

European Lobster

(*Homarus gammarus*)

Summary

Size (total length)	Max. 600 mm Usually 230-500 mm (FAO,1991)
Lifespan	>20 years
Size of maturity (CL₅₀)	83-110 mm
Fecundity	~11,000 (Ellis et al.,2015)
Reproductive frequency	Biennial
Minimum Conservation Reference Size	87 mm (carapace length)
Capture methods	'D' creel/Parlour pots
Fishing Season	All year round



Description

Homarus gammarus, referred to as the European or Common lobster, is widely distributed in the coastal waters of the northeast Atlantic from northern Norway to north Africa (Pawson, 1995). Found in the intertidal zone to depths of 200 m the European lobster favours rocky habitats where boulders and rock crevices provide shelter during the day (Pawson, 1995). At night lobsters forage for crabs, gastropods and polychaetes but they are also opportunistic feeders and will scavenge for carrion (Naylor, 2011).

Reproductive Life history

Female European lobsters display a two-year reproductive cycle (Agnalt et al., 2007; Latrouite et al., 1981). Copulation occurs in the summer between a recently moulted soft-shelled female and hard -shelled male (Pawson, 1995). When a female is ready to mate, she releases a sex pheromone to attract males, it is also thought to reduce the males' aggression and induce mating (Skog, 2009). Following fertilisation eggs are secreted onto the pleopods setae underneath the abdomen (Nagaraju, 2011). Berried (egg-bearing) females appear from September to December however, females can store sperm for over a year and spawn the following autumn (Agnalt et al., 2007; Pawson, 1995).

Eggs develop over winter and in response to water temperature, day length and photoperiodic experience hatch from May to July (Branford, 1978; Cobb and Wahle, 1994). For several weeks the female will 'fan' her tail for a few minutes each night to release the larvae that are ready (Branford, 1978). Upon release larvae enter the water

column and remain planktonic for the first three larval stages (Charmantier et al., 1991). During the planktonic phase larvae are only capable of swimming in the vertical plane therefore dispersal is influenced by currents and wind (Cobb and Wahle, 1994). The fourth stage is referred to as the metamorphosis moult as larvae become recognisable as miniature lobsters and become the first postlarval stage (Cobb and Wahle, 1994). At this stage they are active swimmers and crawlers contributing to further dispersal before settling to a benthic lifestyle (Charmantier et al., 1991). The four larval stages are completed over approximately three weeks (Pawson, 1995). Throughout the early benthic stage of development European lobsters are rarely seen as they remain cryptic to avoid risk of predation (Mercer et al., 2001; Cobb and Wahle, 1994). As juveniles grow beyond 15 mm carapace length (CL) they emerge more frequently to forage for food, but remain close to their burrows (Lawton and Lavalli, 1995).

Lobsters grow by ecdysis, a process by which the hard exoskeleton is moulted to allow for the formation of a larger shell. Moulting occurs several times a year for young lobsters and declines to once every one or two years for mature lobsters, regulated by environmental conditions, particularly water temperature (Agnalt et al., 2007). Mature females increase by 7 mm on average at each moult (Agnalt et al., 2007) however growth is not uniform across an age group. Sheehy et al, (2011) identified at least seven-year classes between 5 to 11 years old at 85 mm CL off the Yorkshire coast demonstrating age-at-size is highly variable. European lobsters are long-lived with a life span of at least 20 years but they are capable of living over 50 years. The average age of large lobsters captured off the Yorkshire coast was 54 and 31 years for females and males respectively (Sheehy et al., 2011). Large females are highly valuable in terms of reproductive output as fecundity is positively correlated with size (Tully et al., 2001). Fecundity in European lobsters varies geographically and is believed to be influenced by temperature range (Ellis et al., 2015). Female lobsters in Poole were estimated to produce an average of 11,208 eggs (Roberts, 1992 cited in Ellis et al., 2015).

