Biologisk rådgivning vedr. forvaltning af hummerfiskeri i Danmark

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RÅDGIVNINGSNOTAT FRA DTU AQUA

Til:	Fødevareministeriet, Kontoret for Bæredygtigt Fiskeri
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1. Anmodning

The request from Ministeriet for Fødevarer, Landbrug og Fiskeri (FVM) was send August 14th:

"På baggrund af drøftelse på møde den 12. august 2025 anmodes hermed om DTU Aquas generelle vurderinger – gerne fordele og ulemper – af forslag til forvaltningstiltag ift. hummerfiskeri med henblik på beskyttelse af hummere i Danmark, herunder:

- Indsatsbegrænsning
- Mængdebegrænsning
- Mindstemål
- Lukkeperioder
- Fredningszoner
- Regler om udsmid
- Tiltag der anvendes i sammenlignelige nabolande
- Evt. yderligere forvaltningstiltag.

Med henblik på at sikre de nødvendige data for dette fiskeri anmodes om anbefaling til monitoreringssystem, f.eks. logbogsdata, observerede landinger, elektronisk overvågning eller andet."

In a follow-up request following the receival of the first version of the memorandum, FVM asked on September 23rd additional advice regarding the current closed season in the Limfjorden (July 1st to August 31st):

- Bør fredningsperioden ikke gælde i hele Danmark, dvs. for hummerfiskeri generelt?
- Er der evt. behov for at justere fredningsperioden, så den er gældende lidt senere på året?

These two specific questions will be addressed in a separate advice.

2. Approach

This DTU Aqua advice identifies potential problems and risks in the fisheries for the different management measures and presents their use or not in the other European countries, advantages and disadvantages based on a literature review and study of regulating practices in a number of countries relevant to Danish conditions. These are summarised together with implementation potential in Table 2.

In view of the follow-up request, text has been added to a new section "Closed period" and Table 2.

3. Potential management measures

Management measures in other northern European countries

Table 1 presents a summary of management measures for European lobster fisheries in northern European countries France, United Kingdom, Ireland, Norway and Sweden.

European lobster fisheries are not managed through quotas or total allowable catches (TAC), but rather through other measures such as effort or technical measures.

All countries require a general fishing licence to enter lobster fisheries, but in France and the UK in some regional fisheries require specific permits.

Most countries only allow pots and creels to fish lobsters, with exceptions for by-catch in other fisheries (e.g. in France for nets and trawling). To our knowledge, only Denmark allows the use of multi pots, fyke nets and gill nets to target European lobsters. Several countries limit the number of fishing gear allowed per permit or boat, depending on boat size or in regional fisheries (UK, France), others nationally (Norway, Sweden), while in Ireland and Denmark there are no limits to the number of fishing gear used. Escape vents are used in all countries (at least regionally) except Ireland. Biodegradable threads or panels in fishing gear are mandatory in Norway and Sweden to reduce ghost fishing.

In Norway fishing gear must be hauled at least once a week, to limit damage or mortality of lobsters from the accumulation of many lobsters in the gear.

All countries except Ireland have areas closed to lobster fishing for conservation.

Closed seasons are used in Norway, Sweden, and in some regions in Denmark and France.

All countries have minimum landing size of either 87 or 90-mm CL, except Denmark in the Skagerrak, Kattegat and Baltic Sea with 78 mm CL. The MLS in fisheries in the UK, France, Norway, Sweden has increased from 87 to 90 mm CL in the last 5 to 10 years. Maximum landing size is used in France, Scotland in the UK, Ireland and Norway.

Berried females are protected in England in the UK, Norway, Sweden and Denmark, but not in Ireland, Scotland, Wales and Northern Ireland in UK and France. Only the UK and Ireland use a prohibition of landing V-notched (i.e. with a mark/notch on the tail) lobsters to permanently protect mature females and/or large lobsters.

In Norway, all lobsters to be sold are individually tagged.

All European lobster fisheries collect data on landings through observer or other sampling programs (ICES 2023).

