

## 7 FLORA AND FAUNA

### 7.1 Introduction

Following submission of the 2001 Offshore EIS, a number of field surveys have taken place in and around Broadhaven Bay and along the offshore pipeline route to the Corrib Field. The following sections provide a summary of the additional information that has been gathered which directly relates to the offshore pipeline route. A re-assessment of the potential impacts of the installation and operation of the export pipeline and the umbilical is provided.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

### 7.2 Study Methodology

#### 7.2.1 Study Methods

New information has been collected for a number of different ecological receptors within the potential footprint of the project. Sources of the information include both surveys specifically commissioned by SEPIL and those carried out by other organisations.

##### 7.2.1.1 Benthos

- 2000 – baseline surveys of Corrib Field and pipeline route (for 2001 Offshore EIS purposes);
- 2002 – pre-construction survey in Broadhaven Bay (to establish baseline for planned pipeline installation in 2002);
- 2005 – pre-construction survey (intertidal) in Broadhaven Bay (and Sruwaddacon Bay) (to establish baseline for planned pipeline works in 2005);
- 2005 – baseline survey around permitted outfall location off Erris Head (to begin development of baseline data set);
- 2007 – repeat of 2000 survey along pipeline route, to update baseline information (to support Offshore EIS Supplementary Update Report);
- 2007 – additional baseline survey around permitted outfall location off Erris Head (providing baseline information against which any future impacts from proposed discharge could be measured);
- 2008 – pre-construction survey of subtidal and intertidal (landfall) sediments in Broadhaven Bay (repeat of 2002 survey, to establish baseline for planned pipeline installation in 2008);
- 2008 – post-drilling survey in and around the Corrib Field;
- 2008 – additional baseline survey off Erris Head to comply with requirements of IPPC licence, further establishing baseline against which any future impacts could be measured; and
- 2009 – post construction monitoring programme of subtidal and intertidal (landfall) sediments in Broadhaven Bay commenced. Whilst these results are not yet available, they will be reported in due course.

##### 7.2.1.2 Fisheries and aquaculture

- Survey data from the Central and North Western Regional Fisheries Board, and Marine Institute, Galway;

- Fish landings data from the Sea Fisheries Protection Authority; and
- Aquaculture site information from Aquaculture licensing team, DCENR.

### 7.2.1.3 Seabirds

- A desktop literature review was commissioned to view and update information regarding seabird diversity and abundance along the proposed pipeline route.

### 7.2.1.4 Marine Mammals

- Monitoring data from Broadhaven Bay surveys carried out by CMRC in 2001–2002, Summer 2005, Summer/Autumn 2008 and onwards;
- Sightings and strandings data from the Irish Whale and Dolphin Group;
- Marine mammal observer (MMO) data from Sruwaddacon geophysical survey, 2007;
- Data from offshore surveys reported in the literature (in Ó Cadhla *et al.*, 2004; Wall, 2004; Wall, 2008); and
- MMO data from 2008 and 2009 (MMOs monitoring during construction work in Broadhaven Bay).

This assessment also draws on the results of the landfall vegetation surveys 2008; overwintering bird survey 2007/2008; preliminary results from the Brent Goose surveys at the start of 2008/2009; Sand Martin monitoring during the 2008 breeding season; and the land based otter surveys in 2010.

## 7.3 Receiving Environment

### 7.3.1 Benthic Surveys

A number of surveys have been undertaken along the route of the offshore pipeline since 2001 to improve the knowledge of the environment into which the pipeline was laid. These include: 1) a series of transects across the subtidal pipeline route through Broadhaven Bay in 2002, 2008 and 2009; 2) intertidal sampling at the landfall in 2005, 2008 and 2009) a benthic survey along the proposed pipeline route in July/August 2007 from the R/V *Prince Madog*. Sampling was also undertaken around the treated surface water run-off outfall diffuser location during the 2007 survey. In addition, SEPIL commissioned a benthic survey in the Corrib offshore field and around the permitted outfall location off Erris Head in July/August 2008 from the M/V *Deepworker*.

#### 7.3.1.1 Offshore

The benthic surveys in 2007 and 2008 comprised sediment sampling by grab sampler, and photographic surveying of the seabed. In 2007, twelve locations of varying depth were identified for both sediment sampling and photography along the offshore pipeline route; these are presented in Figure 7-1. In 2008, a total of twenty nine locations were visited in the Corrib offshore field for sediment sampling and photography; these are presented in Figure 7-2.

Sampling was carried out primarily using a double van-veen grab of 0.2m<sup>2</sup> (2x0.1m<sup>2</sup>) where the seabed sediment was suitable, although a 0.1m<sup>2</sup> Day grab was used where sediments were coarser. At each station, attempts were made to collect four replicate samples; three were retained for macrofaunal analysis while the fourth was used for physico-chemical analysis (results for physico-chemistry are discussed in Section 8).

All macrofaunal samples were sieved over a 0.5mm mesh; all organisms were identified to the lowest possible taxon, enumerated and subject to standard statistical analysis.

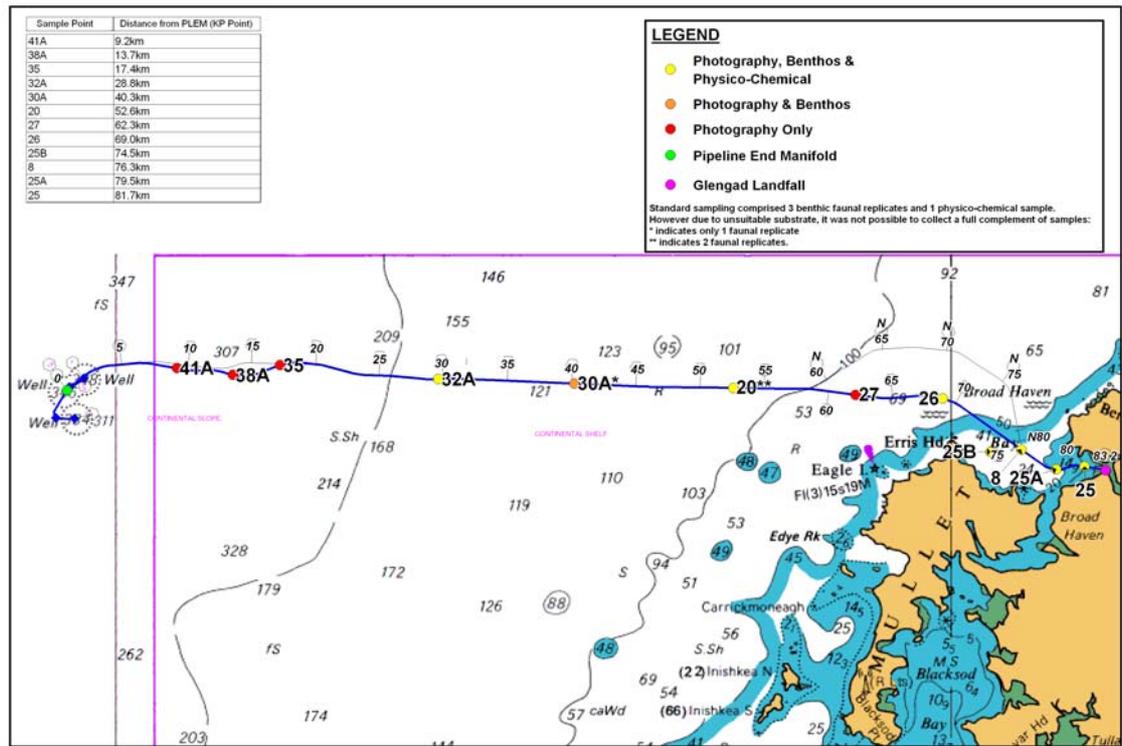
In 2007 seabed photography was performed at 12 stations along the offshore pipeline route using a combination of vertical and sediment profile imagery (SPI) cameras on a

frame. In 2008 seabed photography was performed at 18 stations at the Corrib offshore field. Surface images were used to document general sediment type and bioturbation, to record epifaunal species not easily sampled using the grab, and to screen for any protected habitats (e.g. biogenic reefs). Cross-sectional SPI photographs show a vertical profile of the sediment, recorded by equipment that penetrates a few inches below the sediment surface.

**Benthic infauna**

**Offshore Pipeline Route**

Univariate indices of diversity and abundance, and percentages of constituent phyla for each station (replicates pooled) for the 2007 survey along the offshore pipeline route are presented in Table 7-1. The full benthic infauna report can be found in Appendix 7-1.



**Figure 7-1: Location of Summer 2007 Benthic and Photographic Sampling Points along the Proposed Pipeline Route (RV Prince Madog).**

**Table 7-1: Univariate Indices for Sample Sites on the Proposed Offshore Pipeline Route (2007)**

| Station | Depth (m) | Diversity |      |      |      |           | % of each phyla* |        |          |         |       |
|---------|-----------|-----------|------|------|------|-----------|------------------|--------|----------|---------|-------|
|         |           | S         | N    | J'   | H'   | $\lambda$ | Annelida         | Crust. | Mollusca | Echino. | Other |
| 25      | 13        | 44        | 257  | 0.57 | 2.16 | 0.18      | 34.29            | 62.99  | 0.65     | 1.30    | 0.78  |
| 25a     | 26        | 61        | 545  | 0.50 | 2.05 | 0.33      | 10.27            | 84.60  | 1.83     | 1.90    | 1.41  |
| 8       | 41        | 84        | 396  | 0.75 | 3.32 | 0.06      | 32.18            | 29.65  | 14.91    | 4.97    | 18.28 |
| 25b     | 43        | 84        | 314  | 0.80 | 3.53 | 0.05      | 33.62            | 33.83  | 13.68    | 8.06    | 10.82 |
| 26      | 78        | 103       | 703  | 0.61 | 2.82 | 0.16      | 53.11            | 4.74   | 2.70     | 2.70    | 36.75 |
| 20      | 115       | 83        | 204  | 0.86 | 3.78 | 0.04      | 64.95            | 21.32  | 4.66     | 3.92    | 5.15  |
| 30a     | 142       | 31        | 28   | 0.92 | 2.56 | 0.06      | 19.35            | 9.68   | 16.13    | 3.23    | 51.61 |
| 32      | 173       | 148       | 1732 | 0.31 | 1.55 | 0.58      | 91.09            | 3.21   | 1.31     | 2.46    | 1.92  |

S = Number of species (including encrusting species); N = Number of individuals; J' = Pielou's Evenness

H' = Shannon-Weiner Diversity ( $\log_e$ );  $\lambda$  = Simpson's Dominance index

\*Abundances were used to calculate the percentage of each phyla at each site except for site 30a, where species numbers were used (as epifaunal species dominated the sample at this site).

The data indicate that annelid worms or crustaceans generally dominate the communities at the sampling sites along the offshore pipeline route. Site 30a was an exception in that bryozoans (an encrusting epifaunal group, found on the coarser seabed substrates at this site) were a dominant component of the community.

Most organisms recorded were characteristic of sandy environments. Common to these environments and recorded throughout the data set were the polychaetes *Chaetozone christiei* and taxa from the family Spionidae, particularly the genus *Spiophanes*, crustaceans from the order Cumacea, particularly *Pseudocuma longicornis* and *Bodotria sp.* and the amphipods *Bathyporeia sp.* and *Siphonocetes sp.* Echinoidea (sea urchins) were also present at all sites except 30a.

Diversity along the route was typically moderate to high at all sites; it was relatively low at site 32a due to the high numerical dominance of the polychaete *Galathowenia oculata*. However, dominance by a single or small group of species was low throughout the rest of the data set, indicating established communities.

