Sussex
Inshore Fisheries and Conservation Authority
Species Guide

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Sussex IFCA Inshore Fisheries and Conservation Authority

Bass

Dicentrarchus labrax

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Perciformes**
Family: **Moronidae**

Biological factor	
Size	Up to 1m, commonly 60cm [2] [3]
Lifespan	Over 25 years [5]
Size at reproductive maturity	Males 31-35cm, females 40-45cm [6]
Age at reproductive maturity	Males 4-7 years, females 5-8 years [6]
Fecundity	> 2,000,000 eggs [1]
Larval phase	Approximately 46 days [7]
Adult mobility	Free swimming (mostly demersal) [7]

Fig 1. **Bass** *Dicentrarchus labrax* © www.seasurvey.co.uk

Species description

Bass belong to the order *Perciformes* which are the 'perch-like' fishes [1]. They have two dorsal fins which are of similar size, the first being spiny-rayed the second being soft-rayed, the scales are a large thick ctenoid scale which means they have a toothed margin, this reduces hydrodynamic drag during swimming and their jaws are structured such that they can protrude/extend their mouth to create a large funnel-like cavity which facilitates in hunting [2]. In addition they are thick bodied and streamlined, silvery in colour being slightly darker on their back and lighter on their belly and they have a dark patch on their gill covers [2 & 3]. Juveniles (up to 10 cm) often have many darker spots on their sides and back [1 & 4].

BIOLOGY and ECOLOGY

Reproductive behaviour

Bass spawn in the English Channel from February until June [5 & 6]. Studies of bass egg abundance indicate that spawning is temperature related and that when temperatures exceed 9ºC (around about May), spawning occurs in the eastern Channel from the Isle of Wight to Beachy Head [6]. The eggs are planktonic and hatch after a few days [3] and as the larvae grow they begin to aggregate and move steadily inshore [6]. Upon reaching a specific developmental stage at around 15mm (from June onwards) they begin to respond to environmental cues and actively swim into their estuarine nursery habitats [6]. The young bass remain in the nursery areas for 2 years, after which they overwinter in deeper water and in the larger estuaries (typically greater than 4km2) they may return for the summer periods [6]. Age at maturity is dependent upon size (growth appears to be temperature dependent) and sex (see table above). Once sexually mature they adopt the migratory movements of the adult fish [6].

Migratory behaviour

The seasonal distribution of bass has been studied using tags. The results suggest there are two distinct bass stocks in the English Channel; an eastern stock (which moves between the English Channel and the southern North Sea) and a western stock (which moves along the west coast and into Cornish waters), genetic analysis also supports this theory [6]. A rough boundary between the two stocks has been identified as a southwest line drawn from Start Point in Devon [6]. These tagging studies indicate that the eastern English Channel bass overwinter in the west of the English Channel [6]. Spawning of these fish begins in spring (with the increase in water temperature) and so does their migration. Consequently it is believed that the centre of the spawning area shifts progressively east until June when spawning is complete [6]. The spent fish then continue to move east to feeding grounds in the far eastern English Channel and southern North Sea [6]. They remain on the feeding grounds until late autumn when the water temperature begins to decrease and then migrate south and west back to the winter pre-spawning areas in the west of the English Channel [6]. Juvenile bass i.e. those approaching first maturity, do not perform this migration, instead they exhibit small seasonal movements generally being re-captured within 50 miles of the tagging site [6].

Habitat

Bass are generally regarded as a schooling fish which perform migrations together. They can be found at all depths from near the surface to below

100m and over a wide range of substrates from rocks and sand to shingle and mud [4]. It has been documented that they may occupy the same locality for many months including feeding territories even between tides [4]. Older larger bass can often be solitary and divers have reported seeing the same fish in the same locality for several months [3 & 4].

Predators and prey

Bass are carnivorous predominantly feeding upon fish, crustacea and squid but will also take other cephalopods and worms [1 & 4]. Bass are high in the marine food chain and thus have few predators but amongst these are larger bass and seabirds.

THE SUSSEX FISHERY

Fishing methods

Fishing for bass within the Sussex IFCA district occurs on a commercial and recreational basis. Most bass are caught by commercial trawlers, commonly using the methods of stern trawling(specifically demersal otter trawls) and pair trawling. Pair trawlers specificallytarget bass but they are also a significant and valuable bycatch when bream are being targeted. Drift nets and rod and line are other very popular commercial methods used to target bass. Recreationally bass are targeted by angling and many charter vesselswill take anglers to localities where bass are known to be present. Other fishing methods that catch bass include static nets, bottling, long-lining and spear fishing.

Fishing activity

Shoals of bass start to arrive in Sussex in late spring/early summer on passage to theirfeeding grounds and to breed. During this migration they are often caught as a bycatch in the black bream fishery by pair trawlers; commonly in the area between Selsey Billand Littlehampton. During the summer bass are most commonly found on

Fig 2. Line caught bass with a fish measure (the measure is 50cm long)

harder grounds e.g. the Royal Sovereign shoals off the coast of Eastbourne and on inshore seabed features e.g. wrecks and it is at this time that they are targeted by static gear, commercial anglers and recreational anglers. A small proportion of bass will also be taken in keddle nets during the summer months in the vicinity of Rye bay. From late summer to late autumn the bass are on their return migration from the feeding grounds in the east and they are commonly caught by the method of drift netting; this is most productive at night or during the day after a period of high wind activity (when water visibility is lower) and the fish are closer to the surface. In late autumn the bass gradually move west and offshore to slightly deeper water >25m and this is when they are targeted by the stern trawlers. Few bass are caught within Sussex during the winter.

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Black bream/ Black seabream

Spondyliosoma cantharus

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Perciformes**
Family: **Sparidae**

Biological factor	
Size	Commonly 35cm [3]. Up to 60cm [1]
Lifespan	Approximately 15 years [11]
Size at reproductive maturity	20 cm [4]
Size at reproductive maturity	2 - 3 years [4]
Fecundity	31,000 eggs in a 18.5cm female to
	554,000 in a 33.5cm female [10]
Larval phase	Demersal (stationary) egg phase followed by a 30 day planktonic larval phase [9]
Adult mobility	Free swimming (demersal)

Fig 1. **Black bream** *Spondyliosoma cantharus* © Sussex IFCA

Species description

Black bream have an elliptical, compressed body shape with a single dorsal fin which is spiny-rayed at the front, a tail fin which is forked and a small mouth which does not extend back to the level of the eye [1 & 2]. The adult colouration is silver, tinged with blue and may have broken golden longitudinal lines (although this is more common in juveniles) [1]. Note, the seabreams are not related to freshwater breams.

BIOLOGY and ECOLOGY

Reproductive behaviour

Black bream are a member of the Sparidae family, most of which are hermaphrodites [10]; some are protandrus (mature as male and later change to be female) and some are protogynous (mature as female and later change to be male). There have been mixed reports in the past as to what type of hermaphrodite black bream are [4, 5 & 9] but the most recent research suggests they display protogynous hermaphroditism [10, 11 & 12]. Sexual maturity is believed to take place at approximately 20cm in length [4] and the sex change from female to male is likely to occur between 30 and 40 cm [4]. The larger individuals in the population are mature males and they exhibit a humped shoulder, a concave forehead and during the breeding season may appear dark silver to black with an iridescent blue-grey band between the eyes [2]. They are demersal spawners and exhibit very interesting breeding behaviour. Firstly, they activity seek specific types of seabed upon which to spawn. Habitats which have been identified are; open gravel areas, gravel areas adjacent to chalk reefs, gravel within sandstone reefs and gravel associated with ship's wreckage [5]. The common feature of these habitats is a thin layer of mobile gravel over a hard surface. The males then use their tail to remove the surface gravel layer and expose the bedrock or compacted gravel beneath, thus creating a 'nest' [2 & 5]. The ideal nest size is between 1 - 2m^2 [5]. The females then lay their eggs in a thin layer within the nest, the eggs are sticky and they become strongly attached to the rock surface [5]. It is suggested that the males use their nests in intraspecific competition to attract a female [5]. Following this the male will fertilise the eggs and subsequently guard the nest [4]. The juvenile bream remain in the vicinity of the nest until they are 7 - 8cm in length [2]. Following this they disperse slightly but continue to remain in the inshore areas for 2 - 3 years (approximately 20cm in length), when they become sexually mature and recruit to the adult stock [4]. The hermaphroditic nature of black bream may have important consequences for the sustained reproductive capacity of the stock [4]. Between 1977 and 1979 the modal size of the black bream decreased from 37-38cm to 28-30cm as the bream fishery expanded (the fishing practices used to catch black bream selectively targets larger individuals); this has the potential to effect on the sex-ratio of the population and thus reproduction and repopulation [4].

Migratory behaviour

The adult black bream stock over winter in deep water (50-100m) west of a line from Alderney to Start Point (evidence for this comes from fisheries in the area) [4]. As the water temperature of the English Channel increases in spring the bream migrate east and it is suggested that they follow the 9°C isotherm [4]. They arrive in Sussex in March

and inhabit the shallow inshore areas (<5m) to feed prior to reproducing. Around April they generally move to the area in between the south of the Winter Knoll and Kingmere Rocks [5] (off the coast of Littlehampton). This area has been identified as a black bream breeding ground; it is 5 - 10m deep and consists of the habitats associated with blackbream nesting areas [5]. Egg laying takes place from early May until early June [5] andthey remain in this area until early July. Black bream can also be found in smallerquantities throughout the district during this time (in particular around Selsey Bill andthe Royal Sovereign Shoals near Eastbourne). Post spawning the bream continues tofeed inshore, migrating east to the southern North Sea [4]. In November they begin their return migration west, arriving in the western Channel in January then return offshore to the deeper waters [4].

Habitat

Adult black bream exhibit schooling behaviour and mostly inhabit the inshore shelf region [1]. The stock which occupy the English Channel; over winter in water depths between 50-100m, migrate inshore to breed in spring in habitats which posses a thin layer of mobile gravel over a hard surface [5] and feed on inshore grounds throughout summer and autumn [4].

Predators and prey

Black bream predominantly feed upon seaweed and invertebrates [1] for which they have specially adapted teeth [2]. In addition the stomach contents of fish which inhabit a known cuttlefish nursery ground were investigated; they found black bream to be a main predator of young cuttlefish (8 - 61mm mantle length) but not upon cuttlefish eggs [6]. Male black bream stay in the close vicinity of their 'nest' until their eggs hatch. The purpose of this behaviour is believed to be guarding the eggs from predators [4]. Likely predators on black bream eggs are the clawed crustaceans; spider crabs and brown crabs in particular which are migrating inshore through the black bream breeding sites at that time of year. Adult black bream have few predators; however a few are likely to be taken by seabirds and marine mammals.