Most European lobster fisheries collect data on fishing effort through observer and voluntary surveys, logbooks or VMS (Table 1; ICES 2023).

Table 1. Management measures for European lobster (*Homarus gammarus*) fisheries by country in northern Europe. Gear number refers to pots or creels. For Denmark: [1] North Sea; [2] Limfjorden; [3] Skagerrak, Kattegat and Baltic Sea (includes ICES subarea 22). Compiled from several data sources: Tully, 2004; ICES, 2023; UK: CEFAS, MarineScotland; France: IFREMER-CNPMEM; Ireland: Sea-Fisheries Protection Authority; Norway: Fiskeridirektoratet; Sweden: Havs- och vatten-myndigheten.

Measure	France	United Kingdom	Ireland	Norway	Sweden	Denmark
Landings 2022 (tonnes)	616	3300	612	61	39	71
Licences	Fishing	Fishing	Fishing	Fishing	Fishing	Fishing
Permits / Limited entry	Yes	Yes regional	No	No Annual registration	No	Yes
VMS	> 12m	> 12m	> 12m	> 15m	?	?
Logbooks	Yes	Yes	Yes > 10m	Yes	Yes	Yes >8 m >10 m
Other		Vessel length regional		haul time max. 1 week report loss of gear lobsters for sale tagged	Report loss of gear	
Gear number	Yes regional 75/150/250/300 1000-1200 offshore	No / Yes regional: 300/800	No	100	40	No
Gear type	Pots only Parlour pots restricted (regional) Nets, trawl by-catch	Pots	Pots and creels	Pots	Pots	No / Yes [2] partial ban on nets

Measure	France	United Kingdom	Ireland	Norway	Sweden	Denmark
Marked gear (on buoys/flags)	Yes	Yes (regional)	No	Yes	Yes	Yes
Escape vents	Yes / No regional or type of pot	Yes / No regional	No	Yes	Yes	Yes [1, 2] 60 mm [3] 54 mm
Entrance size	Yes (rigid 14 cm)	?	No	?	?	No
Biodegradable panels/threads	No	No	No	Yes	Yes	No
Closed areas	Yes regional	Yes	No	Yes	Yes (temporal)	? [2] Livø stenrev
Closed season	No / Yes some regional	No	No	Yes Dec-Jan to Sep	Yes Jan to 19 Sep	No / Yes [2] July-August
Minimum size (mm CL)	87 / 90 (from 2026)	87 / 90	87	90	90	[1, 2] 87 mm [3] 78 mm
Maximum size (mm CL)	No	No / Yes Scotland 145-155 mm CL females	Yes 127 mm CL	Yes 115 mm CL females	No	No
Berried female protection	No (discussion)	Yes / No No in Scotland	No	Yes	Yes	Yes
V-notch protection	No	Yes (2017)	Yes	No	No	No
No parts or claws	Yes / No (regional)	Yes / No (regional)	?	No	No	Yes

Fishing effort

The absence of limits to and the lack of knowledge of fishing effort can be a potential management and sustainability risk, which can mask and/or eventually lead to overfishing. If left unrestricted, fishing effort can increase in response to catch restrictions and technical measures (e.g. MLS, maximum size, protection of berried females) to target fractions of the population (e.g. males, large lobsters, Tully, 2004; Tully et al., 2006). Management should thus consider the interaction between fishing effort and catch restrictions and technical measures (e.g. Tully, 2004; Tully et al., 2006).

Restrictions of fishing effort are used by most countries in European lobster fisheries (UK, France, Norway and Sweden), but not all (Ireland). Fishing gear restrictions number and/or type of gear allowed per boat/licence, can vary between fisheries within a country and between countries, but most countries only allow pots and creels to target European lobsters, with exceptions as by-catch in other fisheries (ICES 2023). Fishing effort in Danish lobster fisheries is not directly regulated and only limited by other technical measures (e.g. closed season, MLS, protection of berried females) that reduce fishing mortality in fractions of the population or periods of the year.

