Section 3. Background Information

CONTENTS

3.1	**Introduction**	**3**
3.2	**The Maureen and Moira Fields**	**3**
3.3	**Relative Layout of Facilities**	**5**
	3.3.1 Layout of Facilities	5
	3.3.2 Other Nearby Facilities	6
3.4	**Information on the Physical Environment**	**6**
	3.4.1 Tides and Currents	6
	3.4.2 Wind and Wave Data	7
	3.4.3 Seabed Conditions	9
3.5	**Information on the Biological Environment**	**9**
	3.5.1 Seabed Communities	9
	3.5.2 Plankton	10
	3.5.3 Fish Spawning Grounds and Nursery Areas	11
	3.5.4 Marine Mammals	13
	3.5.5 Seabirds	15
3.6	**Fishing and Other Commercial Activity**	**16**
	3.6.1 Commercial Fisheries	16
	3.6.2 Other Commercial Activities	18
3.7	**Notes and References**	**19**

List of Tables

Table 3-1	Reported Fish Breeding Activity Around Licence Block 16/29 incorporating the Maureen Development Area	13
Table 3-2	Cetacean Distribution in the Maureen Area	14
Table 3-3	Monthly Vulnerability of Seabirds in Block 16/29 incorporating the Maureen Development Area	15
Table 3-4	Hours Fished and Fishing Methods for ICES Rectangle 45 F1 in 1998 (for United Kingdom Vessels landing in Scotland)	16
Table 3-5	Catches in Tonnes for ICES Rectangle 45 F1 in 1998 (for United Kingdom Vessels landing in Scotland)	17

List of Figures

Figure 3-1	Maureen Field Location Map	4
Figure 3-2	Layout of the Maureen Facilities	5
Figure 3-3	Frequency of Wind Direction at the Maureen Platform	8
Figure 3-4	Average Wind Speeds at the Maureen Platform	8
Figure 3-5	Seasonal Variation in Fishing Effort for ICES Rectangle 45 F1 during 1998 (for United Kingdom vessels landing in Scotland)	17

3.1 Introduction

This Section provides relevant background information that has been used when planning the decommissioning of the Maureen Facilities. It includes information on the location and layout of the Facilities, the physical environment, biological environment, and fishing and other commercial activity in the Maureen area.

From these data judgements and conclusions may be drawn on the extent of the decommissioning activity, the limitations on its execution, the environment in which it will be carried out and to what extent it will have an impact.

3.2 The Maureen and Moira Fields

The Maureen Field

The Maureen Field is located approximately 260 km east northeast of Aberdeen in 95.6 m of water in UKCS Block 16/29a (see Figure 3-1). The field consists of the Maureen reservoir, a Palaeocene formation sandstone reservoir which was discovered in 1973, and two other reservoirs which underlie the Maureen reservoir, the Morag reservoir (Zechstein) and the Mary reservoir (Jurassic). Following the drilling of the original exploration well and three appraisal wells, twenty development wells were brought on stream. The field produced approximately 223 million barrels of oil in total during its lifetime (almost 50% more than originally estimated).