THE SUSSEX FISHERY

Fishing methods

Fishing for black bream within the Sussex IFCA district occurs on a commercial and recreational basis. Most black bream are caught by commercial trawlers, commonly using the methods of pair trawling and stern trawling (specifically demersal otter trawls). Other commercial methods used to target black bream are static nets and rod and line. Recreationally, black bream are targeted by angling and many charter vessels will take anglers to localities where bream are known to be present. A common and valuable bycatch when targeting black bream is bass.

Fishing activity

Black bream are only present within the Sussex IFCA district from April to November being most prolific from April until early July. Upon arrival in the district they inhabit the shallow inshore hard ground areas to feed before breeding, it is during this time they are targetedby small inshore boats using fixed nets. The fish then move onto their breeding grounds where nest making, breeding and subsequent guarding of the nests occurs. During this time they are targeted by the by pair trawlers, stern trawlers and commercial and recreational anglers. The pair trawlers appear to get the best catch rates during daylight; this may be because the fish are closer to the seabed. Post breeding (early July) the majority of the fish leave the Sussex district however some are still by caught by anglers in the area until September and further offshore at the Outer Owers until November [5].

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Brill

Scophthalmus rhombus

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Pleuronectiformes (flatfishes)**
Family: **Bothidae**

Biological factor	
Size	Up to 75cm [2]
Lifespan	Approximately 6 years [5]
Size at reproductive maturity	Approximately 22cm [5]
Size at reproductive maturity	Approximately 1.5 years [5]
Fecundity	Mean egg production >100,000 eggs per kg body weight [6].
Larval phase	Yes, planktonic (duration unknown)
Adult mobility	Free swimming (demersal)

Fig 1. **Brill** *Scophthalmus rhombus* © Sussex IFCA

Species description

Brill are flatfish with an oval body outline and eyes on the 'left' side of the head. The dorsal and anal fins run the length of the body but do not join the tail fin [1]; in addition the finrays at the front of the dorsal fin are branched, giving a 'frilly' appearance [1]. Unlike turbot, brill have scales and no 'tubercles' (bony bumps) [1 & 2] but similarly they do have a lateral line which is strongly arched above the pectoral fin [1 & 2]. Their colouration and markings are variable depending on the colour of the seabed [3] but they are commonly greyish brown with an abundance of dark and light speckles on top and white underneath [1].

BIOLOGY and ECOLOGY

Reproductive behaviour

Brill spawn from April to August in water depths of 10 - 20m [2 & 3]. Their eggs are planktonic and hatch after 14 days; following this the larvae remain in the pelagic zone until metamorphosis occurs at 20 - 35mm in length [2]. During this period the larvae will be subject to surface water currents and may have the potential to travel long distances. Following metamorphosis they adopt a demersal life style. Young brill remain in shallow waters for 1 - 2 years then move to slightly deeper depths [3 & 4]. Wild hybrids of turbot and brill have been identified; these individuals exhibit intermediate characteristics of both species [2 & 4].

Migratory behaviour

There has been little research regarding brill movements in the Sussex district. In general it is common for younger/smaller individuals to be found in the shallower waters and older /larger individuals to be found at deeper depths [3 & 4], thus moving in a slight offshore direction as they mature and grow. It is likely that as adults they perform small seasonal migrations, coming into shallower inshore areas to breed. A 5 year tag and recapture study in the Kattegat showed that brill perform short migrations into deeper water in the autumn and winter and return to the same shallow water area each spring [6]. It is likely that brill are very similar in their movements to turbot [6] and that if they have settled as juveniles in the district they are likely to stay within (or in the close vicinity of) the district throughout the year and thus their lifespan. It is therefore likely that the main dispersal potential of this species is during the egg and larval planktonic phase.

Habitat

Brill inhabit the inshore shelf region to depths of 70m but may also be found in brackish waters [3 & 4]. Very small juvenile brill may be found in rock pools on the shore, as they grow they move to inhabit the shallow inshore waters and as they get older reside further offshore at the greater depths [3 & 4]. Their preferred substrate type is sand but they can also be found on mud or gravel bottoms [1, 3 & 4].

Predators and prey

Brill are carnivorous predators, mostly feeding upon other fish species [2 & 4]. Their most common prey items are sand eels and gobies [2 & 4]; they will also take whiting and crustaceans such as crabs and shrimps and molluscs, in particular squid [3 & 5]. Predators of brill include cod and sea mammals [5].

THE SUSSEX FISHERY

Fishing methods

The fishery for brill within the Sussex IFCA district is solely on a commercial basis and they are not targeted alone; they are part of a 'joint targeted'

fishery for large flat bottom dwelling species which includes; turbots, rays and brills. These species are targeted using a specific type of static net commonly called a 'turbot-ray net' or a 'skate net'.This is a single walled gill net with a large mesh; the common mesh size used is between 160 - 270 mm (this is double the mesh size of a standard net used to target sole and plaice) and it is made from a more robust monofilament (this is necessary to handle these larger rougher species). The nets are left on the seabed for up to 3 days and they are mostly set in water depths 20 - 30m. They are a common bycatch for most other fishing methods, in particular beam trawls but they are also caught in standard static nets, otter trawls and scallop dredges.

Fishing activity

Brill are present throughout the Sussex IFCA district, however the 'joint targeted' fishery which uses the large mesh static nets exploits deeper waters which are predominantly outside of 6nm and thus outside of IFCA jursidiction; within the district brill are generally taken only as a bycatch. The joint targeted fishery for brill is from late spring until the end of summer, coincidently this is in line with their breeding season but they can be caught all year round. During the spring and summer the more settled weather allows the fishing vessels to attend offshore areas on a more regular basis and it is a good supplementary fishery to fit in with other fishing practices at that time of year. The most productive fishing is over the neap tides. Similar to turbot brill are a very hardy fish and they are usually live upon hauling.

Fig 2. A Brill © www.seasurvey.co.uk

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Cod

Gadus morha

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Gadiforms**
Family: **Gadidae**

Biological factor	
Size	Up to 150cm [1]
Lifespan	25 years [6]
Size at reproductive maturity	68 - 78cm [2]
Size at reproductive maturity	4 - 5 years [2]
Fecundity	3,000,000 - 6,000,000 eggs [4]
Larval phase	Yes: 60 - 75 days [2]
Adult mobility	Free swimming (demersal)

Fig 1. **A large cod** *Gadus morha* © www.seasurvey.co.uk

Species description

Cod are a typical fish shape with an elongated body however, quite uniquely they have; three dorsal fins, two anal fins, the upper jaw overhangs the lower jaw and the lower jaw possess a barbel [1]. The lateral line is prominently curved and whitish in colour, above this is mottled brown in colour and below is paler, almost white [1]. Cod often form large schools during the day [6].

BIOLOGY and ECOLOGY

Reproductive behaviour

Cod spawn in the southern North Sea and eastern English Channel from January through to April, peaking in late February [8]. The area of the Channel between Beachy Head and Dungeness has been identified as one of the U.K.'s main cod spawning areas [8]. Cod exhibit pre-spawning courtship behaviour. This begins with a fin display and grunting by the males, the pair then move towards the surface and swim in circles with the male inverted below the female whilst spawning occurs [2]. The eggs are 1 - 2mm in size and are buoyant, thus planktonic. Hatching occurs at approximately 4mm; growth rate is temperature dependant but usually hatching occurs between 8 - 23 days [2].
The larvae then drift to nursery areas and at a size of approximately 20mm, 60 - 75 days old they become demersal. The juveniles are known as 'codling' and remain on 'rough' ground for 1.5 - 2 years. Maturity occurs at 4 - 5 years of age, 68 - 78cm in length.

Migratory behaviour

Within the Sussex IFCA district cod begin to migrate inshore to their spawning grounds during autumn and spawning occurs during winter and spring [8]. They then move to feeding areas, which may be associated with herring abundance [2]. A recent tagging study by CEFAS indicated that cod in ICES square VIId (which encompasses the Sussex IFCA district) do not have a consistent pattern of large seasonal movement. Some moved out of the English Channel into the North Sea but many were recaptured close to their release position [7]. Special electronic tags were used to monitor the fish's behaviour. The results found their distribution to be quite closely matched both seasonally and ontogenetically, indicating no obvious pattern of large redistribution of the cod in VIId [7].
In comparison the cod in the adjacent ICES area IVc migrate northwards and eastwards using tidal streams during spring [7]. It is suggested that these behavioral differences limit the mixing of cod from these two areas during feeding and spawning seasons [7]. In addition, it was noted that during autumn and winter the cod were a) more likely to be recaptured closer to their release position and b) there was a greater proportion of overlap between the 'juvenile' range and the 'adult' range [7].

Habitat

Cod spend most of their adult life close to the sea bed and can be found from the shoreline to 600m deep [3].

Predators and prey

Cod are voracious predators feeding on a large variety of zoo benthic invertebrates and fish, including smaller cod. Most of their feeding activity takes place at dawn and dusk [6]. The main predators of young cod include larger cod, squid and pollock, while a common predator of larger cod are marine mammals, notably seals [6].

THE SUSSEX FISHERY

Fishing methods

Quota permitting, cod is commercially caught by; stern trawling, pair trawling, static netting, keddle netting and angling. Cod is also caught by recreational static netters and anglers. It is uncommon to catch cod by beam trawling and currently there is no drift netting activity targeting cod within the Sussex IFCA district.

Fishing activity

Cod begin to migrate inshore into the Sussex IFCA district during autumn and move further offshore again in late winter/early spring, during this time inshore breeding occurs and catch rates are highest.

Due to strict TAC quota regulations in recent years, cod is rarely a target species and is more commonly landed as a bycatch; specially in the use of fixed nets and stern trawls whose target species is most commonly flatfish. A small proportion of cod will also be taken in keddle nets in the vicinity of Rye bay, these nets are set in the evening and recovered the following morning with catches being at their best following a spell of unsettled weather. There appears to be no difference in the catch rate of cod between day and night. It is important to note that the majority of the cod caught and landed within the district are codling; between 1 to 3 years of age and thus are sexually immature.

Fig 2. **Cod** © www.seasurvey.co.uk

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Dover sole

Solea solea

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Pleuronectiformes (flatfishes)**
Family: **Soleidae**

Biological factor	
Size	70cm [1]
Lifespan	26 years [4]
Size at reproductive maturity	25 - 35cm length, the males being smaller than the females [4]
Size at reproductive maturity	3 - 5 years [4] with considerable inter-annual variation [3]
Fecundity	Fecundity is length dependant, annual potential fecundity of a 35cm fish is between 205,000 - 440,000 oocytes [5]
Larval phase	Up to 6 weeks [3]
Adult mobility	Free swimming (benthic)

Fig 1. **Dover sole** *Solea Solea* © www.seasurvey.co.uk

Species description

The Dover sole is a large elliptical shaped flatfish with eyes on the right side of the body, a rounded snout and a curved mouth [1]. The dorsal and anal fin are united thus the fin runs from the eye down the whole length of the body [1]. Generally Dover sole are greyish brown in colour with some darker blotches on the upper side [1] and white on the underside, but colour may vary depending on the substrate colour [2].