Fishing effort has increased in recent years in the Limfjorden and ICES subarea 22, with the number of fishing boats increasing respectively by 34% since 2021 and 84% since 2019 (Landbrugs- og Fiskeristyrelsen). In addition, fishing effort per boat is assumed to have increased in recent years based on anecdotal information from fishermen. This occurred from technological creep (e.g. more efficient boats, improved technology and equipment, higher efficiency fishing gear), but also from increases in the number of fishing gear per boat.

Fishing effort in the Limfjorden is likely excessive considering: 1) the significant increase in the number of active fishing boats in recent years; 2) the high amount of fishing gear used by the commercial fishery (estimated between 18,500 and 24,000 gears in 2024 from anecdotal information: 8 fishermen using over 1,000-1,250 gear and 70 fishermen with 150-200 gear); 3) the high efficiency of most common types of fishing gear used (multi pots and fyke nets are 4.6 and 3.2 more efficient than parlour pots; Frandsen and Feekings, 2023). In ICES subarea 22 it is unclear if the continuous increase in landings over the last 10 years reflects an increase in abundance, the large increase in fishing effort (i.e. active fishing boats and fishing gear), or both.

Restricting fishing effort is an effective way to reduce fishing mortality and increase egg or yield per recruit in lobster fisheries (e.g. Tully 2004; Tully et al., 2006). Inevitably, a restriction of fishing effort would lead to a reduction in catches and economic gains in the fisheries, at least on the short-term. It is expected to predominantly affect those fishermen using the most fishing gear with highest efficiency. Restricting the number of fishing gear would require control and registration systems (e.g. some USA American lobster fisheries mark individual gear with unique tags).

Minimum landing size (MLS)

Minimum landing size (MLS) is generally regarded as a basic principle of good management in crustacean fisheries (ICES 2003, 2023; Tully et al., 2006; Laurans and Loubry, 2023; Kleiven et al., 2024a). In many fisheries, MLS is set to ensure a significant proportion or even all lobsters can reproduce at least once without being fished (ICES 2003, 2023; Tully et al., 2006; Laurans and Loubry, 2023; Kleiven et al., 2024a). However, the use of MLS may not be enough to limit fishing mortality, as its effect can be countered by increases in fishing effort if left unrestricted (e.g. Tully, 2004; Tully et al., 2006; Kleiven et al., 2024a).

Most countries in Europe consider local variations of size-at maturity to be small and have MLS that at most differ by 3 mm CL in different regions, 87- or 90-mm CL (e.g. ICES 2023, Tully et al., 2006; Coleman et al., 2023; Kleiven et al., 2024). This followed the implementation in 2002 of a European wide MLS of 87 mm CL in the North Atlantic and North Sea and 78 mm CL in the Skagerrak, Kattegat and Baltic Sea (EU Regulation 2019/1241). The MLS in several fisheries in the UK, and nationally in France, Norway, Sweden have increased from 87 to 90 mm CL over the last 5 to 10 years (CEFAS, 2024; Laurans and Loubry, 2023, Kleiven et al., 2024).

Currently, only Denmark uses an MLS smaller than 87 mm CL, with 78 mm CL for the Skagerrak, Kattegat and ICES subarea 22. Neighbouring Norway and Sweden use a minimum size of 90 mm CL, including in the Skagerrak and Kattegat. Recent review studies of spatial structure and connectivity of populations showed no differences in the European lobster population structure in the Skagerrak (André et al., 2024; Moland et al. 2025). It is thus unlikely from a biological perspective that differences in size at maturity in the Skagerrak, Kattegat and ICES subarea 22 justify an MLS 9- or 12-mm CL lower than those in the North Sea, the Limfjorden, Norway and Sweden.

A change in MLS (i.e. increase) has several potential implications for the lobster populations and fisheries (e.g. ICES 2003; Tully et al., 2006; CEFAS, 2023; Laurans and Loubry, 2023; Kleiven et al., 2024a): 1) Since natural mortality is low, biomass should increase as a fraction of individuals between the current and a future MLS would increase in size by ca 5-10% per one additional moult. 2) The reproductive potential of the population should increase as a fraction of those individuals would then reach maturity and contribute to one reproduction cycle; 3) More larger females would increase egg production due to the higher fecundity of large females. 4) An initial reduction in landings and economic gains since a significant fraction of landings comes from sizes a few mm larger than MLS, including in the Limfjorden (Freitas et al., 2023).