### **Offshore Gas Field**

Table 7-2 shows univariate indices of diversity and abundance, and percentage for constituent phyla at each station (replicates pooled) for those stations in the offshore field sampled during the 2008 offshore survey from the M/V *Deepworker*. The full survey report is presented as Appendix 7-2.

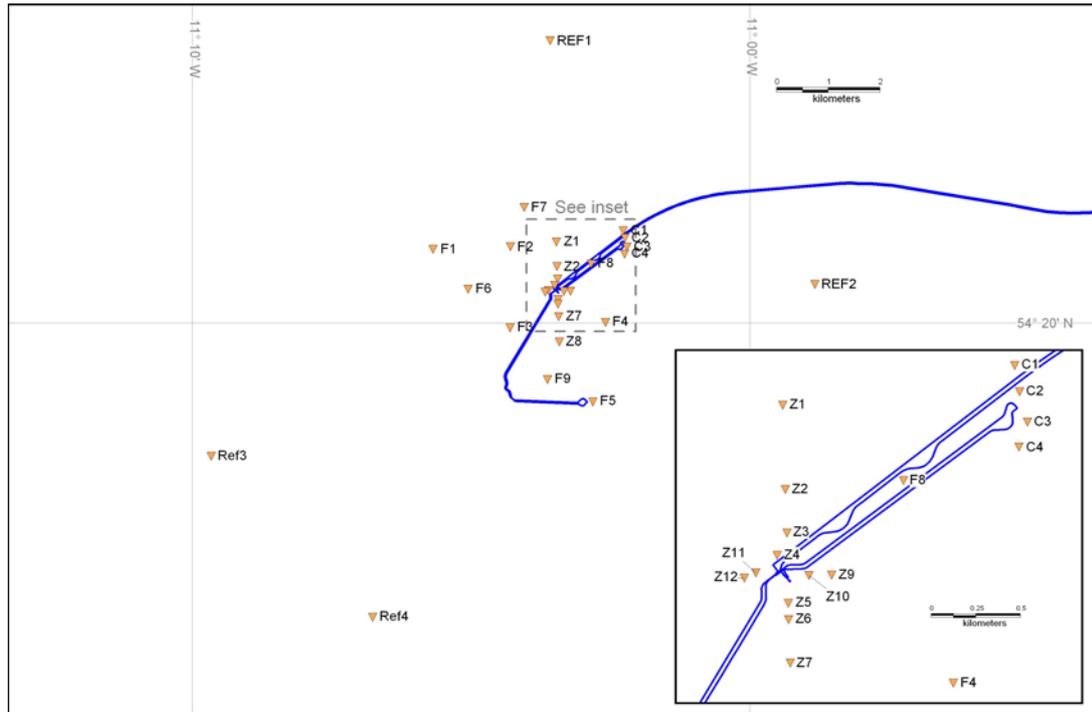


Figure 7-2: Location of Summer 2008 Benthic and Photographic Sampling Points in the Corrib Offshore Gas Field (MV Deepworker).

Table 7-2: Univariate Indices for Sample Sites in the Corrib Offshore Gas Field (2008)

| Station | Diversity |     |      |      |      | % of each phyla* |        |          |         |       |
|---------|-----------|-----|------|------|------|------------------|--------|----------|---------|-------|
|         | S         | N   | J'   | H'   | Λ    | Annelida         | Crust. | Mollusca | Echino. | Other |
| C1      | 82        | 270 | 0.64 | 2.83 | 0.20 | 76.89            | 3.09   | 13.10    | 4.08    | 2.84  |
| C2      | 104       | 284 | 0.74 | 3.44 | 0.10 | 70.81            | 3.87   | 17.94    | 2.58    | 4.81  |
| C3      | 104       | 267 | 0.57 | 2.67 | 0.27 | 81.90            | 4.99   | 7.24     | 2.87    | 3.00  |
| C4      | 76        | 195 | 0.60 | 2.60 | 0.26 | 71.75            | 4.97   | 15.41    | 6.16    | 1.71  |
| F1      | 95        | 308 | 0.59 | 2.71 | 0.24 | 82.14            | 2.71   | 9.96     | 1.62    | 3.57  |
| F2      | 92        | 319 | 0.52 | 2.33 | 0.34 | 83.80            | 3.55   | 8.36     | 3.03    | 1.25  |
| F3      | 84        | 256 | 0.51 | 2.26 | 0.36 | 79.56            | 3.52   | 9.77     | 4.95    | 2.21  |
| F4      | 82        | 255 | 0.52 | 2.28 | 0.33 | 71.99            | 3.66   | 18.46    | 4.58    | 1.31  |
| F5      | 94        | 331 | 0.54 | 2.46 | 0.29 | 75.75            | 3.22   | 15.79    | 3.12    | 2.11  |
| F6      | 55        | 150 | 0.50 | 2.01 | 0.38 | 70.95            | 8.43   | 14.86    | 5.10    | 0.67  |
| F7      | 69        | 259 | 0.47 | 1.98 | 0.41 | 81.85            | 5.92   | 4.25     | 6.69    | 1.29  |
| F8      | 83        | 298 | 0.48 | 2.11 | 0.39 | 80.76            | 2.46   | 9.17     | 5.48    | 2.13  |
| F9      | 74        | 213 | 0.54 | 2.33 | 0.32 | 76.84            | 4.07   | 12.68    | 3.60    | 2.82  |
| Z1      | 89        | 239 | 0.61 | 2.73 | 0.24 | 82.73            | 2.79   | 8.64     | 3.20    | 2.65  |
| Z2      | 77        | 193 | 0.57 | 2.46 | 0.30 | 82.56            | 5.01   | 6.22     | 5.01    | 1.21  |
| Z3      | 89        | 229 | 0.57 | 2.54 | 0.29 | 75.58            | 4.07   | 14.24    | 4.07    | 2.03  |
| Z4      | 60        | 162 | 0.54 | 2.22 | 0.33 | 75.51            | 2.06   | 16.26    | 5.56    | 0.62  |
| Z5      | 100       | 240 | 0.69 | 3.17 | 0.15 | 73.57            | 2.50   | 14.88    | 6.95    | 2.09  |
| Z6      | 90        | 239 | 0.54 | 2.42 | 0.31 | 75.31            | 3.35   | 16.60    | 3.77    | 0.98  |
| Z7      | 85        | 390 | 0.42 | 1.86 | 0.45 | 83.49            | 1.63   | 10.86    | 2.91    | 1.11  |
| Z8      | 79        | 212 | 0.57 | 2.48 | 0.29 | 74.73            | 5.34   | 12.72    | 5.34    | 1.88  |
| Z9      | 72        | 274 | 0.55 | 2.34 | 0.30 | 76.64            | 5.60   | 13.75    | 2.55    | 1.46  |

| Station | Diversity |     |      |      |           | % of each phyla* |        |          |         |       |
|---------|-----------|-----|------|------|-----------|------------------|--------|----------|---------|-------|
|         | S         | N   | J'   | H'   | $\Lambda$ | Annelida         | Crust. | Mollusca | Echino. | Other |
| Z10     | 70        | 167 | 0.65 | 2.76 | 0.21      | 69.20            | 2.80   | 18.40    | 7.00    | 2.60  |
| Z11     | 78        | 300 | 0.43 | 1.89 | 0.45      | 78.22            | 4.78   | 11.11    | 5.22    | 0.67  |
| Z12     | 84        | 209 | 0.59 | 2.62 | 0.25      | 74.16            | 2.87   | 15.47    | 5.58    | 1.91  |
| REF1    | 86        | 174 | 0.63 | 2.83 | 0.22      | 68.71            | 8.45   | 11.71    | 8.06    | 3.07  |
| REF2    | 75        | 180 | 0.56 | 2.43 | 0.30      | 81.15            | 6.65   | 6.10     | 4.25    | 1.85  |
| REF3    | 78        | 225 | 0.58 | 2.52 | 0.27      | 83.14            | 6.36   | 6.66     | 2.81    | 1.04  |
| REF4    | 86        | 276 | 0.53 | 2.34 | 0.32      | 84.76            | 3.26   | 8.95     | 1.81    | 1.21  |

S = Number of species (including encrusting species); N = Number of individuals; J' = Pielou's Evenness

H' = Shannon-Weiner Diversity ( $\log_e$ );  $\Lambda$  = Simpson's Dominance index

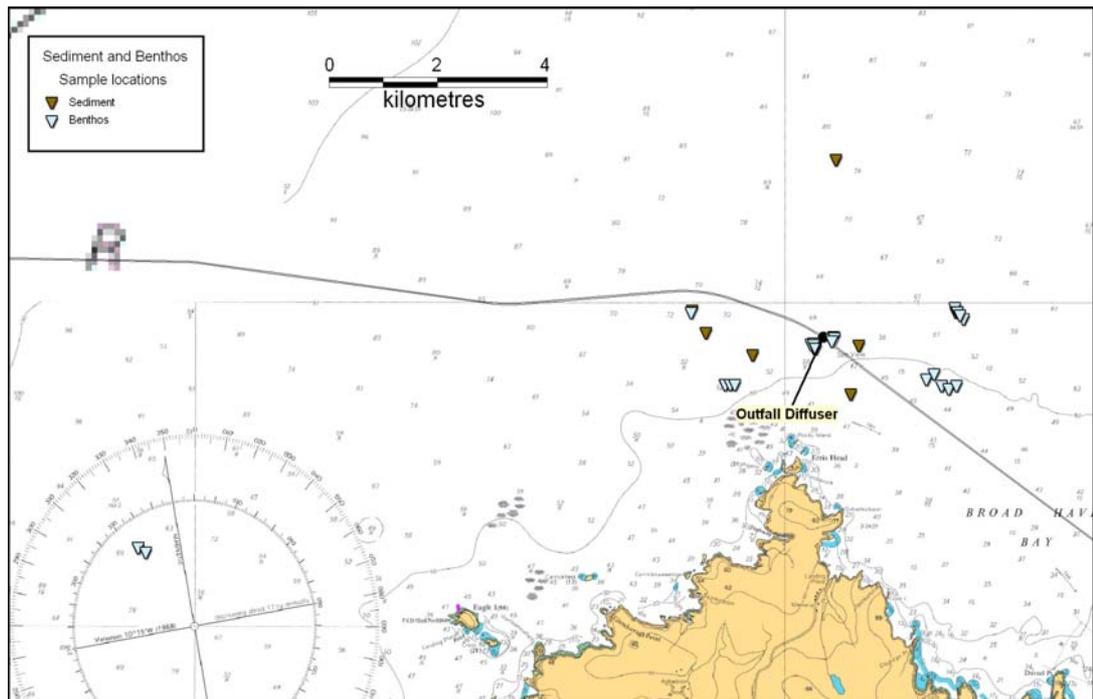
Within site variability was found to be low at all of the sites, replicates of each site having 40% or more similarity with each other. However, there was also a high degree of similarity throughout the whole sampling area such that similarities between replicates from different sites were also high.

The faunal communities observed in the 2008 survey showed a high degree of homogeneity and were typical of those found in muddy sand sediment sampled from the continental slope. They had moderate to high diversity and were dominated by the tube-dwelling polychaete *Galathowenia oculata*, which at all but seven of the sites made up at least 50% of the animals present.

Also common to communities in the survey area were spionid, terebellid and sabellid polychaetes, amphipod and isopod crustacea, opisthobranch molluscs, bivalves and juvenile echinoderms.

#### **Treated Surface Water Outfall Location**

In 2007, in addition to the survey completed specifically to sample the pipeline route, a benthic survey of the area around the permitted outfall location off Erris Head was also performed from the R/V *Prince Madog* using the same grab sampling methods (photography was not performed). This area (Figure 7-3), encompassing stations varying between 48m and 90m water depth, is effectively the border between the "nearshore" and "offshore" environments. Details of this survey are reported fully in Appendix 7-3 and summarised below.



