya arenaria*, *Tapes decussata***

- 9.1.33 *Mya arenaria* frequently occurs in the Harbour living in deep permanent burrows of 20-50cm depth in mixed sediments, often on estuarine flats where they are an important food source for many other estuarine fauna including shorebirds, wintering ducks, flatfish, crabs, shrimp and worms (juveniles only for last two). *Mya arenaria* is mainly found in the Upper Wareham Channel and in the Upper Wych Channel but does occur on the upper shores of Whitley Lake and Parkstone Bay and occurs around Jerry's point near Studland (Thomas *et al.*, 2004). *Tapes decussata* is found in small quantities throughout most of the Harbour and is also farmed on leased beds.
- 9.1.34 Tyler-Walters (2003) sensitivity assessment states that due to high recoverability rates (high fecundity and reproductive potential), *Mya arenaria* has only a low sensitivity to most forms of physical disturbance, but is moderate sensitive to substratum loss. Its permanent burrow means that smothering may cause problems and Grant and Thorpe (1991) suggest that prolonged exposure to suspended sediment concentrations

>100mg/l result in reduced body condition and growth, however it has been shown that feeding continues even where suspended sediment concentration exceeds 300mg/l (Newell and Hidu, 1986).

#### **American hard shell clam *Mercenaria mercenaria***

- 9.1.35 A large and edible bivalve introduced to the UK from the USA. Self-sustaining populations still remain in nearby Southampton Water and the Solent and are exploited but may conflict with conservation objectives. This species is in small quantities throughout the Harbour.
- 9.1.36 *Mercenaria mercenaria* are found buried in muddy sediment on the lower shore and shallow sublittoral and in bays and estuaries. They prefer sandy environments to depths of 15 m and prefer warmer conditions with optimal growth occurring between 20-23 °C. The hard shell clam is less well adapted to survival in turbid conditions compared to mussels and oysters (Bricelj, 1984) and is thus more vulnerable to temporary increases in suspended sediment loads from activities such as dredging. They prefer sandy or mixed sediments. Their success in UK waters may have been by filling the niche of *Mya arenaria* and out competing them after cold winters caused die backs of this native clam (Mitchell, 1974)

#### **Pacific oyster *Crassostrea gigas***

- 9.1.37 The Pacific oyster was introduced into Britain and Ireland for cultivation. They are a hardy species with rapid growth (they can grow to over 75 mm in their first 18 months) and reproductive rates, making them the most cultivated species of shellfish in the world. Successful cultivation has led to their spread and the establishment of wild populations throughout the UK. They are found on the lower shore and shallow sublittoral. Significant quantities of the Pacific oyster *Crassostrea gigas* have been grown in Poole Harbour over the past thirty years where they are farmed; no wild beds are present.

#### **Mussel *Mytilus edulis***

- 9.1.38 The common mussel is very common throughout the UK occurring from upper intertidal zones down to at least 30m subtidally. In Poole Harbour, recent and historical surveys by the University of Swansea show wild stocks of *Mytilus edulis* only to be found within the Wytch Channel to the north-west of Brownsea Island and within the Wareham Channel in the vicinity of the entrance to Rockley Channel (into Lychett Bay). This species is also farmed on leased beds.
- 9.1.39 Moore (1977) reported that *Mytilus edulis* was relatively tolerant of turbidity and siltation, thriving in areas that would be harmful to other suspension feeders. Mussels are not particularly selective feeders and are not dependent on favourable phytoplankton abundance and composition, happily feeding on detritus and dissolved organic matter. They also possess efficient shell cleaning and pseudofaeces expulsion mechanisms to remove silt (Moore, 1977). Mussels are also able to adjust their position and can thus move after disturbance or smothering.

### **Manila clam *Tapes philippinarum***

- 9.1.40 Another exotic species cultivated in the harbour is the Manila clam *Tapes philippinarum*. Initially, hatchery-reared seed stocks were cultivated under meshes on leased shellfish grounds. This species has, however, since become naturalized in the Harbour and a significant winter fishery now involves the harvesting of wild stocks inhabiting natural mudflats. Wild stocks are patchy within the harbour, with isolated areas of high biomass on the intertidal mudflats west of the upper south deep, on Holton Mere in the Upper Wareham Channel, on the tidal flats in the northern areas of the Harbour and within Holes Bay and Lytchet Bay.