BIOLOGY and ECOLOGY

Reproductive behaviour

Within the Sussex IFCA district the area west of Beachy Head to the Isle of Wight has been identified as Dover sole spawning ground [3]. Spawning occurs between February and June, peaking April to May and has been related to water temperature; specifically when temperatures exceed 7ºC [3]. The eggs hatch 2-14 days after fertilisation depending on the water temperature (commonly 8 days) when they are approximately 3mm in length and then they live in the pelagic zone for up to 6 weeks, metamorphosing and moving to bottom dwelling when they attain of a length of approximately 10mm [1 & 3]. At metamorphosis the larvae recruit to shallow inshore nursery areas, commonly estuaries, tidal inlets and shallow sandy bays, with recruitment to the spawning population occurring at 2 or 3 years old [3].

Migratory behaviour

Tagging studies have indicated that the Dover sole can undertake extensive migrations as maturing juveniles but once fully mature their movement is relatively little, only making short seasonal migrations from the deeper offshore areas to the shallower spawning grounds [3]. Dover sole appear to use the same spawning ground year after year to which they first recruit [3].

Habitat

Dover sole are found on sandy and muddy substrates [1]. They are nocturnal, spending the daytime camouflaged against their soft substrate or buried with only their eyes protruding [2].

Predators and prey

Common prey items for the Dover sole are benthic invertebrates including small crustaceans, worms, molluscs and fish [2]. The most common predators of adult soles are rays; in particular the Blond ray and Thornback ray [6].

THE SUSSEX FISHERY

Since 2005 the Marine Stewardship Council (MSC) have certified the Dover sole trammel net fishery by the under 10m Hastings fleet as sustainable; this encompasses the area from Beachy head to Dungeness to 6nm offshore, see [13].

Fishing methods

Fishing for Dover soles within Sussex IFCA district predominantly occurs at a commercial level. The most common practice used is fixed gear then beam trawling and stern (otter) trawling. Smaller quantities are also taken by recreational fishers using fixed gear or rod and line.

Fig 2. Dover sole for sale © Sussex IFCA

Fishing activity

Soles are more active during the night making them easier to catch thus, this is mostly when they are targeted by all fishing methods and higher catch rates are seen. In the Sussex IFCA district the Dover soles move inshore to breed during the spring and offshore again in late autumn, during these periods of migration the fixed net fishery is high; shooting the nets for a one day lay. Fishing with fixed nets also occurs during the summer, when the practice of 'quick shooting' is common to avoid catching large amounts of unwanted bycatch in the nets (predominantly spider crabs). The best catch rates seen from quick shooting are when low water occurs during darkness (very late night/early morning) which in Sussex coincides with neap tides. Trawling for Dover soles predominantly occurs in the summer and large quantities of plaice, a lower value species, are also taken.

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Herring

Clupea harengus

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Clupeiformes**
Family: **Clupeidae**

Biological factor	
Size	Up to 40cm [1]
Lifespan	12 - 16 years [3]
Size at reproductive maturity	22.9 - 26.7cm [3]
Size at reproductive maturity	2 - 5 years [3 & 4]
Fecundity	20,000 - 80,000 eggs for a 28cm individual [3]
Larval phase	Yes
Adult mobility	Free swimming (pelagic)

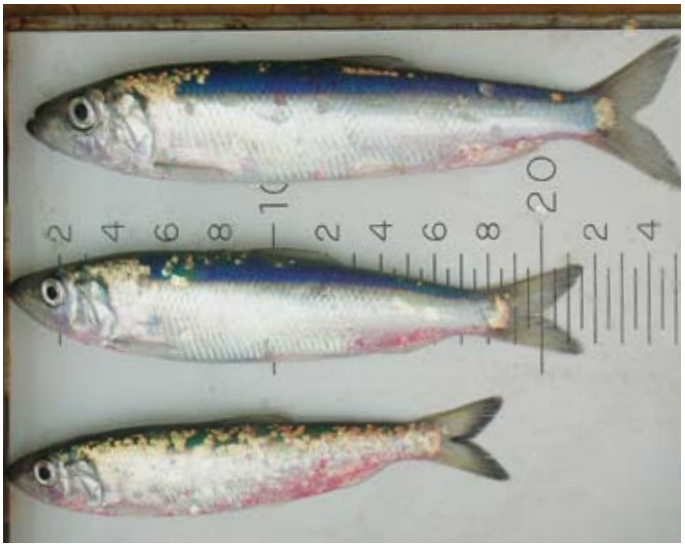

Fig 1. **Herring** *Clupea harengus* © www.seasurvey.co.uk

Species description

The herring has the basic 'fish' form; one short dorsal fin, a deeply forked tail, no lateral line and a body covered in large round scales [1 & 2]. Herring are silver below and dark blue above and have a rounded belly unlike the sprats and shads which have a keel-like edge to their stomach [2]. They are a pelagic, shoal forming, open-water species that perform extensive migrations and can be found all around the coast of the Britain [1]. Herring is an oily fish and young herring are sold in restaurants and as whitebait [2].

BIOLOGY and ECOLOGY

Reproductive behaviour

The main spawning population of herring in the English Channel is referred to as the 'Downs spawners' (see Migratory behaviour below). This group moves into the eastern English Channel to spawn in late November, spawning peaks in December and continues until February [4 & 6]. There are other smaller spawning groups within the Channel and captures of ripe individuals indicate these spawning in autumn, winter and spring at other sites [4]. The female herring lay their eggs over stones or gravel substrates and the eggs remain demersal [2 & 5]. Hatching occurs after 7 to 49 days depending on water temperature (the warmer the water the less time hatching takes to occur) [3]. The larval fish that hatch out are long and slender resembling small sand eels [5], they are pelagic and drift with the current [2]. At approximately 5cm in length they appear 'herring shaped' and begin to gather and shoal moving inshore to shallower waters where they remain for 6-12 months [2 & 5]. Following this, the young herring scatter into deeper water until they are sexually mature and then they join the adult shoals [5].

Migratory behaviour

The herring Clupea harengus is a widely distributed species with many distinct breeding stocks or populations [2]. The time and locations of spawning varies with population and over 50 spawning grounds have been indentified in the North Sea alone [5]. A distinct spawning population referred to as the 'Downs spawners' has been indentified as the main spawning stock in the English Channel [4]. The adult population of Downs spawners spend the summer months feeding in the central North Sea, they make an annual southerly migration in autumn appearing in the eastern English Channel in mid November [4 & 6]. Since the 1970's this distinct population have been identified as spawning from Côte d'Opale near Dunkerque to Cap d'Antifer near Le Havre on the French coast, post-spawning they return to the central North Sea [4]. Winter plankton surveys in the eastern English Channel show the larvae shifting south and east as they grow and in April the post-larval herring are found inshore from Boulogne to Dieppe [4] and/or on nursery grounds in the eastern North Sea [6]. In addition there are nursery grounds along the German and Danish coasts which the young Downs spawned herring may share [4]. At the age of 1 year it is likely the Downs spawned herring move offshore to feed in the central North Sea, reaching maturity at 2-3 years old [4]. Once sexual maturity is attained they join the adult stock and begin to participate in the annual southerly migration each autumn back to the eastern English Channel for spawning [4]. The movements of larvae hatching from the smaller spawning population in the English Channel are poorly understood [4].

Herring also exhibit some diurnal vertical migrations, being closer to the seabed during the day and

moving towards the surface at night for feeding (during this time there is some dispersion of the shoal) [3].

Habitat

Herring are a pelagic open water fish which; form large shoals, can be found to depths of 250m [2] and exhibit some diurnal vertical migrations [3]. Schools of young herring (<1 year) can be found closer inshore and in estuaries [2 & 4].

Predators and prey

Adult herring feed by eyesight on zooplankton (mostly copepods and euphausians), pteropods (floating molluscs) and sand eel larvae [2]. Common predators of adult herring include sea birds, dolphins and larger fish species and haddock have been identified as a major predator on herring eggs [2 & 5].

THE SUSSEX FISHERY

Since 2005 the Marine Stewardship Council (MSC) have certified the drift net fishery for herring by the under 10m Hastings fleet as sustainable; this encompasses the area from Beachy head to Dungeness to 6nm offshore, see [7].

Fishing methods

Fishing for herring within Sussex IFCA district only occurs at a commercial level. The most common practice used is drift netting and small quantities are taken using keddle nets.

Fishing activity

The fishing season for herring in the Sussex IFCA district is short. It begins in late October when the herring arrive to Spawn. At this time they are in peak condition. Catches of herring in the district begin to dwindle in December. The herring are most commonly targeted by drift netters at dawn and dusk when the fish are in the mid-water region. The Hastings-based fleet has MSC accreditation (see stock status below) for drift net fishing with monofilament drift nets of 55 mm (2”); these are usually set about 4 metres below the surface, with a total net depth of around 10 metres [7]. A small proportion will also be taken in keddle nets in the vicinity of Rye bay, these nets are set in the evening and recovered the following morning.

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Mackerel

Scomber scombrus

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Perciformes**
Family: **Scombridae**

Biological factor	
Size	Up to 50cm [1]
Lifespan	20 years [3]
Size at reproductive maturity	30cm [3]
Size at reproductive maturity	2 years [3]
Fecundity	90,000 eggs per spawning [3]
Larval phase	Yes
Adult mobility	Free swimming (pelagic)

Fig 1. **Mackerel** *Scomber scombrus* © Sussex IFCA

Species description

Mackerel have a long streamlined body which is rounded in section, with a row of characteristic bony scales along the lateral line [1 & 2]. There are two well separated dorsal fins and a single anal fin, small finlets extend from the second dorsal fin and anal fin to the tail, the tail is deeply forked [1 & 2]. Mackerel are iridescent blue-green on top crossed by narrow black curving bands, silvery on the flanks and white below [1].

BIOLOGY and ECOLOGY

Reproductive behaviour

Mackerel spawn in the summer peaking in June [3 & 4] however there is little evidence to suggest this occurs within Sussex [4 & 6]. During spawning the eggs and sperm are released into the sea with the females laying up to 90,000 eggs per spawning [3]. Hatching occurs after 2-6 days when they are 3-4mm long and metamorphosis occurs by 21mm [3]. The egg and larval phase are planktonic [3]. Juvenile mackerel live inshore until they are sexually mature, then move offshore to join the major schools [3]. Larval and juvenile mackerel surveys do not indicate the presence of young mackerel within the Sussex IFCA district [4]. Due to their prolonged breeding season members of one year class are very variable in size; on average a 1 year old mackerel will be 24cm in length with sexual maturity occurring in their second year when they are around 30cm [5].