Unlike brown crabs and spider crabs, lobsters do not undertake regular migrations instead they move randomly based on food availability and when seeking new habitat as their size increases (Pawson, 1995). Tagging studies have highlighted the limited scale of movement displayed by lobsters with the majority moving less than 4 km over several years (Smith et al., 2001; Jensen et al., 2000). Therefore, dispersal potential is greatest during the planktonic phase of a lobster's life history.

Size of maturity (SOM)

Size of maturity (SOM) is often used to help establish an appropriate Minimum Conservation Reference Size (MCRS) to ensure individuals can reproduce at least once before capture. For lobsters the SOM is commonly accepted as the carapace length (CL) at which 50% of a population are mature and is referred to as the CL₅₀.

Several definitions can be used to estimate maturity in decapod crustaceans: behavioural maturity; morphometric maturity; functional maturity and physiological maturity (table 1.). However, different studies may vary in how they define these terms. The most accurate measurement of maturity is determined through histological

techniques yet it is time consuming when analysing large samples and gonadal maturity doesn't always correspond with the ability to mate (behavioural maturity) (Conan et al., 2001). Morphological measurements on the other hand are relatively quick and easy to obtain in the field but they have been proven to be less effective at detecting maturity (Conan et al., 2001). Due to the female's biennial reproductive cycle it is also important to note when examining maturity based on egg extrusion that not all mature females will be berried (egg-bearing) at the same time, therefore examination of both internal and external features is required to accurately determine maturity (van der Meeren and Soldal, 1995).

Table 1. Four definitions of maturity used to infer sexual maturity in lobsters (Haig et al., 2016; Öndes et al., 2017; van der Meeren and Soldal, 1995; Conan et al., 2001; Lizárraga-Cubedo et al., 2003).

Maturity term	Description
Behavioural	Individuals show signs of the ability to physically copulate e.g. presence of eggs in females and direct observations of mating behaviour. Doesn't confirm functional maturity.
Morphometric	Crustaceans demonstrate 'allometric growth' where different body parts grow at different rates. Changes in size of secondary sexual characteristics such as female abdomen width and male chelipeds length with growth can be used to estimate onset of maturity. Anderson Cheliped Index (AI) and Crusher Propodite Index (CPI) used for male maturity. Estimate of the abdominal width (AW) and carapace length (CL) (AW/CL) used to assess female maturity.
Functional	Presence of eggs externally attached to a female indicates she is functionally capable of producing offspring. Functional maturity in males is difficult to determine therefore other methods are often used to inform male maturity. AI, CPI and AW/CL indices sometimes referred to as functional maturity estimates.
Physiological	Estimated based on microscopic investigation of the gonads or histological observations of ovaries, testes and the vas deferens. Term used interchangeably with functional maturity.

The available literature suggests that SOM for the European lobster in waters around the British Isles and Ireland ranges from 83 – 110 mm CL₅₀ (table 2.). Studies undertaken in Portland and Mudeford within the Southern IFCA district found 100% of females were mature between 101 and 115 mm and males between 96 and 125 mm based on AW/CL ratio and CPV index. A number of males and females were observed to be mature at 80-81 mm with some females in Mudeford mature at 76 mm (Crosse, 2004; Hampton, 2002). In Portland the smallest berried female observed was 80 mm and the size of the average berried female (n=18) was 113 mm (Crosse, 2004). Just outside the district, at Selsey, SOM for females was estimated at 83 mm based on ovary staging assessments (Free et al., 1992).

In the North Sea the smallest SOM recorded was 84 mm along the Northumberland coast based on morphometric maturity (AW/CL ratio) however, SOM based on ovigerous females estimated maturity at 92 mm (Woodruff, 2017). A similar size was found for female lobsters sampled from three quaysides in Yorkshire (93 mm) although females sampled offshore were found to reach maturity at a much larger size of 100mm (Wood, 2018). Around the Irish coastline SOM varies slightly between 93mm and 96 mm (Tully et al., 2001).

