

The Crayfish Plague of Europe (1860-present)

A case of a North American Native Species being introduced to Europe via ballast water transfer from

Maritime Shipping

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History of the Crayfish Plague (*Aphanomyces astaci*) in Europe:

- Introduced to Italy via ballast water discharge from N. American ship in 1860
- Other countries it spread to: Sweden (1907), Spain (1958), Norway (1971), United Kingdom (1981), Turkey (1984), Turkey (1987)
- The plague has wiped out native populations of the noble European crayfish (*Astacus astacus*) almost to the point of extinction in some locations
- The signal crayfish (*Pacifastacus leniusculus*) has been introduced as a replacement

The noble European Crayfish (*Astacus astacus*)



- The “best tasting” crayfish in Europe
- Considered “vulnerable” (IUCN) today because of the crayfish plague
- Crayfish consumption in Europe (Sweden) is used in many cultural festivities/feasts



The plague fungus (*Aphanomyces astaci*)

- Fungus attaches to the shell of the crayfish
- Fungus grows filaments that penetrate the shell into the soft tissue below
- Infected crayfish dies in 6-10 days



Crayfish plague:
Segment with brown (ventral) markings shows signs of typical infection from fungus.
Segments either side indicate healthy muscle tissue

Enter the Signal Crayfish...

(Pacifastacus leniusculus)



- 1950s-60s the Swedish people decided to introduce the signal crayfish as a replacement for the noble crayfish
- Signal crayfish are more resistant to the plague than the noble crayfish

What happened after the signal crayfish was introduced:

- Signal crayfish increased the spread of the plague to previously unaffected populations of noble crayfish
- Signal crayfish carry the disease but do not die from it



Other non-native crayfish introduced to Europe after the crayfish plague

The Three Species of Crayfish Most Commonly Exported to Europe



- *Orconetes limosus* native to the NE United States
- *Pacifastacus leniusculus* native to Northwestern US and Canada (signal crayfish)
- *Procambarus clarkii* native to southern US (Louisiana crayfish)

Enter the Louisiana Crayfish...

(Procambarus clarkii)

- Introduction has increased the spread of the plague to even more populations
- Is able to out-compete the native crayfish, especially in clear water
- Is able to survive poor quality water and move overland to other habitats



Other effects as a result of the introduction of non-native crayfish:

- Re-introduced the fatal plague to other crayfish populations in Europe
- Reduced biological diversity
- Disrupted host environment and community
- Provided a now permanent source of plague fungus
- Reduced fisheries in Europe
- Changed the diet of indigenous mammals in Europe

Controlling ballast water discharge to reduce chance of more species introductions (Maritime shipping)



Ballast water discharge in port

- “the prevention, reduction or elimination of the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments, consistent with international law” (International Maritime Organization)

Better techniques for managing ballast water will reduce future species introductions

Techniques for treating ballast water:

- *filtration

- *ultraviolet irradiation

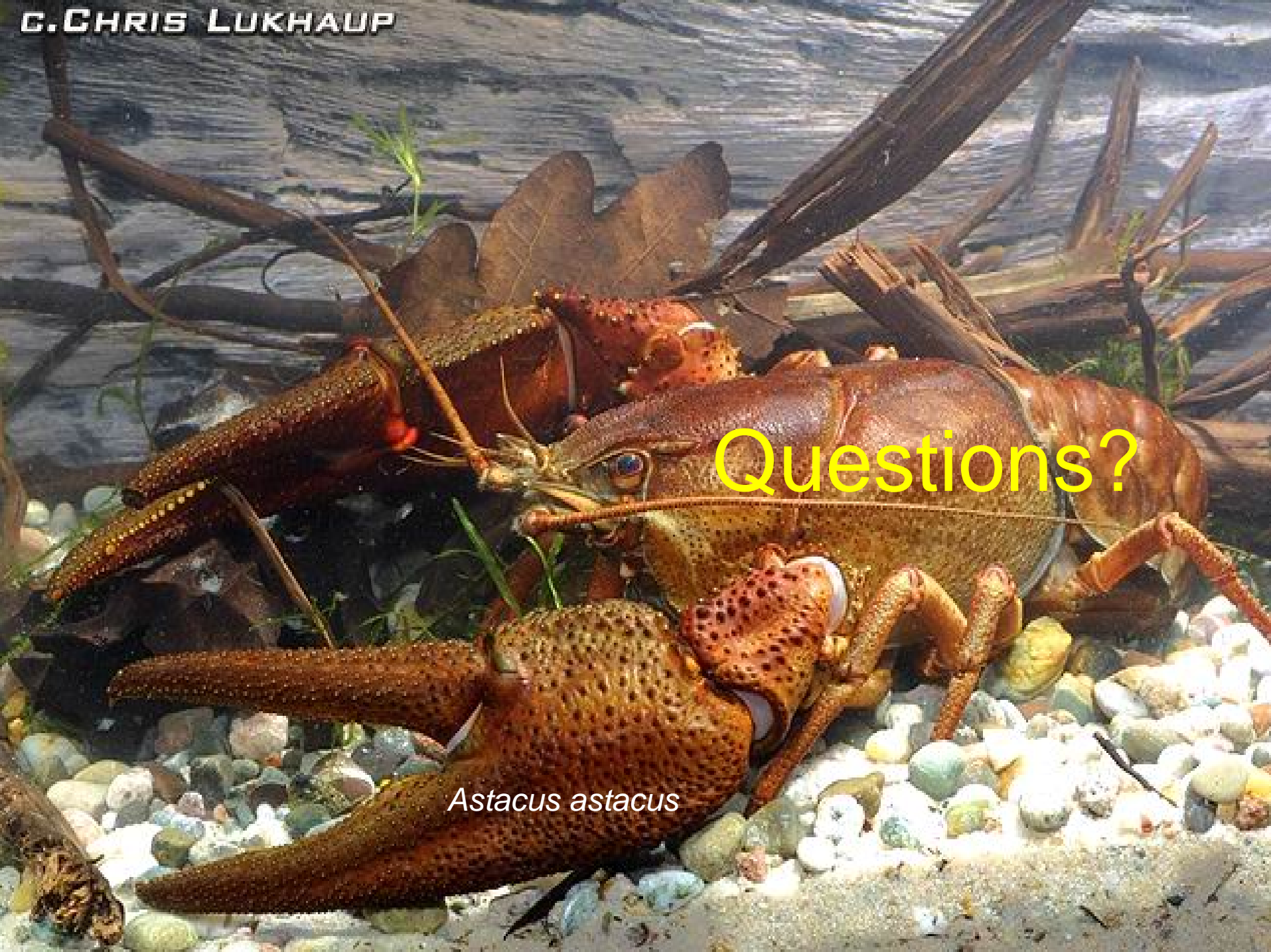
- *deoxygenation

- *cyclonic separators

- *biocides

- *thermal energy

Just to name a few!



Questions?

Astacus astacus

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