

The Invasion Is On

The problem of alien species finding their way to other habitats and causing problems for the natives is something that maybe we should all be a little more worried about as Richard Shucksmith and Elizabeth Cook explain...

ALIENS ARE invading! Not the little green men of sci-fi fame - although some might look far weirder than that. The scary invaders we are talking about are marine aliens from far flung waters. It's been happening for a long time and is still happening today - the coastal waters of the UK are being invaded by marine animals from all over the world!

What is a marine alien?

A marine alien is a marine plant or animal which has managed to jump across its naturally restrictive boundary into a new environment where that species has never been found before.

How do they do that?

Mainly through human mediated introductions, either accidentally on ship hulls, in ships' ballast water, or intentionally for aquaculture (brought in with an aquaculture species or escaped from aquariums).

There are some classic examples of devastating introductions around the world.

In the Mediterranean Sea, the seaweed *Caulperpa taxifolia* was used by Monaco Aquarium as an attractive plant for their aquariums. In 1984 a small patch was observed growing outside the aquarium on the seabed. By 1989 this had spread to cover an area of 8000 square metres and by 1997 a massive 44.5 million square metres was covered by this alien species.

The Russians introduced the red king crab into the Berant Sea in the 1960s to create a new and valuable fishery. This species has spread approximately 400 miles in the last 10 years and now lies a third of the way down the Norwegian

coastline. It has been suggested that this species could eventually reach as far south as Spain and Portugal.

The North American comb jelly *Mnemiopsis leydii* was introduced to the Black Sea and the Sea of Azov through ships' ballast water in the 1980s where it became the most dominant animal in the Black Sea and the Sea of Azov. Ballast water has been shown to be one of the greatest threats to the world's oceans.

After unloading their cargo at port, ships pump millions of gallons of

devastating effect.

It is estimated that about three to ten billion tonnes of ballast water are transferred globally each year, however regulations have been implemented and improved to reduce the risk of aliens in ships' ballast water invading a new environment.

What's the cost to the environment?

The introduction of invasive species by humans has been identified as second only to habitat destruction in causing the

global loss of biodiversity. In the Mediterranean Sea the seaweed *Caulperpa taxifolia* has displaced the native sea grass beds and drastically reduced the number of animals living there. It has also had a negative impact on tourism, commercial and recreational fishing and scuba diving.

The red king crab can grow to a length of 1.6 metres, live up to 25 years and consume a massive 400-700 grams of scallops in 48 hours. It also preys on other flatfish and has



red king crabs photo courtesy of Dr. Lis Lindal Jørgensen

seawater on board as ballast to give the ship stability. They then sail to their next destination which could be anywhere in the world with a ship full of seawater carrying millions of tiny marine animals. On reaching the next port they load on the new cargo while pumping out the ballast (sea water from the previous port) releasing millions of organisms into a new environment which they could not naturally reach.

Most of the organism will die due to the environment not being right for that particular species, however, a few may survive some of which will have a

been reported as having devastating effects on scallop beds and flatfish populations in Norway. How long before it reaches the north coast of Scotland? That would give you a fright emerging from a kelp bed to be confronted by a 1.6 metre giant crab!

The North American comb jelly devastated the Black Sea and the Sea of Azov after its accidental introduction in the 1980's. It fed voraciously on large zooplankton including small fish such as anchovies, causing the collapse of the fishery by 1994. However, there is a twist to this story. In 1997, another alien



comb jelly from the Mediterranean Sea, *Beroe ovata* got into the Black Sea. The Mediterranean comb jelly ate its way through millions of the American comb jellies to redress the balance and the Black Sea is now showing signs of recovery. I hear you shout, "Why not introduce an alien species to eradicate or control other aliens then?"

This is dangerous ground to tread, as it can be very difficult to predict how an introduced species will react in a new environment; you may get rid of one nuisance alien only to be replaced by another. For example on land, the Small Indian Mongoose was introduced to control rats on the Hawaiian Islands, the rats themselves being alien invaders. The mongoose is known to have caused at least five endemic species to become extinct and is now on the The World Conservation Union (ICUN) list of the top 100 world's worst invaders.

The introduction of new species for aquaculture over the last 50 years has had a positive benefit economically to many coastal communities around the world. However, many of these species have established in the wild displacing native species from their preferred place to live. They have also brought new diseases and parasites, which infect native marine life that have no natural defence against these new diseases.

So what's happening in UK?

