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South (West) Limited**

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South (East) Limited**

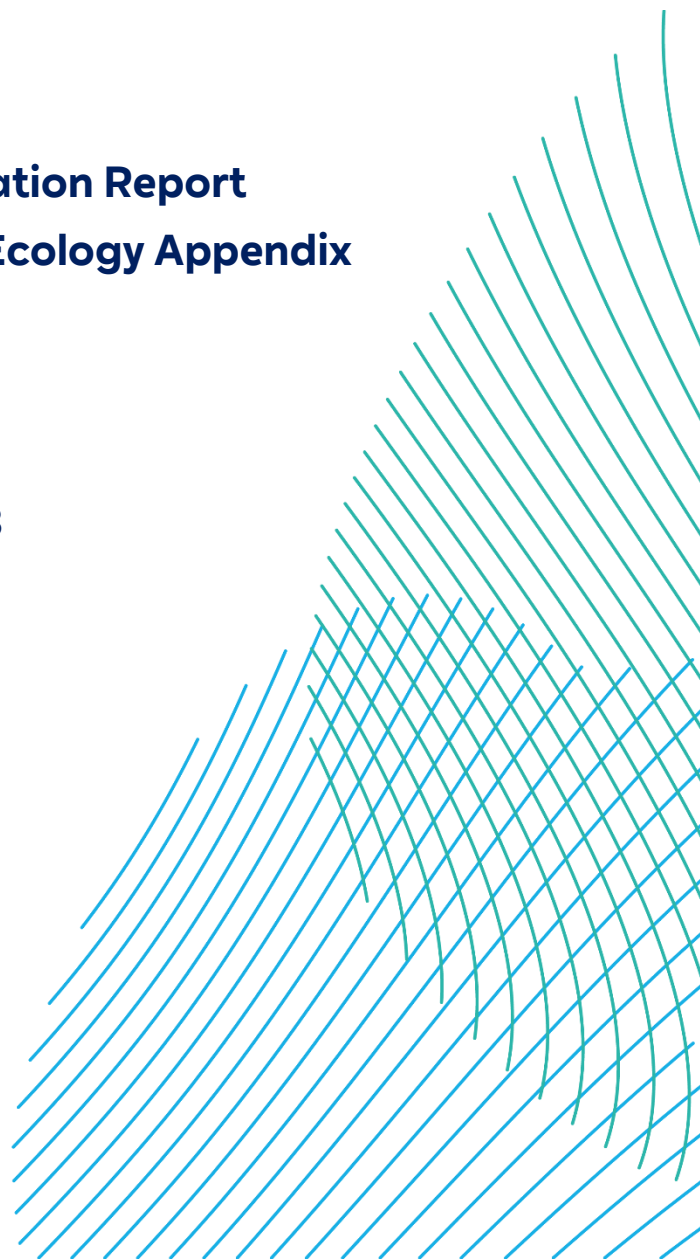
Dogger Bank South Offshore Wind Farms

**Preliminary Environmental Information Report
Appendix 10-1 Fish and Shellfish Ecology Appendix**

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Dogger Bank South Offshore Wind Farms Appendix 10.1 – Fish and Shellfish Ecology

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1. Appendix Purpose

The Fish and Shellfish Ecology Appendix presents ecology and conservation information relevant to species identified as having potential presence within the Fish and Shellfish Ecology Study Area, defined as ICES Rectangles 36E9; 36F0; 37E9; 37F0; 37F1; 37F2; 38F0; 38F1; and 38F2. This Appendix should be read alongside **Chapter 10 – Fish and Shellfish Ecology**. Data through this Appendix are organised by receptor group as defined within this chapter:

- Elasmobranchs;
- Demersal Fish;
- Pelagic Fish;
- Shellfish;
- Migratory Fish.

2. Elasmobranchs

Table 2.1: Ecology of elasmobranch species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Basking shark <i>Cetorhinus maximus</i>	Present in the summer months, but with a low density of sightings	Occurs mostly offshore but does venture into shallows near shore	Unknown	Passive filter feeder, feeding solely on plankton	Fish with no swim bladder
Blonde ray <i>Raja brachyura</i>	Spawning occurs between February and August	Varied depth range depending on location, up to 150 m in NE Atlantic, 10-300 m in Mediterranean, and globally up to 900 m. Typically occurs on soft substrate such as sandy and muddy ground	Shallow, coastal waters are used as nursery areas, leading to an increased presence of juveniles	Both adults and juveniles feed on crustaceans, with larger adults also taking cephalopods and small teleosts	Fish with no swim bladder
Common skate <i>Dipturus batis</i>	Egg-laying occurs in spring and summer	Demersal, preferring sandy and muddy substrates at depths between 10 and 600m, with juveniles found in shallower waters	Not described as migratory	Typically feeds on benthic prey, including bristle worms, crustacea, and small demersal fish species (such as sandeel and flatfish spp.)	Fish with no swim bladder
Common smoothhound <i>Mustelus mustelus</i>	Limited information on the reproductive biology of this species	Most common over sandy and muddy substrates at <50 m over continental shelf, recorded up to 350 m. Mostly demersal in nature, occasionally midwater	Not described as migratory	Primarily feeds on crustaceans, also cephalopods and teleosts	Fish with no swim bladder