**Figure 7-3: Location of Summer 2007 Benthic Sampling Points at the Corrib treated surface water outfall location off Erris Head (R/V *Prince Madog*).**

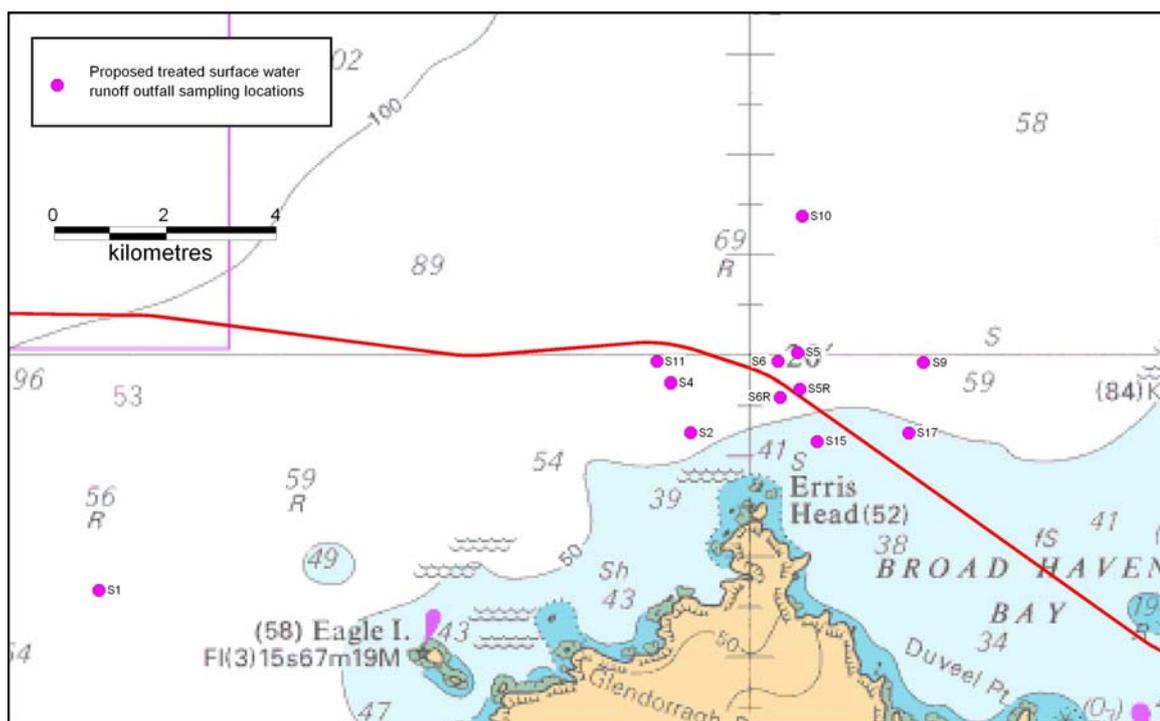
Fauna communities recorded were of moderate to high diversity, and mostly displayed low dominance, although there were some stations where a single species dominated. Polychaete worms, molluscs and crustaceans were all key groups, with nematode and nemertean worms also important in some places.

While there were some noticeable differences in communities, there was also a relatively high degree of similarity over the sampling area, indicating a reasonably homogenous environment. Within-site variability between replicate samples was generally low.

Throughout the outfall sampling area, communities were found to be typical of subtidal sands, ranging from species generally found in stable, fine sand to those found in more exposed coarse sand with gravel, and are generally similar to those recorded from the area in the 2000 survey.

Seabed sampling was also undertaken at the permitted outfall location off Erris Head in 2008 as part of the M/V *Deepworker* survey programme. A total of 12 stations were sampled around the outfall location, and a number of stations were also sampled to cover a wider area in the vicinity of the outfall.

Figure 7-4 shows the 12 locations in the vicinity of Erris Head where benthic sampling took place during the summer 2008 M/V *Deepworker* survey programme. The full report from the 2008 survey at the Erris Head outfall is presented as Appendix 7-4.



**Figure 7-4: Location of Summer 2008 Benthic Sampling Points at the Corrib treated surface water outfall location off Erris Head (M/V *Deepworker*). Sample locations are the same as the 2007 R/V *Prince Madog* summer programme.**

## Photography

### ***Offshore Pipeline Route***

Examples of seabed surface photography (from 2007) at representative shallow and deep stations on the proposed offshore pipeline route are presented in Figure 7-5. The full SPI and surface sediment photographic survey report can be found in Appendix 7-1.



**Figure 7-5: Examples of Surface Seabed Photography along the Proposed Pipeline Route, Summer 2007 (Left: rippled sand in Broadhaven Bay at station 25a in 26m water depth; Right: Sediment showing evidence of bioturbation at station 41 (329m), approaching the offshore gas field).**

Overall, the photographic surveys found that all pipeline stations surveyed showed evidence of healthy conditions based on the presence of a characteristically deep oxidised layer, fauna and prominent biogenic features such as burrows, tubes and feeding casts. No evidence of impact or habitat quality degradation was recorded; and no sensitive or Annex 1 habitats were found.

#### **Offshore Gas Field**

Examples of seabed surface photography at stations in the offshore gas field (from 2008) are presented in Figure 7-6. The full SPI report is included in Appendix 7-2.



**Figure 7-6: Examples of Surface Seabed Photography from the offshore field (Summer 2008) (Left: Intensive reworking of sediments by fauna at Corrib Field Reference Station 4. Also shown are anemones, mounds and decapod burrows. An anemone (*Actinuaige richardi*) can be seen on the surface; Right: The typical sediment habitat at the central areas of the Corrib offshore field (Station Z1). Sediments here show intensive reworking by benthic fauna. An urchin can be seen on the sediment surface.).**

All offshore field stations surveyed were characterised by the presence of very fine sands and showed evidence of faunal activity. Biological features observed across the site are broadly similar, with the majority of stations showing intensive reworking of sediments by infauna; sediments were observed to have been fluidised to a degree,

through the activities of burrowing fauna (bioturbation). This biological activity has resulted in an apparent oxidised layer that is characteristically quite deep.

The photographic survey results from 2007 and 2008 were in general accord with those obtained along the pipeline route and in the offshore gas field in 2000.

### 7.3.1.2 Nearshore

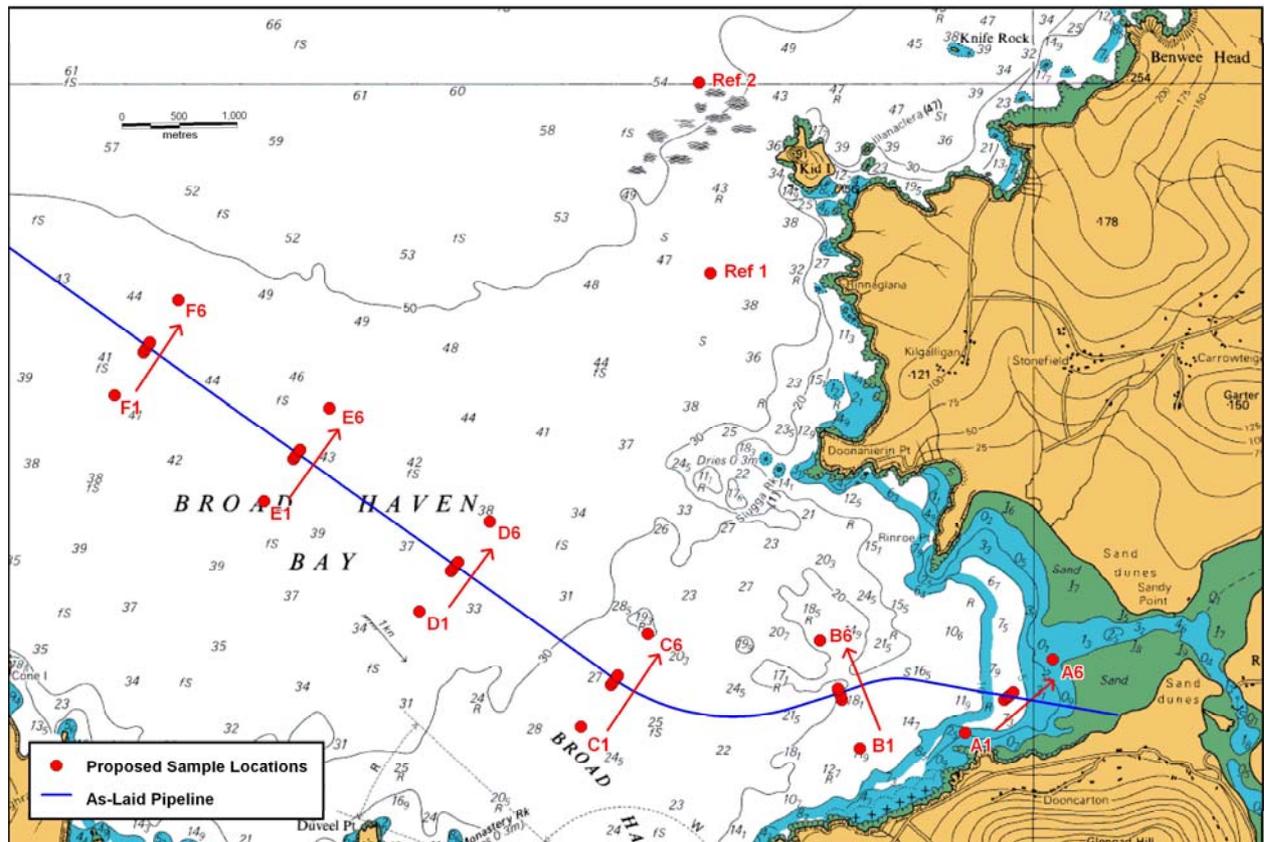
In accordance with the construction monitoring programme agreed for the Corrib pipeline, sediments were sampled in Broadhaven Bay in the following surveys:

- 2002 (by EcoServe), intended as a pre-construction survey to installation works that were subsequently delayed;
- Summer 2008 (by RSK), immediately prior to the scheduled installation of the offshore pipeline (subsequently delayed),

In all surveys, sediment was sampled along six transects (A–F), which were positioned across the route of the pipeline through Broadhaven Bay. There were six stations on each transect at 10m, 50m and 500m either side of the route. In addition to the 36 stations on the 6 transects, 2 further stations were sampled as reference stations (it should be noted that the location of these reference stations were changed in 2008 due to sampling difficulties).

Samples were collected from each station for analysis of benthic infauna, grain size and total organic carbon. Seabed photography was also undertaken using an ROV (2002) or by analysing still captured images from a drop-down video camera system (2008).

Figure 7-7 shows the sampling locations along transects across the nearshore pipeline route for the 2008 RSK survey.



**Figure 7-7: Locations of planned sampling stations in Broadhaven Bay during the 2008 RSK survey.**

The reports of the 2002 and 2008 nearshore surveys are provided as Appendices 7-5 and 7-6 to this Supplementary Report respectively.

### **Infauna**

The following briefly summarises the results of the 2002 Ecoserve nearshore pipeline survey:

Grab samples were taken from each station identified from the video to consist of relatively soft sediments. A total of 79 species or higher taxa were identified from the grab sampling, including annelids, crustaceans, molluscs, echinoderms, anthozoans, platyhelminthes, nemertean, and a sipunculid

The number of taxa appears to increase with distance from the shore (Appendix 7-5) reaching a peak at Transects D and E, with a slight decrease at Transect F.