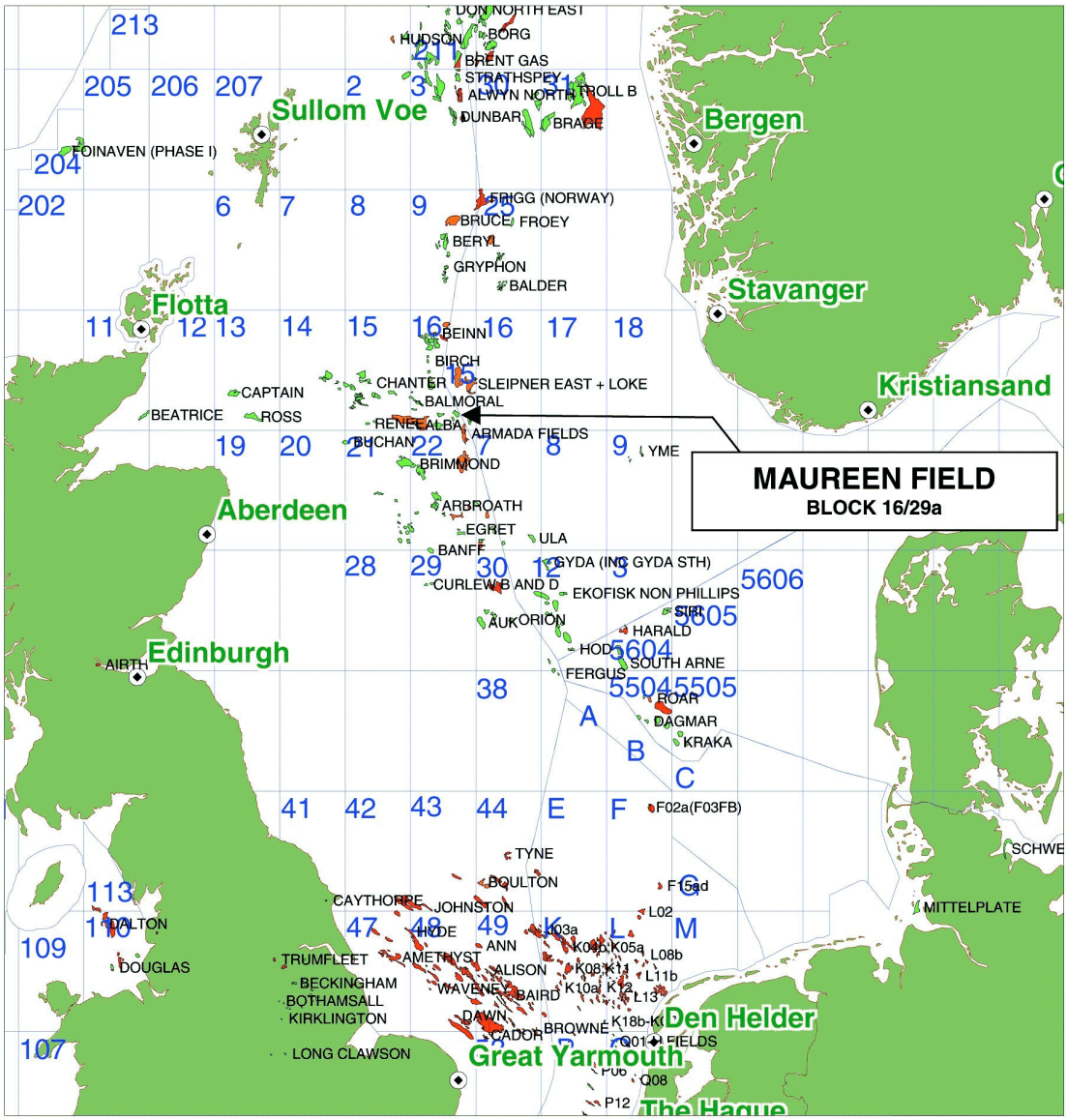
The Moira Field

The Moira Field, discovered in 1988, is located 10 km south southwest of the Maureen Platform. The field consists of the Palaeocene Moira sandstone reservoir and was developed as a single subsea well tied back to the Maureen Platform. The Moira Field produced over 4 million barrels of oil during its production lifetime.

Cessation of Production

Oil production from the Maureen and Moira Fields became uneconomic in June 1999 following a rapid decline in production rates. There were no remaining opportunities to economically increase production levels and the Cessation of Production (COP) consent was granted by the DTI on 7 October 1999.