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Cuckoo ray <i>Leucoraja naevus</i>	Egg cases produced throughout the year	Demersal from 30-500 m, though most common <200 m. Found on continental shelf and upper slopes over sandy and coarse sediment	Not described as migratory	Feeds on crustaceans, polychaete worms and teleosts	Fish with no swim bladder
Lesser spotted dogfish <i>Scyliorhinus canicula</i>	Egg-laying occurs during spring and early summer	Found from shallow sublittoral waters up to 400 m, mostly on sand and mud, but also on algae, rocky and gravelly bottoms	Females come inshore during the warmer months to lay eggs	It feeds opportunistically on a range of benthic fauna, mostly crustaceans and molluscs. Feeding intensity is highest during the summer	Fish with no swim bladder
Shagreen ray <i>Leucoraja fullonica</i>	Limited information on the reproductive biology of this species	Demersal from 30-550 m, found primarily on outer continental shelf. No preference for substrate	Not described as migratory	Predominant prey comprise benthic invertebrates and teleosts, though large individuals take teleosts and cartilaginous fish	Fish with no swim bladder
Spotted ray <i>Raja montagui</i>	Limited information on the reproductive biology of this species	Majority of population found in waters 100-500 m deep. Prefers soft, sandy substrates in coastal seas and on continental shelves	Mostly non-migratory, though females migrate to shallow waters from April-July to spawn	Adults feed on large crustaceans, teleost fish, polychaetes and molluscs, juveniles on small crustaceans	Fish with no swim bladder
Starry smoothhound <i>Mustelus asterias</i>	Gives birth to pups in the summer. Adults may migrate	Predominantly found on sandy and gravelly bottoms, at depths of 1-100 m on continental	Young are born inshore, adults may migrate inshore in the	Feeds almost exclusively on crustaceans	Fish with no swim bladder

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
	inshore in summer	shelves	summer		
Thornback ray <i>Raja clavata</i>	Overwinters in deeper water, migrating into shallower areas in the late spring and summer (February-September) to spawn	Inhabits continental shelf and upper slope waters from 10-300 m, though it is most abundant in waters 10-60 m. Frequents a range of sediments, though not typically coarser sediments	Mostly non-migratory, though fish often moves close inshore during the spring	Adults feed on large crustaceans and small teleost fish such as sandeels, small gadoids and dragonets, whereas juveniles prefer small crustaceans	Fish with no swim bladder
Velvet belly lanternshark <i>Etmopterus spinax</i>	Present in UK waters throughout the year, with a long reproductive cycle	Typically found at depths of between 300 and 1000 meters, and is associated with rocky and muddy environments	Not described as migratory	Feed on smaller fish, crustaceans, and cephalopods	Fish with no swim bladder
Spurdog <i>Squalus acanthias</i>	Timing of reproduction varies by location, though it broadly occurs between January and August	Found in inshore waters to continental shelf, most commonly 10-200 m but recorded up to 900 m. Is epibenthic but also occurs in water column, with no preference for habitat	Highly migratory, dependent on age and sex. Young females migrate to shallow waters to give birth	Diet consists of mostly teleost fish (herring, whiting, Norway pout, cod, and Atlantic mackerel), with crustaceans often taken by smaller individuals	Fish with no swim bladder
Tope shark <i>Galeorhinus galeus</i>	Mating and parturition occurs during the spring	Found inshore through to 550 m depth, mostly near the seabed	Females give birth in shallow waters	Feeds mostly on a wide variety of teleost fish, in addition to some invertebrates	Fish with no swim bladder

Table 2.2: Conservation status of elasmobranch species identified as having potential for presence within the Fish and Shellfish Ecology Study Area.

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)	Marine and Coastal Access Act 2009 (c.23)
Basking shark <i>Cetorhinus maximus</i>	Endangered (Global and Europe)	Yes	Yes	Yes	No	No	No
Blonde ray <i>Raja brachyura</i>	Near Threatened (Global and Europe)	No	No	No	No	No	No
Common skate <i>Dipturus batis</i>	Critically Endangered (Global) with decreasing population	Yes	Yes	No	No	No	No
Common smoothhound <i>Mustelus mustelus</i>	Vulnerable (Global and Europe)	No	No	No	No	No	No
Cuckoo ray <i>Leucoraja naevus</i>	Least Concern	No	No	No	No	No	No
Lesser spotted dogfish <i>Scyliorhinus canicula</i>	Least Concern	No	No	No	No	No	No

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)	Marine and Coastal Access Act 2009 (c.23)
Shagreen ray <i>Leucoraja fullonica</i>	Vulnerable (Global and Europe)	No	No	No	No	No	No
Spotted ray <i>Raja montagui</i>	Least Concern	Yes	No	No	No	No	No
Starry smoothhound <i>Mustelus asterias</i>	Vulnerable (Global), Endangered (Europe)	Yes	Yes	No	No	No	No
Thornback ray <i>Raja clavata</i>	Least Concern (Global), Near Threatened (Europe)	No	No	No	No	No	No
Velvet belly lanternshark <i>Etmopterus spinax</i>	Near Threatened (Global and Europe)	Yes	No	No	No	No	No
Spurdog <i>Squalus acanthias</i>	Vulnerable (Global and Europe)	No	Yes	No	No	No	No