### **Edible crab *Cancer pagarus***

- 9.1.41 This is a common and widely distributed species in the UK, found from the upper intertidal zone down to 100m. There is a relationship between size and distribution, with juveniles settling (during late summer/early autumn) and remaining in the intertidal zone until their carapace is about 6-7cm wide (3-4 years of age), then moving subtidally and being found with an average carapace width of 14cm below 25m water depth. Below this depth the average size increases with carapace width for males being around 18cm below 55m (Brown & Bennett, 1980). They are present inside the Harbour only in low numbers (Dyrynda, 1985).

### **Common European spider crab *Maja squinado***

- 9.1.42 *Maja squinado* is usually found on flat and sandy substrates and sometimes amongst rocks and seaweed. The spider crab has been found to be common in the Harbour entrance and into the lower South Deep, being confined to these areas due to intolerance of low salinities. Occurrence in the Harbour is a summer phenomenon, probably associated with moving inshore to breed (Dyrynda, 1985).

### **Lobster *Hommarus gammarus***

- 9.1.43 Lobsters live in rocky substrata, occupying holes and excavated tunnels from the low tide limit to around 60m. They leave these refuges at night to forage the seabed within the vicinity, normally returning to the same hideaway. They demonstrate a high level of loyalty to particular reefs but some may undergo short seasonal migrations of several kilometres. This has been found to occur through tagging experiments in Poole Bay (Jensen *et al*, 1992). Analysis of landings by ICES rectangle has suggested that populations in the local region (Dorset around the Isle of Wight) are some of the densest in the English Channel (Pawson, 1995)

### **Whelk *Buccinum undatum***

- 9.1.44 Populations of the whelk occur within the downstream sections of the Middle Ship Channel, within the Haven and out in the Swash Channel (Dyrynda, 1985). Larger populations are found to the east of Hook Sands.

**Figure 9.1 Seasonal ecology of fish species of commercial or conservation importance in the study area**

	Migration period
	Nursery period
	Spawning period

Species	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	
Sole													
Plaice													
Flounder													
Bass													
Thornback Ray (Roker)													
Whiting													
Salmon (smolts)													
Salmon (adult)													
Twaite Shad													
Lesser sandeel													
Grey Mullet													
European Eel (Adults)													
European Eel (Elvers)													

**Figure 9.2 Seasonal shellfish ecology of the study area**

 Spawning period

Species	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	
Cockles													
Manila clam													
Mussels													
Pacific oyster <sup>1</sup>													
European oyster													
Hard-shell clam													
Lobster													

<sup>1</sup> There is no significant natural spatfall for this species

## 9.2 POTENTIAL IMPACTS ASSOCIATED WITH THE APPROACH CHANNEL DEEPENING

9.2.1 The following sections assess the potential impact of the proposed capital dredging on the fish and shellfish resource of the study area. This assessment focuses on the resource that is targeted by commercial fishing activities; the potentials impacts from an infaunal and epibenthic community aspect are addressed in Section 6.2.

### Construction phase

*Potential impact on fish and shellfish due to direct uptake (entrainment) and disturbance during capital dredging*

### Impact on finfish

9.2.2 During the capital dredging there is the potential for fish and fish eggs to be directly taken up by the dredger. The potential effects on fish are injury or mortality. Fish at greatest risk are demersal species (i.e. those which live on the seabed) such as flatfish that burrow in sediments.

9.2.3 Many fish species migrate offshore during the winter period (i.e. the proposed dredging period) and are not found in significant numbers within the main channels. Adult and juvenile flounder may be found within the channel during the winter months. Although there would be some direct uptake of fish during dredging, fish tend to exhibit an avoidance reaction to dredging (and other sources of disturbance) thus greatly limiting their direct uptake.