Evaluation of MLS relative to size-at-maturity of European lobsters in Denmark requires the collection of catch data (size, sex, ovigerous condition and possibly gonadal development) from research fishing (e.g. in collaboration with the fisheries) without escape vents to include ovigerous females and sizes smaller than MLS.

Maximum landing size (MaxLS)

Maximum landings size (MaxLS) is used by some countries ranging from 115 mm CL in Norway, 127 mm CL in Ireland and 145-155 mm CL for females only in Scotland in the UK (ICES 2023).

MaxLS is used to permanently protect large female and/or male lobsters to increase egg production due to the long-life span of European lobsters, substantially higher fecundity and reproductive value of large lobsters than smaller ones (e.g. ICES, 2003; Tully et al., 2006 and references therein). MaxLS also partially mitigates the effects of sex specific fishing mortality from the protection of berried females, i.e. female skewed sex ratio, size differences relative to males and associated impacts on mating behaviour and success (e.g. Theberge et al., 2024).

Implementing a MaxLS has limited impact on the fisheries, since large lobsters are normally rare in fished populations and usually have a lower market value (e.g. Tully et al., 2006). For instance, in the Limfjorden in spring 2022 only 2.5 % of lobsters in landings were larger than 114 mm CL (Freitas et al., 2023).

Closed period

Closed periods are used as a management measure for European lobster fisheries in Norway, Sweden, and some regions of France and Denmark (ICES, 2023; Laurans and Loubry, 2023; Norway: Fiskeridirektoratet; Sweden: Havs- och vatten-myndigheten). Norway and Sweden have long closed periods covering late autumn or early winter to early autumn, with fishing only allowed for 2 to 3.5 months in autumn. The UK and Ireland do not use closed periods as a management measure.

Closed periods are used mainly to reduce fishing effort (i.e. number of fishing days) and protect mature female lobsters that are not berried between the hatching of eggs and the extrusion of new eggs from late spring-summer to summer-early autumn and least importantly to reduce mortality of soft lobsters in the fishing gear during the main moulting period in late spring-summer (e.g. ICES, 2003; Whale et al., 2013). The objectives of implementing a closed season or periods and knowledge on the local/regional lobster biology and population dynamics (e.g. spawning and main moulting periods, growth, recruitment) should determine its duration and when it should occur and also consider interactions with other measures (e.g. gear limitations, MaxLS, V-notch program).

Implementation of a closed season has several implications for the lobster populations and fisheries: 1) it is a simple measure to implement and control; 2) it is effective in reducing the number of fishing days; 3) it is partially effective at protecting non-berried mature females, since larger lobsters may not reproduce every year and mature lobsters may be non-berried outside the closed season (e.g. Coleman et al., 2021, 2023). 4) It is partially effective to reduce mortality of lobsters that moult in fishing gear as moulting can

occur throughout the year. These recently moulted lobsters would be again available to fishing once the closed period ends, and with a larger size relative to pre-moulting.

For the fisheries, implementing a closed season will result in lower catches and landings at least in the short term as it reduces the number of fishing days. Since European lobster catch rates are temperature dependent (e.g. Tully et al., 2006; Freitas, 2023), closure during the warm summer months will have a higher impact on catches than closure in colder months. Fishing effort (i.e. number of active fishing boats) is also higher in the warmer spring to autumn months (i.e. May to October). For instance, landings from other areas (Central North Sea, Skagerrak, Kattegat, ICES subarea 22) during the closed period used in the Limfjorden (July and August) represented between 33 and 37% of annual landings (2020 to 2024, data from LFST). Changes in fishing behaviour (e.g. seasons distribution of fishing effort) and improvement of stock status may compensate for those losses

Protected areas and closed zones

Several European countries have MPAs or MCZ closed to lobster fishing (e.g. Hoskins et al., 2011; Moland et al., 2013; Fernández-Chacón et al., 2015; Calef 2016; Halvorsen et al., 2017; Bergström et al., 2022; Knutsen et al., 2022; Torgan 2024; Van Hoey et al., 2024), and use multi-year scientific monitoring programs to determine its effects on lobster populations within and around protected or closed areas, and on nearby fisheries (e.g. Knutsen et al., 2022; Kleiven et al., 2024b).