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)	Marine and Coastal Access Act 2009 (c.23)
Tope shark <i>Galeorhinus galeus</i>	Least Concern	No	No	No	No	No	Yes

3. Demersal Fish

Table 3.1: Ecology of demersal fish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Anglerfish <i>Lophius piscatorius</i>	Spawning occurs between January-June	Occur at depths from coast up to 1,000 m, on sandy and muddy bottoms. May also be found on rocky bottoms	Migrate between inshore and offshore spawning grounds	Feeds mostly on fish that it lures	Data deficient
Atlantic cod <i>Gadus morhua</i>	Spawning occurs in winter and beginning of spring	Juveniles prefer shallower waters (10-30 m) with complex habitats than adults (up to 600 m)	Migrate between spawning, feeding and overwintering areas, journeys of <200 km	Omnivorous, feeding on mostly fish and invertebrates	Fish with a swim bladder involved in hearing
Bass <i>Dicentrarchus labrax</i>	Spawning occurs in spring	Inhabit coastal waters up to 100 m on range of bottom types	Migrate from coastal to offshore waters in winter	Feeds mostly on shrimp and molluscs, as well as fish	Data deficient
Blue Whiting <i>Micromesistius poutassou</i>	Spawns late winter - early spring	Pelagic, found commonly at depths of 300-400 m but can reach 1000 m	Daily vertical migrations	Feeds primarily on small crustaceans, but large individuals will take small fish and cephalopods	Fish with a swim bladder involved in hearing
Brill <i>Scophthalmus rhombus</i>	Spawning occurs in first half of year, varies by location	Live on sandy or mixed bottoms up to 50 m	Adults found more offshore than juveniles	Feed on benthic fish and crustaceans	Data deficient

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Dab <i>Limanda limanda</i>	Spawning occurs in spring and early summer in British waters	Mostly found over sandy ground at depths of 20-40 m, sometimes up to 150 m. Young live inshore	Adults migrate inshore from deeper water in the warmer summer months	Opportunistic feeder, though mainly on crustaceans and small fish	Fish with no swim bladder
Dover sole <i>Solea solea</i>	The timing of spawning is related to a temperature threshold	Found on stony bottoms at depths 20-200 m	None reported	Feeds on invertebrates, primarily polychaetes	Fish with no swim bladder
European flounder <i>Platichthys flesus</i>	Spawns in spring in deeper, warmer waters	Found on muddy or sandy substrates in shallow water. Tolerant of marine, brackish and freshwater environments	Migrates to saltwater to spawn	Feeds on benthic fauna, including small fishes and invertebrates	Fish with no swim bladder
European hake <i>Merluccius merluccius</i>	Spawning occurs April-December, with a peak in February-March	Found usually between 30-1075 m, normally 70-400 m	Diurnal; off bottom during day, on bottom at night	Feed mainly on fish, with young feeding on small crustaceans	Data deficient
Four-Spotted Megril <i>Lepidorhombus boscii</i>	Spawns between February and May	Found on soft substrates	Unknown	Feeds mainly on crustaceans and fish	Fish with no swim bladder
Grey gurnard <i>Eutrigla gurnardus</i>	Spawns April to August	Common on sand, rocky and muddy bottoms between coastal and 140 m depth	None reported	Feeds on crustaceans and fish	Data deficient

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Grey triggerfish <i>Balistes capriscus</i>	Spawning uncommon in UK waters	Found from intertidal to 100 m. Inhabits rocky areas and wrecks	Poor swimmers, likely in UK waters by travelling along currents	Feeds on benthic invertebrates, such as molluscs and crustaceans	Data deficient
Haddock <i>Melanogrammus aeglefinus</i>	Spawning takes place from March to May	Found over rock, sand gravel or shells, at depths of 40-300 m	None reported for UK waters	Feeds on variety of benthic organisms, including crustaceans, molluscs, and teleosts	Fish with a swim bladder involved in hearing
Atlantic Halibut <i>Halibut hippoglossus</i>	Spawning takes place in the winter and early spring	Found near areas with a rocky or gravelly substrate across a range of depths	None reported	Feeds on a variety of other marine species including fish, crustaceans, and molluscs.	Fish with no swim bladder
John Dory <i>Zeus faber</i>	Spawning occurs at the end of winter/early spring	Remains near seabed	None reported	Feeds mostly on teleosts, also cephalopods and crustaceans	Data deficient
Lemon sole <i>Microstomus kitt</i>	The timing of spawning is related to a temperature threshold	Found on stony bottoms at depths 20-200 m	None reported	Feeds on invertebrates, primarily polychaetes	Fish with no swim bladder
Ling <i>Molva molva</i>	Spawn in spring	Occurs mostly in deep water (100-400 m) over rocky bottoms	Unknown	Feeds on large fish and invertebrates	Fish with a swim bladder involved in hearing
Lumpfish	Spawning takes place	Typically found in shallow,	None reported	Feeds on a variety of small	Data deficient

