Japanese Skeleton Shrimp *Caprella Mutica*

Erika Pinney

Fish 423: Invasion Ecology

Fall 2009

Background Information

Caprella Mutica is of the **Order:** Amphipoda, **Infraorder:** Caprellida, **Family:** Caprellidae , **Genus:** Caprella, **Species:** mutica. It is either referred to as the skeleton shrimp or the Japanese skeleton shrimp because they are native to North-east Asian coastal waters. (marlin.ac.uk). It also know to do a very interesting "dance" when observed it looks like it's doing a crunch exercise.

Life Cycle and basic ecology

Caprella Mutica can be best identified by their size of the three projections on the grasping margin of the propodus of their feeding antennae. In large males, the middle projection is the largest and most noticeable. (Cook 2007) Another easy way to identify a skeleton shrimp is by their color, *Caprella Mutica* has distinct green and red to orange pigmentation covering their adult bodies. The females brood their eggs in a dark red spotted pouch. The males develop faster than the females and grow to a larger size (35-40mm) in adulthood (Ashton 2007).

Males attach themselves to the females and transfer their sperm directly to the opening of her reproductive organs. When the females brood their egg pouches in late fall, the young skeleton shrimp emerge as miniature adults and therefore do not have a planktonic phase therefore without a free swimming stage they must attach to a hard substrata for relocation(Cook 2007). *Caprella Mutica* are opportunistic feeders whose diet mostly consists of detritus with smaller occurrences of planktonic crustaceans (copepods, amphipods) and polycheates (Guerra-Garcia, 2009). *Caprella Mutica* is a temperate species, they can be found in temperatures ranging from -2 to 25 degree Celsius. In their native habitat, salinity levels of 11 to 35 ppm were recorded. While *Caprella Mutica* can handle changes in salinity, after 48 hours they can't survive in waters with a salinity of 20 or below. (Cook, 2007) *Caprella mutica* feeds by trapping small food particles on its antennae and between its feeding appendages then cleans the food particles off its antennae by curling them down around its mouth (Cook

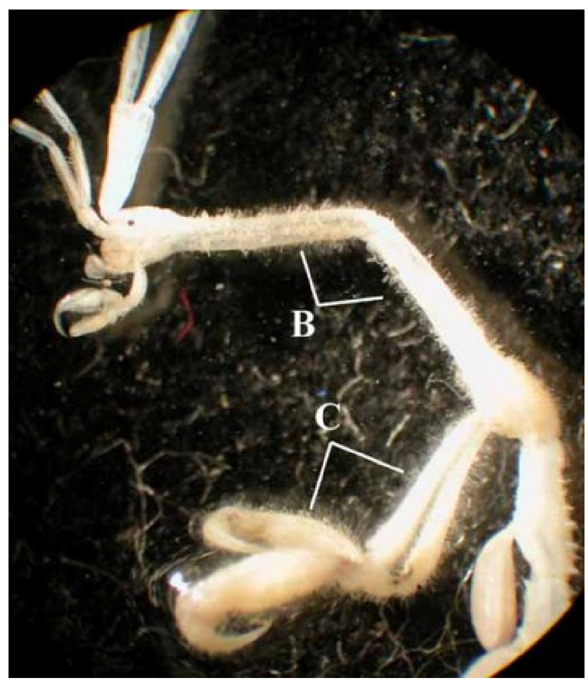


Image provided by:
nas.er.usgs.gov/.../2009/20090317162659.jpg

2007). They are widely known to be filter feeders both adult and juveniles use the same feeding mechanism but because the younger *Caprella* lack the full antenna they must perform the motion much faster. The "dance" as discussed earlier is an important mechanism to gather food particles efficiently. The back and forth movements that they do is to trap food particles in their antenna (Rug 2007).