The number of taxa at station Ref 1 is comparable to stations along transects D and E. Broadhaven Bay is uniformly sandy and this is reflected in the faunal taxa recorded in the grab samples. None of the species identified are of specific nature conservation importance and are widespread in Ireland (Picton and Costello, 1999).

The overall species abundance and diversity reflect the nature of the bay, being unimpacted and of moderate wave exposure, with a predominantly sandy seabed, with bedrock and boulders at the margins. In addition the species recorded are consistent with the findings of the benthic sampling along the offshore pipeline route carried out in 2000 and reported in the 2001 Offshore EIS.

The benthic macrofaunal communities observed during the 2008 survey were of moderate to high diversity and generally exhibited high evenness and low dominance. These communities showed a high degree of homogeneity and species were typical of those found in sandy sediments, with high contributions to community composition from spionid polychaetes, the amphipods (*Bathyporeia* sp.) and cumaceans.

The community at site A1 proved to be the exception as the species found here were more typical of a shallow water, coarse sediment, encrusting community in the presence of significant macroalgal growth. Such species included the amphipod *Jassa falcata* and a number of colonial encrusting organisms.

It was observed that with increasing depth there was an increasing diversity and abundance of echinoids and *Abra* bivalves, with the highest diversity and number of these species found at transect F sites and the lowest at A sites (except A1).

Although not designed to sample invertebrates, further information on the epifauna within Broadhaven Bay is available from the Irish Groundfish trawl survey (station 25) in October 2009. In addition to fish species hermit crabs (Paguridae) and asteroid seastars (*Asterias rubens*, *Marthasterias glacialis*, *Astropecten irregularis*) were amongst the invertebrates recorded.

### **Photography**

The 2002 results showed that rock habitats varied from sand influenced infralittoral bedrock and boulders at the shallower stations (A1, B1, B5, B6 and C6) to deep circalittoral bedrock at Ref 2. Shallower stations supported kelp with a sparse understory of red algae; however, it was observed that at deeper stations that greater sediment movement was restrictive to the growth of foliose red algae on hard sediment. At site B6 and C6, the water was deeper and the rock was most likely subject to less scour except during stormy conditions. At these stations attached fauna included tunicates *Aplidium punctum*, dead mans fingers (*Alcyonium digitatum*) and the sponges *Cliona celata* and *Polymastia* sp. Mobile fauna such as the sea urchin *Echinus esculentus*, the sea cucumber *Holothuria forskali*, starfish *Asterias rubens* and *Marthasterias glacialis* were found on all areas of the rock but would be likely to avoid areas of high scour when such conditions prevailed. At these sites, the bedrock

supported a kelp park with a more established understory of brown and red algae. At station Ref 2, the water was in excess of 70m deep where it was unlikely for algae to occur due to the reduced light penetration through the water column. The ROV was unable to access the site completely, although it was possible to identify a number of echinoderm species including the sea urchin *Echinus esculentus*, the sea cucumber *Holothuria forskali* and starfish *Luidia ciliaris*. In addition the sponge *Cliona celata* was observed.

None of the species identified from the seabed imagery were of specific nature conservation importance and are widespread in nearshore waters of Ireland (Picton and Costello, 1999).

The 2008 video footage of the seabed produced results that were not wholly in agreement with sediment infauna data produced from macrofaunal analysis. From the video transects, it was observed that increased epifaunal and floral species were encountered at stations adjacent to the shoreline and in shallower waters (Transect A) (particularly off the mouth of the Sruwaddacon). These results were in contrast to the deeper water stations, such as those on Transect F.

It should be noted however, that the two survey methods targeted species with different habits: the grab sampling collects species that live in the seabed, while the photographic work records those that live on it.

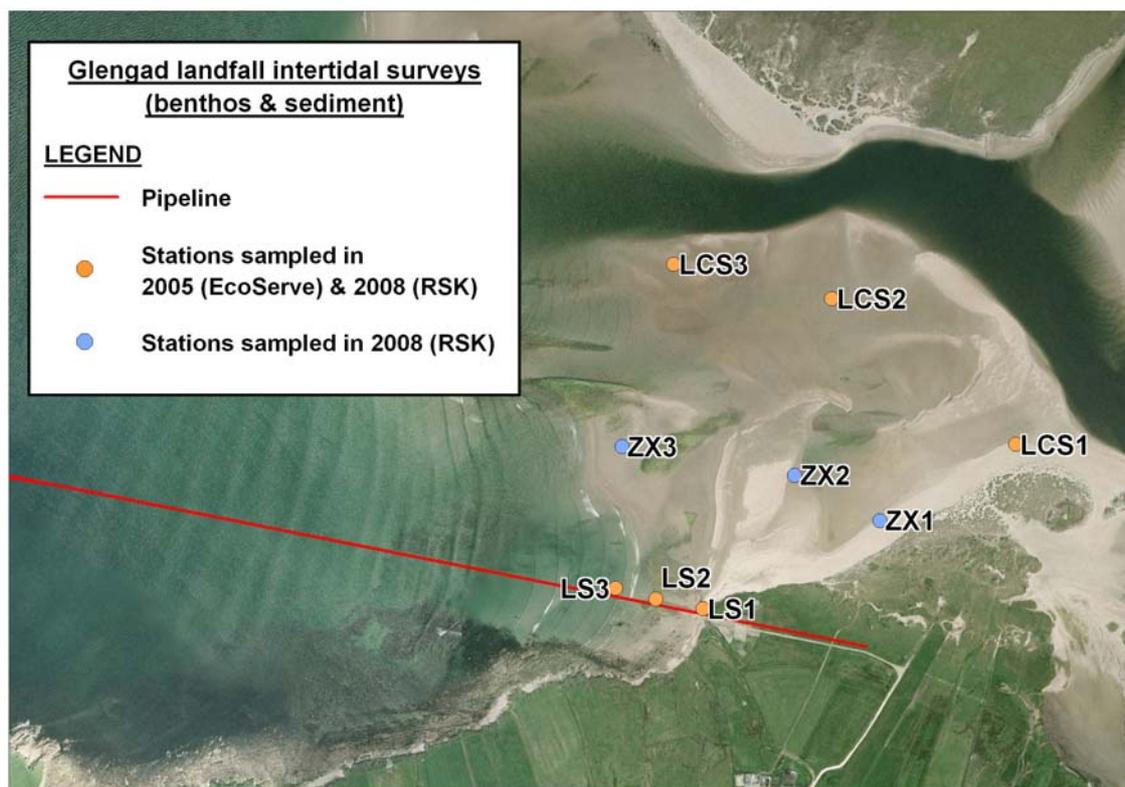
### 7.3.1.3 Landfall

Baseline surveys were undertaken in the intertidal area at the landfall as follows:

- June 2005 (by EcoServe), pre-construction survey; and
- June 2008 (by RSK) pre-construction survey

Sampling locations are presented in Figure 7-8. In the 2005 pre-construction survey, two transects were surveyed: one corresponding to the route of the pipeline and the second representing a control. For the 2008 survey, an additional transect (ZX) was inserted between the control and landfall transects in order to provide further information on the general landfall environment. Three stations were surveyed on each transect corresponding to upper, middle and lower shore. At each station, sediment samples were taken using a core sampler of 10.5cm diameter, to a depth of 20cm. The 2005 survey used a sieve of 1mm to retain fauna, while the 2008 survey used two sieves (1mm and 0.5mm) in order to provide both comparative and additional information. Full survey reports for the 2005 and 2008 surveys are presented as Appendix 7-7 and 7-8 respectively; a summary of results is provided below.

Fine and medium sands dominated the substratum at all stations on both transects, with some coarser material at the lower shore stations. The coarse material is indicative of a disturbed environment and it is the relative instability, which is probably the main reason for the low diversity and abundances recorded.



**Figure 7-8: Locations of Landfall Sampling Stations in 2005 (EcoServe) and 2008 (RSK).**

For all surveys, the following general points can be made:

- Upper shore stations were often entirely devoid of infauna, and usually had the lowest diversity and abundance. Occasionally (June 2008, LCS1), relatively high abundances of talitrid amphipods and oligochaete worms were recorded, associated with dead algae on the highly mobile strandline;
- A fauna characteristic of exposed, high-energy sand beaches was recorded, naturally low in both abundance and diversity. Amphipods and polychaetes comprised the majority of all fauna, with the amphipods *Bathyporeia pelagica* and *Pontocrates arenarius*, and the polychaetes *Ophelia rathkei*, *Microphthalmus*, and *Scolelepis squamata* occurring frequently;
- Other fauna recorded in low abundances included nemerteans (flatworms), nematodes (roundworms) and mysids (opossum shrimps). Molluscs and echinoderms were absent, as expected for a high-energy mobile intertidal sand community.

The 2008 survey recorded the capitellid polychaete *Baldia johnstoni* from the landfall transect, a species only described relatively recently; this is likely to represent a noteworthy first record for Ireland, as it has previously only been recorded on the western North Sea coast of Scotland and northern England (R. Bamber, Associate, Natural History Museum, London, pers. comm.).

### Offshore Fisheries

Unpublished data on fish landings by Irish and foreign vessels for 2003–2007 were collected from the Sea Fisheries Protection Authority for the three ICES administrative rectangles along the offshore pipeline route, which is presented in Table 7-3. (NB 37D8=offshore, 37E0=inshore).

Pelagic fish (i.e. living in the water column) are by far the most important in terms of weight, comprising the majority of the catch weight in each of the triangles. Mackerel, horse mackerel, blue whiting and herring are all important.

Demersal (i.e. found on or near the seabed) finfish species such as hake, monkfish, haddock and some flatfish (e.g. megrim, witch) are also caught, along with some elasmobranch fish (dogfish and skates). Deep-sea red crab is caught on the outermost rectangle and edible crab is important in the two inshore rectangles.

All of these data are consistent with those presented in the 2001 Offshore EIS, in both the species present and that pelagic landings were far greater than demersal and/or shellfish landings. However, it is reiterated that the latter two usually command higher prices compared to pelagic fish.

### Research surveys

Irish Groundfish Survey weight data for the top ten species for Station 22 (ICES VIIIb, 37D9), West of the Belmullet peninsula and approximately halfway along the length of the pipeline) were collated from the Marine Institute for the two recent surveys (2006 and 2007), and are presented in Table 7-4. It is noted that this station was not sampled in October 2008. These data complement the commercial species data; pelagics were most important with mackerel (and, to a lesser extent, horse mackerel), dominating catches in terms of weight. Commercial demersal species were relatively unimportant by comparison, although haddock was relatively important in 2007. Low-value (gurnard, dab) or non-commercial species (poor cod, dragonet) also comprised some of the catch, providing further information on the fish communities present.

Unpublished data from a Groundfish Survey conducted in 2004 by the Marine Institute allow comparison of relative abundance of species all around Ireland. Unlike usual groundfish surveys, this survey was conducted in spring with the purpose of identifying maturity status of commercial species. None of the important commercial species (haddock, whiting, cod, megrim, hake, monkfish, blue whiting, horse mackerel and herring) were recorded from stations in the vicinity of the pipeline route, suggesting that either these species were not abundant in the area in the spring, and/or the gear being used was not suited to collection of these species. Mackerel, however, was recorded in the pipeline area at its highest abundance throughout Irish waters, and a relatively high number of rays were recorded in this area.

In addition to Groundfish Surveys (conducted using trawling only), Clarke *et al.* (2005) conducted longlining and trawling surveys of eight areas along the shelf edge to the west and north-west of Ireland and, in particular, examined the presence of deepwater elasmobranchs (sharks and skates) in these catches. One of the survey areas was just to the north of the proposed pipeline route (on the slope to the Rockall Trough) and recorded the deepwater shark species *Deania calceus* as a significant component of longline catches here, as well as the commercial teleost fish ling (*Molva* sp.) and tusk (*Brosme brosme*).