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
<i>Cyclopterus lumpus</i>	in the spring and early summer	rocky areas of the coast, including rocky shores and kelp habitat from 50 to 500 meters.		marine animals including fish, crustaceans, and molluscs	
Megrim <i>Lepidorhombus whiffiagonis</i>	Unknown, though spawning occurs in deep waters off west of British Isles	Occurs at depths 100-700 m, over soft bottoms	Not reported	Feeds on small bottom-living fishes, cephalopods, and crustaceans	Fish with no swim bladder
Monkfish <i>Lophius piscatorius</i>	Spawn in deep water during spring/early summer	Deep offshore areas >50 m. Often several hundred m deep.	None reported	Feeds on almost any organism within size and range of jaws	Data deficient
Mullet Mugilidae	Catadromous, migrating to sea to spawn in February - April	Inshore areas up to 10 m depth. Common in brackish water in estuaries and harbours	Migrate into saltwater to spawn	Scavenger that feeds on vegetation and organic matter on the seabed or in the water column.	Data deficient
Plaice <i>Pleuronectes platessa</i>	Spawn mostly between January-March in well-defined spawning grounds	Occurs on mud and sandy bottoms, from intertidal to about 100 m depth (increase in water depth with age)	Migrate for spawning activity	Feed mainly on thin-shelled molluscs and polychaetes. Active at night	Fish with no swim bladder
Pollock <i>Pollachius pollachius</i>	Spawn in the late winter to spring	Found from nearshore to 200 m, over hard bottoms	Larger individuals move to more open sea. May take spawning migrations	Major predator of young cod	Fish with a swim bladder involved in hearing

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Pouting <i>Trisopterus spp.</i>	Unknown	Found inshore down to 300 m, over mixed rock and sand, also around wrecks	Moves inshore to waters <50 m for spawning	Feeds mostly on crustaceans, but also on small fish, molluscs and polychaetes	Fish with a swim bladder involved in hearing
Red gurnard <i>Chelidonichthys cuculus</i>	Spawns in the summer in inshore waters	Found over sand, gravel, and rocky substrates	Migrates from deep to shallow waters to spawn in the summer	Feeds on crustaceans, other invertebrates, and fish	Data deficient
Saithe <i>Pollachius virens</i>	Unknown	Occurs up to 350 m	Enters coastal waters in spring and returns to deeper waters in winter	Adults feed on other fish, whereas small fish feed primarily on crustaceans	Fish with a swim bladder involved in hearing
Sand eel <i>Ammodytidae</i>	Spawning recorded in December and January	Occurs up to 150 m over sandy bottoms, both inshore and offshore	Bury in bottom during night and winter, migrate in water column during strong tidal currents	Feed on plankton	Fish with no swim bladder
Striped red mullet <i>Mullus surmuletus</i>	Spawning occurs in May-July	Occurs mostly at depths up to 100 m over hard broken grounds	Adults migrate to shallows in spring/summer; juveniles move summer/autumn	Feeds mostly on benthic invertebrates	Data deficient

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Tub gurnard <i>Chelidonichthys lucerna</i>	Spawns in the summer in inshore waters	Found on muddy sand and gravel up to 318 m depth	Migrates from deep to shallow waters to spawn in the summer	Feeds on fish, crustaceans, and molluscs	Data deficient
Turbot <i>Scophthalmus maximus</i>	Spawning season is April-August	Most common on sandy, rocky or mixed bottoms. Depth range 20-70 m	None reported	Feeds mostly on benthic fish and less on crustaceans and bivalves	Fish with no swim bladder
Whiting <i>Merlangius merlangus</i>	Spawning occurs January-September	Depth range 10-200 m, most commonly 30-100 m, over mud and gravel bottoms mostly, but also on sand and rock	Individuals migrate to open sea after first year	Feed on a range of benthic prey	Fish with a swim bladder involved in hearing
Witch flounder <i>Glyptocephalus cynoglossus</i>	In Irish Sea, spawns March-May	Inhabits soft mud bottoms at depths of 45-366 m	None reported	Feeds on crustaceans, polychaetes, brittle stars and fish	Data deficient

Table 3.2: Conservation status of demersal fish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area.

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
Anglerfish <i>Lophius piscatorius</i>	Least Concern	No	Yes	No	No	Yes
Atlantic cod <i>Gadus morhua</i>	Vulnerable (Global), Least Concern (Europe)	Yes	Yes	No	No	Yes
Bass <i>Dicentrarchus labrax</i>	Least Concern	No	No	No	No	No
Blue Whiting <i>Micromesistius poutassou</i>	Least Concern	No	Yes	No	No	No
Brill <i>Scophthalmus rhombus</i>	Least Concern	No	No	No	No	No
Dab <i>Limanda limanda</i>	Least Concern	No	No	No	No	No
Dover sole <i>Solea solea</i>	Least Concern	No	No	No	No	No
European flounder <i>Platichthys flesus</i>	Least Concern	No	No	No	No	No
European hake	Least Concern	No	Yes	No	No	Yes

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
<i>Merluccius merluccius</i>						
Four-Spotted Megrin <i>Lepidorhombus boscii</i>	Least Concern	No	No	No	No	No
Grey gurnard <i>Eutrigla gurnardus</i>	Least Concern	No	No	No	No	No
Grey triggerfish <i>Balistes capriscus</i>	Least Concern	No	No	No	No	No
Haddock <i>Melanogrammus aeglefinus</i>	Least Concern	No	No	No	No	No
Atlantic Halibut <i>Halibut hippoglossus</i>	Endangered	Yes	Yes	No	No	No
John Dory <i>Zeus faber</i>	Vulnerable (Global), Least Concern (Europe)	No	No	No	No	No
Lemon sole <i>Microstomus kitt</i>	Data deficient	No	No	No	No	No
Ling <i>Molva molva</i>	Least Concern	No	No	No	No	No