Figure 3-1 Maureen Field Location Map

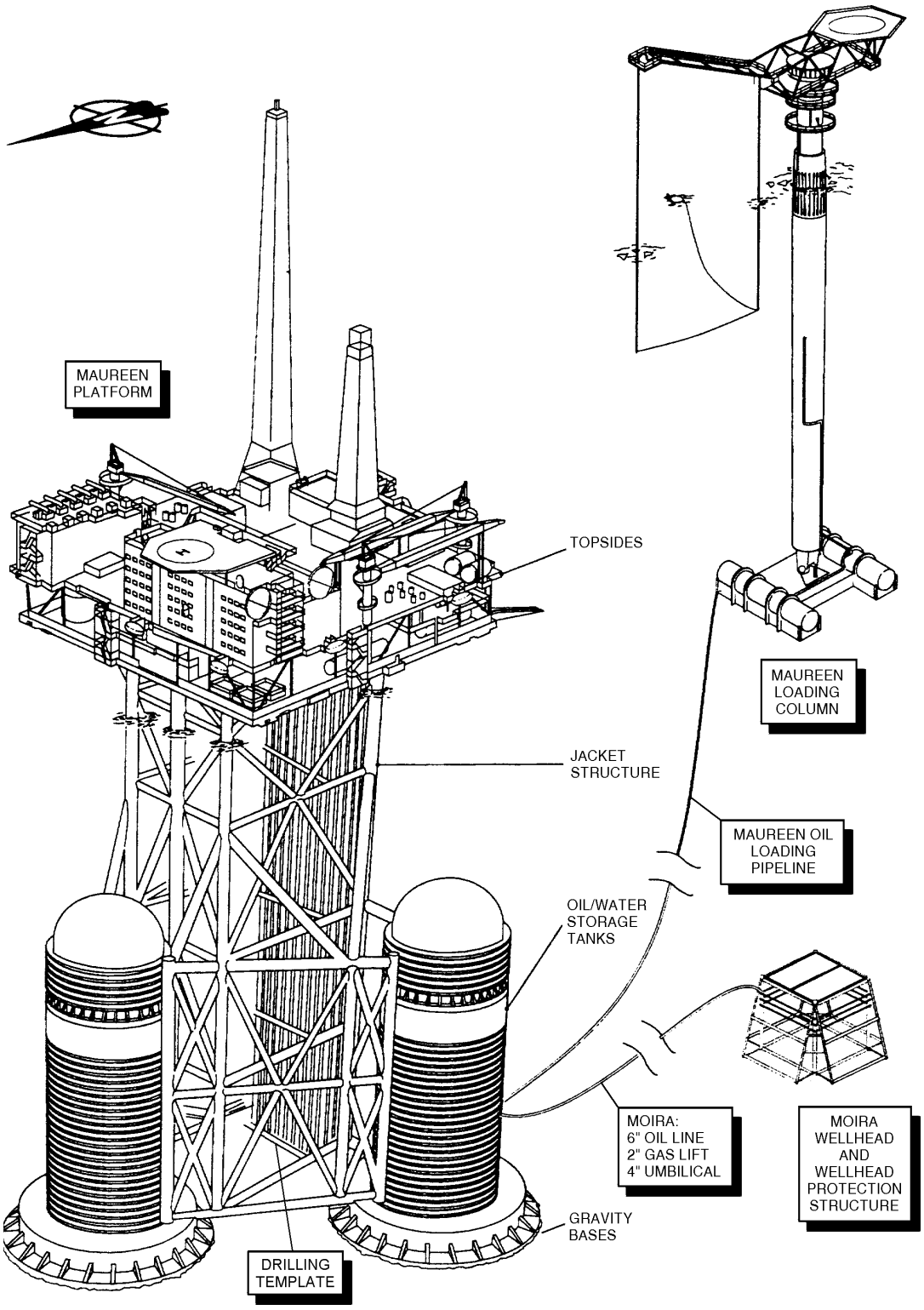


3.3 Relative Layout of Facilities

3.3.1 Layout of Facilities

The layout of the Maureen Facilities is shown in Figure 3-2.

Figure 3-2 Layout of the Maureen Facilities



3.3.2 Other Nearby Facilities

The Maureen and Moira Fields are relatively isolated from other offshore oil and gas installations. The nearest developments on the United Kingdom Continental Shelf are:

- The Cyrus subsea development, located approximately 15 km west of the Maureen Field
- The Andrew field development located approximately 20 km southwest of the Maureen Field
- The Armada Field development, located approximately 21 km south southeast of the Maureen Field.

The nearest oil and gas developments on the Norwegian Continental Shelf are:

- The Sleipner field development, located approximately 30 km northeast of the Maureen Field
- The Varg Floating, Production, Storage and Offloading (FPSO) vessel located approximately 36 km north northeast of the Maureen Field.

None of these field developments will directly affect, or be affected, by the Maureen decommissioning operations.

There are no third party pipelines or cables in the immediate vicinity of the Maureen Facilities.

3.4 Information on the Physical Environment

3.4.1 Tides and Currents

The general near surface pattern of water movement in the Maureen area is eastwards, owing to the Fair Isle current. The maximum surface tidal current speed during mean spring tides is between 0.5 and 0.75 knots. The near-bottom mean speed of the long-term water circulation in the North Sea generally decreases with depth. In areas of the central and northern North Sea greater than 70 m deep, water circulation can virtually cease in the summer months owing to the development of a pronounced vertical temperature gradient or thermocline over large areas of the North Sea. The thermocline separates the water column into two distinct layers or stratifications. The water depth around the Maureen development is approximately 96 m, and it is thermally stratified in the summer months. In autumn, the thermocline is broken up by wind and wave action and this, along with lower surface temperatures, results in mixing of the surface and bottom layers.

3.4.2 Wind and Wave Data

Wind speed and direction have been measured during the operational phase of the Maureen Platform. Measurements were taken at 10 m above the Lowest Astronomical Tide (LAT). Wave height and period have also been measured using a downwards facing infrared sensor placed on the underside of the deck.

The maximum wind speeds recorded during normal operating conditions are summarised below:

Three second gust	39 m/s
One minute mean	34 m/s
One hour mean	29 m/s

The following wave data has been gathered during the operational phase:

Highest Astronomical Tide (above LAT)	1.6 m
Crest elevation of maximum wave	10 m
Height of maximum wave	18 m
Wave mean period	13.3 seconds
Surface sea current	0.88 m/s

50 year design storm conditions are summarised below:

Wind

Three second gust	54.5 m/s
One minute mean	48.0 m/s
One hour mean	41.0 m/s

Waves

Highest Astronomical Tide (above LAT)	1.6 m
Crest elevation of maximum wave	15.5 m
Height of maximum wave	27 m
Wave mean period	15.0 seconds
Surface sea current	1.25 m/s

Figure 3-3 and Figure 3-4 give the wind rose for frequency of wind direction and average wind speed as recorded on the Maureen Platform over an eighteen month period from June 1991 to February 1993.