9.2.4 The sandeel is another important species in the Harbour in that it forms a useful fishery from May to early October, particularly during periods of bad weather when conditions may be too severe for fishing outside the Harbour. This species is concentrated in the Soldier Bank area adjacent to the Middle Ship Channel and is also found in the Hook Sands area to the east of the Swash Channel. This species lives within the sandy sediment and, therefore, would be particularly vulnerable to the direct impacts of dredging. However, the main navigational channels do not form an important habitat for sandeels.

9.2.5 Overall, although there would inevitably be direct uptake of fish during dredging, the impact is expected to be of low magnitude due to the fact that fish that are present within the navigation channel will tend to move away from the source of disturbance. Furthermore, the channels do not support populations of fish species that are not widespread elsewhere within the Harbour and therefore no overall effects the population level are predicted for any fish species as a direct effect of the capital dredging. The impact on finfish is therefore predicted to be of **negligible significance** overall.

### Impact on shellfish

9.2.6 The potential impact of the capital dredging on the infaunal and epibenthic resource of the existing navigational channels is addressed in Section 6.2. There is no shellfishing activity targeted within the main navigational channels that are proposed to be deepened and as such there would be **no impact** as a result of the capital dredging.

*Mitigation and residual impact*

It is not possible to mitigate the direct impact of dredging on finfish and therefore the residual impact would be of **negligible significance**. There would be **no residual impact** on shellfisheries.

*Effect of the predicted change in tidal range on fish and shellfish populations*

- 9.2.7 The proposed capital dredge would affect the tidal propagation with the Harbour with the result that the level of low water would fall on spring tides thus converting existing shallow subtidal area into intertidal. For shellfish, the significance of this change would be similar to that described in Section 6.2 for the benthic community as a whole. In summary, the change does not have the potential to affect the structure of shellfish populations in the Harbour and as a result **no impact** is predicted.
- 9.2.8 Finfish feed over intertidal areas when they are covered by the tide and in subtidal areas at low water. The effect of the proposed dredging on tidal range would not have any effect on the ability of fish to feed throughout the tidal cycle and therefore **no impact** is predicted.

*Mitigation and residual impact*

No mitigation measures are required and there would be **no residual impact** on shellfish or finfish communities.

*Potential impacts on fish and shellfish populations due to increased suspended sediment concentrations (SSC) and sediment deposition*

- 9.2.9 As described in Sections 3.6, increases in peak SSC concentrations of the order of hundreds of mg/l above background are predicted in the north and west parts of the Harbour, with higher values in the immediate vicinity of the dredging operations. To the south of Brownsea Island and in eastern parts of the Harbour, peak concentration increases of the order of 20 to 100mg/l above background levels are predicted. The average concentration increases would be in the range of natural conditions but during the dredging of the siltiest material the capital dredging would result in increases in SSC above background within the Harbour for a period of about 2 to 3 months. The information presented in Section 4 indicates that the concentration of contaminants with the dredged sediments are not of concern with respect to the Shellfish Waters Directive.

**Impact on finfish**

- 9.2.10 The main potential effects of the proposed increase in SSC on adult fish, particularly in the immediate vicinity of the dredging activity, are the physiological effects resulting from the impingement of sediment particles on gill tissues resulting in reduced gill function. In addition, very high increases in SSC and resulting higher turbidity can result in reduced foraging and feeding ability due to a reduced visual range.
- 9.2.11 Due to the typically turbid nature of estuarine areas with extensive intertidal areas comprised of fine sediments, particularly during periods of wave action, the fish within estuaries and inlets are able to tolerate periods when SSC are elevated above

background levels, although the high increases that are predicted to occur within the immediate vicinity of the dredger are atypical and would not be experienced naturally.