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
Lumpfish <i>Cyclopterus lumpus</i>	Near Threatened (Global), Vulnerable (Europe)	No	No	No	No	No
Megrim <i>Lepidorhombus whiffiagonis</i>	Data deficient (Global and Europe)	Yes	Yes	Yes	No	Yes
Monkfish <i>Lophius piscatorius</i>	Least Concern	No	No	No	No	No
Mullet Mugilidae	Least Concern	No	No	No	No	No
Plaice <i>Pleuronectes platessa</i>	Least Concern	No	No	No	No	No
Pollock <i>Pollachius pollachius</i>	Least Concern	No	Yes	No	No	Yes
Pouting (Bib) <i>Trisopterus luscus</i>	Least Concern	No	No	No	No	No
Red gurnard <i>Chelidonichthys cuculus</i>	Least Concern	No	No	No	No	No

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
Saithe <i>Pollachius virens</i>	Least Concern	No	No	No	No	No
Sand eel <i>Ammodytidae</i>	Least Concern	No	No	No	No	No
Striped red mullet <i>Mullus surmuletus</i>	Least Concern	No	No	No	No	No
Tub gurnard <i>Chelidonichthys lucerna</i>	Least Concern	No	No	No	No	No
Turbot <i>Scophthalmus maximus</i>	Least Concern	No	No	No	No	No
Whiting <i>Merlangius merlangus</i>	Near Threatened (Global), Vulnerable (Europe)	No	No	No	No	No
Witch flounder <i>Glyptocephalus cynoglossus</i>	Least Concern	No	Yes	No	No	Yes

4. Pelagic Fish

Table 4.1: Ecology of pelagic fish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Albacore <i>Thunnus alalunga</i>	Spawn in winter	Pelagic species typically found at depths ranging from 20 to 200 meters	Migrate long distances, often following the movements of their prey species	Feed on a variety of other marine species including fish, crustaceans, and molluscs	Data deficient
Atlantic bluefin tuna <i>Thunnus thynnus</i>	Arrive in late spring and may remain until winter	Up to depths of 1000 m	Wide ranging migration moving between UK waters, central and western Atlantic and Mediterranean	Feed on a wide range of fish species	Data deficient
Atlantic Bonito <i>Sarda sarda</i>	Spawn in June	Pelagic above the continental shelf	Unknown	Feed on schooling fish and invertebrates	Data deficient
Atlantic herring <i>Clupea harengus</i>	Comes to coastal areas to spawn. Both autumn and winter-spawning stock present	Occupy the water column from surface to 200m depth	Comes to coastal areas to spawn	Feed mostly on small shrimps and copepods, with occasional filter-feeding	Fish with a swim bladder involved in hearing
Atlantic horse mackerel <i>Trachurus trachurus</i>	Spawning occurs in early spring for the “West stock”	Found on continental shelves (frequently over sandy bottoms) up to 500 m depth	Following spawning the stock migrates north to southern Norway/northern North Sea	Feeds on crustaceans, cephalopods and fish	Data deficient

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Atlantic mackerel <i>Scomber scombrus</i>	Spawning occurs during summer	Widely distributed on coastal shelves up to 200 m depth	Migrate in winter and early spring to spawning areas (inshore); spawn in summer; migration to post-spawning feeding grounds and overwinter areas	Filter-feeders on zooplankton, such as small fish and prawns	Data deficient
Capelin <i>Mallotus villosus</i>	Spawn in the spring in inshore waters	Found in open water up to depths of 100m	Migrate north during summer months to feed	Feeds primarily on plankton and krill	Data deficient
European Pilchard <i>Sardina pilchardus</i>	Spawn in summer	Littoral, commonly found at 25-55 m depth	Diurnal vertical migration, spawn in the North Sea and English Channel	Feed primarily on planktonic crustaceans	Data deficient
European sprat <i>Sprattus sprattus</i>	Spawn throughout the year, though primarily in spring and summer	Occurs in the water column at depths of 10-150 m	Shows strong migrations between winter feeding and summer spawning grounds. Diurnal migrations through the water column	Feeds on planktonic crustaceans	Fish with a swim bladder involved in hearing
Rudderfish <i>Centrolophus niger</i>	Spawning occurs (pelagically) offshore throughout the year	marine, bathypelagic with a depth range of 40-1050m usually 300-700m	Found in temperate waters across the Atlantic and Pacific	Feeds of whatever is available, small fish, squid, pelagic crustaceans, and other plankton.	Data deficient
Snake Mackerel	Spawning occurs	Oceanic pelagic with a	Diurnal vertical migration	Feeds largely on squid and	Data deficient

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
<i>Gempylus serpens</i>	year-round in the Caribbean Sea and off the coast of Florida	range from 0-820m		pelagic fish species	
Sunfish <i>Mola mola</i>	Spawning occurs between August and October	Found in temperate and tropical waters globally up to approximately 600m but have been recorded at 800m	Thought to migrate northward during the summer, and southward in winter	General feeders, including fish, crustaceans, jellyfish and salps	Data deficient