Table 2. Size at maturity estimates (CL₅₀) for the European lobster (*Homarus gammarus*) in studies undertaken in the UK, Ireland and France. Male and female carapace length (CL₅₀) given in mm. Maturity method: CPI - Crusher Propodite Index; AI - Anderson Cheliped Index; Gonad – gonad stages assessed; Ovigerous – observation of berried females; AW: Abdominal width/Carapace length ratio. F – female; M – Male. Please refer to the Appendix for more information about each study.

Location	Male	Female	Method	Reference
England – Portland	121-125*	111-115*	F:AW M:CPV	Crosse, 2004
England- Portland	96-100*	-	CPI	Crosse, 2004
England - Mudeford	96-100**	101-105**	F:AW M:CPV	Hampton, 2002
England - Selsey	-	82.5	Gonads & Ovigerous	Free et al., 1992
England - Bridlington	-	90	Gonads & Ovigerous	Free et al., 1992
England - Northumberland	-	84.3 91.6	AW Ovigerous	Woodruff, 2017
England – Yorkshire offshore	-	100.17	Ovigerous	Wood, 2018
England – Yorkshire Quayside (3 ports)	-	92.59	Ovigerous	Wood, 2018
Wales - Dale	-	100	Gonads & Ovigerous	Free et al., 1992
Ireland – North west	-	96	AW & Gonad	Tully et al., 2001
Ireland - West	-	92.5	AW & Gonad	Tully et al., 2001
Ireland – South west	-	94	AW & Gonad	Tully et al., 2001
Ireland – South east	-	95	AW & Gonad	Tully et al., 2001
Scotland – Firth of Forth	80	79	M:CPI & AI F: AW	Lizárraga-Cubedo et al., 2003
Scotland - Hebrides	98	110	M: CPI & AI F: AW	Lizárraga-Cubedo et al., 2003
France – Le Croisic	-	103-106	Ovigerous	Laurans et al., 2009
France – Le Conquet	-	99	Ovigerous	Latrouite et al., 1981
France – Bay of Biscay	-	98	Ovigerous	Latrouite et al., 1981

*100% maturity not 50%. Number of females and males observed to become mature from 81mm

**100% maturity not 50%. Onset of maturity 76 mm females, 80 mm males

Size at maturity cannot be absolutely compared between studies due to the differences in methods used to establish 50% maturity. Nonetheless, in general the SOM for the majority of populations sampled are above the current Minimum Conservation Reference Size (MCRS) of 87 mm CL. Within the Southern IFCA district mature females have been observed from 76-81 mm however, the size at which 50% of the population become mature is unknown (Crosse, 2004; Hampton, 2002). In the Sussex IFCA district CL₅₀ is 5 mm below the current MCRS based upon females sampled at Selsey (Free et al., 1992). SOM was also found to be below 87 mm in Firth

of Forth (79-80 mm) and for females sampled in Northumberland (84 mm) (Lizárraga-Cubedo et al., 2003; Woodruff, 2017).

Southern IFCA Fishery

Fishing activity

The European lobster is the third most valuable fishery in England after scallops and crabs. In 2018, 1,500 tonnes of lobster worth £21.7 million was landed by UK vessels into England (MMO, 2019).

Historically, lobster has been caught across the Southern IFC District; in the Solent, around the Isle of Wight and along the coast of Dorset. The fishery is most prominent in the west throughout Dorset due to the presence of large areas of rocky benthic habitats. Weymouth port supports the largest lobster and crab fishery. Figure 1. illustrates sightings data of crab and lobster potting activity from 2005-2020 in the District. The lobster fishery supports more than 250 fishers within the Southern IFC District based on fishing permits data. Of the 250 permitted pot fishers registered as undertaking potting activity in the district 227 fish fulltime.