The conservation effects of protected areas or no-take zones on lobster populations are well documented in the UK, Norway and Sweden, with significant positive effects on lobster abundance, mean size, biomass, reproductive potential and spill-over (e.g. Hoskins et al., 2011; Moland et al., 2013; Fernández-Chacón et al., 2015; Calef 2016; Halvorsen et al., 2017; Bergström et al., 2022; Knutsen et al., 2022; Torgan 2024; Van Hoey et al., 2024). Protected areas or no-take zones (e.g. excluding passive fishing gear used for lobster fishing) can positively impact lobster populations and improve fisheries catches outside protected or closed areas (Bergström et al., 2022; Knutsen et al., 2022 Freitas et al., 2023; van Hoey et al., 2024).

The evaluation of protected or closed areas as a management measure in Denmark and its potential effects on lobster populations and fisheries, requires data on fishing activity, lobster and habitat distribution.

Quotas and total allowable catch

No European lobster fisheries are managed through quotas or total allowable catches (TAC), but rather through measures such as fishing effort or other technical measures (e.g. ICES, 2023).

Rules on discards

In European lobster fisheries in other countries undersized and protected lobsters (e.g. berried, oversized, V-notched) are discarded (e.g. ICES 2023), since lobsters show high resilience and low damage from fishing with pots, and thus non-legal lobsters (i.e. undersized and berried females) are expected to have high survival and contribute to recruitment (Tully, 2004). The introduction of mandatory escape vents in 2025 and the partial ban against nets in the Limfjorden have reduced the handling of undersized lobsters by fishermen

The relatively large mesh size and escape vents used in European lobster fishing gear in Denmark are expected to significantly reduce bycatch of non-target fish species. However, bycatch may occur of other crab species (i.e. edible crab *Cancer pagurus* and shore crab *Carcinus maenas*) and gastropods (e.g. common whelk *Buccinum undatum*).

Monitoring and data collection programs

European countries use different data sources, monitoring programs, and stock assessment approaches (Table A5 in ICES, 2023). Data is obtained from a series of sources that require different effort and resources to obtain (Table A5 in ICES 2023):

- Regular fishery independent surveys are not used in any country.
- Size frequency data from landings (size, weight, sex, fishing location, boat, date) using observer or other sampling programs is obtained in all countries.
- Data on undersized pre-recruits is obtained in the UK (Jersey), Ireland and France (development), and requires research fishing using gear without escape vents.
- Most countries obtain fishing activity, effort, and catch data (date, location, number and type of fishing gear, number of gear hauled per day, soak/haul time, catch in number per sex over and undersized) from observer and/or voluntary self-reporting (e.g. UK regionally, France, Ireland, Norway), and only Ireland uses a reference fleet.
- Logbooks are used by UK, France, Ireland (vessels >10 m), Norway and Sweden to register fishing activity and catch data.
- VMS fishing activity data is obtained in several countries (UK, France, Ireland), above a certain vessel size (10 or 12 m).
- All countries use stock indicators (landings, LPUE, size frequency data; Ireland only DPUE).

- All countries use analytical assessment methods, Length Cohort Analysis (UK, production (France and Norway in development), change in ratio (Scotland in UK).
- Analytical assessment output include biomass (England and Scotland in UK, France in some areas), spawning stock (England in UK), and fishing mortality (England and Scotland in UK, France in development).

Currently, monitoring data on European lobster fishing in Denmark is limited to landings (fresh weight) and the number of active commercial fishing boats landing lobsters per fishing area but no other data on stock status or effort are available. Qualitative data on size and sex composition of catches, landings and fishing effort (number and type of fishing gear, soak time, date and number of hauls per day) are inexistant (except for data produced in the Hummerfiskeri i Limfjorden project; Freitas et al., 2023).