**Table 7-3: Commercial Fish Landings (Ten most Common Species) for 2008 by ICES Rectangle Along the Export Pipeline Route (NB 37D8=offshore, 37E0=inshore)**

| 37D8                        |                                 |               | 37D9                        |                                 |               | 37E0                        |                                 |              |
|-----------------------------|---------------------------------|---------------|-----------------------------|---------------------------------|---------------|-----------------------------|---------------------------------|--------------|
| Species                     | Scientific name                 | Tonnes        | Species                     | Scientific name                 | Tonnes        | Species                     | Scientific name                 | Tonnes       |
| Blue whiting                | <i>Micromesistius poutassou</i> | 812.6         | Horse mackerel              | <i>Trachurus</i> spp.           | 3,353.1       | Horse mackerel              | <i>Trachurus</i> spp.           | 321.0        |
| Horse mackerel              | <i>Trachurus</i> spp.           | 468.1         | Mackerel                    | <i>Scomber scombrus</i>         | 174.3         | Edible crab                 | <i>Cancer pagurus</i>           | 190.9        |
| Hake                        | <i>Merluccius merluccius</i>    | 401.6         | Edible crab                 | <i>Cancer pagurus</i>           | 160.9         | Mackerel                    | <i>Scomber scombrus</i>         | 146.6        |
| Monkfish                    | <i>Lophius</i> spp.             | 107.9         | Hake                        | <i>Merluccius merluccius</i>    | 145.5         | Herring                     | <i>Clupea harengus</i>          | 90.5         |
| Atlantic Pomfret            | Bramidae                        | 71.2          | Blue whiting                | <i>Micromesistius poutassou</i> | 135.0         | Monkfish                    | <i>Lophius</i> spp.             | 14.8         |
| Ling                        | <i>Molva molva</i>              | 56.5          | Haddock                     | <i>Melanogrammus aeglefinus</i> | 37.8          | Lobster                     | <i>Homarus gammarus</i>         | 11.7         |
| Megrim spp.                 | <i>Lepidorhombus</i> spp.       | 43.1          | Monkfish                    | <i>Lophius</i> spp.             | 33.6          | Haddock                     | <i>Melanogrammus aeglefinus</i> | 11.0         |
| Edible crab                 | <i>Cancer pagurus</i>           | 18.0          | Ling                        | <i>Molva molva</i>              | 11.3          | Pollack                     | <i>Pollachius pollachius</i>    | 6.4          |
| Greater forkbeard           | <i>Phycis blennoides</i>        | 15.5          | Saithe                      | <i>Pollachius virens</i>        | 9.4           | Cod                         | <i>Gadus morhua</i>             | 4.1          |
| Squid various               | <i>Loliginidae</i>              | 11.5          | Lobster                     | <i>Homarus gammarus</i>         | 7.6           | Rays and skates             | Rajidae                         | 3.5          |
| <b>Top 10 species total</b> |                                 | <b>2005.9</b> | <b>Top 10 species total</b> |                                 | <b>4068.5</b> | <b>Top 10 species total</b> |                                 | <b>800.6</b> |
| <b>All species total</b>    |                                 | <b>2064.3</b> | <b>All species total</b>    |                                 | <b>4112.3</b> | <b>All species total</b>    |                                 | <b>818.4</b> |

Key to colours: Pelagic teleost fish; demersal teleost fish; shellfish; elasmobranchs. NB 37D8 and 37D9 data: Irish and foreign vessels; 37E0: Irish vessels only.

**Table 7-4: Ten most abundant species from Irish Groundfish Survey for 2009 for Station 22 (ICES VIIIb, 37D9, offshore W of Belmullet peninsula, approximately halfway along pipeline route)**

| Species                | Scientific name                 | Catch (kg) | % weight<br>(% cumulative weight) |
|------------------------|---------------------------------|------------|-----------------------------------|
| Boar fish*             | <i>Capros aper</i>              | 1525.5     | 73.3 (73.3)                       |
| Mackerel               | <i>Scomber scombrus</i>         | 281.3      | 13.5 (86.8)                       |
| Grey gurnard*          | <i>Eutrigla gurnardus</i>       | 104.7      | 5.0 (91.9)                        |
| Haddock                | <i>Melanogrammus aeglefinus</i> | 93.3       | 4.5 (96.4)                        |
| Lesser spotted dogfish | <i>Scyliorhinus canicula</i>    | 13.4       | 0.6 (97.0)                        |
| Argentine*             | <i>Argentina sphyraena</i>      | 12.8       | 0.6 (97.6)                        |
| Thornback ray          | <i>Raja clavata</i>             | 7.5        | 0.4 (98.0)                        |
| Horse mackerel         | <i>Trachurus trachurus</i>      | 4.8        | 0.2 (98.2)                        |
| Tub gurnard*           | <i>Trigla lucerna</i>           | 4.7        | 0.2 (98.4)                        |
| Lemon sole             | <i>Microstomus kitt</i>         | 3.4        | 0.2 (98.6)                        |

%=percentage of total catch weight; cum%=cumulative percentage of total catch weight.

Key to colours: Pelagic teleost fish; demersal teleost fish; elasmobranch

\*=Lower value or trash fish, often discarded

### 7.3.2 Nearshore Fisheries

The Marine Institute at Galway performs the Irish Groundfish Survey during the fourth quarter of each year at a number of fixed stations around the Irish coast for the express purpose of providing scientific advice on commercial fish stock management at a national scale. These research surveys provide important additional data to that of the commercial landings, as fishing vessels only retain, and therefore report, commercially important fish. The surveys are carried out using demersal otter trawling gear similar to that which would be used by commercial trawlers, although for a half-hour towing period (commercial vessels usually for 4-5 hours).

One of the Irish Groundfish Survey stations (Station 25) is located within Broadhaven Bay. Data from the 2006 and 2007 surveys at this station show the greatest catches to be of the shoaling pelagic fish mackerel *Scomber scombrus* and, to a lesser extent, horse mackerel *Trachurus trachurus*. However, these species are likely to be transitory through the bay. Demersal species caught in smaller more consistent quantities, but likely to be much more representative of the fish community in the bay, are dab *Limanda limanda*, grey gurnard *Eutrigla gurnardus*, plaice *Pleuronectes platessa*, thornback ray *Raja clavata*, whiting *Merlangius merlangus*, lesser spotted dogfish *Scyliorhinus canicula* and other species (Table 7-5). These results show a different dominance from those presented in the 2001 Offshore EIS, where the dominant species at this site was whiting. However, overall species composition remains much the same as in the 2000 survey, although percentage composition shows considerable variation based on the opportunistic sampling of shoaling pelagic fish such as mackerel. The 2008 survey data indicates that catches are mostly demersal species and likely to be present year-round; there were relatively small catches of the shoaling and transitory pelagic fish (mackerel and horse mackerel) that have previously both been opportunistically sampled and made up a large percentage of catches.

**Table 7-5: Ten Most Abundant Species from Irish Groundfish Survey for 2009 for Station 25 (ICES VIIb, 37E0, within Broadhaven Bay)**

| Species                | Scientific name                 | Kg   | % weight<br>(% cumulative weight) |
|------------------------|---------------------------------|------|-----------------------------------|
| Plaice                 | <i>Pleuronectes platessa</i>    | 42.2 | 37.1 (37.1)                       |
| Dab*                   | <i>Limanda limanda</i>          | 28.1 | 24.7 (61.8)                       |
| Thornback ray          | <i>Raja clavata</i>             | 11.9 | 10.5 (72.3)                       |
| Grey gurnard*          | <i>Eutrigla gurnardus</i>       | 10.1 | 8.9 (81.1)                        |
| Squid                  | <i>Loligo forbesi</i>           | 6.1  | 5.4 (86.5)                        |
| Sole                   | <i>Solea solea</i>              | 3.2  | 2.8 (89.3)                        |
| Tub gurnard*           | <i>Chelidonichthys lucernus</i> | 1.8  | 1.6 (90.8)                        |
| Mackerel               | <i>Scomber scombrus</i>         | 1.3  | 1.2 (92.0)                        |
| Edible crab            | <i>Cancer pagurus</i>           | 1.3  | 1.2 (93.2)                        |
| Lesser spotted dogfish | <i>Scyliorhinus canicula</i>    | 0.98 | 0.9 (94.1)                        |

%=percentage of total catch weight; cum%=cumulative percentage of total catch weight.

Key to colours: Pelagic teleost fish; demersal teleost fish; shellfish; elasmobranch

\*=Low value or trash fish, often discarded

N/A=Not a "top 10" species in this year. NR=not recorded.

In addition, in 2006 the Central Fisheries Board conducted a series of fish investigations in a number of estuaries and lagoons around the Irish coast in an EPA-funded study. These surveys used several sampling methods (such as beach-seine netting, fyke netting and beam trawling) to accurately record diversity and relative abundance of fish species from a range of habitats. Sruwaddacon Bay was sampled in October 2006 as part of this programme (CFB, 2006). The survey included performing beam trawls at stations just seaward of the entrance to Sruwaddacon Bay (i.e. SE of Rinroe Point). A list of species recorded in these beam trawl samples from the area is presented in Table 7-6.

**Table 7-6: List of Fish Species Recorded SE of Rinroe Point by Beam Trawl in CFB October 2006 Survey**

| Scientific name               | Common name            |
|-------------------------------|------------------------|
| <i>Entelurus aequoreus</i>    | Snake pipefish         |
| <i>Gaidropsarus vulgaris</i>  | Three-bearded rockling |
| <i>Gobiusculus flavescens</i> | 2-spot goby            |
| <i>Labrus bimaculatus</i>     | Cuckoo wrasse          |
| <i>Liparis liparis</i>        | Sea snail              |
| <i>Spinachia spinachia</i>    | 15-spined stickleback  |

Trawls in the Sruwaddacon Bay area were characterised by a relatively low catch per unit effort and the lowest diversity of any trawl samples taken under the project (CFB, 2006), which included Newport and Tullaghan Bay, both in County Mayo. None of the species are of particular commercial or conservation interest.

Additional information on fish species found within inner Broadhaven Bay is provided by the Central Fisheries Board's literature on sea angling (CFB, undated). This notes mackerel, flatfish (plaice, flounder, small turbot), rocky-ground associated species (pollack, coalfish, conger, wrasse), elasmobranchs (dogfish and rays) and the high-value sporting fish bass and sea-trout (CFB, undated).

### 7.3.3 Aquaculture/Shellfishery Activities

There are two licensed aquaculture sites within the Broadhaven Bay area as of January 2009 (presented in Table 7-7); this has fallen from the five sites listed in the 2001 Offshore EIS. As detailed in the RPS Onshore Gas Pipeline EIS 2010, a licence for oyster culture exists at Pollatomish pier within Sruwaddacon Bay. At the current time, this site remains the only licensed aquaculture area in Sruwaddacon Bay.

**Table 7-7: Aquaculture Sites within the Broadhaven Bay Area**

| Code      | Location                      | Species           | Method            |
|-----------|-------------------------------|-------------------|-------------------|
| T10/275A* | Moyrahan Point Area           | Pacific oysters   | Not stated        |
| T10/81    | Pollatomish Pier, Sruwaddacon | Oysters           | Bags and trestles |
| T10/164   | Off Moyrahan Point, Belmullet | Oysters and clams | Not stated        |

Source: A. O'Keeffe, Shellfish Licensing team DCENR 12 October 2007; confirmation as correct K. Gill, Coastal Zone Management Division, 23 January 2009; \*Application, updated by K.Gill CZMD 22.2.10.