- 9.2.12 As described above for the direct uptake of fish during dredging, fish exhibit avoidance reactions and move away from the immediate vicinity of the adverse conditions. The ability of fish to exhibit avoidance reactions varies between species, but generally adult fish can avoid adverse conditions more rapidly and effectively than larval and juvenile fish.
- 9.2.13 Of the fish species that are known to occur within the Harbour, salmonids (salmon and sea trout) are likely to be the most susceptible to increases in SSC above background. Salmonids are highly sensitive to water quality effects and upstream migration could be reduced if SSC were too high to permit movement past the area of dredging. However, salmonids in estuarine areas with natural turbidity are likely to have adapted physiologically to such conditions (Simenstad, 1988). One such adaptation that occurs as salmonids make their transition to estuarine waters include changes in visual acuity reflecting visual adaptation to the light environment of estuarine waters (Simenstad and Nightingale, 2001).
- 9.2.14 As important as the SSC in the water column is the area of the cross section of the migration route that is affected by the sediment plume arising from dredging. The highest SSC are in the vicinity of the dredger and would be along the streamline of the dredging activity (i.e. generally along the navigation channel). Elsewhere, further away from the dredger, concentrations are significantly lower (by an order of magnitude) and salmonid migration is unlikely to be affected by such concentrations. The overall cross section of the Harbour affected by very high SSC is therefore low and the dredging would not result in a sediment barrier to migration.
- 9.2.15 In addition to the above, salmonid migration does not occur during the winter months when the proposed capital dredging would take place (the Environment Agency has stated that migration occurs from the beginning of March to the end of August). As a result, it is concluded that there would be **no impact** on migrating salmonids as a result of elevated SSC generated by the capital dredging.

#### **Impact on shellfish**

- 9.2.16 The potential effects of increased SSC and deposition on the intertidal and subtidal benthic infaunal communities of Poole Harbour was discussed in Section 6.2. However, this section focuses on that part of the benthic community that is targeted on a commercial basis by fishermen.
- 9.2.17 Smothering of shellfish can result in reduced feeding ability and growth, restricted respiratory functioning and, in extreme cases, mortality. The extent to which smothering may affect these species will depend on the amount and rate of deposition, the duration for which species are smothered and the local hydrodynamic conditions. Although occurring during a time of reduced respiration and growth (over the winter period) the elevated SSC and deposition of fine sediment on intertidal areas has the potential to affect shellfish beds within Poole Harbour.
- 9.2.18 As shown on Figure 3.8, it can be seen that peak deposition of the order of 0.5 to 5mm is predicted over much of the intertidal areas within the Harbour, with some areas (in the

Wareham Channel area in west of the Harbour) predicted to accumulate up to 10mm of fine sediment. In the Wareham Channel area, sediment accumulation is not linear over the period of the dredging because, under neap tide conditions, there is no pathway for fine sediment to reach this area from the dredging operations. Under spring tides, however, sediment does disperse into this area and settles on the bed. Therefore, during spring tides there would be a gradual build up of sediment followed by a stable period (during neap tides) with no accumulation and then a further period of sediment accumulation on the following spring tide.

- 9.2.19 The ability of shellfish to tolerate sediment deposition is variable between species. Species less able to cope with increased suspended sediment loads and deposition include *Mya arenaria*, *Mercenaria mercenaria* and *Ostrea edulis*. *Ostrea edulis* cannot move itself and is therefore more vulnerable to smothering than other species that are mobile and can burrow up through deposited sediment.
- 9.2.20 As described above, the intertidal areas surrounding the Wareham Channel would experience the highest levels of sediment deposition as a result of the capital dredging. These areas, along with the intertidal areas in the south-west of the Harbour, are fished at high intensity for clams. The main area of high intensity cockle fishing is in Whitley Lake, where negligible deposition is predicted.
- 9.2.21 It is considered that the predicted amount of deposition over the intertidal areas within the Harbour is unlikely result in smothering of shellfish in any area to the extent that significant adverse effects on shellfish populations would arise. The depth of deposition predicted for the various areas of the Harbour is predicted to be well within the tolerance of shellfish species. It is predicted that most accumulation of fine sediment would be within the Wareham Channel area (as this location is more sheltered and accumulates fine sediment naturally) and, therefore, the species in this area are adapted to living in periodically turbid areas that experience erosion and accretion in response to waves and tidal action. It should also be noted that waves and currents would be expected to re-erode much of the material deposited on intertidal areas. Overall, the predicted impact is expected to be of **negligible significance** in terms of effect on shellfish populations.