History of Invasiveness and the Invasion Process

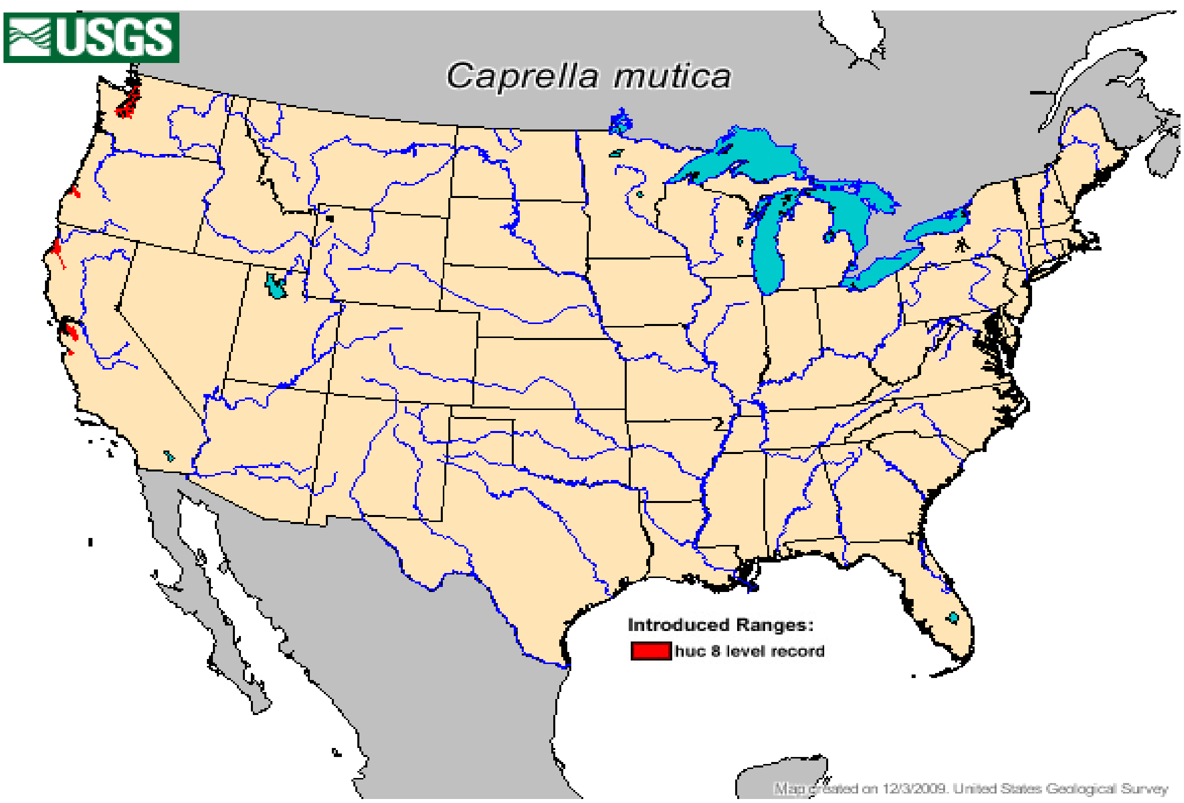
Because this species has not been studied extensively in their invasive nature it is difficult to predict where the next invasions take place. Their continuation of spreading is most certain despite the lack of research that has been applied to this species. They are the first non-native crustacean to establish in Alaska (Ashton 2008.)Their preference of temperate water common vector and substrate preference, I would assume that since they have established in the Puget Sound, the surrounding waters with similar salinities and temperatures would be a likely undiscovered niche for *Caprella Mutica.*

Mostly recreational boating seems to be the most occurring vector of *Caprella Mutica* transport from one ecosystem to another. They spend their entire lives attached to substrata so they have cause problems in all invaded areas associated with fouling (Ashton2006). Puget Sound has felt the effects of *Caprella Mutica* because they often foul hulls of boats and gunk up netting for aquaculture (Ashton 2007). *Caprella* is a an excellent example of an invader with virtually no predators, they occur in large numbers on artificial structures such as mooring ropes and nets at aquaculture sites, and on floating docks and boat hulls in marinas. *Caprella mutica* can also be found on various natural substrata such as mussels and tubeworms. They are not known to be parasitic in anyway but mostly associated with fouling. Besides the most common vector of hitching a ride on a recreational boat, they have also been known to "raft" from place to place. *Caprella Mutica* attaches to floating Japanese brown seaweed *Sargassum Muticum* which has been recorded to take them from one ecosystem to another (Buschbaum 2005). *Caprella mutica* co-occurs with other invasive species such as the tunicate *Styela clava Herdman* and the Japanese oyster *C. gigas* on artificial hard substrata. By contrast, *Caprella mutica* has not yet been found in any natural habitats. *Caprella mutica* was restricted to artificial structures such as mooring ropes, nets and boat hulls in marinas. Information on the ecology of them is hard to come by, it is difficult to predict the possible effects on other ecosystems. The tunicate *S. clava* was at the beginning only found on artificial hard substrata in harbors. But the idea of evolving to their new ecosystem (which invaders are quite good at) several years later it became a permanent member of epibenthic mussel beds *Mytilus* *edulis L*. (Buschbaum 2005). Possibly, the artificial hard substrata in the relatively covered harbor basins could provide a stepping stone habitat for new species where they could adapt and evolve for some years until spreading into natural habitats of the new location. Knowing this, *Caprella mutica* might spread on natural habitats, too. (Buschbaum 2005.)