Figure 3-3 Frequency of Wind Direction at the Maureen Platform

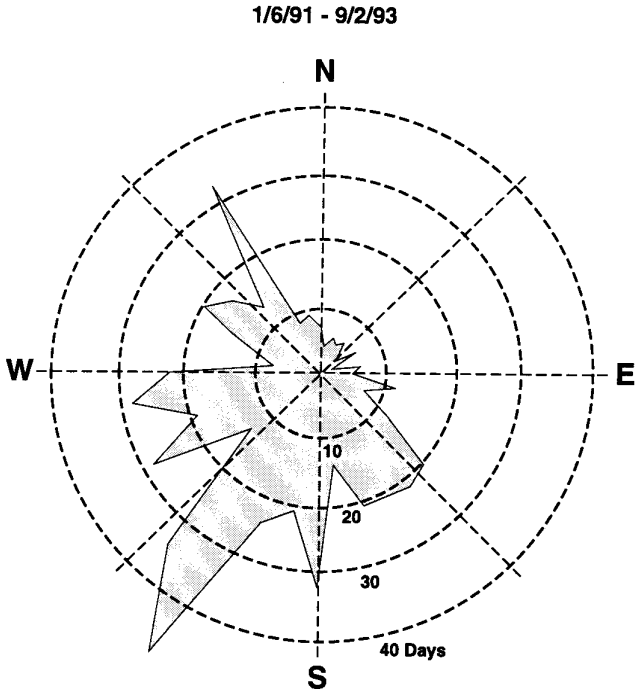
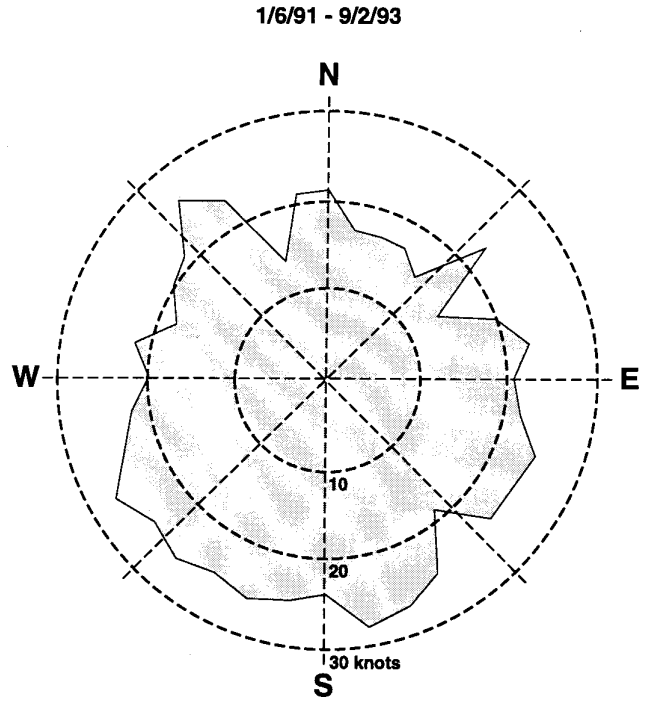


Figure 3-4 Average Wind Speeds at the Maureen Platform



3.4.3 Seabed Conditions

The stratigraphy of the seabed sediments under the Maureen Platform consists of a layer of clean fine sand, overlaying either interlayered sands and clays or a thick layer of clean clay. Where present the interlayered zone then overlies clean clay. A review of the soil conditions indicates that the outer skirts of all three of the Platform storage tanks currently dip either into the clay layer or into the interlayered material which underlies the clean surface sand.

The seabed at the Loading Column is level and consists of a dense fine silty sand. This sand has little cohesive strength. Consequently, it is not expected to adhere to the underside of the Loading Column base or the skirts.

3.5 Information on the Biological Environment

Communities of organisms are found on the seabed (benthos), in the water column (e.g. plankton, fish) and on the sea surface (e.g. seabirds). The habitats, foraging territory and natural life cycles of these plants and animals determine their vulnerability to changes in environmental conditions.

3.5.1 Seabed Communities

Benthic fauna are located near, on or in the seabed and may crawl, burrow or remain attached to the substrate. The seabed sediments are utilised as a habitat and nutrient source by these organisms.

A number of surveys of North Sea benthic fauna have been carried out in order to assess the abundance and distribution of benthic organisms. An International Council for the Exploration of the Sea (ICES)[1] benthos survey of the North Sea in 1986 showed that the benthic infauna were primarily distributed according to water depth and secondarily according to substrate type. Similarly, a survey of benthic epifauna showed that community composition was determined mainly by depth, particle size and sorting, although there was some inter-correlation between all the parameters.

Several seabed sediment surveys have been carried out around the Maureen Platform since 1979. The surveys have indicated that while species richness and faunal density were reduced in sampling stations closest to the Platform, the seabed communities have shown steady recovery since drilling ceased. Cordah[2,3] also investigated sediments around the Moira Subsea Well and the Maureen Loading Column in 1998/99.