Migratory behaviour

The North East Atlantic mackerel are defined and managed as one stock [7], however they have 2 or 3 distinct spawning regions; the North Sea (which may be divided into north-eastern and central-southern) and along the continental shelf/Celtic Sea; it is currently debatable whether mixing between these groups occurs [4 & 6]. Tagging studies of the continental shelf/Celtic Sea stock at Cornwall in the 1960's indicated an active migration of these fish during the spring and autumn; some travelling northwards and some eastwards through the English Channel. The ones which travelled eastwards were re-captured east of Brighton and along the French coast, it is thought that they were travelling to the southern North Sea to spawn in the early summer and then returning [6]. To summarize the research suggests that the mackerel found within the Sussex IFCA district are part of the continental shelf/Celtic sea stock travelling to and from the southern North Sea and due to their prolonged breeding season individuals may be travelling in opposite directions along the coastline depending on whether they are 'coming 'or 'going' [6].

Habitat

Mackerel are very fast swimmers and are constantly on the move; it is necessary for mackerel to have a constant water flow through their gills for respiration [5]. They are pelagic and form large shoals [1]; spending the summer inshore closer to the surface and the winter offshore, closer to the seabed [2 & 3].

Predators and prey

Mackerel can filter plankton through their gills [2] and predate upon shallow inshore crustaceans and small fish [3]. Post spawning mackerel are voracious predators feeding upon schools of sprat, herring and sand eels; it is at this time they are easier to catch by rod and line [2]. In the winter mackerel inhabit deeper waters and have a reduced feeding rate [2]. Mackerel are an important food supply for larger fish including members of the tuna family and sharks and dolphins [2].

THE SUSSEX FISHERY

Since 2005 the Marine Stewardship Council (MSC) have certified the drift net fishery for mackerel by the under 10m Hastings fleet as sustainable; this encompasses the area from Beachy Head to Dungeness to 6nm offshore [8].

Fishing methods

There are commercial and recreational fisheries for mackerel within the Sussex IFCA district. The most common commercial practice used to specifically target mackerel is drift netting, mackerel is also semi-targeted in the mixed demersal trawl fisheries. Smaller quantities are taken as a bycatch in pair trawling and they are targeted by keddle netters and charter anglers. Mackerel are also a popular target of the recreational anglers.

Fishing activity

Mackerel are a migratory species and are present within the Sussex IFCA district from late spring until early autumn. Mackerel are most commonly caught commercially at dawn and dusk by drift netters and commercial anglers. A small proportion will also be taken in keddle nets in the vicinity of Rye bay, these nets are set in the evening and recovered the following morning. Mackerel are mainly targeted for human consumption for which the larger individuals are preferred, as there are quota restrictions on mackerel this has the potential to cause 'high-grading' whereby the smaller, less marketable fish are discarded [7]. Mackerel are also commonly targeted by recreational anglers from the shore and at sea.

Fig 2. **Mackerel** © Sussex IFCA

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Plaice

Pleuronectes platessa

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Pleuronectiformes (flatfishes)**
Family: **Pleuronectidae**

Biological factor	
Size	50cm [1], rarely up to 90cm [3]
Lifespan	20 years [6]
Size at reproductive maturity	Males 25cm, females 32cm [5]
Size at reproductive maturity	3 years [5]
Fecundity	From 16,000 eggs in a 22cm female to 345,000 eggs in a 61.5cm female [4]
Larval phase	60 - 120 days [5]
Adult mobility	Free swimming (benthic)

Fig 1. **Plaice,** *Pleuronectes platessa* © www.seasurvey.co.uk

Species description

The plaice is a flatfish with eyes on the right side of the body and a pointed snout/mouth. The head is less than 0.25 of the total fish length [1] and has line of 4 to 7 bony warts between the eyes extending to the lateral line [3]. The upper side is dark brown with distinct orange blotches and the underside is pearly white [1]. To some degree plaice can adapt their colour to match their substrate [2], thus increasing camouflage.

BIOLOGY and ECOLOGY

Reproductive behaviour

Plaice spawn from December until March, peaking in January and February [5] in well defined spawning grounds that are 20-40m deep [5 & 7]. Spawning occurs above the seabed with the female across the upper side of the male [4]. At the time of spawning the eggs are approximately 2mm in size, are yellow and have no oil globule [4]. Hatching occurs at approximately 7mm; growth to this size takes between 12-21 days depending on the water temperature, 10 to 5°C respectively (i.e. growth and thus hatching is faster in warmer water) [4]. At approximately 40 days old the left eye shifts round to the right side of the body [4], metamorphosis is complete at 60-120 days depending on the water temperature [5] and the fish takes on the typical flatfish form. By this time the juvenile plaice will have drifted inshore to an appropriate shallow nursery ground, sunk to the bottom, adopted the benthic environment and be approximately 3cm in length [3 & 5]. Juvenile plaice spend up to 2 years on the nursery grounds before joining the adult stock [5].

Migratory behaviour

A tagging study of adult plaice has indicated that there are three groups of plaice present in the English Channel; resident plaice in the west English Channel, resident plaice in the east English Channel and migratory North Sea plaice which enter the English Channel in the autumn, spawn and rapidly leave [5]. There is very little traversing between the English Channel/North Sea plaice and the Irish Sea plaice [5]. Interestingly however, hydrographic studies indicate that juvenile plaice do not recruit to nursery grounds near to the area they were spawned, instead showing an eastwards movement [5]. This can be explained as the eggs/larvae have a period of several weeks in the water column before they settle to the benthic environment during which they are subject to an easterly moving current system [5]. These hydrographic studies suggest that plaice spawned in the western English Channel recruit to nursery grounds in the eastern English Channel, whilst plaice spawned in the eastern English Channel, recruit to nursery grounds in the southern North Sea [5]. Tagging of juvenile plaice on these nursery grounds found that over one third of the adult plaice in the eastern English Channel came from nursery grounds in the North Sea, whilst the western English Channel received 34% of its recruits from the eastern English Channel and 53% from the North Sea [5].

Studies by CEFAS [15] have shown that plaice adopt 'selective tidal stream transport'; this is where the fish leaves the bottom at slack water and swim down tide i.e. with the current, and return to the seabed when the tide turns. Maturing fish select the tidal stream flowing towards the spawning ground and spent fish use the opposing tidal stream to return to the feeding grounds. This behaviour is very energy efficient.

Habitat

Adult plaice can be found on sandy or muddy substrates to over 100m deep [3], whilst the juveniles are found predominantly in inshore shallower waters [4]. Plaice often increase their camouflage on the seabed by flapping their fins to cover their body with a fine layer of bottom sediment, often only leaving the eyes protruding [3].

Predators and prey

Plaice most commonly feed upon bivalves including; cockles, razor shells, and small scallops [3], they also predate upon some polychaetes and crustaceans and larger plaice may even take small fish. Plaice have 'cutting' teeth on the 'under side' of the jaw which they use to bite off soft protruding parts of the bivalve e.g. the siphons, whilst further back in the throat region they have crushing teeth used for crushing e.g. the shells [3]. Predators of the plaice include anglerfish, weever fish, gurnards, cod, conger eels, rays, seals and dolphins [8].

THE SUSSEX FISHERY

Fishing methods

Fishing for plaice within Sussex IFCA district predominantly occurs at a commercial level.The most common practices used are fixed gear, beam trawling and stern (otter)trawling. Small quantities are also taken by recreational fishers using fixedgear or rod and line.

Fishing activity

There are no defined seasonal or daily movements of plaice which play a role in the fishery; however, it is common for flatfish to be more active at night. Plaice are predominantly taken as a valuable bycatch in the sole fishery thus the activities of the sole fishery play a large role in the activities of the plaice fishery. The trawlers targeting sole will often fish for 24+ hours; the sole are mostly caught during the hours of darkness but fishing continues during the day as plaice are still caught. Plaice appear to be in their best condition and have the greatest meat yield during autumn and winter.

Fig 2. Plaice for sale © Sussex IFCA

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Red mullet

Mullus surmuletus

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Perciformes**
Family: **Mullidae**

Biological factor	
Size	Up to 40cm [1]
Lifespan	10 years [4]
Size at reproductive maturity	15 - 20cm [4 & 5]
Size at reproductive maturity	2 - 2.5 years [4 & 5]
Fecundity	Unknown
Larval phase	Yes, eggs & larvae planktonic (duration unknown)
Adult mobility	Free swimming (demersal)

Fig 1. A spring catch of Red mullet *Mullus surmuletus* from Newhaven © Sussex IFCA

Species description

Red mullet belong to the *Mullidae* family which are commonly known as the 'goat fish' and are generally associated with the tropics (despite the name they are not closely related to the grey mullet which is also found in UK waters). They have a moderately elongated body, with a steep snout and are easily recognized by their two long chemosensory barbels that protrude from the chin [1]. They have two dorsal fins which are spaced well apart and large fragile scales [1 & 2]. Their colouration varies with depth, emotion and time of day but generally they are reddish to pink with three yellow strips along their sides [1 & 2].

BIOLOGY and ECOLOGY

Reproductive behaviour

Red mullet breed form May until July [1 & 5]. The female deposits her eggs over the seabed in depths of 10-55m [2], the larvae hatch out of the eggs at a size of 2.8mm [1] and both the egg and larval phase are planktonic [4]. The young red mullet live in the open water; they are silvery blue in colour which provides camouflage and they drift with the plankton until they are 5cm in length [2 & 3]. Following this they take up their bottom dwelling existence [2 & 3].

Migratory behaviour

There has been little research regarding the movements of red mullet in the Sussex district. In general it is common for younger/smaller individuals to be found in the shallower waters and older/larger individuals to be found at deeper depths [2] and it is likely that as adults they perform seasonal migrations, coming into shallower inshore areas to breed. Research conducted off the coast of Crete revealed; small individuals in the shallow water during all seasons, a migration of individuals reaching sexual maturity into deeper water, a higher abundance of larger individuals in the deeper water and a change in distribution in spring with the larger individuals moving inshore and spawning [6]. In addition the study reported that red mullet do not exhibit 'homing behaviour' and suggested instead that the separation between the immature and mature individuals is bathymetric rather than geographical [6].

Habitat

Red mullet inhabit the inshore area and can be found on a range of seabeds including sand, mud and coarse gravel [1 & 2]. The young can be found in waters as shallow as 1m browsing on algae covered rocks whilst the adults can be found from 3 - 90m [2]. Red mullet may be found singularly or in groups of up 50 individuals (especially as juveniles) [2].

