NOBANIS - Invasive Alien Species Fact Sheet

Homarus americanus

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Species description

Scientific name: *Homarus americanus*, Milne Edwards 1837, Nephropidae, Decapoda.
Synonyms: *Astacus marinus* Say 1817; *Astacus americanus* Stebbing 1893; *Homarus mainensis* Berrill 1951
Common names: Amerikansk hummer (DK, NO, SE), American lobster (GB) Ameerika homaar (EE), Amerikanischer Hummer (DE), humr evropský (CZ).

Fig. 1. *Homarus americanus*, photo by Astrid Woll, Møre Research, Ålesund.

Species identification

Clawed lobster with powerful tail, one pair of long antennae, shorter, branched antennulas, differentiated large claws and four pairs of walking legs. The colouration is usually a dark bluish green to greenish brown, with a reddish tint on body and claws, and a greenish tint on walking legs. It has very dark greenish black spots on carapace and orange to whitish below. Variations in colour composition are common, but white spots near the eyes and mouth, or marbled colouration, commonly found in European lobsters (*Homarus gammarus* L.1758) are unusual. The protruding rostrum between the eyes has several lateral teeth and usually on or more ventral teeth, which is not found in the European Lobster. In *H. americanus* the ventral teeth on the rostrum are visible even in the first zoea larval stage (Helluy & Beltz, 1991). The body length can reach 50 cm and body

weight can reach up to 20 kg or more, although large specimens are rare (Wollf 1978). See Williams (1987) and Holthuis (1991), for full descriptions. Methods of identifications are described in Jørstad et al. (2007).

Native range
The native range is the Northeastern American coast and waters from Cape Hatteras, Carolina in USA to Labrador, Newfoundland and Straits of Belle Isle in Canada. Depth range: from the shore to 700 m depth (See Lawton & Lavalli 1995).

Alien distribution

History of introduction and geographical spread
Two lobsters captured in Icelandic waters were classified as American lobster based on colour and morphology at the Marine Research Institute, Iceland. One of these was captured as bycatch in a trawl, at 150-155m depth southwest of Iceland in May 1965. The specimen was a male measuring 39cm from rostrum to telson (total body length). The colour was greenish black. The carapace length/carapace width measurements were identical to those of *H. americanus* from Canada and USA but differed greatly from the mean ratio for *H. gammarus* in Great Britain. This was confirmed by lobster specialists both from Canada and England. This has however not been verified genetically, since no genetically identification methods were available at the time. The other lobster, a female, was captured in the early 1960s off the west coast of Iceland, but no further details on that specimen are available (Skúladóttir 1968).

In 1999 the first American lobster was captured in Norwegian waters, and since, as much as 23 individuals have been recorded captured in Norwegian waters (Dr. A.-L. Agnalt, pers comm.). All were identified based on genetic analysis since this is the only valid method to distinguish American lobster from European lobster (Jørstad et al. 2006, Jørstad et al. 2007). Six of the American lobsters were berried females. All lobsters have been captured along the coast; near Larvik, Sandefjord, Kristiansand, Bergen and Ålesund. In Denmark, one specimen was captured in 2006, in Øresund. In Sweden, four American lobsters have been captured close to the Norwegian border in 2008/2009. In September 2008 four individuals were caught off the coast of Bohuslän, Sweden. All of these had rubber bands around their claws, which indicates that they were escapees (Fiskeriverket 2008). American lobsters have also been captured in the English Channel (Laing 2002).

All Atlantic, North Sea and possible Mediterranean coastal waters of Europe with native stocks of the European lobster must be considered as potential areas for introductions.
Intentional implants to areas outside the range of the *Homarus* species, like the American West coast, Japan and Oceania, have not been successful.

Pathways of introduction
The introduction pathway to Norway has not been investigated, but is presumably based on release/escapees of American lobsters from live import, either legally and illegally.
All the four regions where American lobsters have been found in Norway are close to airports with international traffic, harbour with large ferry lines and visiting cruise ships and live marine crustaceans offered for sale on the market. In Sweden three specimens were found within a few 100 m from the auction hall. It has been speculated that they originated from a batch held in a sea closure from which they escaped.
In the rest of Europe, a large part of the European import of live American lobsters is stored on both sides of the English Channel, in Belgium, the Netherlands, UK and France. France was also releasing a

few clutches of hatched and cultivated American lobsters in a sea ranching project in the late 1970's. (Dr. F. Latrouite, pers comm.).

Alien status in region
All the positively identified specimens are found incidentally in Norway, Denmark and Sweden while none have been observed in Germany (see table 1). Faroe islands, Iceland and Greenland as well as the Barents Sea are north of the climatic range of any of the *Homarus* species, although an early, not genetically certified find, was made in Icelandic waters (see above). Most of the Baltic is probably too limnic for the lobsters to survive.