A monitoring and data collection program allows to obtain knowledge on lobster biology, follow stock and fishery status trends, and is a fundamental initial step towards the common assessment methods for the management of European lobster stocks being developed in the ICES working group WGCRAB (ICES, 2023).

Any monitoring, data collection or stock assessment programs will inevitably require the availability of resources and should be adequate to stock assessment and management objectives. Norway and Sweden have similar European lobster catches to Denmark, and obtain data other than just landings (e.g. effort, size frequencies) and at least Norway is developing stock assessment production methods (Table 1; ICES 2023).

Table 2. Summary of management measures, advantages and disadvantages and implementation potential. Implementation potential reflects how simple implementing a measure would be in five qualitative classes (very low to very high). However, implementation potential also depends on other regulations, its control, cost, available data, stakeholder interests, stock assessment and management objectives and policies.

Measure	Advantages	Disadvantages	Implementation Potential	Comments
Fishing effort	- Effective to limit fishing mortality - Improves the effect of technical measures (e.g. MLS, MaxLS, berried female protection)	- Must be correctly set to avoid over or under restriction of fishing mortality - Requires control and registration - Negative impact on landings, at least in the short term	- Medium / High	- Very relevant with the recent increase in fishing effort (number of fishing boats and gear), and landings - Fishing effort can be restricted from number of fishing days, number of fishing boats, type and number of fishing gear per boat
Minimum landing size	- Effective and easy to control - Effective limit to fishing mortality and protection of reproductive potential	- Countered by unrestricted increase of fishing effort - May not be sufficient to ensure or maintain lobster population abundance	- Very high - Current measure	- MLS in the Limfjorden and ICES sub area 22 should be evaluated based on biological knowledge
Maximum landing size	- Easy to implement and control - Low impact on fisheries as large lobsters are rare and have lower market value - Permanently protects large lobsters with high longevity and reproductive potential value - Protection of large females is effective way to increase egg production - Mitigates negative effects of protection of berried females: skewed sex ratio, female-male size differences impact on mating success	- May not be effective in increasing egg production as few individuals reach large sizes	- Very high	

Table 2. (Cont.) Summary of management measures, advantages and disadvantages and implementation potential.

Measure	Advantages	Disadvantages	Implementation Potential	Comments
Closed period	- Easy to implement and control - Limits fishing mortality - Protection of non-berried mature females - Reduces mortality in fishing gear of recently moulted "soft" lobsters (less relevant)	- Does not fully protect non-berried mature females or "soft" lobsters - Negative impact on landings, at least in the short term - Effect can be countered by unrestricted increase of fishing effort in other periods	- High	- Contributes to simplification of rules in political agreement - How long and when may require local/regional biological knowledge - Should consider other measures and management objectives
Protected areas	- Positive conservation effect on abundance, size, reproductive potential - Positive effects on nearby fisheries	- Variable and potentially uncertain scale of effects - Potential closure of high value fishing grounds - Implementation, monitoring and control costs	- Variable - Dependent on other factors	- Integration with Danish nature conservation and maritime spatial planning policies
Quotas	- Easy to control - Limits fishing mortality	- Complex, difficult, expensive to determine	- Very low	- Not used in European lobster fisheries
Discards	- Favours higher yield per recruit due to low natural and discard mortality - Contributes to recruitment	-	- Very high - Current measure	- Applied in other European lobster fisheries in France, UK, Ireland, Norway and Sweden
Data collection	- Knowledge on local biological parameters - Knowledge on stock and fisheries status - Data timeseries allows for better stock assessment and management - Multiple options for data programs - Necessary for stock assessment methods and reference points developed by ICES	- Cost and resources required for data collection and analysis for relatively small fisheries	- Medium / High	- Implementation potential depends on scale and cost of program - Data timeseries allows for better stock assessment and management - Increasing importance with recent increase in number of fishing boats, fishing effort and landings

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