Ecology and the Marine Environment

Attack of the Killer Ctenophores

In 1999 the Caspian Sea was invaded by one of the most feared invasive species, the comb jelly *Mnemiopsis leidyi*. Within a short period of time, 75% of the zooplankton in the southern portion of the Caspian Sea were wiped out, disrupting food chains and especially affecting fishes such as kilka and sturgeon. As a result of the invasion, some species of zooplankton have vanished from Caspian waters due to *Mnemiopsis*’ ability to consume up to 15 times its body weight per day and reproduce quickly. Within 2 weeks after hatching, the hermaphroditic species reaches sexual maturity and can produce thousands of eggs each day. Although *Mnemiopsis* mainly preys on zooplankton, it will also eat fish eggs and larvae.

Researchers assume that *Mnemiopsis* may have entered the Caspian Sea in ballast water that was taken on in the Black Sea or the Sea of Azov by ships that later entered the Caspian Sea. Once introduced, *Mnemiopsis* quickly spread, with populations reaching densities of more than 2,000 individuals per square meter. Their numbers remain high for 6 months of the year, peaking in August. As a result of zooplankton predation by *Mnemiopsis*, the zooplankton biomass in the Caspian Sea has been reduced to about one tenth of its normal amount. This has caused the Iraninan kilka fishery to plummet from 85,000 tons in 1999 to 15,000 tons in 2004, causing an economic loss in excess of $125 million. Other countries that border the Caspian Sea, such as Russia and Azerbaijan, have reported similar declines. There is also a concern that the Caspian seal, which feeds on kilka, may also become a casualty of the invasion. The seal population is already under pressure from pollution, hunting, and an outbreak of canine distemper virus, which has reduced the seal population by 83% over the last 50 years. Adding to the environmental nightmare are phytoplankton blooms that result from reduced grazing pressure due to the decline in zooplankton. The situation is especially dire in the Caspian Sea because degradation of the environment and overfishing already have placed excessive pressure on the kilka and sturgeon populations.

*Mnemiopsis* is native to the waters off the East Coast of the United States. It was introduced to the Black Sea in 1989 in ship ballast water. The bloom that resulted that summer was overwhelming. As many as 800 million tons on *Mnemiopsis* filled the Black Sea, which represented a biomass 800 times that year’s total fish catch. Local fisheries were decimated by the event. The problem continued until 1997 when *Beroe ovata* arrived in the Black Sea, probably from ballast water again. *Beroe* appears to prey exclusively on *Mnemiopsis,* and by 2001 the numbers of *Mnemiopsis* in the Black Sea had declined so greatly that researchers had trouble finding specimens for analysis.

In 2001 researchers organized a program to determine if *Beroe* could be introduced into the Caspian Sea. The water in the Caspian Sea is not as saline as that in the Clack Sea, and in early experiments the *Beroe* survived but did not breed well. Since it is difficult to re-create the conditions of the Caspian Sea in the laboratory, the only way to find out if *Beroe* will survive well enough and reproduce in the Caspian Sea is to introduce it. Some environmentalists are concerned that once introduced, the *Beroe* will prey on zooplankton other than *Mnemiopsis*. Laboratory experiments indicate that *Beroe* does not feed on other zooplankton at all. *Beroe* was also tested for its ability to introduce other pests into the Caspian Sea. Parasites associated with *Beroe* die off, probably because of the less saline water, and the Black Sea and Caspian Sea have similar bacteria fauna, so it is unlikely that *Beroe* would introduce new bacteria. The strategy of introducing *Beroe* to control *Mnemiopsis* could be used in the Caspian Sea, but the Caspian is bordered by five nations and the politics of the region have interfered with the deployment of this plan.

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1. What is the organism that is causing all these problems?
2. What domain is it in?
3. What kingdom?
4. How much food can it consume daily?
5. What is its main food source?
6. How long until they reach sexual maturity?
7. What waters are in danger?
8. What other organisms are affected because of these organisms (organisms they don’t eat)?
9. Where is this organism native to?
10. What is a way researchers are thinking about trying to control the population?
11. What is the name of the organism researchers are thinking about using?
12. What are some of the potential issues with introducing this species that were discussed?