Potting for lobster takes place all year round using 'D' creel/parlour pots although some vessels use large rectangular creels. Higher catch rates are seen in the warmer months when lobsters are more active due to warmer sea temperatures. On average vessels will work around 420 pots; however, the number of pots worked can vary greatly, from as few as 50 to as many as 1200, depending on the size of the vessel and frequency of trips. There are 124 vessels under seven metres and 107 vessels between seven and ten metres in length that pot throughout the district. Due to their small size they tend to fish close inshore however, there are approximately 22 ten to twelve-metre vessels that do fish further offshore (>6nm), outside of the District.

Recreational potting does occur in the District but the number of active recreational pot fishers is not known. Greater recreational activity takes place around the Isle of Wight, Swanage, Weymouth, Portland, and Lyme Bay.

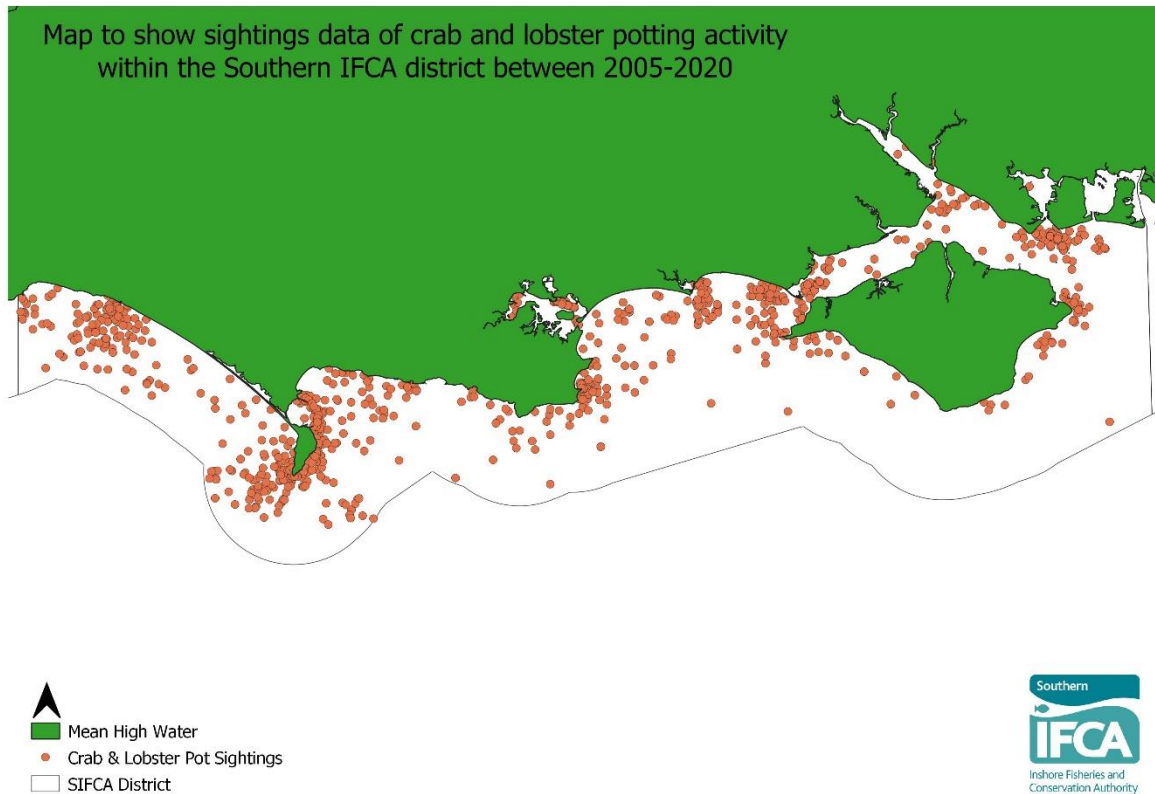


Figure 1. Location of crab and lobster potting activity in the Southern IFC District based on sightings data from 2005-2020.