Predators and prey

Red mullet use their specially adapted barbels to locate their prey. Their barbels are chemosensory and as they move along the seabed they probe them into the sediment in search of food [1]. Once a prey item has been located they energetically dig and can excavate a hole as deep as themselves to get it [2 & 3]. Common prey items are benthic invertebrates including; shrimps, amphipods, polychaetes, small crabs and bivalves [4]. Once individuals grow greater than 17cm in length fish becomes an important contribution to their diet [7]. Small wrasse and seabream often follow shoals of feeding red mullet picking up any food which is thrown up in their feeding process [2 & 3]. Common predators of red mullet include weever fish and rays [4].

THE SUSSEX FISHERY

Fishing methods

The fishery for red mullet with the Sussex IFCA district is on a commercial basis only. Within the district they are not directly targeted, instead being taken as a small bycatch in small-mesh static nets, otter trawls and beam trawls. Outside of the district in the deeper water they are part of a 'joint targeted' fishery that uses otter trawls to catch the small demersal deeper water species which include; squid, red mullet, lemon soles and angler (monk) fish. Squid are usually the more abundant species in this activity but per kilo red mullet are more valuable. Offshore there is also a fly-seine fishery for squid and red mullet, however this is predominantly at activity of the Dutch vessels and it is not landed into the UK.

Fishing activity

Red mullet are mostly caught between the months of April and November. Offshore of the Sussex IFCA district they are most commonly targeted as part of a joint fishery by otter trawlers from the port of Newhaven. There appears to be no difference in catchability at day or night. Red mullet are a very soft fish with delicate flesh and scales; they usually suffer damage during capture and are mostly dead upon hauling. Following the increasing quota restrictions on other more traditional species in the late 1980's species like red mullet, (along with bass, black bream, cuttlefish and squid) have attracted more interest.

Fig 2. **Red mullet** *Mullus surmuletus* © Sussex IFCA

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Turbot

Psetta maxima
previously known as *Scophthalmus maximus*

Phylum: **Chordata**
Class: **Osteichthyes**
Order: **Pleuronectiformes (flatfishes)**
Family: **Bothidae**

Biological factor	
Size	Up to 90 cm [2]
Lifespan	Up to 25 years [5]
Size at reproductive maturity	Males 30 cm, females 35 - 45cm [2]
Size at reproductive maturity	3 - 5 years [6]
Fecundity	10 - 15 million eggs [2 & 4]
Larval phase	Yes, planktonic phase 4 - 6 months [2]
Adult mobility	Free swimming (demersal)

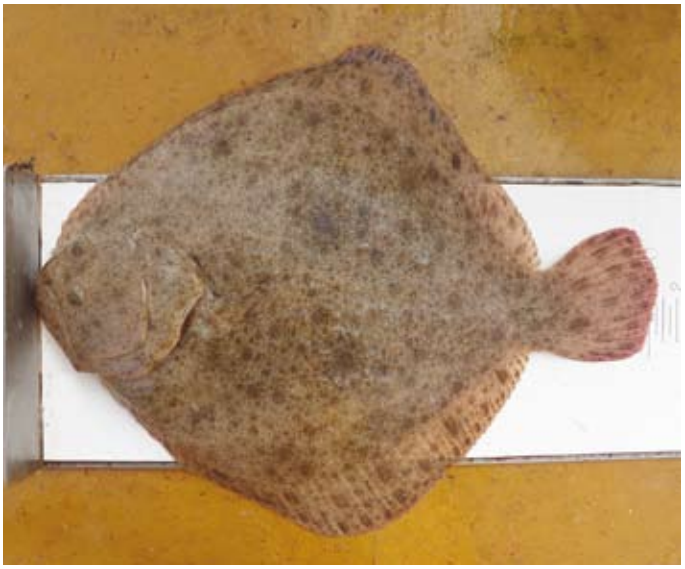

Fig 1. **Turbot** *Psetta maxima* © www.seasurvey.co.uk

Species description

Turbots are flatfish with a circular body outline and eyes on the 'left' side of the head. The dorsal and anal fins run the length of the body but do not join the tail fin [1]. Turbot have no scales but they do have prominent 'tubercles', bony bumps that are scattered irregularly on their upper side [1 & 2]. Their lateral line is strongly arched above the pectoral fin [1 & 2] and their colouration and markings are variable depending on the colour of the seabed [3]; commonly they are greyish brown with an abundance of dark and light speckles on top and white underneath [1].

BIOLOGY and ECOLOGY

Reproductive behaviour

Turbot breed from April until August, laying their eggs predominantly on gravel bottom at depths >10m [2, 3 & 6]. The eggs are planktonic and hatch after 7 - 9 days; following this the larval remain in the pelagic zone for 4 - 6 months [3, 4 & 6]. During this period the larvae will be subject to surface water currents and with such a long planktonic phase they have the potential to travel long distances. Metamorphosis occurs at approximately 25mm after which they adopt their demersal life style [2 & 3]. Wild hybrids of turbot and brill have been identified; these individuals exhibit intermediate characteristics of both species [2].

Migratory behaviour

There has been little research regarding turbot movements in the Sussex district. In general it is common for younger/smaller individuals to be found in the shallower waters and older /larger individuals to be found at deeper depths [3], thus moving in a slight offshore direction as they mature and grow. It is likely that as adults they perform small seasonal migrations, coming into shallower inshore areas to breed, but if they have settled as juveniles in the district they are likely to stay within (or in the vicinity of) the district throughout the year and thus their lifespan. Tagging studies conducted in Sweden suggest that turbot move into breeding areas (which are shallower) during spring and summer to spawn and then return back to deeper waters in the autumn [7, 8 and 9]. During the spawning period all re-captures were made within a small area, the furthest distance between release and re-capture being 35km [7, 8 and 9]. This study also suggested that the turbot showed breeding area fidelity; the tagged individuals returned to the same area to breed the following year [7, 8 and 9]. The mean distance between release and recapture one year later was 7.6 km with 95% of all recaptures being made within a 30 km radius (the longest recorded displacement was 90 km) [7, 8 and 9]. Similar studies monitoring the movements of hatchery reared turbot that were released into the wild support the theory that adult turbot do not make large scale migrations [4 & 5]. A study in the Kattegat revealed that after one year the migration of cultured one year old turbot was less than 10km; they continued to remain close to the shore for the first 2 years then moved offshore [4], as would be expected as they mature. A study in Norway found that after 3 years the tagged fish were recaptured within a 50km radius of the release locations [5]. It is therefore likely that the main dispersal potential of this species is during the 4-6 month planktonic larval phase.

Habitat

Turbot inhabit the inshore shelf region to depths of 80m but may also be found in brackish waters [2 & 3]. Their preferred substrate type is sand or gravel but they can also be found in upon shelly and muddy seabeds [3].

Predators and prey

Turbot are carnivorous predators, mostly feeding upon other fish species [2 & 3]. Their most common prey items are sprats and sand eels [2]; they will also take herring, whiting, gobies, other flatfish, dragonets, crustaceans and molluscs [4]. Predators of turbot include large cod (for young turbot) and sea mammals [6].

THE SUSSEX FISHERY

Fishing methods

The fishery for turbot within the Sussex IFCA district is mostly on a commercial basis and they are not targeted alone; they are part of a 'joint targeted' fishery for large flat bottom dwelling species which includes; turbots, rays and brills. These species are targeted using a specific type of static net commonly called a 'turbot-ray net' or a 'skate net'.This is a single walled gill net with a large mesh; the common mesh size used is between 160 - 270 mm (this is double the mesh size of a standard net used to target sole and plaice) and it is made from a more robust monofilament (this is necessary to handle these larger rougher species). The nets are left on the seabed for up to 3 days and they are mostly set in water depths of 20 - 30m. Turbot are a common bycatch for most other fishing methods, in particular beam trawls but they are also caught in standard static nets, otter trawls and scallop dredges.

Fishing activity

Turbot are present in small quantities throughout the district, however the 'joint targeted' fishery which uses the large mesh static nets exploits deeper waters which are predominantly outside of 6nm and thus outside of the Sussex IFCA district; within the district turbot are generally taken only as a bycatch. The joint targeted fishery for turbot is from late spring until the end of summer, coincidently this is in line with their breeding season but they can be caught all year round. During the spring and summer the more settled weather allows the fishing vessels to attend offshore areas on a more regular basis and it is a good supplementary fishery to other fishing practices at that time of year. The most productive fishing is over the neap tides. Turbot are a very hardy fish and they are usually live upon hauling. It is common to 'bleed' a turbot; this is the practise of cutting a 'V' shape out of the base of the tail and prevents the white underside of the fish discolouring. Turbot are less common than most commercially exploited species within the district but as they are a valuable fish to catch because they are a large fish, commonly 10 - 30lbs and the price per kilo is high.

Fig 2. Turbot for sale © Sussex IFCA

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Brown/Edible crab

Cancer pagurus

Phylum: **Crustacea**
Class: **Eumalacostraca**
Order: **Decapoda**
Family: **Cancridae**

Biological factor	
Size	Up to 250mm carapace width [1]
Lifespan	20 years [2]
Size at reproductive maturity	Male 110mm, female 115mm [3]
Size at reproductive maturity	10 years [3 & 4]
Fecundity	>1,000,000 eggs [3]
Larval phase	60 - 90 days [14]
Adult mobility	Crawls (benthic)

Fig 1. **A Brown/Edible crab** *Cancer pagurus* © Mark Coombes

Species description

Cancer pagurus is known locally in Sussex as the brown crab, it has an oval shaped body with a distinctive 'piecrust' edge. It is reddish-brown in color with black tipped pincers.

BIOLOGY and ECOLOGY

Reproductive behaviour

The sex of a brown crab can be determined by the shape of the abdomen; the males being narrow and the females being broad and rounded for carrying eggs. The females move inshore in late spring to moult and shortly afterwards mating by copulation occurs [5]. The females store the sperm, then in late summer they move offshore again and use the stored sperm to fertilise their eggs in the winter [2]. The females carry their eggs under their abdomen; this is commonly known as being 'berried'. Berried females rarely feed or move, instead they lay in pits dug in the sediment or under rocks and thus are less likely to be caught in a baited pot [3]. Around late spring/early summer (6 - 9 months after copulation) the larvae are released into the water column [6]. The larvae remain in the plankton for 2 months and then settle as juveniles in the intertidal zone in late summer/early autumn [7]. They remain in the intertidal zone until they reach a carapace width of 60 - 70mm (which takes about 3 years) then they migrate to subtidal areas [3]. Growth rate varies with age, gender and water depth from 1 - 10mm increase in carapace width per year [3]. Generally growth rate decreases with age, is higher in deeper waters and males grow faster than females [5]. The majority of the south coast of England has been identified as brown crab nursery ground [14].