Table 4.2: Conservation status of pelagic fish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
Albacore <i>Thunnus alalunga</i>	Least Concern	Yes	Yes	No	No	No
Atlantic bluefin tuna <i>Thunnus thynnus</i>	Near Threatened	Yes	Yes	No	No	Yes
Atlantic Bonito <i>Sarda sarda</i>	Least Concern	No	No	No	No	No
Atlantic herring <i>Clupea harengus</i>	Least Concern	No	Yes	No	No	Yes
Atlantic horse mackerel <i>Trachurus trachurus</i>	Vulnerable (Global), Least Concern (Europe)	No	Yes	No	No	Yes
Atlantic mackerel <i>Scomber scombrus</i>	Least Concern	No	Yes	No	No	Yes
Capelin <i>Mallotus villosus</i>	Least Concern	No	No	No	No	No
European Pilchard <i>Sardina pilchardus</i>	Least Concern (Global) Near Threatened	No	No	No	No	No

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
	(Europe)					
European sprat <i>Sprattus sprattus</i>	Least Concern	No	No	No	No	No
Rudderfish <i>Centrolophus niger</i>	Least Concern	No	No	No	No	No
Snake Mackerel <i>Gempylus serpens</i>	Least Concern	No	No	No	No	No
Sunfish <i>Mola mola</i>	Vulnerable (Global)	Yes	No	No	No	No

5. Shellfish

Table 5.1: Ecology of shellfish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships
Brown crab <i>Cancer pagurus</i>	Mating takes place in spring and summer. Females are berried for 6-9 months, during which they remain in pits dug into the sediment or under rocks, not feeding. Larvae are released in late spring/early summer juveniles settle in the intertidal zone in late summer/early autumn	Usually at depths between 6 m-40 m, but can be found offshore at depths of up to 100 m. Found on a range of substrates such as sand, gravel and rocky seabed	Juveniles may remain in intertidal areas for approximately 3 years before moving to subtidal areas	Crustaceans including smaller brown crabs as well as bivalve molluscs
Brown Shrimp <i>Crangon crangon</i>	Core-spawning season between January and late June	Coastal waters, often in close association with the seabed	During growth they migrate seaward to deeper, salter waters	Omnivorous filter feeders, worms, algae, microscopic species, and organic debris
Clams Bivalvia	Spawning late spring and early summer (twice a	Usually present buried in muddy substrate	Migrate shoreward after the tide turns. And cease migrating during low tide.	Filter feeders / plankton, algae, and other organic matter

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships
	year)			
Common cockle <i>Cerastoma edule</i>	Main reproductive season is May-June	Burrows in sand, mud, and gravel substrate in intertidal zone	N/A	Filter feeder
Common cuttlefish <i>Sepia officinalis</i>	Spawns in shallow waters in spring and summer	Found on sandy and muddy substrate, up to 200 m though more common up to 100 m	Undergoes seasonal migrations between inshore waters in spring and summer and shelf grounds in autumn and winter	Feeds on small molluscs, crustaceans, cephalopods and teleosts
Common octopus <i>Octopus vulgaris</i>	Spawning peaks in spring and early summer	Prefers rocky, sandy muddy bottom, in water depths from the intertidal to 150 m	Undertakes limited seasonal migrations	Feeds mostly on fish, crustaceans and molluscs
Common whelk <i>Buccinum undatum</i>	Whelk have a low fecundity and entirely benthic reproductive strategy. Whelk spawn between November and January, laying distinctive egg masses which are then attached to suitable substrate	Muddy sand, gravel and rock	Common whelk has low growth rates and restricted adult movements	Carnivorous predator and active scavenger
European lobster <i>Homarus gammarus</i>	Mating takes place in the summer and	Rocky and stony substrata, usually not deeper than 50 m	Do not undertake migrations; will only move a few miles along	Preys on crabs, molluscs, sea urchins, polychaete worms and starfish

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships
	is annual or bi-annual. Eggs carried for 10-11 months		the shore	
European spider crab <i>Maja squinado</i>	This species is thought to move offshore during the autumn and inshore during the spring	Adults occur in sublittoral to depths of 90 m, on rocky bottoms with algae. Juveniles prefer shallows on mixed soft/hard bottoms	Only use slow, small-scale, non-directional movements	Feed upon algae and molluscs during the winter and echinoderms during the summer; general omnivorous diet
European spiny lobster <i>Palinurus elephas</i>	Mating takes place between June and October and oviposition is 2-10 after mating	Subtidally on rocky, exposed coasts, circalittoral zone	Migrate inshore to breed and offshore again in the late autumn	Feeds on detritus, small annelids and other crustaceans
European flying squid <i>Todarodes sagittatus</i>	Females spawn mainly during winter and mature males nearly all year round	Northeast Atlantic, Mediterranean and the Arctic. Neritic species, found from the surface to depths in excess of 1000m and in UK waters at 4595m previously. Occasionally among the fauna of the seabed on the continental shelf or the upper continental slope.	Undertake migrations for feeding as it matures. Moving into the North Atlantic. Large school have been seen in the Faroe Islands, Norway, Iceland, and Scotland; they stay there until the winter.	Prey on fish, crustaceans, and cephalopods. Albatross and sperm whales are regular feeders on squid, others such as dolphins, seals, baleen whales rays.
European squid <i>Loligo vulgaris</i>	Spawning occurs intermittently over several months (season varies; in	Usually in the water column over sandy and hard bottoms. Occurs down to 200 m	Abundance varies	Squid feed upon fish, as well as crustaceans, polychaetes and other cephalopods