In the UK, 50 alien species were identi-

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fied in 1997 by the Joint Nature Conservation Committee (JNCC) as established in British waters, although it is believed that many more species have become established or have considerably expanded their range in the last 8 years. One such species is the Japanese skeleton shrimp, *Caprella mutica*, which was discovered in 2001 on the west coast of Scotland. This species can grow to a length of 35+ mm and typically inhabits man-made structures, such as fish farms and lines used for rope grown mussel culture, in densities reaching 10,000 per metre square.

Mussel growers on the west coast of Scotland and Canada have experienced failed spat settlement in recent years. It is thought that *C. mutica* may have prevented the mussel spat from settling either by predating on or out-competing the mussel spat for space on the lines. Researchers at the Scottish Association of Marine Science (SAMS) are currently assessing the ecological impact of *C. mutica* on the rope grown mussel industry and sub-tidal marine communities as part of a larger UK project, known as 'Marine Aliens' (see overpage for more details).

Other species that have extended their range include; the seaweed, *Sargassum muticum* (or Japweed) and the Chinese Mitten Crab, *Eriocheir sinensis*. *Sargassum* was first identified in the UK in the mid-1970s along the south coast of England and over the last few years it has spread northwards, finally reaching Loch Ryan in the Scottish Borders in April 2004. *Sargassum* can cause serious ecological damage by over growing and shading underlying native species. Worryingly, a natural habitat for *Caprella mutica* in its native waters is *Sargassum*. It is almost certain that these two species will meet in the next few years. The question is, what will be the environmental consequences of their meeting on native biodiversity?

The Chinese mitten crab, *Eriocheir sinensis* has also extended its range in recent years. The largest population of mitten crabs is still located in the Thames region, including the Medway and Blackwater estuaries, however this species has been spreading further north in recent years and has reached as far



north as the Humber and Tyne. How long before it reaches Scotland? The Chinese mitten crab can cause serious structural damage to embankments and pose a significant threat to native animals in the estuaries it has invaded. As a consequence, it has been placed on the IUCN 100 of the world's worst invaders.

The Economic Cost

It is estimated that the ecological damages and control costs of alien species in the United States total more than US\$137 billion per year. The most serious aquatic invading species based on damages and control, in terms of millions of dollars per year, are fishes (US\$5400); zebra and quagga mussels (US\$500); others (US\$3000). Closer to home, it has been estimated that fisheries production was reduced by more than US\$200 million per year in the Black Sea and by US\$40 million in the Sea of Azov through the introduction of the North American comb jelly, *Mnemiopsis* in the late 1980s. These figures, however, were for the fish species only and did not include the additional costs of inactive fishing fleets, factories and ports. The estimated costs to the UK taxpayer of aquatic alien species are unknown.

The lack of information on the economic costs of aquatic alien species in the UK may reflect the fact that we have yet to experience any serious problems that can be easily attributed to an alien species, such as fouling of industrial power plants by zebra mussels in the US, the reduction of fisheries production in the Black Sea or the loss of protected seagrass beds by the invasion of the toxic seaweed, *Caulerpa taxifolia* in the Mediterranean.

The fact that alien species in the UK have been associated with aquaculture sites, marinas and ports and that they have been recorded in areas created to

protect specific species or habitats, such as the presence of *Sargassum muticum* in the Strangford Lough Special Area of Conservation (SAC) and *Caprella mutica* in the Firth of Lorn candidate marine SAC suggests that it is only a matter of time before either an existing or an entirely new alien species causes serious economic or environmental damage in the UK.

The importance of establishing rigorous monitoring and surveillance programmes in the near future can not be stressed enough and the development of policies to assess risk and to rapidly eradicate or control the spread of 'high risk' alien species must be raised to the highest level on the political agenda before an alien species really does cause irreversible damage to our marine environment and serious dents in our wallets.

We need your help, please report any sightings of alien species to the Marine Aliens website at www.marlin.ac.uk/marine_alien

You can also get a free underwater Marine Alien ID guide, please see website for details.



Not a pretty pair - *Caprella mutica* large mal

If you would like more information on alien species the following websites might be worth a visit:
www.sams.ac.uk/research/pelagic/Aliencaprellid.htm

SOE and NHM talk
www.nhm.ac.uk/visit-us/galleries/darwin-centre/live/asx/181103PaulClarkhi.aspx

Mitten crab talk
www.nhm.ac.uk/visit-us/galleries/darwin-centre/live/asx/crabshi.aspx

More about mitten crabs
www.nhm.ac.uk/nature-online/life/other-invertebrates/chinese-mitten-crabs/chinese-mitten-crabs.html

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