A seabed environmental survey of the sediments surrounding the Maureen Field in 1988 included macrofaunal analysis at 35 sampling stations (AUMS, 1988[4]). The number of species (taxa) identified at the 8 stations within 500 m of the Platform ranged from 19 to 45. The two lowest counts of 19 and 31 were closest to the platform at a distance of 100 m north and south respectively. At stations between 500 m and 6000 m the number of taxa ranged from 40 to 73.

At the sites closest to the Maureen Platform the polychaete worm *Capitella capitata* was present in high numbers. This opportunistic species is commonly recorded in sediments around oil installations, where sediments are frequently disturbed and can contain hydrocarbons. Other species are either absent or occur in low numbers in these areas. By 250 m from the Platform the fauna included the polychaete worms *Chaetazone setosa* and *Paramphinome jeffreysii*, but the faunal community was not diverse.

As distance from the installation increased, the total number of species increased and the number of species considered to be numerically significant also increased. Between 250 m and 750 m species diversity rapidly increases to the extent that it is equivalent to pre-drilling conditions. This pattern of increasing species diversity with increasing distance from platforms is typical of many sites in the North Sea.

3.5.2 Plankton

Plankton refers to animals (zooplankton), plants (phytoplankton) and micro-organisms which drift passively in the water column with little or no control over their lateral movement. Plankton forms an important part of the food chains of marine ecosystems with larger animals such as fish, birds and cetaceans (eg whales) being dependent on it. The distribution of larger marine species is often closely linked to the distribution of plankton. The composition of plankton is naturally seasonally variable and dependent on nutrient availability and patterns of water circulation. Plankton also includes the eggs, larvae and spores of non-planktonic species (fish, benthic invertebrates and algae). These temporary plankton enter and leave the water column depending on the reproductive and development cycles of the individual species.

Drifting with the water movements, plankton communities are often characterised according to the water masses from which they originate. Those in the waters around Maureen are dominated by the north North Sea Water current and reflect the influence of the Atlantic Water (west) current.

Phytoplankton

There is seasonal variation in the type of phytoplankton that dominates the community. The main diatom bloom in spring (April and May) is followed by a late summer (August-October) peak of dinoflagellates (comprising mainly species of *Ceratium*), while the winter species of diatom, *Odontella sinensis,* peaks in January (Reid *et al*., 1987[5]). The timing of the Spring bloom is variable and largely dependent on the light regime and the reduction in mixing caused by the onset of thermal stratification in the water column. The bloom usually starts in April, reaches a peak, and then declines after May. Much of the Spring production probably falls to the sea floor and is not consumed by zooplankton. The summer bloom peaks in September and numbers then decrease to winter levels which are reached in November (Ref. North Sea Task Force (NSTF, 1993b[6])).

The plankton community of a particular area is less vulnerable to one-off incidents than the benthos because there is continual exchange of individuals with the surrounding waters. The local plankton community is known to be vulnerable to chemical or hydrocarbon releases from a platform into the sea, but is expected to recover quickly because of this continual exchange of individuals.

In the northern North Sea, where the Maureen Platform is located, neritic or coastal water species are relatively scarce, while intermediate or mixed water species are abundant. In autumn a considerable number of oceanic species may be carried into the area by currents.

Zooplankton

Zooplankton commonly includes species of jelly fish and anemone (*medusae*), Portuguese man 'O' war (*siphonophores*), worms (*polychaetes*), and crustaceans (including amphipods, mysids and copepods). Species of copepod (*Calanus*) and Euphausid (*Thysanoessa*) are found in large numbers throughout the area, particularly in Spring and Summer. Copepod production is important in the winter months (NSTF, 1993b[6]).

3.5.3 Fish Spawning Grounds and Nursery Areas

The fisheries resources of the North Sea can be classified into the following categories according to their type/origin and commercial use:

- Pelagic - mid-water fish such as herring (*Clupea harengus*) and mackerel (*Scomber scombrus*)

- Demersal - near-bottom dwelling fish such as haddock (*Melanogrammus aeglefinus*), blue whiting (*Micromesistius poutassou*), cod (*Gadus morhua*), plaice (*Plaeuronectes platessa*) and sole (*Solea solea*)

- Industrial - species generally used for fish meal production, such as sand eels (*Ammodytidae* family) and Norway pout (*Trisopterus luscus*)

- Shellfish - bottom dwelling and commercially important molluscs and crustaceans such as crabs (*Carinus maenas, Cancer pagurus, Liocarcinus puber* and *Eupagurus bernhardus*), lobsters (*Homarus gammarus*), prawns (*Leander serratus*), scallops (*Pecten maximus*), mussels (*Mytilus edulis*), squid (*Loligo forbesi*) and common octopus (*Octopus vulgaris*).

There are also migratory stocks of salmon (*Salmo salar*) and sea trout (*Salmo trutta)*, that are not commercially exploited offshore in the Maureen area.