Migratory behaviour

A brown crab can travel 2 - 3km per day and may perform migrations of up to 200 nautical miles [14]. Suture tags (which persist through moulting) were used to study the movements of brown crabs and the results infer that they perform a 'one-way' migration [14]. The females in the English Channel were found to move west or southwest with no indication of a return movement [14]. The research suggests that this westerly movement of the females may be contranatent (i.e. against the prevailing current), thus ensuring that their progeny drift back towards their own nursery grounds [14]. The males make shorter less directed movements [14]. There are no records of brown crabs moving into the English Channel from the North Sea [14].

Habitat

The brown crab frequents a variety of habitats depending during its life cycle from sublittoral rocky shores as a juvenile to depths of 200m as an adult [2 & 14]. Some research suggests that there may be sex segregation with habitat, suggesting that mature males are caught predominantly on rocky substrates whilst females are more abundant on sand and gravel [14]. Commonly adults of both sexes can be found sheltering under boulders.

Predators and prey

The brown crab is a scavenger for carrion and an active predator which hunts a variety of crustaceans and molluscs including the green shore crab, the broad clawed porcelain crab, the long clawed porcelain crab, the hairy crab, the squat lobster, the dog whelk, the winkle, razor shells, the blue mussel, the common cockle and the oyster and it will also eat smaller members of their own species (conspecifics) [3 & 8]. Motile prey may be taken [8]. The brown crab is mainly nocturnal, research suggests this is to reduce its risk of predation from cod and seals [9].

THE SUSSEX FISHERY

Fishing methods

The fishery for brown crab is solely commercial within the Sussex IFCA district and is intertwined with the lobster fishery. Brown crab is often not the main target species, instead it is often considered as a valuable bycatch from the lobster fishery. Traditionally inkwell pots were used to catch brown crab and are considered the best gear type to catch and retain them, however, parlour pots are better for lobsters and as the brown crab and lobster fisheries have converged most commercial fishermen use only parlour pots. Typically parlour and inkwell pots are worked in strings of 20 to 60 pots, with a spacing of 12 to 16 fathoms in between each pot. They are laid for 1 to 2 days, being hauled, emptied, re-baited and shot in succession. Common bait used for these pots is horse mackerel, scad, dogfish, gurnard and skate chog (the head, torso and tail remnants from skate winging). In static nets brown crabs are often an undesirable bycatch, they become tangled up and are difficult to remove intact thus they are often broken up into 'back and claws' or destroyed and discarded. There is a market for the 'back and claws' product but per kilo the price is much less than for whole crab. They are also occasionally caught in scallop dredges. Brown crab is commonly used as bait in whelk pots and many lobster/crab fishermen retain some brown crab for this purpose, either to whelk fish themselves or sell as a bait product.

Fishing activity

The main fisheries for lobsters and brown crab within the SSFD are based at the fishing stations of Selsey and Eastbourne. Brown crab can be caught all year round but the highest catch rates are seen March - April and October - December. During these months meat quality is at its best. Market prices/ demand peaks in the run up to Christmas. Lower catch rates and poorer meat qualities are seen from June until September. During the months of June and July the catch is predominantly hens (females), at this time the females are presumed to be migrating inshore locally to moult and breed. Similar to lobsters, brown crabs are more active during the hours of darkness, feeding more and thus are more likely to be attracted to bait in a pot during the night. Out of season many lobster/crab fishermen also fish for whelks and consequently during the winter it is fairly common for such fishermen to move their parlour pots further offshore and haul them less frequently (once or twice a week) whilst working whelk gear too.

Within the SSFD brown crabs are most commonly transported and sold live. Several fisherman within the SSFD use 'store-pots', these are a large cage-like devices left on the sea-bed in which they store the crabs and lobsters for up to two weeks until they have a desirable quantity for their respective markets. Brown crabs have a notoriously strong and persistent claw grip. To prevent damage to adjacent crabs and handlers some fishermen immobilise their claws by the method of 'kiving', this is the process of cutting the tendon which controls the claw.

Fig 2. A catch of approximately 4 kg of 'kived' brown crab stored in a basket © Sussex IFCA

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Common cuttlefish

Sepia officinalis

Phylum: **Mollusca**
Class: **Cephalopoda**
Order: **Sepioidea**
Family: **Sepiidae**

Biological factor	
Size	40cm length [1]
Lifespan	Approx. 18 - 24 months [3 & 4]
Size at reproductive maturity	13cm mantle length [3]
Size at reproductive maturity	Approx. 18 months [3]
Fecundity	1000 - 3000 eggs [4]
Larval phase	No
Adult mobility	Free swimming (mid-water to demersal)

Fig 1. **Common cuttlefish** *Sepia officinalis* top: male, below: female © Sussex IFCA

Species description

The common cuttlefish is a highly evolved mollusc with large eyes, tough jaws, 8 arms, 2 retractable tentacles and an internal cuttlebone [1]. The body is flattened and oval in shape, with lateral fins running the entire length of the body [1]. The cuttlebone is made of calcium carbonate and is used to control the animals' buoyancy. The cuttlefish is capable of changing colour and texture very rapidly, this may be used in sexual or competitive behaviour or to camouflage.

BIOLOGY and ECOLOGY

Reproductive and migratory behaviour

The sexes of the common cuttlefish are separate with the males having a specialized left ventral (hectocotylized) arm used to transfer sperm packages to the female [1]. During the winter the common cuttlefish inhabits the central western English Channel and moves inshore to breed during spring and summer [3]. Spawning is gregarious with eggs being laid between February and May (peaking mid-April to mid-May) [3]. The common cuttlefish eggs are similar in size and appearance to black grapes with a small nipple and can be found attached to a range of substrates from algae, sessile animals and man-made objects e.g. mooring lines or fishing pots, most commonly on sandy bottoms [2 & 3]. The eggs hatch after 80 - 90 days (however this is temperature dependant) and the juveniles remain close inshore burrowing in the sand during the day and emerging to feed at night [3]. Tagging studies suggest the juveniles begin to move offshore in October when they are 6cm in mantle length [3]. The cuttlefish become sexually mature during their second winter and return to inshore areas in their second spring/summer to breed but not necessarily to their original nursery area [3].

Once mating and egg laying has occurred the cuttlefish die. It is unknown whether the cuttlefish in the Channel are members of one stock or whether they are separate breeding stocks which overwinter in the same region [3].

The common cuttlefish has two modes of movement. Normal swimming is achieved using a wave action of the lateral fins or for fast movement i.e. an escape response, jet propulsion is used by actively pumping water into the mantle cavity and expelling it through a short funnel [1].

Habitat

Cuttlefish can be found from the shallow sub-littoral to offshore as deep as 250m, most commonly around sand or mud substrates [1].

Predators and prey

The common cuttlefish is a highly adapted predator and escape artist. As a predator it is capable of camouflaging itself with its background and has two retractable tentacles with suckers grouped on the terminal pads which it can rapidly shoot out to seize prey. Their primary prey is crustaceans; juveniles commonly feeding on shrimps and adults commonly feeding on crabs [1 & 5]. Apart from being able to quickly change colour and become camouflaged another predator avoidance attribute is the 'ink sac' from which they can expel a dark fluid inhibiting the vision of the predator thus assisting in escape (it is also thought to be a mild narcotic) [6]. The main predators of the juvenile common cuttlefish are bass, wrasse, brill and eels [7], predators of adults are more limited but include members of the shark family and angler (monk) fish [5].

THE SUSSEX FISHERY

Fishing methods

Within the Sussex IFCA district the fishery for cuttlefish is only on a commercial basis and three fishing methods are employed; cuttlefish traps, static nets and otter trawls. The most predominant method is cuttletraps of which there are two designs; one is a metre square steel frame with a nylon net covering, the other is a smaller round trap (also known as a 'French style' trap).

Both types have a feathered finger entrance designed for the cuttlefish to be able to enter but not exit and a trap door for emptying and baiting. The traps are worked in strings of 10 - 20 (depending upon the size of the vessel) with a spacing of around 50ft in between each trap; it is common practice to haul the traps every 2 days. Instead of food a female is used as'bait' as it is their breeding season and this attracts the males and thus other females into the trap. On each haul the catch is emptied, the female is replaced and the gear is shot again in succession. It is common to see cuttlefish traps on fishing quays, this is because the fishing season is short and the gear would get damaged if it was left at sea thus at the end of the season they are brought ashore. Unfortunately these traps often have the progeny (eggs) attached (see fishing activity below).

Other commercial methods used to catch cuttlefish are trammel nets, commonly with a mesh size of 120 - 160mm and otter trawls, specifically rock hoppers. In addition cuttlefish are caught as a bycatch in beam trawls and otter trawls with light foot ropes.

Fishing activity

The start of the cuttlefish season is temperature dependent, when the water is 13 - 14°C (around May), they come into the district to breed. Breeding is so energy expensive that once this has occurred they die and thus the fishery for the adults begins to dwindle around July. From July to August small quantities of cuttlefish are still caught in beam trawlers as a bycatch, some are adults but most are 2 - 3 month old juveniles. The cuttlefish breeding areas and therefore the fishery are in distinct regions; they are inshore commonly 4 - 15m deep, from Fairlight to Beachy Head and from Brighton to the Solent (including the region of Chichester harbour).

There is very little bycatch in the cuttlefish fishery. Firstly the cuttlefish trap is designed to utilise the cuttlefish's behaviour and it is rare to find any other species in the trap. Secondly, cuttlefish are voracious predators and thus nothing appears to move in the water column with them so there is little bycatch when the methods of static nets and otter trawls are used to target them. There appears to be no difference in catchability between day and night. It is common for the cuttlefish to exhibit their escape response upon handling and storage thus; the catch, the fishermen and the fishing vessels are often coated in a layer of black ink.

Due to the fishing activity utilising the cuttlefishes breeding behaviour it is common for the females to lay her eggs on trap and subsequently they are damaged. In 2006 the Sussex Sea Fisheries Committee investigated the feasibility of laying artificial substrates as receptors for cuttlefish eggs; the artificial substrate used was similar to a string of cuttlefish traps but without the traps i.e. just the backline, weights and floats. The cuttlefish did use the alternative egg receptors provided in addition to the trap lines. The study recommended that further techniques should be developed in the form of 'removable receptors' which could be placed on the actual traps and once covered in eggs be removed and returned to the sea [8].

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European lobster

Homarus gammarus

Phylum: **Crustacea**
Class: **Eumalacostraca**
Order: **Decapoda**
Family: **Nephropidae**

Biological factor	
Size	Up to 1 metre in length [1]
Lifespan	15 - 20 years [1]
Size at reproductive maturity	Females 25cm [2]
Size at reproductive maturity	Females 7 years [2]
Fecundity	Up to 30,000 eggs [3]
Larval phase	3 weeks [4]
Adult mobility	Crawls (benthic)

Fig 1. **European Lobster** *Homarus gammarus* © Mark Coombes

Species description

The European lobster is dark blue in colour with off-white markings and bright red antennae. It has two front claws that are different in shape, the right-hand claw being larger with blunt serrations used for crushing, the left-hand claw being more slender with sharper serrations used for cutting. It is a solitary animal and can be quite aggressive [1].