Landings & Value of Fishery

Southern IFCA do not currently hold effort or catch data for the lobster fishery. However, landings data from the MMO can help indicate the scale of the fishery over time. In 2019, approximately 84* tonnes of European lobster worth £1,277,525* was landed into ports across the Southern IFC District (MMO, 2020).

*these figures represent vessels that land into ports in the Southern IFC District, some of which would have fished outside the district and be >12 metres in length.

Landings have fluctuated over the last 14 years with four low catch periods in 2005, 2013, 2018 and 2019 (fig 2.). A peak of 143 tonnes was seen in 2007, with the lowest landings at 84 tonnes in 2019. Since 2015 lobster landings have declined year-on-year from 128 tonnes to 84 tonnes in 2019. The value of the fishery remained relatively stable during this recent decline at an average of £13,600 per tonne. In 2019 value increased by over £1000 to £15,200 per tonne.

The value of the recreational pot fishery in the district is not known.

In 2016 Cefas reported the status of the European lobster stock in the southeast south coast was low with high exploitation rates above Maximum Sustainable Yield (MSY) but below maximum reference point limits (Cefas, 2017). Biomass for both sexes was around the minimum reference point limit but had increased since 2014. It was calculated that, at the MCRS applied across the region, between 99-100% of males and 86-92% of females should be mature (basis of SOM calculation unknown).



Figure 2. Landings and value of European lobster (*Homarus gammarus*) into the Southern IFC District from 2005 to 2019. Data received from the Marine Management Organisation (MMO).

Associated management

Landings of European lobster are primarily managed through Minimum Conservation Reference Size (MCRS) restrictions to prevent the landing of sexually immature individuals. This allows individuals to grow and reproduce at least once before harvesting. In the Southern IFCA district the MCRS for the commercial fishing of European lobster is 87 mm (CL) under European legislation (Regulation (EU) 2019/1241). The Southern IFCA Minimum Conservation Reference Size Byelaw, which is currently awaiting sign off from the Secretary of State, will apply the MCRS to all fishery participants in the district. The ‘Protection of berried (egg bearing) lobsters’ byelaw also prohibits the removal of berried lobsters from the fishery. Additionally, to prevent the capture of undersized individuals the use of escape gaps in crab and lobster pots is promoted on a voluntary basis throughout the district.

Fishing effort is also indirectly managed through the ‘Vessels used in fishing 2012’ byelaw that prohibits commercial vessels over 12 metres from fishing in the Southern IFCA district. The reduction in vessel size naturally restricts fishing effort as it limits the quantity of static gear that can be worked by each vessel.

Table 3. illustrates the different MCRSs in place across the IFCA districts, the British Isles and Ireland. The majority of IFCAs enforce a MCRS of 87 mm (CL) under European legislation (Regulation (EU) 2019/1241) or have transferred the EU size to an IFCA byelaw. The Devon and Severn, Cornwall and Isles of Scilly IFCAs have a slightly larger MCRS of 90 mm introduced under the Sea Fisheries Committees as a measure to manage fishing effort due to declining stocks. It is not believed to be based

upon size of maturity data. Wales and the west coast of Scotland also enforce a minimum size of 90 mm. Additionally, Scotland applies a maximum landing size of 155 mm for females caught in Orkney and the Shetland Islands and 145 mm for females caught in the rest of Scotland.

Table 3. Minimum Conservation Reference Sizes (MCRS) for European lobster (*Homarus gammarus*) in Inshore Fisheries and Conservation Authority (IFCA) Districts in England and other areas of the British Isles and Ireland. All measurements in mm for carapace length (CL).

IFCA	Minimum Conservation Reference Size (MCRS) (mm)
Northumberland	87
North Eastern	87
Eastern	87
Kent & Essex	87
Sussex	87
Southern	87
Devon & Severn	90
Cornwall	90
Isles of Scilly	90
North Western	87
Other	
West coast of Scotland	90
	<i>155 female maximum landing size in Orkney and Shetland Islands</i>
Rest of Scotland	87
	<i>145 female maximum landing size</i>
States of Jersey	87
Isle of Man	87
Wales	90
Northern Ireland	87
Republic of Ireland	87

Bold MCRS – above EU/national MCRS of 87mm, introduced by relevant authority.