The main information source for the distribution of stocks comes from commercial catch statistics collated by ICES[1] for statistical source units of 30 nautical miles x 30 nautical miles sea area, as well as fisheries surveys carried out by Fisheries Research Services[12].

Pelagic Species

The Maureen Platform lies within the general North Sea spawning area for mackerel between May and August (Coull *et al*, 1998[7])

Demersal Species

The Maureen Platform lies in a Norway pout spawning area (January to April). The nursery areas of haddock, Norway pout and blue whiting, extend into this area (Coull *et al*, 1998[7]).

Shellfish

The Maureen Facilities are located at the edge of a scampi (*nephrops*) spawning and nursery area. Nephrops spawn throughout the year, with peak spawning occurring from April to June (Coull *et al*, 1998[7]).

Protected Species

Of the 166 fish species recorded in Scottish marine waters, seven have a protected status under UK or international legislation. These are the lampern (*Lampetra fluviatilis*), sea lamprey (*Petromyzon marinus*), sturgeon (*Acipenser sturio*), Allis shad (*Alosa alosa*), Twaite shad (*Alosa fallax*) and common goby (*Pomatoschistus minutus*) (also known as the sand or freckled goby). The goby are rockpool and shallow sub-tidal species and would not be present in the vicinity of Block 16/29. No information is available on the distribution of the remaining five species. All of them are highly mobile and there are no reported catches for Block 16/29a.

The most vulnerable phase of the life cycle of demersal, pelagic fish and shellfish from oil pollution and general disturbance is during the egg and larval stage. Spawning activity and nursery areas in the Maureen Licence Block 16/29a are summarised in the table below.

Table 3-1 Reported Fish Breeding Activity Around Licence Block 16/29 incorporating the Maureen Development Area

Species	J	F	M	A	M	J	J	A	S	O	N	D	Nursery Area
Mackerel													
Norway Pout													
Haddock													
Blue Whiting													

Spawning period *nursery / juveniles*

Only 2 species of commercially important fish, mackerel and Norway pout, have spawning grounds in Block 16/29a. Norway pout is a demersal or near-bottom dwelling species that spawns between January and April. Mackerel lay eggs in the upper part of the water column between May and August. If mackerel spawning occurred in close proximity to the Maureen Facilities during decommissioning activities, the spawning could be temporarily disturbed during the operations in the local area. However, mackerel spawning takes place over a large area of the North Sea and there is no evidence of any specific concentration at the Maureen Site.

The Maureen Facilities are located within nursery areas for 3 species; haddock, blue whiting and Norway pout. These nursery grounds cover large areas of the North Sea. Consequently, the impact of the Maureen decommissioning activities on either spawning or nurseries are predicted to be minimal taking the North Sea as a whole.

3.5.4 Marine Mammals

Marine mammals include whales and dolphins (cetaceans), seals and otters, all of which are susceptible to both chemical and noise pollution and are protected by law in UK waters as a result of a review in 1996 of the Wildlife and Countryside Act (1981, Schedule 5). Seals and otters tend to frequent inshore waters but seals have been sighted from a number of platforms in the North Sea, including Maureen.

British populations of grey seals (*Halichoerus grypus)* and common seals (*Phoca vitulina*) represent 40% and 5% respectively of world populations of these species. Both grey and common seals are found along the Scottish coast to the west of the Maureen Field, and along the Norwegian coast to the east of the area.

There is little data available regarding the presence of seals in the area of the North Sea in which Maureen is located, and it is unlikely that many seals occur as far out to sea as Block 16/29a. Studies have shown that 78% of the foraging trips by grey seals are within 50 km of the coast and common seals have also been found to forage within this limit. It is therefore unlikely that seals would be present in the Maureen area, since it is over 200 km from the nearest coast, and even less likely that they would choose to stay in the immediate area if disturbed by the decommissioning activities.

Information on the numbers and distribution of cetaceans is limited and general, owing to difficulties in observation and species identification. The available information indicates that harbour porpoises (*Phocoena phocoena*) appear to be widely distributed across the North Sea, and minke whales (*Balaenoptera acutorostrata*) and white-beaked dolphins (*Lagenorhynchus albirostris*) are also known to occur regularly in the North Sea, especially in northern areas (Northridge *et al*., 1995[8]). Recordings of cetacean sightings carried out on seismic survey vessels during 1996 found that minke whales and harbour porpoises were seen in the North Sea (Stone, 1997[9]). Lower numbers of these species were recorded however, than may have been expected. White-beaked dolphins were also seen in the North Sea. Most species were sighted in low numbers and seasonal peaks in abundance were recorded, with the greatest numbers of cetaceans sighted from July to September.

As marine mammals feed on fish and/or plankton, clouding of the water column affecting this food source could have a negative impact on cetaceans. However, as these species are largely migratory through Block 16/29a, individuals are not likely to be affected by any localised clouding that may occur. The table below shows cetacean sightings in the Maureen area.