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships
	English Channel peak is late autumn/early winter)			
Green crab <i>Carcinus maenas</i>	Copulating in spring and late summer, releasing larvae in June, July and August	Found in a wide range of salinities and substrates, including mud, sand, and rock	None reported	cod, bass, marine birds eat crabs. They prey on juvenile crabs, other crustaceans, juvenile lobster, mussels, and small fish.
King scallop <i>Pecten maximus</i>	Scallops spawn in spring or summer and probably require dense concentrations to achieve the successful production of larvae	Coarse gravel with some erect epifauna and shell is known to be suitable for successful settlement and recruitment of larvae to the stock	None reported	Filter feeder
Northern Stone Crab <i>Lithodes maja</i>	Unknown but fecundity is thought to be low	Demersal from 10-1000 m depth, various substrates	None reported	Scavenger
Norway lobster <i>Nephrops norvegicus</i>	Spawn in summer and autumn	Inhabits muddy bottoms, in waters 20-800 m deep, though usually 200-600 m	None reported	Nocturnally feeds on detritus, crustaceans, and worms
Queen scallop <i>Aequipecten opercularis</i>	Scallops spawn in spring or summer	Coarse gravel with some erect epifauna and shell is known to	None reported	Filter feeder

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships
	and probably require dense concentrations to achieve the successful production of larvae	be suitable for successful settlement and recruitment of larvae to the stock		
Shortfin squid <i>Illex illecebrosus</i>	Long Spawning season, females die after spawning, occurs all year round but has spikes from October to June	Deep and Shallow waters on the continental shelf, continental slope and pelagic - season dependant.	Migration occurs off the continental shelf, between depths of 150 to 275m. Diurnal migrations between cooler deep water and warmer surface water. Seabed in the day, water column at night.	They are predated by bluefin tuna, silver hake, red hake, bluefish, goosefish, four-spot flounder, Atlantic cod, sea raven, spiny dogfish, and swordfish. Seabird predators include shearwaters, gannets, and fulmars. They eat fish, crustaceans, other squid, including their own species.
Velvet swimming crab <i>Necora puber</i>	Mating occurs after the moult. Females bear eggs mostly in spring, eggs hatch in late spring	Shallow and intertidal to 80 m	Females migrate to soft substrates for egg laying	Opportunistic feeder, mostly on molluscs and crustaceans but also detritus and algae
Ocean quahog <i>Arctica islandica</i>	Spawn once per year in summer or autumn months	Sandy seabed	None reported	Filter feeders, that may act as a source of food for demersal species

Table 5.2: Conservation status of eshellfish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
Brown crab <i>Cancer pagurus</i>	Not assessed	No	No	No	No	No
Brown Shrimp <i>Crangon crangon</i>	Not assessed	No	No	No	No	No
Clams Bivalvia	Not assessed	No	No	No	No	No
Common cockle <i>Cerastoma edule</i>	Not assessed	No	No	No	No	No
Common cuttlefish <i>Sepia officinalis</i>	Least Concern	No	No	No	No	No
Common octopus <i>Octopus vulgaris</i>	Least Concern	No	No	No	No	No
Common whelk <i>Buccinum undatum</i>	Not assessed	No	No	No	No	No
European lobster <i>Homarus gammarus</i>	Least Concern	No	No	No	No	No
European spider crab	Not assessed	No	No	No	No	No

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
<i>Maja squinado</i>						
European spiny lobster <i>Palinurus elephas</i>	Vulnerable	No	Yes	No	No	Yes
European flying squid <i>Todarodes sagittatus</i>	Least Concern	No	No	No	No	No
European squid <i>Loligo vulgaris</i>	Data deficient	No	No	No	No	No
Green crab <i>Carcinus maenas</i>	Least Concern	No	No	No	No	No
King scallop <i>Pecten maximus</i>	Not assessed	No	No	No	No	No
Northern Stone Crab <i>Lithodes maja</i>	Not assessed	No	No	No	No	No
Norway lobster <i>Nephrops norvegicus</i>	Least Concern	No	No	No	No	No
Queen scallop <i>Aequipecten opercularis</i>	Not assessed	No	No	No	No	No

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
Shortfin squid <i>Illex illecebrosus</i>	Least Concern	No	No	No	No	No
Velvet swimming crab <i>Necora puber</i>	Not assessed	No	No	No	No	No
Ocean quahog <i>Arctica islandica</i>	Not assessed	Yes	No	No	No	No