Italics – Maximum landing size for female lobsters

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Appendix

Table A. Estimates of size at maturity for European lobster (*Homarus gammarus*) in studies undertaken in the UK, Ireland and France. Table shows study location, total number of individuals sampled overall, size range sampled, total number of individuals used to assess size at maturity, size of smallest mature individual, size at 50% maturity (CL₅₀), size range of mature individuals and maturity definition used to assess maturity. All sizes based on carapace length (CL) in mm.

Study location	Total No. of individuals surveyed	No. of individuals (n)		Length Data		Size at Maturity Data									Reference		
				Size range (mm)		Total No. of individuals	No. of individuals (n)		Size of smallest mature individual (mm)		Size at 50% maturity (CL ₅₀) (mm)		Size range of mature individuals (mm)			Maturity Definition	
		M	F	M	F		M	F	M	F	M	F	M	F			
England - Portland	1009	542	467	52-148	47-145	-	-	-	-	-	-	121-125*	111-115*	81-125	81-115	F: AW M: CPV M: CPI	Crosse, 2004
England - Mudeford	1578	808	770	35-135	55-146	-	-	-	-	-	-	96-100**	101-105**	-	-	F: AW M:CPV	Hampton, 2002
England - Selsey	-	-	-	-	-	-	-	-	-	76	-	82.5	-	-	-	Gonads & Ovigerous	Free et al., 1992
England - Bridlington	-	-	-	-	-	-	-	-	-	81	-	90	-	-	-	Gonads & Ovigerous	Free et al., 1992
England - Northumberland and	8831	4062	4769	-	-	-	-	-	-	-	-	84.3 91.6	-	-	-	AW Ovigerous	Woodruff, 2017
England – Yorkshire offshore	2437	-	2437	-	-	-	-	-	-	-	-	100.17	-	-	-	Ovigerous	Wood, 2018
England – Yorkshire Quayside (3 ports)	4239	-	4239	-	-	-	-	-	-	-	-	92.59	-	-	-	Ovigerous	Wood, 2018
Wales - Dale	-	-	-	-	-	-	-	-	-	95	-	100	-	-	-	Gonads & Ovigerous	Free et al., 1992

Ireland – North west	-	-	-	-	66-114	129	-	129	-	-	-	96	-	-	Gonads & AW	Tully et al., 2001
Ireland – South east	-	-	-	-	75-127	118	-	118	-	-	-	95	-	-	Gonads & AW	Tully et al., 2001
Ireland – South west	-	-	-	-	61-121	108	-	108	-	-	-	94	-	-	Gonads & AW	Tully et al., 2001
Ireland - West	-	-	-	-	70-115	91	-	91	-	-	-	92.5	-	-	Gonads & AW	Tully et al., 2001
Scotland – Firth of Forth	1166	555	611	-	-	-	-	-	-	-	80	79	-	-	M: CPI & AI F: AW	Lizárraga-Cubedo et al., 2003
Scotland - Hebrides	588	264	324	-	-	-	-	-	-	-	98	100	-	-	M: CPI & AI F: AW	Lizárraga-Cubedo et al., 2003
France – Le Croisic	16884	-	-	-	-	-	-	-	-	-	-	103-106	-	-	Ovigerous	Laurans et al., 2009
France – Le Conquet	1788	-	1788	-	-	-	-	-	-	-	-	99	-	-	Ovigerous	Latrouite et al., 1981
France – Bay of Biscay	1635	-	1635	-	-	-	-	-	-	-	-	98	-	-	Ovigerous	Latrouite et al., 1981

*100% sexual maturity within the population. Number of individuals observed to be mature from 81mm

** 100% sexual maturity within the population. Onset of maturity F:76mm M: 80mm