Table 3-2 Cetacean Distribution in the Maureen Area

Species	Sightings
Harbour porpoise (*Phocoena phocoena)*	Regular
White-beaked dolphin *(Lagenorhynchus albirostris)*	Regular
Common dolphin (*Delphinus delphos)*	Occasional
Bottle-nosed dolphin (*Tursiops truncatus)*	Occasional
Atlantic white-sided dolphin (*Lagenorhynchus acutus)*	Regular
Risso's dolphin (*Grampus griseus)*	Regular
Minke whale (*Baleanoptera acutorostrata)*	Regular
Killer whale (*Orcinus orca)*	Regular
Long-finned pilot whale (*Globicephala melas)*	Regular

3.5.5 Seabirds

Seabirds are present in the Maureen area throughout the year but there are seasonal fluctuations in the number of species present at any one time because of their migratory and feeding patterns.

The Joint Nature Conservation Committee (JNCC)[10] has produced an Oil Vulnerability Index (OVI) for seabirds encountered within each offshore licence block within the southern, central and northern North Sea and the Irish Sea. The index is based on a scoring system for individual species that ranks the relative vulnerability of the various species, and the density values over time for each species within defined offshore areas.

The OVI of seabirds within each offshore licence block changes throughout the year. This is owing to the natural seasonal fluctuations in numbers and species of birds present in an area. In general, offshore densities of seabirds tends to be lowest in May and June as the majority of birds will be present at their breeding colonies and raising young. Thus the OVI for offshore blocks will be lower at this time of year. Conversely, species of auks such as guillemots and razorbills undergo a post breeding feather moult in August and September and lose the ability to fly. These birds are very vulnerable to pollutants on the sea surface, if present at this time, and so licence blocks where these moulting flocks are known to occur will have a high OVI score for this time of year.

The table below shows the monthly vulnerability of seabirds in Block 16/29a incorporating the Maureen development area.

Table 3-3 Monthly Vulnerability of Seabirds in Block 16/29 incorporating the Maureen Development Area

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
*			*								-

= Very high **= High** **= Moderate** **= Low**

***** No figure given for January or April, vulnerability is an average of surrounding squares.

- No figure is available for December.

As shown above, seabird vulnerability in and around Block 16/29 is highest between August and February. Vulnerability is lowest in March and moderate to low between May and July, which is the main scheduled period of decommissioning activity at Maureen.

3.6 Fishing and Other Commercial Activity

There is a number of commercial activities that take place at or near the Maureen area, including, fishing, shipping, and other oil and gas exploration and production.

3.6.1 Commercial Fisheries

The International Council for the Exploration of the Sea (ICES)[11] has divided the North Sea into a number of sea areas, each of which is sub-divided into rectangles. Each rectangle covers 15 licence blocks. The Maureen development lies within ICES rectangle 45 F1.

The following assessment of commercial fishing activity in the Maureen development area has been compiled using ICES statistical data provided by the Fisheries Research Services[12]. UK fishermen are obliged to report catch information when landing their catches. This information includes quantities of species landed, where they were caught and by what method (which type of gear/duration of fishing).

Fishing effort is an indicator of the importance of a sea area to the fishing industry. Effort may vary considerably from year to year. Fishing effort (hours fished) for ICES rectangle 45 F1 for 1998 is shown in Table 3-4 below. A range of fishing techniques was used. These data are not necessarily complete since it is not known that all catches landed in Britain are captured by the survey. However, the data give the best available indication of fishing activity in the region.

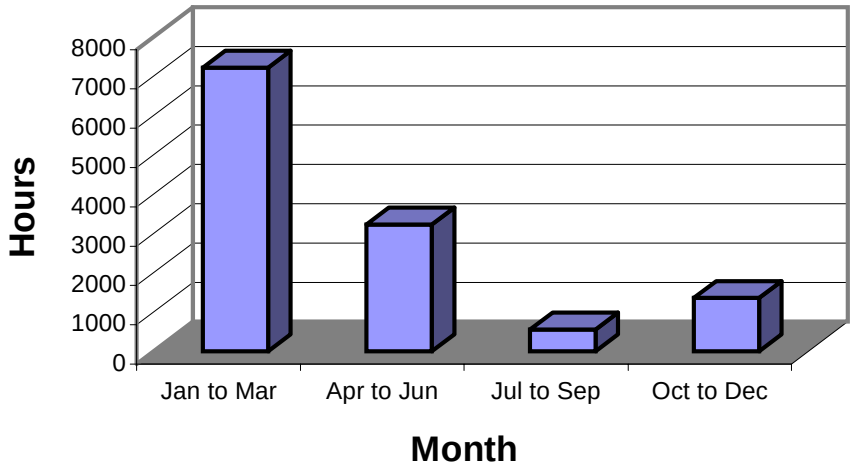
Table 3-4 Hours Fished and Fishing Methods for ICES Rectangle 45 F1 in 1998 (for United Kingdom Vessels landing in Scotland)