The population distributions shown on the map above give incite to habitat preferences for *Caprella Mutica*. Puget Sound provides this invasive species with temperatures and salinities for optimal fitness. Puget Sound has an average year-round average temperature of 12.8^{o}C in summer and 7.2^{o}C in winter and salinities range from 25-30ppm depending on the season (NOAA.gov).

Management Strategies and Control methods

Hull fouling as a vector for *Caprella Mutica* can be managed. Debates are going on about the most effective way to clean hulls without adding to the propagate pressure in the environment. Two popular methods of cleaning hulls are dry-docking the boat and scraping it on land. The other is in water cleaning which is very risky (Hopkins 2008). It's important for regulations to be enforced when scraping biota from fouled hulls. This is an easy way for



Caprella Mutica's current geographic distribution in the Pacific Northwest and the US .http://nas3.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=11 invasive species to be released into a non-native environment and possibly establish. For the skeleton shrimp, though it has established in many temperate waters in the world, their impact is not known, but as said earlier in this paper the possibility for *Caprella Mutica* to evolve to different environments and it's invasive effects may be felt more on the introduced area.

Literature Cited

(http://www.marlin.ac.uk/marine_aliens/species.asp?SpID=20#Taxonomy)

Ashton, Gail et al. 2007. Environmental tolerance of Caprella mutica: Implications for its distribution as a marine non-native species. Marine Environmental Research lab Wanfang data. 2007Vol.64(No.3)

Ashton, Gail et al. 2006. Risk assessment of hull fouling as a vector for marine non-natives in Scotland. Aquatic Invasions (2006) Volume 1, Issue 4: 214-218

Ashtone, Gail et al. 2006. Rapid assessment of the distribution of marine non-native species in marinas in Scotland

Maciejeski, Jennifer. 2008. Substrate Preference between two Caprellid species: *Caprella mutica* and *Caprella drepanochir*. Oregon Institute of Marine Biology-Charleston, OR

Cook, E.J., Willis, K.J. and Lozano-Fernandez, M. (2007). Survivorship, Growth and Reproduction of the Invasive Caprella mutica Schurin (Crustacea: Amphipoda). Hydrobiologia.

José Manuel Guerra-García ,
José Manuel Tierno de Figueroa. 2009. What do caprellids (Crustacea: Amphipoda) feed on? Marine Biology. Springer Berlin / Heidelberg. Volume 156, Number 9 / August, 2009

Ashton GV, Riedlecker EI, Ruiz GM . 2008. First non-native crustacean established in coastal waters of Alaska. Aquatic Biology , Volume: 3 , Issue: 2 , Pages: 133-137

K. Michel, Rug, The Netherlands, S. Nauwelaerts, RuG, The Netherlands, K. Boos, SAMS, United Kingdom and E. Stamhuis, RuG, The Netherlands. Is the Japanese skeleton shrimp *Caprella mutica* a filter feeder? I. Head morphology and kinematics. Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology
Volume 146, Issue 4, Supplement 1, April 2007, Page S125

Buschbaum ,Christian, Gutow, Lars. Mass occurrence of an introduced crustacean (Caprella cf. mutica) in the south-eastern North Sea. Received: 25 November 2004 /

Revised: 28 April 2005 / Accepted: 28 April 2005 / Published online: 17 June 2005 Springer-Verlag and AWI 2005. Helgol Mar Res (2005) 59: 252–253

http://www.nwfsc.noaa.gov/publications/techmemos/tm44/environment.htm. ENVIRONMENTAL HISTORY AND FEATURES OF PUGET SOUND

Hopkins, Grant A. and Forrest, Barrie M. Management options for vessel hull fouling: an overview of risks posed by in-water cleaning. Originally published online on March 7, 2008 ICES Journal of Marine Science: Journal du Conseil 2008 65