BIOLOGY and ECOLOGY

Reproductive behaviour

The sex of the European lobster can be determined by the first pair of pleopods; in males they are hard/'boney' being modified for copulation [1] in the females they are soft/'feathery'. Lobsters breed once per year in the summer and newly berried females begin to appear from September to December [4]. The females carry their eggs for 9 months in clumps attached to the pleopods which then hatch as planktonic larvae in spring and early summer [1]. The larvae are pelagic for 3 weeks and undergo 3 moults before settling on the seabed [4]. It is rare to see young lobsters, one theory is because they burrow in the soft sediments [1] another is that they inhabit rocky inshore ground [4].

Migratory behaviour

Lobsters have well developed walking legs and are also capable of swimming short distances; this is done by quickly flexing the abdomen which projects the lobster backwards. Capture and release studies of adult lobsters have been conducted around the English coast, including Selsey. Tags which were designed to persist through moulting were used and most lobsters were re-captured within 1 - 2 years [4]. The results indicated that lobsters do not undertake regular migrations like many other decapods, instead they make small movements; this may be due to local competition for food or to change habitat which is necessary as their size increases [4]. Thus the main dispersal potential of this species is likely to be during the planktonic larval phase.

Habitat

Adult lobsters live in holes in rocks or excavate soft material from beneath boulders to create deep tunnels [1]. They can also be found inhabiting artificial habitats e.g. crevices in shipwrecks. Lobsters are most commonly present from the lower shore to a depth of 60m [5] with individuals on offshore grounds generally being less abundant but larger (and thus more fecund) [4].

Predators and prey

It is commonly believed that the sheltering and nocturnal behaviour of the lobster is a predator avoidance tactic [6]. To support this research shows that juvenile lobsters released on open sandy grounds suffer higher predation compared to those released on rocky shelter-providing ground [6]. Juvenile lobsters are preyed upon by a large variety of fish and crustaceans including; cod, wrasse, eels, flatfish, brown crabs, shore crabs and larger lobsters [6]. Adult lobsters are one of the largest marine invertebrates and are an unlikely prey item for most marine organisms because of their sheltering and nocturnal behaviour and their deterrent claws. Interestingly, research suggests that the size of the lobster's claws is disproportionate to the size of their prey and that rather than being adapted for foraging or predator defence, they may be more related to intra-specific competition for shelter, food and mates and as a warning indicator of power [7].

Juvenile lobsters predate upon annelids, echinoderms and small molluscs [6]. The diet of

an adult lobster is extended to include smaller lobsters, crabs and larger molluscs. The feeding rate of a lobster decreases with decreasing water temperature in conjunction with their metabolic rate slowing down.

THE SUSSEX FISHERY

Fishing methods

Within Sussex IFCA district lobsters are caught on a commercial and recreational basis. Predominantly they are caught commercially with parlour pots which are especially designed to retain lobsters. Lobsters are also a common bycatch in inkwell pots (mostly used to target brown crab and spider crab) however, these are less desirable as lobsters will quite easily escape through the entrance hole once the bait is used or becomes less desirable. Common bait used to attract lobsters is horse mackerel, scad, dogfish, gurnard and skate chog (the head, torso and tail remnants from skate winging). Typically parlour pots are worked in strings of 20 to 60 pots, with a spacing of 12 to 16 fathoms in between each pot. They are laid for 1 to 2 days, being hauled, emptied, re-baited and shot in succession. A common and valuable bycatch in parlour pots is brown crab. Lobsters are a valuable bycatch for static netters and are occasionally caught in trawls. Recreationally lobsters are taken by divers and snorkelers.

Fishing activity

The main fisheries for lobsters and brown crab within the Sussex IFCA district are based at the fishing stations of Selsey and Eastbourne. There is an all year round fishery for lobsters, however they are mostly targeted from spring to autumn. As the water temperature increases so does their metabolic rate, this increases their feeding rate and the attraction to the baited pots, thus it is during the warmer water months that higher catch rates are seen. Lobsters are nocturnal and it is during the night time they predominantly feed and thus find their way into pots and nets. Lobsters are sometimes caught with a soft shell, this occurs when they have just moulted and are generally unmarketable. Usually fishermen just return these individuals to the sea. Out of season, during the winter and into spring many parlour pot fishermen turn to whelking.

Dead and/or damaged lobsters are found in the pots, this has been attributed to fighting as lobsters are territorial and aggressive (and cannibalistic). It is usually the bigger individual that wins. A baited pot attracts all sizes of lobsters many of which are under the minimum legal size and must be returned to the sea. Small lobsters which are caught and discarded suffer in numerous ways; they may be damaged by larger lobsters whilst in the pot, they may be damaged during the hauling and sorting process and when they are returned to the sea they are vulnerable whilst in search for a new territory/habitat. To try and reduce this the Sussex Sea Fisheries Committee and now the Sussex IFCA, provide 'lobster escape hatches' to the local fishing fleets. The hatch is a plastic square which is of the appropriate dimension to allow undersize lobsters to escape and is laced into the side of the parlour pot. This scheme reduces the number of undersize lobsters retained in the pots (thus reduces the mortality on this portion of the population) and it reduces the time it takes the fishermen to sort their catch. For more information on the project please see reference 9.

In static nets, lobsters are a particularly significant bycatch in the autumn when nets are often shot close inshore; this does not occur during the summer months (1st May – 30th September) due to the Sussex IFCA fixed engine byelaw.

Within the Sussex IFCA district lobsters are most commonly transported and sold live and so to prevent fighting and damage occurring their claws are immobilised using elastic bands. Several fisherman within the district use 'store-pots', these are a large cage-like devises left on the sea-bed in which they empty their the crabs and lobsters into and can store them for up to two weeks until they have a desirable quantity for their respective markets. The best market prices for lobsters and brown crabs are during the run up to Christmas when the festive demand is high.

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Native/Flat/ Common oyster

Ostrea edulis

Phylum: **Mollusca**
Class: **Pelecypoda (Bivalvia)**
Order: **Ostreoida**
Family: **Ostreidae**

Biological factor	
Size	Up to 100mm diameter [1]
Lifespan	10 years (max. 15 years) [2]. The majority in a population is between 2 - 6 years old [3].
Size at reproductive maturity	Females 50mm shell length [2], males unknown
Size at reproductive maturity	3 years [2]
Fecundity	Up to 2,000,000 eggs from a large individual [2]
Larval phase	11 - 30 days [2]
Adult mobility	None: permanently attached

Fig 1. **The Native oyster** *Ostrea edulis* © Sussex IFCA

Species description

Ostrea edulis has an oval or pear-shaped shell with a rough, scaly surface which is off-white in colour [4]. The lower left valve is concave and fixed to the substratum, the right valve is flat and sits inside the left [2]. The only commercial fishery for the native oyster in the Sussex IFCA district is in Chichester Harbour. It is likely that the individuals found here are part of the larger Solent population which exists in our neighbouring Southern IFCA district.

BIOLOGY and ECOLOGY

Reproductive behaviour

Oysters are protandrous alternating hermaphrodites; they start off as males producing sperm then switch to egg producing females then back to males and so on [2]. They breed between May and August [1], this is in part temperature dependent with spawning peaking during the full moon periods [2]. The eggs produced during the female stage are held in the gills and mantle cavity. The eggs are fertilized by sperm drawn in by the inhalant water flow used for feeding and respiration. The fertilized eggs are retained for 7-10 days whilst development to the veliger stage occurs [2]. Following this there is a free swimming larval period with settlement taking place after 11-30 days [2]. Growth is quite rapid for the first 1.5 years; it then remains constant at approximately 20 grams per year for five years, subsequently slowing down [2]. Highest growth rates are seen between April and October [2].

Migratory behaviour

Adult native oysters are permanently attached to the substrate. The dispersal potential of this species is at the spawning stage (larval settling time 11-30 days [2]). The individuals in Chichester Harbour are considered to be part of the wider Solent population thus interbreeding and cross settlement between Sussex and Southern IFCA districts is highly likely.

Habitat

Ostrea edulis is associated with highly productive estuarine and shallow coastal water habitats [2], up to depths of 80m [4]. They can be found on firm seabed's of mud, rock, muddy sand, muddy gravel with shells and hard silt [2]. One of the most suitable settlement substrates (also known as 'cultch') for oyster larvae is natural oyster shells [8]. In exploited areas cultch can be created in the form waste shells and ropes.

Predators, prey and competitors

The native oyster feeds by the process known as filter feeding; pumping water through a filter in the gill chamber to remove suspended organic particles which are subsequently ingested. They are preyed upon by a variety of species including starfish, the sting winkle/rough tingle (Ocenebra erinacea) and American oyster drill (Urosalpinx cinerea) which was accidentally introduced to the British Isles and feeds almost entirely on oyster spat [2]. In addition the oyster faces serious competition from the slipper limpet (Crepidula fornicata) another introduced species from the U.S. The slipper limpet can occur in very high densities and competes with the native oyster for space and food whilst depositing pseudo faeces which forms 'mussel mud', this changes the substrate and hinders oyster settlement [2].

THE SUSSEX FISHERY

Fishing methods

The oyster fishery in the Sussex IFCA district is solely commercial using specially designed dredges. The dredges used within the district are locally

known as the Chichester Harbour oyster dredge and the Solent oyster dredge; they are similar in design but the Solent dredgeis slightly heavier. Commonly two dredges are used, each on a single warp being hauled and shot at 10 minute intervals.

Fishing activity

There is only a small oyster fishery within the Sussex IFCA district; it exists within the confines of Chichester Harbour and is seasonal and diurnal. There are several reasons for this. Firstly Chichester Harbour is where oysters predominantly occur, secondly there is a byelaw preventing oyster dredging in other areas of the district, thirdly there are seasonal restrictions to protect the oysters during their breeding season and finally there is a diurnal restriction to prevent night fishing.
In addition to the public fishery there is currently a disputed claim to a small private fishery.

There are several other matters regarding the Chichester oyster fishery which should be considered. Firstly the location, Chichester harbour is of national and international importance for landscape and nature conservation and has a long list of protection designations. These include; Amenity Area (Chichester Harbour Conservancy Act 1971), Special Area of Conservation (EU Habitats Directive), Ramsar (International Convention of Wetlands of International Importance), Special Protection Area (EU), Area of Outstanding Natural Beauty, a Site of Special Scientific Interest and several local nature reserves (the latter three being accredited by Natural England). Secondly, there are several directives relevant to all UK oyster fisheries which are designed to protect the health of the stocks and ensure that shellfish are safe for human consumption. These include the EU fish and shellfish health regime, Shellfish Hygiene Directive and monitoring for marine biotoxins [10].