### 7.3.4 Seabirds

A desktop study drawing together information available on the bird communities found along the offshore portion of the pipeline route has been completed to provide an up to date understanding. Data have been compiled from several reports and publications. The study focuses primarily on data published since the 2001 Offshore EIS, but also provides a new assessment of results from previously reviewed reports. These sources are described in the full report by Fehily Timoney & Company, attached as Appendix 7-9. The report also acknowledges that data are limited in their capacity to confidently establish overall seabird utilisation over the area over time.

The coastal and offshore waters of Ireland are essential feeding grounds for many seabirds, including non-breeders and passage migrants, throughout the year. Species that have been recorded as present year-round included Fulmar (*Fulmarus glacialis*), Northern Gannet (*Morus bassanus*) and European Shag (*Phalacrocorax aristotelis*), although the Shag was only recorded from the offshore section of the pipeline route. Fulmar and gannet, as well as Atlantic Puffin (*Fratercula arctica*) were recorded throughout the length of the offshore pipeline route. Seasonal migrants present included Manx Shearwater (*Puffinus puffinus*), Storm Petrel (*Hydrobates pelagicus*) and passage migrants include Great, Cory's and Sooty Shearwaters (*Puffinus gravis*, *Calonectris diomedea* and *P. griseus*), Great, Arctic and Pomarine Skuas (*Catharacta skua*, *Stercorarius parasiticus* and *S. pomarinus*). Most of these species are summer migrants, occurring in higher abundance between July and August, however some species such as Great-Northern Diver (*Gavia immer*) occur mainly in winter.

Other notable species recorded are Wilson's and Leach's Petrels (*Oceanites oceanicus* and *Oceanodroma leucorhoa*) and Sabine's Gull (*Larus sabini*). It is likely that other migrant species, e.g. Glaucous Gull (*Larus hyperboreus*), may also occur in the area. Due to increasing conservation concerns, some seabird species present in the area have been "upgraded" in status since the original Offshore 2001 EIS, such as the herring gull (*Larus argentatus*), which was formerly on the Amber list (medium concern) but is now on the Red List (high concern).

Based on July 1999–September 2001 data (Appendix 7-9), seabird species richness on the eastern half of the proposed pipeline route was low (1–4 species) and increased to moderate (5–9 species) in the western half and to 10+ species near the field. Seabird abundance was also shown to be low over the pipeline route with the exception of an area in the western half of the route. While density offshore is generally low, dense concentrations may be encountered occasionally, often in association with changes in oceanographic conditions. During passage migrations (spring and autumn)

and foraging during the breeding season, very large numbers of seabirds (up 10,000 per hour) can pass within 5km of the coast in the area.

Seabird breeding colonies are identified and mapped in the full report (Appendix 7-9); the nearest colony (Danish Cellar) is located approximately 3km from the offshore pipeline route in Broadhaven Bay. There are large colonies of Annex 1 European Storm-petrels close to the pipeline route on Inishglora, Inishkeeragh and the Duvillaun Islands (all off the Mullet Peninsula) and on the Stags of Broadhaven and Illanmaster off the north Mayo coast. The Annex 1 Leach's Storm Petrel has its only Irish breeding colony (310 pairs) on the Stags of Broadhaven.

While the 2001 Offshore EIS did not list the closest breeding colonies to the pipeline route, the other information in the review is broadly in line with the findings of the baseline information presented in 2001.

#### *Little Tern and other tern species*

In the 2001 Offshore EIS potential "Minor" impacts to a little tern colony on a shingle/sandpit area to the north of the proposed landfall were discussed. Since 2001, the area on which the colony was situated has been subject to natural wave erosion and no longer exists.

Inishderry is a known breeding colony for a number of species including Sandwich, Common and Arctic Terns. Little Tern have bred there in the past. It is a small island at the southern end of Broadhaven Bay, near Belmullet. It is located over 7 km from the nearest point of the offshore pipeline. In the past, birds commuted between Inishderry and Derreens Island (Carrowmore Lake) via Barnatra, nesting in alternate years on either one or the other of these islands.

The four Annex 1 tern species – Sandwich, Common, Arctic and Little Terns – have nested in the past at various sites in north-west Mayo. Quite large colonies (up to 200 pairs) of Sandwich Terns have nested on Inishderry and on islands in Carrowmore Lake, but none was recorded during the *Seabird 2000* survey in 1998-2002 (Mitchell *et al.*, 2004). Little Terns now seem to be confined mainly to the Inishkea Islands, where there are also colonies of Common and Arctic Terns (Mitchell *et al.*, 2004).

It is considered that there will be no likely significant short term or long term impact on tern species. There will be no impacts on Inishderry from the remaining construction activities associated with the offshore pipeline, neither can it be considered to be within the zone of influence. This was confirmed in consultations with NPWS in August 2008.

### **7.3.5 Landfall and Onshore Birds**

The landfall is on the westerly shore at Glengad where the low cliff is of glacial till. Part of the west-facing cliff comprises the section, which was reinstated in autumn 2002, 2008 and 2009 as part of the offshore pipeline works.

In 2008 surveys were undertaken in order to establish the status of cliff vegetation (if present) at Glengad. The west facing section within, and on either side of, the zone of impact (reinstated cliff) was subsequently surveyed prior to construction and was found not to be ascribable to the Annex I habitat vegetated sea cliffs of the Atlantic and Baltic Coasts.

Prior to excavation in 2002, the cliff was a vertical stony cliff more or less devoid of vegetation, topped by improved agricultural grassland. At that time it would also not have been ascribable to the Annex I habitat Vegetated sea cliffs of the Atlantic and Baltic Coasts.

Further details are provided in the RPS Onshore Gas Pipeline EIS 2010, Appendix J.

Two discrete 'sub-colonies' of Sand Martins were identified during the survey visits to the cliff in 2008 – Colony A (the "original colony") is located 30 m north of the proposed

pipeline landfall while Colony B is located several hundred metres to the south west of the landfall. These two sub-colonies were again found to be active in the 2009 breeding season and a new Sand Martin colony (Colony C) was recorded across the bay at Rinroe Strand.

Sand martins are summer visitors, usually arriving at Glengad in and around the first week in May. Construction activities on the cliff and causeway during the breeding season in 2002 did not appear to interfere with their breeding success or normal feeding activity.

Additionally, there was no evidence to suggest that the construction activities in the vicinity of the colonies in 2008 and 2009 had any impact on Sand Martin breeding activity. This was confirmed by monitoring throughout the breeding season in 2008 and 2009, and also by NPWS Conservation Rangers who visited the site on a number of occasions during the 2008 landfall construction period. Further details are provided in the RPS Onshore Gas Pipeline EIS 2010, Appendix J.

In addition to general high and low water surveys, the Light-bellied Brent Goose (Amber listed, Lynas, *et al.*, 2007) has been surveyed as a target species during overwintering seasons from 2002/2003. The main feeding grounds for this species are at Rinroe and to the west and north of the landfall at Glengad.

Prior to the 2007/08 winter season, the arrival of Light-bellied Brent Geese into the Broadhaven Bay sites was typically recorded in mid-November. However, a much earlier return, by several weeks (typically mid-October), of this species has been recorded in the last three consecutive winter seasons (2007/08, 2008/09 and 2009/10). It should be noted that, despite the early return of the geese, their distribution and behaviour within the bay remains largely unchanged.

The intertidal zone around Glengad is a dynamic system, being subject to continuous erosion and deposition. The Light-bellied Brent Geese are quick to exploit new feeding and roosting opportunities such as the formation of pools or the growth of algae on newly deposited sand and gravel beds. In the most recent season (2009/2010) Light-bellied Brent Geese have been more regularly recorded in North Rossport Bay, particularly at high tide and during heavy swells. In all survey years the number of Light-bellied Brent Geese increased towards the end of the overwintering period, with peak counts typically recorded in March or April. The maximum number of Light-bellied Brent Geese recorded in the Broadhaven Bay/Sruwaddacon area since the 2002/03 peak was 426 on 14th April 2010.

Further details of bird survey results are given in the RPS Onshore Gas Pipeline EIS 2010 Appendix J1.

### 7.3.6 Marine Mammals

Since the submission of the Offshore ES in 2001, a number of additional studies, commissioned by SEPIL, have been performed in the Broadhaven Bay area. These are discussed below.

#### Offshore

No project-specific dedicated survey data are available for the pipeline route and field area. However, there have been several studies in the area offshore of Mayo since 2001 that provide updated information on cetaceans:

- 1999–2001: offshore data on records from observers on several “vessels of opportunity”, between July 1999 and October 2001 (reported in Ó Cadhla *et al.*, 2004);
- Summer 2000: a dedicated three-week survey between 30th July–22nd August 2000 (Surveys in Western Irish Waters and the Rockall Trough-SIAR), 2000; also reported in Ó Cadhla *et al.*, 2004); and

- Summer 2004: during May to September 2004, Wall *et al.* (2006) conducted offshore surveys; although no dedicated survey effort took place in the project area, some incidental observations were recorded.
- September 2008: opportunistic offshore data from two-week dedicated Irish Whale and Dolphin Group MMO placed on a vessel of opportunity (RV *Celtic Explorer*, conducting deepwater survey program) (reported in Wall, 2008).

Table 7-8 presents records of cetaceans recorded within 50km of the pipeline and Corrib field. All were previously listed as occurring off north-west Mayo in the 2001 Offshore EIS.

**Table 7-8: Cetacean species reported within approximately 50km of the Corrib Offshore Pipeline Route and Field since 2001**

| Common name               | Scientific name                   | Survey    |             |      |      |
|---------------------------|-----------------------------------|-----------|-------------|------|------|
|                           |                                   | SIAR 2000 | 1999 - 2001 | 2004 | 2008 |
| Cetaceans                 |                                   |           |             |      |      |
| Humpback whale            | <i>Megaptera novaeangliae</i>     | NR        | •           | NR   | NR   |
| Northern Bottlenose whale | <i>Hyperoodon ampullatus</i>      | •         | NR          | NR   | NR   |
| Bottlenose dolphin        | <i>Tursiops truncatus</i>         | •         | NR          | NR   | NR   |
| White-sided dolphin       | <i>Lagenorhynchus acutus</i>      | •         | NR          | NR   | NR   |
| White-beaked dolphin      | <i>Lagenorhynchus albirostris</i> | •         | •           | NR   | NR   |
| Common dolphin            | <i>Delphinus delphis</i>          | •         | •           | •    | •    |
| Striped dolphin           | <i>Stenella coeruleoalba</i>      | •         | NR          | NR   | NR   |
| Harbour porpoise          | <i>Phocoena phocoena</i>          | •         | NR          | NR   | NR   |

NR=Not recorded. Sources: SIAR 2000: Ó Cadhla *et al.*, 2003 (Appendix 7-10); 1999-2001: Ó Cadhla *et al.*, 2004; Wall *et al.*, 2006; 2008: Wall, 2008.

Based on the results of the offshore studies, the following conclusions can be made:

- Although no specific pipeline or field surveys have been carried out, the offshore environment of the west coast of Ireland is confirmed as being of European importance for cetaceans; and
- Common and white-sided dolphins were the most frequently occurring cetacean species in the offshore environment in the vicinity of the field and pipeline.