Country	Not found	Not established	Rare	Local	Common	Very common	Not known
Austria							
Belgium							
Czech republic	X						
Denmark		X					
Estonia	X						
European part of Russia	X						
Finland	X						
Faroe Islands	X						
Germany	X						
Greenland	X						
Iceland		X					
Ireland		X					
Latvia	X						
Lithuania	X						
Netherlands							
Norway		X					
Poland	X						
Slovakia							
Sweden		X					

Table 1. The frequency and establishment of *Homarus americanus*, please refer also to the information provided for this species at www.nobanis.org/search.asp. Legend for this table: **Not found** –The species is not found in the country; **Not established** - The species has not formed self-reproducing populations (but is found as a casual or incidental species); **Rare** - Few sites where it is found in the country; **Local** - Locally abundant, many individuals in some areas of the country; **Common** - Many sites in the country; **Very common** - Many sites and many individuals; **Not known** – No information was available.

Ecology

Habitat description
American lobsters are found in a wide variety in their native range. Inshore populations are found in shallow waters on mud, cobble, bedrock, peat reefs, eelgrass beds and occasionally within sandy depressions (Lawton & Lavally 1995). Offshore populations inhabit depths down to 200 m depth, are found on similar substrates, as well as clay. The temperature in this area ranges from 5º C to 20º

C, although the species tolerate from –1º C to 30.5º C. They can also survive shortly in low salinity, although they are usually found in areas with salinity above 25 psu.

In the invaded areas, American lobsters have been caught between 10 and 50 m depth near the coast, in habitats consisting of a mixture of bedrock, sand, mud and cobble, although the first one captured in Swedish waters came from more than 100m depth in the Skagerrak. All captures in shallow waters have been caught in typical habitats for native crabs and lobster species, as they have been caught in lobster or crab pots, while the one from deeper waters was captured by a trawl.

Reproduction and lifecycle

The life cycle of the American lobster is, in many aspects, similar to the European lobster. Female lobsters mate immediately after a moult, build up the internal egg-clutch during the following year, and spawn the next summer, when the eggs get fertilized during transfer and attachment to the pleopods underneath the tail. The embryonic development takes 9-16 months, when the prelarvae are hatched. The planktonic prelarvae moult into the first larvae stage within hours, followed by three more planktonic larval stages, where the fourth is called a postlarva. The development time ranges from 22 to 103 days, dependent of the temperature. Total length of the first stage larva is on average 7.8 mm, while the postlarva reach on average 12.6 mm (this section based on Ennis 1995). The postlarvae seek to the bottom and shelter within the habitat, where they moult and become juveniles, which remain in shelter for the next two-three years. With increasing size, the juveniles will gradually move more extensively outside the shelters. They are considered to have reached the adult phase at a size of 50 mm in carapace length. This can take four years or more from hatching, dependent of temperature and habitat. Functional maturity is when they are able to mate, and produce fertilized eggs. American lobsters are known to be long-lived. Some specimens are known to be up to 100 years old and more in aquariums (Lawton & Lavalli 1975).
The habitat and food preference of the American lobster seems to be similar to the European lobster. The offshore populations of the American lobster live in burrows similar to the Norwegian lobster (*Nephrops norvegicus* L. 1758) (Chapman 1980). Norway lobsters and American lobsters are found in the same depth range. They might therefore be a potential space and food competitor also to this species.

The fecundity of the American lobster female is dependent on the size of the female, which can produce from a few thousand to several tens of thousands eggs per clutch. Smaller females tend to moult and spawn every second year, while larger females can produce egg-clutches two years in a row before moulting the third year (Talbot & Helluy 1995). As the larval stages have relatively short durations, where stage 3 and 4 are actively seeking into the shoreline, the dispersal is not expected to be very wide. Due to the many years it takes from mating to maturation, the population growth rates are slow, but if all life stages are established, it will be impossible to eradicate the species from invaded areas.

Dispersal and spread

It is not known if the American lobsters in Norwegian waters have produced offspring. However, one female in the Oslofjord-catches was carrying eggs, where some seemed to have been hatched immediately before being caught (van der Meeren *et al.* 2000, Jørstad et al. 2006). However, no juvenile or adolescent lobsters have been found.
Some long-distance movements has been suggested for the lobsters escaping from the holding box near Kristiansand, Vest Agder, where the distance between the most distant lobster catches was up to 30 km to each side of the escape location. As American lobsters in off shore habitats are known to have seasonal long-distance migrations, the potential is present (Campbell & Stasko 1985; 1986).

One American lobster was caught in deep water in the middle of Skagerrak, just inside the Swedish EEZ.

Impact

Affected habitats and indigenous organisms
Live American lobsters are themselves a competitor to the native European lobster and possibly Norwegian lobsters, by sharing the same habitat and food preferences (Dybern 1973; Cooper & Uzmann 1980; Chapman 1980; Lawton & Lavalli 1995; Collins 1998).

Additionally, they can carry various diseases and parasites, as the Gaffkemia, a lethal bacterial blood disease, which has led to outbreak in lobster holding facilities for imported lobsters in Europe (Wiik *et al.* 1987; Mortensen 2002). Many imported American lobsters carry with them encrusting organisms, like barnacles and polychaeta with no harmful effect on the lobsters, but with a potential for being invasive species themselves.