*Mitigation and residual impact*

The dispersion of fine material during capital dredging and its subsequent deposition in intertidal areas is not possible to mitigate. The residual impact would be of **negligible significance**.

*Potential impact on fish and shellfish populations due to noise, vibration and light disturbance*

**Impact on finfish**

- 9.2.22 Fish detect and respond to sound utilising its cues to hunt for prey, avoid predators and for social interaction. However, the capital dredging would not generate significant vibration or require any lighting. The noise generated by a trailing suction hopper dredger has similar characteristics to other vessels operating within Poole Harbour on a daily basis. Given that the construction works are likely to require the presence of a single dredger

operating within the main navigation channel, the impact on fish population resulting from noise generated by dredging is predicted to be of **negligible significance**.

#### **Impact on shellfish**

- 9.2.23 Shellfish would be unaffected by noise generated by the capital dredging and therefore it is predicted that there would be **no impact** on shellfish populations.

#### *Mitigation measures and residual impact*

No mitigation measures are possible and the residual impact would be of **negligible significance** (finfish) and there would be **no residual impact** on shellfisheries.

#### **Operational phase**

##### *Potential impact of the loss of habitat due to changes in morphology of the Harbour*

- 9.2.24 As described in Section 3.7, the proposed channel dredging is predicted to enhance ebb dominance of the Harbour and therefore increase the net export of sediment from the Harbour. In addition, it is predicted that there would be an increase in deposition of 5,700m<sup>3</sup> of sediment per year in the Turning Basin. If it is assumed that this material is lost from the Harbour through maintenance dredging and offshore disposal then the total increase in loss of material from the Harbour as a result of the proposed works is predicted to be between 9,300 and 11,200m<sup>3</sup> of sediment per year. The net effect of this net export of sediment is to result in the loss of between 0.15 and 0.6ha of intertidal area per year from the Harbour.

#### **Impact on finfish**

- 9.2.25 Changes to the morphology of the Harbour (i.e. increase in export of sediment) have the potential to affect finfish through the potential effects on the benthic invertebrate community (i.e. the food resource for fish) and on overall area of feeding resource.

- 9.2.26 As described in Section 6.2, the effect of the predicted increase in the rate of intertidal erosion in the Harbour on the intertidal benthic community structure is predicted to be of negligible significance. In addition, although the predicted increase in intertidal erosion rate represents a marginal annual decrease in intertidal area, this decrease is predicted to be due to loss of saltmarsh with the area of intertidal mudflat remaining the same. Consequently, the net area of habitat available for feeding fish would remain unchanged given that fish feed both intertidally and subtidally and the biological communities at the intertidal/subtidal margin are of similar nature (i.e. infaunal communities in mud/sand). Therefore, it is predicted that the effect on finfish would also be of **negligible significance** as the nature of the food resource available for finfish is unlikely to be affected by the proposed channel dredging.

#### **Impact on shellfish**

- 9.2.27 Shellfish, particularly less mobile species such as mussels and oysters, would be more sensitive to an increase in intertidal erosion rate compared with many components of the benthic community as they are less able to respond to changes in the level of intertidal

area through burrowing. It is, however, predicted that rate of loss that is predicted to arise as a result of the proposed channel deepening is of such a low magnitude (fractions of a millimetre per year) compared with the existing erosion rate that population effect on shellfish over the reasonably foreseeable future would not arise. The impact on shellfish populations is therefore expected to be of negligible significance.

- 9.2.28 As summarised in Section 3.7 there would not be significant changes to the speed of tidal currents across intertidal areas, with minor decreases in current speeds in the vicinity of the Middle Ship Channel while the entrance to the Harbour would experience small increases in current speeds. These areas are previously impacted as a result of maintenance dredging and are not important areas in terms of shellfish resources. Overall the impacts resulting from changes in the morphology of the harbour are considered of **negligible significance**.