### Inshore

Data used in the 2001 Offshore EIS were largely from desk-based sources and SEPIL therefore made a commitment to commission monitoring work as part of the Corrib development. Since then the following surveys have been undertaken by staff from the Coastal and Marine Centre (CMRC), part of University College, Cork and from dedicated MMO's aboard vessels involved in the offshore pipeline construction works through Broadhaven Bay:

- 2001–2002: marine mammal monitoring in Broadhaven Bay. This comprised cliff- and boat-based surveys (both visual monitoring and photo-identification) between August 2001 and October 2002, and acoustic monitoring (Ó Cadhla *et al.*, 2003) (see Appendix 7-10);
- Summer 2005: marine mammal monitoring in Broadhaven Bay, comprising dedicated survey using both visual and acoustic survey methods. Visual monitoring (cliff-based only) comprised 281 hours on 46 separate days between 12<sup>th</sup> June and 30<sup>th</sup> September 2005. Acoustic monitoring took place

over a total of 99 days from 24<sup>th</sup> June to 30<sup>th</sup> September 2005 (CMRC, 2006) (see Appendix 7-11);

- Summer 2007: during a geophysical survey of the Sruwaddacon undertaken from 19<sup>th</sup> June to 1<sup>st</sup> August 2007, a qualified marine mammal observer (MMO) was aboard one of the survey vessels at all times to ensure compliance with best practice. This comprised a total of 20 days observer effort. All sightings of marine mammals were recorded (Collins, 2007) (see Appendix 7-12);
- Summer 2008 onwards: ongoing dedicated marine mammal monitoring in Broadhaven Bay; this comprised dedicated cliff-top visual survey (336 hours total active survey on 45 days in the period May 15<sup>th</sup>-November 1<sup>st</sup>), acoustic monitoring (7,852 hours in 2008) and boat-based transect surveys on July 29<sup>th</sup> and September 25<sup>th</sup>, the latter of which allowed for photo-identification of bottlenose dolphins (CMRC, 2009) (see Appendix 7-13);
- Summer and Autumn 2008: MMO data from aboard construction vessels within Broadhaven Bay (from July to October);
- 2009: continuation of ongoing dedicated marine mammal monitoring in Broadhaven Bay, comprising cliff-top visual survey from primary monitoring locations (541 hours total active survey over 68 days in the period January 1<sup>st</sup> – December 31<sup>st</sup>), cliff-top visual survey from secondary monitoring locations (69 hours over 139 days commencing in May, over a period of 139 days), acoustic monitoring (13,687 hours total during 2009) and boat-based visual transect surveys (55 hours, over a period of 14 days) (see Appendix 7-14); and
- 2009: MMO data from aboard construction vessels within Broadhaven Bay (from April to October) (see Appendix 7-15)

In addition to this dedicated survey effort, validated records of incidental sightings and strandings are available from the database maintained by the Irish Whale and Dolphin Group ([www.iwdg.ie](http://www.iwdg.ie)). Searches were performed for the period since the submission of the original EIS (October 2001). Table 7-9 summarises the records of marine megafauna (including cetaceans (whales and dolphins), pinnipeds (seals), otter, turtles, basking shark and sunfish) made within Broadhaven Bay.

**Table 7-9: Species List of Marine Megafauna Recorded within Broadhaven Bay during Marine Mammal Surveys and Monitoring since October 2001 (NB: does not include cetacean records not identified to species level)**

| Common name         | Scientific name                   | Survey    |      |      |                |           |          |           |          |
|---------------------|-----------------------------------|-----------|------|------|----------------|-----------|----------|-----------|----------|
|                     |                                   | 2001-2002 | 2005 | 2007 | IWDC 2001-2008 | CMRC 2008 | MMO 2008 | CMRC 2009 | MMO 2009 |
| <b>Cetaceans</b>    |                                   |           |      |      |                |           |          |           |          |
| Minke whale         | <i>Balaenoptera acutorostrata</i> | •         | •    | NR   | NR             | •         | NR       | •         | •        |
| Killer whale        | <i>Orcinus orca</i>               | NR        | •    | NR   | NR             | •         | NR       | •         | •        |
| Pilot whale         | <i>Globicephala melas</i>         | NR        | NR   | NR   | •              | NR        | NR       | NR        | NR       |
| Sei whale           | <i>Balaenoptera borealis</i>      | NR        | NR   | NR   | NR             | NR        | NR       | •         | NR       |
| Risso's dolphin     | <i>Grampus griseus</i>            | •         | •    | NR   | •              | •         | NR       | •         | NR       |
| Bottlenose dolphin  | <i>Tursiops truncatus</i>         | •         | •    | NR   | NR             | •         | •        | •         | •        |
| White-sided dolphin | <i>Lagenorhynchus acutus</i>      | •         | NR   | NR   | NR             | NR        | NR       | •         | NR       |

| Common name                                   | Scientific name                   | Survey    |      |      |                |           |          |           |          |
|---|-----------------------------------|-----------|------|------|----------------|-----------|----------|-----------|----------|
|   |                                   | 2001-2002 | 2005 | 2007 | IWDC 2001-2008 | CMRC 2008 | MMO 2008 | CMRC 2009 | MMO 2009 |
| White-beaked dolphin                          | <i>Lagenorhynchus albirostris</i> | •         | NR   | NR   | NR             | NR        | NR       | NR        | NR       |
| Common dolphin                                | <i>Delphinus delphis</i>          | •         | •    | NR   | •              | •         | NR       | •         | •        |
| Harbour porpoise                              | <i>Phocoena phocoena</i>          | •         | •    | NR   | •              | •         | NR       | •         | •        |
| <b>Pinnipeds</b>                              |                                   |           |      |      |                |           |          |           |          |
| Common seal                                   | <i>Phoca vitulina</i>             | •         | •    | •    | NR             | NR        | •        | •         | •        |
| Grey seal                                     | <i>Halichoerus grypus</i>         | •         | •    | •    | NR             | •         | •        | •         | •        |
| Unidentified seal                             | Phocidae                          | •         | •    | •    | NR             | •         | •        | •         | •        |
| <b>Other species of conservation interest</b> |                                   |           |      |      |                |           |          |           |          |
| Otter   | <i>Lutra lutra</i>                | •         | NR   | NR   | NR             | •         | NR       | NR        | NR       |
| Basking shark                                 | <i>Cetorhinus maximus</i>         | •         | •    | NR   | NR             | •         | NR       | •         | •        |
| Sunfish                                       | <i>Mola mola</i>                  | •         | •    | •*   | NR             | •         | •        | •         | •        |
| Turtle (unidentified)                         | Chelonioidae                      | •         | NR   | NR   | NR             | NR        | NR       | •         | NR       |

NR=Not recorded. \*Observed in Broadhaven Bay during RSK inshore benthic survey, July 2007

Sources: 2001–2002: Ó Cadhla *et al.*, 2003 (Appendix 7-10); 2005: CMRC, 2005 (Appendix 7-11); CMRC 2007 (Appendix 7-12); Collins, 2007; IWDC 2001–2008: IWDC database records; CMRC – Monitoring Study 2008 (Appendix 7-13); RSK MMO Report, 2009 (Appendix 7-15) and Visser *et al.*, 2010 (Appendix 7-14)

The site-specific surveys above have allowed for a much more accurate assessment of the existing populations in the inshore environment. Based on the results of these studies, the following conclusions can be made:

- Broadhaven Bay and its neighbouring waters are nationally important in terms of both diversity and abundance of cetaceans;
- Photo-identification studies suggested a level of residency of bottlenose dolphins;
- Records of newborn and young calves of dolphins in Broadhaven Bay (common, bottlenose and Risso's) suggest possible importance as a nursery area; and
- Broadhaven Bay is also of importance to other species of conservation importance such as grey and common seals, basking sharks and sunfish.

CMRC monitoring results on cetacean diversity and abundance from 2009 are similar to pre-construction (i.e. 2001-2 and 2005) results. There is a general trend which shows reduced sighting rates in all subsequent monitoring seasons since 2002, however cetacean sightings rates during 2009 are comparable with 2008, with the exception of bottlenose dolphins, which were sighted more frequently in 2009. A similar trend since 2002 is observed with pinnipeds, although the increase in sighting rates was stronger in 2009 compared to 2008.

Although overall sighting numbers for marine mammals are reduced compared to the initial pre-construction monitoring in 2002, numbers of individual animals have

remained relatively consistent throughout the monitoring. The obvious exception to this is bottlenose dolphin, which showed a marked increase in numbers between 2008 and 2009

Acoustic monitoring data shows similar trends in bottlenose dolphin and harbour porpoise detections during 2009 compared to 2008; suggesting similar habitat usage throughout the year

In 2009, the sei whale was observed in Broadhaven Bay. This is the first recorded sighting in Irish coastal waters since the early 1900's (Oudejans and Visser *in press*), and means that a total of 11 species of marine mammals have been observed within Broadhaven Bay cSAC. This is the highest marine mammal diversity found to date in a concentrated area in Irish inshore waters (e.g. Ingram *et al.*, 2003, 2005a, 2005b).

### **Otters**

Otters were recorded in Broadhaven Bay during the marine mammal monitoring survey in both 2001-2002 and 2010 (see Table 7-9). Shore-based otter surveys have been carried out from 2002 to 2008, both as part of general faunal surveys and as targeted species-specific surveys throughout the Sruwaddacon Bay area. Details of these are given in the RPS Onshore Pipeline EIS 2010, Appendix J1. Spraints have been reported from the coastal fringe throughout the Sruwaddacon and Broadhaven Bay areas. Proposed mitigation measures to reduce impacts during construction and the assessment of impacts to this species are also covered in the RPS Onshore Pipeline EIS 2010.

While the surveys carried out since 2001 have greatly added to the baseline information available for the Broadhaven Bay and offshore pipeline route areas, with the exception of the recorded increased usage of the bay by several species of dolphin, the baseline information provided in the 2001 Offshore EIS is broadly accurate.

## **7.3.7 Designated Conservation Areas along the Subsea Pipeline Route**

### **Broadhaven Bay cSAC**

At the time the 2001 Offshore EIS was submitted, Broadhaven Bay was a candidate SAC, this is understood to still be the case, with the same features of interest as proposed in 2001.

### **Blacksod Bay / Broadhaven pSPA**

This site is of high ornithological importance for its excellent diversity of wintering waterfowl and for the nationally important populations of five species that it supports. Of particular note is the usage of the site by over 3% of the national Ringed Plover population. It is also of importance as a breeding site for terns and gulls, especially the Sandwich Tern. It is of note that seven of the species that occur regularly are listed on Annex I of the EU Birds Directive, i.e. Great Northern Diver, Red-throated Diver, Golden Plover, Bar-tailed Godwit, Sandwich Tern, Common Tern and Arctic Tern. Sruwaddacon Bay is part of this large pSPA.

Unlike more recently designated SPAs there is no formal site citation – i.e. the “Intention to designate” notice which lists the species for which the site was designated. However the site synopsis lists species for the site as a whole and includes numbers of birds of international and national importance.

From information received from NPWS in 2008 and subsequently, it is understood that this site is to be re-designated “As part of this process the special conservation interests of the site have been provisionally identified using (a) the 4-year mean peak counts from the period 1995/96 - 1998/99 for wintering water-birds and (b) the 1995 all-Ireland tern survey along with the Seabird 2000 census for breeding seabird interests”(NPWS, 2008). In addition, it is understood that, as a result of recently

recorded numbers of Light-bellied Brent Goose (i.e. from Corrib Brent Goose surveys) that it “should be regarded as a special conservation interest for this site”.

## 7.4 Characteristics of the Proposed Development

The characteristics of the proposed development are the same as presented in the 2001 Offshore EIS, with minor exceptions. The changes to the original specification are presented in Sections 2 and 3.