Fishing Method	Hours fished in ICES Rectangle 45 F1
Beam Trawl	10
Heavy Trawl	62
Light Trawl	5517
Demersal Trawl (twin/multiple nets)	2106
Demersal Pair Trawl	293
Seine Net	301
Pair Seine	237
Nephrops (Lobster) Trawl (single net)	2038
Nephrops (Lobster) Trawl (twin/multiple nets)	953
Shrimp Trawl	843
All gears	**12360 hours**

The majority of the fishing effort in ICES Rectangle 45 F1 in 1998 was made using light trawl, demersal trawl and *Nephrops (Scampi)* trawl gear. The amount of fishing that is carried out using beam trawl and heavy trawl gears is of importance, since these methods involve dragging heavy gear over the seabed, which could potentially impact upon an exposed pipeline. Fishing effort using such gear in the Maureen area would appear to be low, since only 72 hours were fished by these methods in 1998.

Seasonal variation in fishing effort (hours fished) for ICES rectangle 45 F1 during 1998 is shown in Figure 3-5 below.

Figure 3-5 Seasonal Variation in Fishing Effort for ICES Rectangle 45 F1 during 1998 (for United Kingdom vessels landing in Scotland)



In 1998 most fishing activity took place between January and March with almost 7000 hours fished. There was a considerable drop in fishing activity for the rest of the year. From this it is concluded that the Maureen decommissioning activities will mean little or no interference with fishing activity.

Table 3-5 shows catch data from 1998 for the ICES rectangle around the Maureen area. It demonstrates that ICES Rectangle 45 F1 is a relatively important fishing area for demersal fish species and shellfish, but is of low commercial importance for pelagic species including mackerel.

Table 3-5 Catches in Tonnes for ICES Rectangle 45 F1 in 1998 (for United Kingdom Vessels landing in Scotland)

Catch	Rectangle 45 F1
Demersal	805,777
Pelagic	4
Shellfish	384,075
Total	**1,189,856 tonnes**

3.6.2 Other Commercial Activities

Shipping

The main shipping activity in the Maureen area consists of ferry traffic between Newcastle, UK and Bergen in Norway and coastal vessels travelling between the UK, Norway and Holland. Shipping traffic also includes oil tankers travelling from the Flotta Oil Terminal in the Orkneys and the Sullom Voe Terminal in the Shetlands to the UK and northern Europe, and supply boats and construction vessels operating in the North Sea oil and gas industry.

Oil and Gas Activities

None of the oil and gas developments mentioned in subsection 3.3.2 above are closer than 10 km to the Maureen Facilities.

3.7 Notes and References

The notes below provide additional reference information relevant to this section. A Glossary of terms and abbreviations is also included within Appendix A and a complete list of supporting studies is contained within Section 17.

[1] International Council for the Exploration of the Sea (ICES) http://www.ices.dk

[2] An Assessment of the Sediment Contamination Beneath the Maureen Platform: Cordah Report 0572-33-493.

[3] Pre-decommissioning Baseline Seabed Survey of the Maureen Alpha Platform and Associated Infrastructure: Cordah Report 0572-33-506 (Draft) March 2000.

[4] Environmental Seabed Survey of the Benthic Sediments Around the Maureen Oil Field October 1988 – Aberdeen University Marine Studies Ltd, Report BE-88-58, July 1989.

[5] Reid, P.C., Robinson, G.A. and Hunt, H.G. 1987: Spatial and Temporal Patterns of Marine Blooms in the North Eastern Atlantic and North Sea from Continuous Plankton Recorder Survey. Rapp.P-v. cons.Int.Explor.Mer. 187: 27-37.

[6] North Sea Task Force (NSTF) (1993b) North Sea Subregion 2b Assessment Report. Oslo and Paris Commissions, London.

[7] Coull, K.A., Johnstone, R., & Rogers. 1998: Fisheries Sensitivity Maps in British Waters.

[8] Northridge, S.P., Tasker, M.L., Webb, A., and Williams, J.M. 1995: Distribution and Relative Abundance of Harbour Porpoises (Phocoena phocoena L), White Beaked Dolphins (Legenorhynchus albirostris Gray) and Minke Whales (Balaenoptera acutorostrata lacepede) around the British Isles. ICES Journal of Marine Science 52: 55-66.

[9] Stone, C.J. 1997: Cetacean observations during seismic surveys in 1996. JNCC Report No. 228. Joint Nature Conservation Committee, Peterborough. 41pp plus appendices.

[10] Joint Nature Conservation Committee (JNCC),. http://www.nhbs.co.uk/services/jncc.html

[11] International Council for the Exploration of the Sea (ICES) http://www.ices.dk

[12] Fisheries Research Services http://www.marlab.ac.uk/FRS.htm

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