*Mitigation and residual impact*

In mitigation of the predicted morphological effects in Poole Harbour, it is proposed that the maintenance dredging strategy is changed following the approach channel deepening, as described in Section 3.10. In summary, it is proposed that agitation dredging methods are used in the Turning Basin to retain fine material in the Harbour system. As a consequence of the proposed maintenance dredging strategy, the net effect of the proposed channel dredging would be to increase the rate of loss of intertidal area (i.e. saltmarsh habitat) by about 0.11 and 0.34ha per year.

The residual impact would be of **negligible significance** for finfish and shellfish.

*Potential effect of the proposed maintenance dredging strategy on the shellfish resource*

- 9.2.29 The proposed agitation dredging in the Turning Basin would result in the release of about 10,000 dry tonnes of sediment into the Harbour annually. This material would disperse in a similar manner to that predicted for the fine material dispersed during capital dredging. However, the potential impact in terms of deposition onto intertidal areas is predicted to be about 10% of that predicted for the capital dredging, with no deposition predicted in intertidal areas to the south of Brownsea Island. Therefore, deposition of a fraction of a millimetre is predicted to arise from agitation dredging and **no impact** is predicted of shellfish populations as a result.

*Mitigation and residual impact*

No mitigation measures are required and there would be **no residual impact**.

*Potential effect on food resources within the dredged channels*

- 9.2.30 The capital dredging would have the effect of removing a potential source of food for fish within the footprint of the dredge, but such losses would be localised to the dredge area and of a temporary nature and affect a small percentage of the overall potential feeding area for fish in Poole Harbour. Although the seabed within the proposed dredge area

would be largely devoid of fauna immediately following the capital dredging, it is predicted that the nature of the seabed in terms of the sediment type exposed at the surface would be similar following the capital present as it is at present. Therefore, during the operational phase, the nature of benthic communities that would colonise the seabed would be expected to be similar to that currently occurring with the dredged channels, particularly given that the disturbance caused by maintenance dredging would be the same as at present. There would, however, be a marginally greater area of seabed affected by dredging (about 9ha) given the proposed widening of the Middle Ship Channel to the north.

- 9.2.31 Given that the above, the overall potential impact is considered to be of **negligible significance**.

*Mitigation and residual impact*

No mitigation measures are possible and the residual impact would be of **negligible significance**.

### 9.3 POTENTIAL IMPACTS ASSOCIATED WITH THE OFFSHORE DISPOSAL OF DREDGED MATERIAL

#### Construction phase

*Direct impact on finfish and shellfish populations due to smothering*

#### Impact on finfish

- 9.3.1 The deposition of fine material at the offshore disposal ground has the potential to effect finfish that utilise the seabed such as rays, sole and flounder. The material to be disposed of at the offshore disposal ground is dispersive material (with the exception of a small quantity of gravel that is mixed with the sand and silts), but on release from the dredger it would fall through the water column as a dynamic plume and impact on the seabed below the disposal vessel.

- 9.3.2 Many adult fish are likely to be able to avoid deposited sediment although it is likely that some fish may be impacted, particularly young fish which are less capable of escape. Overall, the disposal of dredged material would impact on a very localised area of seabed and when combined with the fact that a relatively small number of individuals would be expected to be impacted the overall impact is considered to be of **negligible significance**.

#### Impact on shellfish

- 9.3.3 No significant populations of shellfish exist within the disposal ground and no targeted harvesting of shellfish occurs in this area. Therefore, it is predicted that there would be **no impact** on shellfish populations as a result of the disposal of dredged material. The overall effect on the benthic community as a whole is assessed in Section 6.3.

*Mitigation and residual impact*

The disposal operations would be confined to a targeted area of seabed (within the south-east quadrant of the disposal ground) in order to minimise the overall area of seabed affected by disposal. No further mitigation measures are possible and the residual impact would be of **negligible significance** (finfish) and there would be **no impact** on shellfish populations.