Perhaps the most significant change from an ecological impacts perspective is the avoidance of proposed blasting works to construct the pipeline trench through Broadhaven Bay.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and it will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

The pipeline was placed on the seabed, and impacted no more than the surface sediments with the exception of the route in Broadhaven Bay. The pipeline was buried along the route through Broadhaven Bay by constructing a trench in the harder sediments into which it was placed, then covered using the material extracted from the trench. In other areas of the bay, the pipeline was buried using a trenching device.

The placement of rock to protect the pipeline from scour and potential free-spanning and aid pipeline stability in the near shore sections of Broadhaven Bay will be continued (from the works undertaken in 2009) during 2010 and 2011 when the umbilical is planned to be installed.

The umbilical will be trenched throughout its route from the landfall to the field, with the exception of sections with high concentrations of (sub) surface boulders. The umbilical will pass through a conduit at the shore crossing at Glengad. As detailed in Section 2, treated surface water run-off will be discharged through a HDPE pipeline co-located with the offshore pipeline between the terminal and a point approximately 12.5km from the landfall. The umbilical will be used to carry treated produced water to the Corrib field manifold where it will be discharged.

## 7.5 Potential Impacts of the Proposed Development

### Installation of the Pipeline and Umbilical

Impacts from the installation of the pipeline in the offshore areas of the pipeline route were the same as those predicted in the 2001 Offshore EIS, these being temporary in nature and negligible in magnitude. More detailed information on the techniques to be used in the nearshore and landfall areas of the pipeline are now available, and the potential impacts to the ecological interest in the area have been re-assessed based on this new information (provided in Section 3).

At the time when the 2001 Offshore EIS was written, it was expected that blasting of bedrock in the nearshore area would be required to allow for pipeline burial, and the associated potential impacts to fauna in the area were discussed at some length. However, during pre-construction work performed in 2002 in advance of the full installation programme, it became clear that it would be possible to construct the nearshore trench using only mechanical rock breaking techniques, and that there would be no need for blasting. Therefore, there have been no impacts from blasting, and any noise impacts from the excavation of the trench in the nearshore area, and associated vessel activity will be temporary. Given the increased level of information now available on marine mammal activity in the bay, a reassessment of the level of impacts was carried out. It concluded that these impacts would be minor, as the source of greatest potential impact had been removed. Further discussion of noise levels is provided in Section 11.

The footprint of the rock berm placed in Broadhaven Bay in 2009 may increase as result of further rock placement activities in 2010 and 2011. The sandy sediments and rock outcrop seabed habitat within this footprint will be directly impacted in that it will be smothered by rock. This will result in permanent loss of the existing habitat.

### **During Operation**

During operation of the pipeline, there is the potential for leaching of trace metals from the sacrificial anodes placed throughout the length of the pipeline. The potential impact on benthos, plankton and fish will be negligible because of the small volumes involved. The tonnage of anode planned has also been revised downwards since 2001, reducing the possible impact further. Further information is provided in Section 9.

### **Potential Impacts of the Water Discharges**

Emissions of treated surface water run-off and treated produced water will arise from the terminal operations. The treated surface water run-off from hard surfaces around the terminal will be discharged through a pipeline that terminates around 12.5km from the landfall. The produced water will be subject to three stages of treatment before it is discharged via the umbilical to the Corrib Field. The contaminants likely to be present in the produced water discharge have been identified on the basis of the fluids analysed from well testing operations. These contaminants will be treated to their respective Environmental Quality Standards (EQS) (Water Framework Directive (2000/60/EC)). The dispersion of the discharge has been modelled, and the results of that modelling are presented in Appendix 9.1 of this Supplementary Update Report. Initial dilution of the discharge will be significant in the immediate vicinity of the outfall, and as it rises through the water column (because it is less dense than seawater), it will be subject to considerable further dilution. It is anticipated that the dilution of the discharge will be around 100 fold within 5m of the discharge. The discharge of the treated water is therefore predicted to have a negligible impact. The EPA has granted an IPPC licence for the terminal operations. In granting this licence, the potential for environmental damage from the discharge was fully considered by experts in the field of ecotoxicology, with the conclusion that the discharge would not cause detrimental effects to the fauna and flora of the area. While the discharge location for treated produced water is now subject to change (moving from off Erris Head to the Corrib Field), the dilution available will not be reduced, hence there will be no predicted detrimental effects to the fauna in that area.

## **7.6 Do-Nothing Scenario**

No change from 2001 offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

## **7.7 Mitigation Measures**

Mitigation measures have been developed to prevent, control and minimise potential impacts from the offshore components of the development. All works within the cSAC will be subject to detailed consultations with NPWS.

### **Landfall**

Pre-entry ecological surveys were carried out in 2002, 2005, 2008 and 2009 to identify any particular constraints. Construction operations were managed to avoid any impacts to the sand martins that nest in the cliff face adjacent to the work area. Details of mitigation measures to protect this species are given in the RPS Onshore Pipeline EIS 2010, together with more baseline information. It should be noted that there has not been, neither will there be, direct impact on the Sand Martin colony, which is located to the north and northeast of the landfall. There was no evidence to suggest that the construction activities in the vicinity of the colonies in 2008 and 2009 had any

impact on Sand Martin breeding activity. This was confirmed by monitoring throughout the breeding season in 2008 and 2009.

The temporary working area will again be fenced off during construction to prevent encroachment by personnel and machinery outside of the allowable work area and to protect the adjacent habitats. There will be signage to further delineate this exclusion zone.

Observations in October 2008 during the Winter Bird Survey of 2008/9 confirmed that the feeding behaviour of the Brent geese was not affected by onshore or intertidal works associated with the dismantling the causeway, hence no impacts are anticipated to this population.

The algal beds on which the over wintering Light-bellied Brent geese feed are located to the west and north of the landfall at Glengad. These are the main Brent Goose feeding grounds at Glengad and Rinroe and are far enough away from the landfall to be unaffected by construction activities.

The algal beds were observed prior to, and throughout the 2008 and 2009 construction periods at Glengad. It was very noticeable that there was an almost immediate "greening" of the area after the Brent geese left on migration in April.

There was no noticeable reduction in the extent of the algal beds during the 2008 and 2009 construction periods. Indeed, the extent and obvious growth in the algal beds continued throughout and there is no question that the amount of available food crop at Glengad appeared greater in autumn 2008, and subsequently, than it did previously. The area of algal bed also appears to be extending even further eastwards - along the southern edge of the channel edge.

Further information on Brent geese is contained in the RPS Onshore Gas Pipeline EIS 2010, Appendix J.

## **Broadhaven Bay**

### *Marine Mammals*

Vessels and personnel operating within the Broadhaven Bay cSAC do so according to a Code of Conduct that has been developed, and which will be reviewed with any recent information and discussed and agreed with NPWS for all future works. The Code (Appendix 7-16) is based on a risk assessment (Appendix 7-17), which considers the potential for impacts to marine mammals (and other large vertebrates) and is designed to ensure that impacts to marine mammals are minimised. A marine mammal monitoring programme is in place during the construction works through Broadhaven Bay.

The mitigation measures proposed in the 2001 Offshore EIS to minimise impacts to marine mammals from blasting works are no longer necessary as the trench will be constructed using conventional dredging.

Rock-placement works will be undertaken using a fall pipe vessel and for the nearshore works a side stone casting vessel, resupplied with material from a bulk-carrier. It is envisaged that this approach to the rock-placement works will keep the number of vessels involved to a minimum, thus minimising the potential for disturbance. MMO's will be present during rock-placement works, and work will be undertaken during on-going cliff based marine mammal monitoring.

### *Seabed Habitats*

The design of the rock berm to protect a section of the pipeline in Broadhaven Bay is such that the footprint is of minimum dimensions, but sufficient to prevent seabed scour.

The rock berm will provide stable seabed habitat for colonisation by epibenthic species. In addition the rock will be graded and washed prior to placement and is of a type that will remain inert in the marine environment, with no leaching of contaminants.

#### **Water Discharge Pipe and Umbilical**

While the impacts of the discharge were assessed as being negligible in 2001, relocation of the discharge to two locations in deeper water will increase the levels of dispersion further such that any impacts will be reduced even further.

## **7.8 Predicted Impacts of the Proposed Development**

### **Landfall**

The mitigation measures that will be employed during construction will ensure that any impacts to the species present in the area will be minimised as far as possible. The assessment of the impacts to onshore species such as nesting birds is discussed further in the RPS Onshore Pipeline EIS 2010.

### **Broadhaven Bay**

The presence of vessels and machinery in the bay during the construction period is likely to result in a temporary disturbance to marine fauna in Broadhaven Bay. However, the extent of activity, and thus potential impact, will be limited in terms of area and duration. Adherence by the vessels involved to the agreed Code of Conduct will further ensure that any impacts to marine mammals are minimised. Since the 2001 Offshore EIS was submitted, the importance of Broadhaven Bay to cetaceans has been established by lengthy field surveys, which have concluded that the area may be used by some species of cetaceans throughout the year, and that it may also be used as a nursery area. In assessing the impacts to marine mammals, it should be noted that the cetacean species recorded in Broadhaven Bay are wide ranging, and Broadhaven is likely to form only a small part of their range.

In the 2001 Offshore EIS, the impacts of pipeline construction on marine mammals were predicted to be minor. While further studies have established the importance of the area for marine mammals, the construction methods to be used in Broadhaven Bay are environmentally more benign. Consequently, the predicted impacts of pipeline construction on marine mammals have been re-assessed and found to be minor.

The predicted impacts to fish from construction in Broadhaven Bay have been reduced from minor to negligible due to the change in trench construction methodology.

The 2001 impact assessment classified the potential impacts to Little Terns as "Minor"; however, these birds do not breed in the area now, and the impact classification should therefore be revised down to negligible.

The sandy sediments and rock outcrop seabed habitat within the footprint off the rockberm will be directly impacted in that it will be smothered by rock. This will result in permanent loss of the existing habitat.

## **7.9 Monitoring**

### **Offshore Pipeline Route**

Marine mammal activity has been monitored closely during the construction and pipe-laying phases.

In the years following construction, the pipeline route will be surveyed periodically using a combination of ship deployed ROV and sidescan sonar surveys. Duration of the surveys will be a few weeks in each case and the survey spread will be continually moving along the pipeline route.

### **Broadhaven Bay**

During the 2002 and 2005, construction operations in Broadhaven Bay, marine mammal surveys were carried out. Since 2008, continuous monitoring has been undertaken reflecting the requirement to monitor both during construction activities and for a 12 month period post construction.

Surveys with a similar scope will be established for future construction work and the protocol will be agreed with the National Parks and Wildlife Service (NPWS).

Future marine mammal observations will be compared with those previous recorded in 2002, 2005, 2008 and 2009. During and post-construction land based otter monitoring surveys will also be carried out.

Monitoring of Brent geese and sand martins will continue throughout the construction period and post-construction.

### **Seabed sediments and biota**

A series of seabed surveys will continue to be carried out in Broadhaven Bay to monitor the sediments following the completion of the construction of the offshore pipeline. The specification of these surveys has been agreed with the DCMNR (now the DCENR) in consultation with the Marine Institute, and pre-construction surveys were carried out in 2002 and 2008 in both cases before pipeline installation was suspended. Post-installation surveys will be scheduled for approximately one and six months post-installation and the final survey scheduled for approximately 12 months after construction and at the same time of year as the pre-construction survey to reduce seasonal influences on the comparison of results between the surveys.

The first of the baseline monitoring surveys for the area around the treated surface water outfall location was undertaken in 2005 (and repeated in 2007 and 2008). This has established a robust baseline against which any future changes can be measured.

## **7.10 Reinstatement and Residual Impacts**

Taking the new data detailed above into consideration, there is no change to the nature of the residual impacts as described in the 2001 Offshore EIS.