6. Migratory Fish

Table 6.1: Ecology of migratory fish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
Atlantic salmon <i>Salmo salar</i>	The seasonality of salmon species can vary by population. Spawning usually takes place between November and February. Eggs hatch in spring and with juveniles remaining in a freshwater environment for 1-4 years before entering the marine environment between April and May as smolts. They then remaining at sea for 1-4 years. In the first year at sea Atlantic salmon are known as grilse, becoming multi sea winter (MSW) salmon in subsequent years.	Atlantic salmon spawn in rivers, before migrating to the marine environment as smolt. UK populations are known to migrate north to feed. Post-smolts are thought to remain close to the surface, but they may migrate to deep-sea feeding areas, within the Norwegian Sea and Greenland.	Adults return to the freshwater environment after 1-4 years in the marine environment. During migration adults tend to remain at water depths of between 13m and 118m, averaging 64m. Natal river migration peaks in late summer early autumn. Prior to upriver migration salmon spend time in brackish waters. Following the transition to freshwater adult salmon largely stop feeding, instead relying on fat reserves.	It has been hypothesised that deep dives to up to 280m are related to feeding or predator avoidance. Based on work undertaken by Malcom et al., 2010[1], gut content analysis suggest that adult fish are often still feeding, particularly early in the year.	Fish with a swim bladder not involved in hearing
Brown/sea trout <i>Salmo trutta</i>	Trout spend 1-3 years in the freshwater environment. They migrate downstream in spring/early summer (both as post-smolts and as	Brown trout that migrate to and are present in the marine environment can be either post-smolts, when they are in the	Trout usually spend 1 or 2 years at sea, in coastal areas. They migrate to freshwater environments in April-June.	Brown trout in the marine environment are known as sea trout. Some post-smolts return to fresh water relatively quickly	Fish with a swim bladder not involved

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
	adults).	marine environment for the first time, or post-spawned returning adults.		after migration to sea. There is considerable uncertainty as to the movement of sea trout after the initial few months in the marine environment. Whilst in the marine environment sea trout spend most of their time in the upper 5 m, though dives of up to 30 m are also recorded.	in hearing
European eel <i>Anguilla anguilla</i>	European eels spend most of their life cycle in the freshwater environment. Downstream migration is from August to December (as silver eels)	Both juvenile and adult eels are found throughout the water column. Depth selected can vary with time of day; tagged adult eels swim in shallow warm waters at night and then make a deep dive to 1,000 m where they remain for the day before ascending again. The purpose of the dive may be for predator avoidance.	European eel spawn in the Sargasso Sea with larvae drifting to Europe on the Gulf Stream. Following this they morph into glass eels and enter rivers from January-June. After between an average of 5-20 years of freshwater living, they travel back to the Sargasso Sea to spawn and die.	European eel diet comprises primarily fish, mollusc and crustaceans whilst in the marine environment. Adults do not feed on migration.	Fish with a swim bladder involved in hearing
River lamprey <i>Lampetra fluviatilis</i>	River lamprey remain in freshwater for 5 years or	After metamorphosis (July–September) at	River lamprey spend up to 2 years in the marine	The distribution of river lamprey whilst in the	Fish with no swim

Species	Seasonality	Habitat Association	Migration	Predator-prey relationships	Hearing Group
	more, where they remain in burrows in river silt beds until adults. They transit to feed in estuaries and coastal waters in July-September.	three to five years of age, the young adults migrate downstream during darkness to estuaries and coastal waters.	environment whilst they reach maturity. In the autumn they stop feeding in preparation for their migration into freshwater, which occurs between October and December. Their upstream migration to spawning grounds occurs in winter and spring, when temperature is low. They undertake these movements at night.	marine environment is dependent on the distribution of the prey species to which they are attached.	bladder
Sea lamprey <i>Petromyzon marinus</i>	Sea lamprey spend 3-4 years in freshwater environment. Following this, they transit to the open sea, primarily in July-September.	Metamorphosis to the adult form takes place between July and September. The time of the main migration downstream seems to vary from river to river.	Sea lamprey spend 18-24 months in marine waters. Following this, they migrate into freshwater in April-May spawning in May-June.	After metamorphosis and the downstream migration to the sea, the adults feed on fish there. They seem to feed on a wide variety of marine and anadromous fishes, including herring, salmon, cod and haddock.	Fish with no swim bladder
Shad species (allis <i>Alosa alosa</i> and twaite <i>A. fallax</i>)	Shad remain in the freshwater environment for a short period, usually a few months. Juveniles migrate downstream in April-May.	A suitable estuarine habitat is likely to be very important for shad, both for passage of adults and as a nursery ground for juveniles.	Shad spend 3-4 years in marine environments, specifically in estuarine areas. They return to freshwater in April-May to spawn.	Shad species feed primarily on plankton as juveniles, and small crustaceans and fish in later life stages.	Fish with a swim bladder involved in hearing

Table 6.2: Conservation status of migratory fish species identified as having potential for presence within the Fish and Shellfish Ecology Study Area

Species	IUCN Red List	OSPAR Annex V species	UK Post-2010 Biodiversity Framework	UK Wildlife and Countryside Act 1981, Schedule 5	Habitats Directive, Annex II	Species of Conservation Interest (under Marine Conservation Zone process)
Allis shad <i>Alosa alosa</i>	Least Concern	Yes	No	Yes	Yes	Yes
Atlantic salmon <i>Salmo salar</i>	Least Concern	Yes	No	No	Yes	Yes
Brown/sea trout <i>Salmo trutta</i>	Least Concern	No	No	No	No	No
European eel <i>Anguilla anguilla</i>	Critically Endangered (Global and Europe)	No	No	No	No	Yes
River lamprey <i>Lampetra fluviatilis</i>	Least Concern	No	No	No	Yes	No
Sea lamprey <i>Petromyzon marinus</i>	Least Concern	Yes	No	No	Yes	No
Twaite shad <i>Alosa fallax</i>	Least Concern	No	No	Yes	Yes	No

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