*Potential impact on finfish and shellfish due to the increased suspended sediment concentrations (SSC) in the vicinity of the disposal ground and deposition of fine sediment*

9.3.4 The elevated levels of SSC that are predicted to occur at the disposal ground during disposal would be expected to result in the redistribution of fish. This effect is likely to occur only on the streamline of disposal where the greatest increases in SSC are predicted, with concentrations elsewhere within Poole Bay being lower and unlikely to be of concern. Consultation with local fishermen revealed that experience from previous disposal operations would suggest that catches can be improved as fish are attracted to the food source released from the dredged material on disposal. This suggests that SSC beyond the immediate vicinity of the disposal ground are unlikely to be intolerable to finfish.

9.3.5 The deposition of fine sediment on particular communities of conservation interest and elsewhere within Poole Harbour is described in Section 6.3. No significant impacts are predicted on these communities. Given that such communities (e.g. *Sabellaria spinulosa* reefs) are important habitats for fish and also the fact that the subtidal resource represents a feeding resource for fish, the impact on fish populations is expected to be of **negligible significance** at worse. Shellfish form part of the subtidal community as a whole and, therefore, the impact significance would be similar to that described in Section 6.3 for the community of Poole Bay as a whole (i.e. **negligible significance**).

*Mitigation and residual impact*

The location of the offshore disposal of dredged material has been optimised to limit the potential for accumulation of fine sediment on sensitive habitats. It is considered that there are no further practicable mitigation measures that can be implemented and the residual impact on fish and shellfish would be of **negligible significance**.

## Operational phase

### *Potential impact of the disposal of maintenance dredgings on finfish and shellfish communities*

- 9.3.6 The proposed regime for maintenance dredging (and associated disposal) is described in Section 3.10. In short, the volume of material deposited at the offshore disposal ground would be reduced compared with the existing situation given the proposals for agitation dredging in the Turning Basin which would retain fine material in the Harbour. As such, the effect of the disposal of maintenance dredgings would be of lower significance to that which currently occurs and, therefore, **no additional impact** is predicted.

#### *Mitigation and residual impact*

No mitigation measures are required and there would be **no additional residual impact**.

## 9.4 POTENTIAL IMPACTS ASSOCIATED WITH BEACH NOURISHMENT

### Construction phase

#### *Potential smothering of areas of importance for shellfish and finfish populations*

- 9.4.1 The proposed beach nourishment areas are recreational beaches and are not important habitats for finfish or shellfish. As a result, the proposed beach nourishment schemes would have **no impact** on shellfish or finfish populations. The potential impact on the benthic communities of the beach nourishment areas generally is described in Section 6.4.

#### *Mitigation and residual impact*

No mitigation measures are required and there would be **no residual impact**.

#### *Potential impact on fish and shellfish populations due to increased suspended sediment concentration (SSC) and sediment deposition*

- 9.4.2 Although the beach nourishment material would comprise sand, there is the potential for an increase in the SSC due to the outwash of fine material from the nourishment sites and the subsequent deposition of this fine material on the seabed. There is no concern with respect to contaminant concentrations within the material to be utilised for beach nourishment (see Section 4).
- 9.4.3 The effect of the outwash of fine material on biological communities is described in Section 6.4 which concludes that an impact of negligible significance would arise. As a result, the food resource of finfish would not be significantly affected and there would be **no impact** on finfish populations as a result of deposition of fine material from the beach nourishment schemes. The deposition of fine sediment on shellfish would have a similar

effect to that described on the biological community as a whole and is also expected to be of **negligible significance**.

*Mitigation and residual impact*

No mitigation measures are possible and the residual impact would be of **negligible significance** (shellfish) and there would be **no residual impact** on finfish.

**Operational phase**

*Potential environmental impacts associated with beach renourishment*

- 9.4.4 During the operational phase, it is recognised that there is the potential for using appropriate material that arises from the maintenance dredging of the approach channel in a beneficial manner for beach renourishment within Poole Bay. The potential environmental impacts of such renourishment are dependant on the location where it is considered that nourishment is required, the volume of material that is placed on the beach and the nature of the material.
- 9.4.5 Given that there is no scheme for renourishment at present, this is outside the scope of this EIA which focuses on the potential impacts of the initial nourishment scheme. The potential environmental impacts associated with any renourishment scheme that may be required would need to be taken into account during the application for the Food and Environment Protection Act and Coast Protection Act consents that would be required.