Shell disease has become a major problem for American lobsters in their natural southern range, north to Rhode Island and Massachusetts, USA (American lobsters found in Norwegian waters have been caught with shell damages, similar to the symptoms of this disease (Dr. N. Sandlund, pers. comm.)). Some developed the symptoms in aquariums after being caught, but two specimens were caught with the symptoms in October 2009, in Norwegian waters (G.I. van der Meeren 2008).

Being large and long-lived predators, able to manipulate their environment by digging and shuffling substrate, they might have a long-term modern effect on the ecosystem.

Being spawned only in limited seasons, and hatched as relatively large larvae, they are not expected to be prone to enter and survive in ballast-water tanks.

Genetic effects
Due to the inherent ability in both species to distinguish between the two, natural mating will not take place as long as a mate of the same species is available (van der Meeren *et al.* 2003). Cross-species mating has been achieved in laboratories when no mate choice has been offered. Such matings produce live, fast growing and vigorous offspring (F1), with traits from both species. (Adouin & Leglise, 1972; Carlberg *et al.* 1978; Hedgecock *et al.*1977; Talbot *et al.* 1984; Bowser & Rosemark 1981), In some cases these were reported to be sterile (Talbot *et al.* 1984), while in one laboratory they also produced a second F2 generation (Dr. J. Kittaka, pers. comm.).

Human health effects
None

Economic and societal effects (positive/negative)
The European lobster stocks in the Nordic region are quite small and vulnerable, and much smaller than in historic time. Efforts are made to enhance them (Agnalt *et al.* 1999; 2004). The presence of a competitive sibling species could, if the density of the invasive species gets high, be harmful and slow the rebuilding of the native stocks. If the diseases known only in American lobsters are spread to European waters it could/will have a serious negative effect, and in the worst case, close down in the fisheries.
It is because of the low landing volume of European lobsters that live American lobsters are imported. Frozen lobsters are of inferior quality compared to live quality, and the local fisheries

cannot support the demand. European countries are the most important customers of the Canadian lobster fishery.

Management approaches

Prevention methods
The present laws for Denmark, Norway and Sweden include international agreements for the prevention of biological variation (ANON 2001; 2002, 2004a; 2004b), and instructions for handling imported live animals (van der Meeren *et al.* 2004). Further, national action plans for biodiversity and international trade agreements are present, with import-laws similar in the 3 countries, requiring veterinary certificates and including a prohibition of release of lobsters in coastal waters.

Eradication, control and monitoring efforts
In Norway there is a money reward for any caught and positively identified American lobster. Most of the public aquaria and the Institute of Marine Research (IMR) are collaborating to inform the public and receive all possible specimens delivered by professional and recreational fishermen. All findings are to be analysed genetically by IMR and registered.
Improved control routines have been employed for control of imported lobsters as well as fishmongers and the fish markets. Still, it is a problem that American lobsters imported into a EU country are regarded as “lobsters” and cannot be traced as a species in the trade statistics if sold on to a second EU country.

Information and awareness
When the first American lobsters were identified in Norway, it caught the public attention and was followed by a broad media interest, The ensuing part governmental, part media driven information campaigns have successfully educated the public about the two lobster species and their differences. This has possibly stopped further illegal import, as no new American lobsters have been identified the last two years.
However, as long as live American lobsters can be legally imported, there is a risk that someone will violate the legislations, by accident or intentionally, and release more American lobsters in Nordic waters.

Knowledge and research
Research is undertaken in several of the Nordic countries. The investigations are closely related to the putative effect the species might have on native lobsters. Themes are amongst others:

- American lobsters seem to be dominant in shelter conflicts.
- Mate choice seems to be species specific when the female is given a choice (European female with one American lobster and one European lobster male) but hybrids are known to be vital and reproductive.
- Genetic analyses to distinguish between the two species
- Disease outbreak in Norway.

Recommendations or comments from experts and local communities
In the case of the American lobster, it is recommended to implement the first line of defence, already with its import, since it is very difficult to control once the animals have been imported. In practice our view means that all import of live American lobsters should be forbidden, both from non-EU/EØS countries and via EU/EØS countries. If this is not possible for the Nordic countries alone within the EU/EØS regulations, we suggest that an import restriction for the whole EU/EØS area should be considered. Trade within EU concerning lobsters should be registered in the import

statistics at species level and it should be possible to trace the origin. Information on, and administration of, import, and handling instructions should be established and centralised within each country. This should also be coordinated between the Nordic countries, as should the registration and management of lobster fishery in common waters. This would be essential because a restriction on live lobster import may increase demand and fishing pressure on the European lobster. If is it impossible to restrict the import of live American lobsters, there is an urgent need to launch information campaigns focusing on disseminating knowledge and risks regarding the introduction of live American lobsters in native waters.

Continuous information to the public and scientific community should be maintained, as well as collecting suspected American lobster specimens for identification at the Institute of Marine Research. It is a need for development of the genetic analytic methods to get a cost- and time-effective method that also can detect hybrid lobsters.

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Links
Nordisk Ministeråd

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