Fig 2.The typical catch from an oyster dredge on the sorting table at the stern of the fishing vessel © Sussex IFCA

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Great scallop

Pecten maximus

Phylum: **Mollusca**
Class: **Pelecypoda (Bivalvia)**
Order: **Ostreoida**
Family: **Pectinidae**

Biological factor	
Size	Most <150mm shell width [1] but up to 210mm shell width [3]
Lifespan	20 years [1 & 2]
Size at reproductive maturity	Minimum 60mm [2]
Size at reproductive maturity	Full maturity 3 - 5 years [2]
Fecundity	15 - 21 million oocytes per emission for a 3 years old [11]
Larval phase	11 - 30 days [2]
Adult mobility	Limited swimming mobility (benthic)

Fig 1. **The Great scallop** *Pecten maximus* © Sussex IFCA

Species description

The great scallop, *Pecten maximus* is a bivalve mollusc (it has a shell consisting of two valves). The lower right valve is convex and off-white in colour whilst the upper left valve is flat and reddish-brown. It is has many common names including the great scallop, the king scallop, the giant scallop, escallop and Coquille St. Jacques.

BIOLOGY and ECOLOGY

Reproductive behaviour

The great scallop is a hermaphrodite, fertilization is external and either sperm or eggs may be exuded first [3]. Temporal gonad studies indicate there maybe a bi-modal spawning pattern with partial spawning in the spring (April or May) and then further spawning in the autumn (late August) [3], however some studies have hypothesized that a part of the decrease in gonad contents in the autumn may be attributed to re-absorption. Following fertilisation a planktotrophic veliger larva develops, this stage is free living and subject to water transport. Within 30 days the veliger will settle from the water column and attach by the form of byssal thread to a suitable substrate. Young scallops generally remain attached until they are between 4 - 13 mm in length [5]. Then detaching and settling on the seabed.

Migratory behaviour

The great scallop is capable of 'swimming' and 'jumping' however research indicates that these movements are small and localised [10] and that this behaviour is generally exhibited as an escape reaction. Swimming is achieved by rapidly 'clapping' the valves and expelling the water on either side of the dorsal hinge so that the scallop moves with the curved edge of the shell foremost [6]. Jumping is achieved through the gradual relaxation of the adductor muscle followed by the rapid opening and closing of valves, which jumps the scallop hinge forward [6]. It is generally believed that adult scallops do not migrate and they will only move if disturbed, instead they rely on larval dispersal for distribution and consequently are affected by local hydrographic regimes. Estimates of how far the larvae may travel range from 10 - 40km [2]. It is therefore possible that recruitment to one scallop bed may actually be supported by another scallop bed some distance away; it is also possible that a scallop bed may be self-sustaining, depending on the hydrographics (there is scientific evidence for both scenarios) [2 & 7].

Habitat

The great scallop is found offshore to a depth of 100m [8], normally on a seabed of fine sand and gravel where it lies recessed in slight hollows. Recessing is achieved through a series of powerful adductions (valve closures) where water is ejected from the mantle cavity and lifts the shell at an angle to the seabed so that subsequent water jets blow a hollow into the sediment [7]. The great scallop has an aggregated distribution within their geographic range which is most likely due to the hydrography as they are dispersed as larvae and the availability of suitable settlement substrate. Major fishing grounds are generally widely separated, so much so, that respective environmental conditions produce marked differences in population parameters [7].

Predators and prey

The great scallop feeds by filter feeding; pumping water through a filter in the gill chamber to remove particulate organic matter and phytoplankton [2]. Predators of the great scallop include a range of starfish, commonly Asterias rubens, large crabs and cephlapods. Scallops posses primitive 'eyes' and on

detection of a change in light caused by a shadow or a movement a scallop may swim, re-orientate itself or close its shell in response [9]. Research also suggests they may 'smell/taste' danger. Experimental contact with different starfish species elicited distinct, energy adaptive types of response; full swimming response was initiated only by extracts of Asterias rubens and Astropecten irregularis which prey on molluscs, while limited jumping or valve-closing responses were induced by non-predatory starfish [6].

THE SUSSEX FISHERY

Fishing methods

The scallop fishery in the Sussex IFCA district is solely commercial using a specific dredge type; the 'spring-loaded Newhaven dredge', this is the only type of dredge permitted within the district. It was originally designed in Newhaven but is now used throughout the British Isles. Typically the inshore trawlers within the district alternate between beam trawling, otter trawling and scallop dredging depending on the time of year and economics. The duration of a scallop fishing trip will typically be between one day and one week depending on the size and storage capacity of the individual vessel. Under chilled conditions scallops can stay alive for a week. At present there are no established SCUBA diving activities that target scallops commercially within the Sussex IFCA district.

Fishing activity

The scallop fishery within the Sussex IFCA district is predominantly east of Brighton. No scallop dredging occurs within 3 nautical miles of the shoreline nor during their spawning period which makes it a winter and spring fishery, this is because of local Sussex IFCA byelaws. The best price for scallops is obtained when the gonad/roe is in good condition; typically this is better in the winter fishing months. Fishing activity for scallopsoccurs equally during daylight and night time.

Fig 2. Scallop dredges hanging over the gantry of a fishing vessel and the catch on deck © Sussex IFCA

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Common whelk

Buccinum undatum

Phylum: **Mollusca**
Class: **Gastropoda**
Subclass: **Prosobranchia**
Order: **Neogastropoda**
Family: **Buccinidae**

Biological factor	
Size	Up to 110mm shell length x 68mm shell width [1]
Lifespan	10 years [3]
Size at reproductive maturity	60mm shell height for 50% maturity;90mm shell height for 100% maturity (estimate for males from a Worthing fishing ground*). In the vicinity of Whitstable individuals spawn from 50mm in shell height [3].
Size at reproductive maturity	In the vicinity of Whitstable individuals spawn from 2-3 years of age [3]. The age of reproductive maturity has not been confirmed for the Sussex district but could possibly as late as 7 years old*.
Fecundity	Up to 2,000 capsules [2]. Each capsule may contain up to 3,000 eggs [3] but an average of only 13-14 individuals hatches from each capsule [3].
Larval phase	Within the egg capsule, no planktonic phase
Adult mobility	Limited crawler: up to 20cm per min* (benthic)

* personal communication 02/12/08 Dr. Peter Walker, CEFAS, Lowestoft, England

Species description

The common whelk *Buccinum undatum* is a relatively large gastropod mollusc with a tall spired shell. The body of the animal is yellowish white, flecked with black and it is a popular sea food in countries around the Southern North Sea.
It is common on all British coasts.

BIOLOGY and ECOLOGY

Reproductive behaviour

The sexes of the common whelk are separate and reproduction occurs by internal fertilization in late autumn [3]. Once mating has occurred the females often gather in a group and lay their eggs together [3]. Spawning in many creatures is triggered by an increase in temperature however, the trigger for the whelk is believed to be a temperature decrease; when the water falls below 9ºC, thus the females begin to lay their eggs around the month of November [3], this may continue until April (pers. comms. Dr. Peter Walker.). The females lay their eggs in lens-shaped capsules which are stuck together in a sponge-like mass, commonly known as a 'sea wash ball' [2]. Up to 2,000 capsules may be laid by a female [2] and estimates vary on how many eggs each capsule contains from up to 1,000 [2] to up to 3,000 eggs [3]. Only a small proportion of the eggs will develop, on average 13 to 14 individuals will hatch from each capsule, the remainder being used as a food source by the developing embryo's [3]. The juveniles hatch from the egg cluster as a fully formed whelk mostly during February and March and immediately take to the benthic environment [3], there is no planktonic stage, and thus dispersal potential of this species is very low.

Fig 1. The Common whelk *Buccinum undatum*
© seasurvey.co.uk

Migratory behaviour

There is no evidence to suggest that adult whelks perform any significant migrations and it is likely that their total movement is very limited [3]. The adults are incapable of travelling long distances and there is no larval planktonic phase in their life cycle; these two factors significantly limit their potential dispersal. Thus, it is very likely that the whelks in the Sussex IFCA district will spend their entire life-span in a local area within the district.

Habitat

This species of whelk can occasionally be found at the low water mark on spring tides but it is much more common in the sublittoral zone to the continental shelf edge (as deep as 1200m) [1]. They live on a wide variety of hard and soft substrates including; rock, cobbles, gravel, coarse sand and muddy sand. On the softer sediments they spend some of their time burrowed in the surface layers of the seabed with only their siphon protruding [3].

Predators and prey

Whelks are carnivorous predators and scavengers often using scent to locate food and can travel in

search of food for several hundred metres [10]. They commonly feed on tube-dwelling polychaetes such as Lanice conchilega, bivalves (commonly cockles) and carrion [3 & 4]. Research shows that whelks attack cockles by using their foot to asphyxiate the cockle or by using the lip of its own shell to push the shell valves apart [3 & 5]. The whole process of opening and eating a cockle can take less than 1 hour [3]; unlike some similar species the common whelk cannot drill into the shell of its prey as it lacks a pedal boring organ [4]. Laboratory experiments on the diet of whelks revealed the maximum feeding rate; of 2 cockles per whelk per week; to occur during the spring, incidentally this is when maximum growth occurs [9]. These experiments also showed oysters not to be a food of preference [9]. Adult whelks are a prey item for a range of species including cod, dogfish, crabs [3], rays, flatfish and starfish. Predators of whelk eggs include sea urchins and starfish. It should be noted here that the empty shells of whelks are often inhabited by hermit crabs and such shells are an integral part of a hermit crabs life (note, hermit crabs are not a predator of the whelk).

THE SUSSEX FISHERY

The long life-span and lack of population mobility i.e. absence of planktonic larval phase and limited mobility of the adults, makes the common whelk vulnerable; should over-fishing occur the population is likely to take a long time to recover.

Fishing methods

Fishing for whelks within the Sussex IFCA district only occurs at a commercial level. When whelks are the target species whelk pots are used, a very small portion is also taken as bycatch in fixed gear.

The most common whelks pots used in district are recycled 25l plastic containers. Whelks are attracted into the pot by the scent of bait; the most common bait used in Sussex is dogfish, brown crab and spider crab. It is common for the pots to be left at sea permanently and hauled on a 1 to 3 day basis. If the pots are left for several days and the bait is used up catches decrease, this is probably because the whelks escape in search of another food source.

Fishing activity

Whelks are fished all year round. The highest catch rates of whelks are seen between February and April; this coincides with when the whelks are most actively feeding [3]. In the autumn lower catch rates are seen, this is probably due to two factors; there will be increased disturbance of the pots on the sea bed due to the poorer weather conditions and at this time the whelks are breeding and thus feeding activity is likely to decrease.

Fig 2. A basket of common whelks caught in commercial potting activity © Sussex IFCA

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