

*Rhithropanopeus harrisi* , Estuarine mud crab or Harris mud crab

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Fish 423

December 5, 2011



## Diagnostic information

Scientific name

Order: *Decapoda*

Family: *Panopeidae* – mud crabs

Genus: *Rithropanopeus*

Species: *Rithropanopeus harrisii*

Common names: estuarine mud crab, Harris mud crab, dwarf mud crab, white-fingered or white-tipped crab (UK), Zuiderzee crab

*Rithropanopeus harrisii* are small greenish-brown crabs with a carapace width of about 2 cm. The front of the carapace between the eyes is almost straight, with a small notch. It is transversely grooved and appears double if viewed from the front. There are four anterolateral teeth or spines that line the side of the carapace between the eyestalks and the widest part of the carapace. The first tooth is actually two fused teeth and the last three are dentiform. The helipeds (or claws) are unequally sized and dissimilar, with white tips. They are nearly smooth in old individuals. The carpus of chelae in juveniles is rough and has lines and granules. The major chela has a short fixed finger and strongly curved dactyl. The minor chela has a longer fixed finger and straight dactyl. The dactyls are light in color. The walking legs are long and slender, with sparse hair. (Perry 2007, Williams 1984, Rathbun 1930)

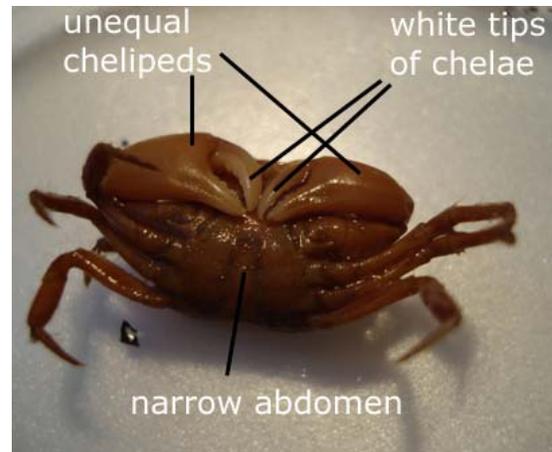


Fig1. Anatomy of *R. harrisii*. a) is male and b) is female. Pictures from <http://www.nobanis.org/MarineIdkey/Crabs%20and%20lobsters/RithropanopeusHarrisii.htm>

## Life-history and basic ecology

*Rhithropanopeus harrisi* are omnivorous scavengers. They will feed on mangrove and leaf detritus and algal material or on small invertebrates such as amphipods, copepods, polychaetes and other oligochaetes, bivalves, or even on dead organic matter. Like other Decapoda, the frequency at which they feed and the quality of what they eat depend on where the individual crab lives and also on the diurnal cycle of activity and foraging. (Hegele-Drywa and Normant 2009, Williams 1984). *R. harrisi* reproduce sexually, are oviparous, and brood their eggs. Copulation occurs during the summer months depending on the temperature and the females do not molt beforehand as most crabs do. The females bury themselves in the sand three to four days later to lay their eggs, a behavior that facilitates the attachment of the eggs to the pleopods. The ovigerous females then shelter themselves in debris, shells, or sediment while they brood their eggs for 15-19 days. When the eggs are ready, the mothers help synchronize the hatching and facilitate larval release by displaying a rhythmic pumping motion of their abdomens. Females can lay 1200-5000 eggs at a time and can produce up to four broods during a mating season. (Turoboyski 1973)

*R. harrisi* are euryhaline, meaning they can withstand a wide range of salinities which is likely a significant reason for their success in new habitats. (Projecto-Garcia et al. 2010,

Petersen 2006). Adults can be found in salinities from 0.5 to 41 and larva can survive salinities as low as 0.5 even though they are generally less tolerant of low salinity (Boyle et al. 2010). Besides a wide range of salinity, *R. harrisi* occur over a wide latitudinal and temperature range. They prefer brackish water and muddy or sandy substrates and can be found in estuaries or quasi-freshwater lakes. They are also usually found by a kind of shelter such as oyster reefs, vegetation, logs, or marine or manmade debris. (Williams 1984, Petersen 2006).

*R. harrisi* can carry a herpes-like virus that is fatal to juvenile oysters, lobsters, and shrimp. And in their native range, they can carry the parasite *Loxothylacus panopaei* but the parasite seems to have not been introduced anywhere else with the crab. The parasite castrates the crab and is most frequent in areas where the salinity is about 15ppt. (Projecto-Garcia et al. 2010)

## Current geographic distribution

*R. harrisi*'s native range is on the east coast of North America, in fresh to estuarine waters from the Gulf of St. Lawrence, Canada, around the Gulf of Mexico, and to Vera Cruz, Mexico (Williams 1984) (See Figure 2). In the Pacific Northwest It has been introduced to coastal estuaries of Oregon and northern California. It has also been introduced to Texas estuaries, Panama, Brazil, and many European countries such as Britain, Denmark, Belgium, the Netherlands, France, Spain, Portugal, and

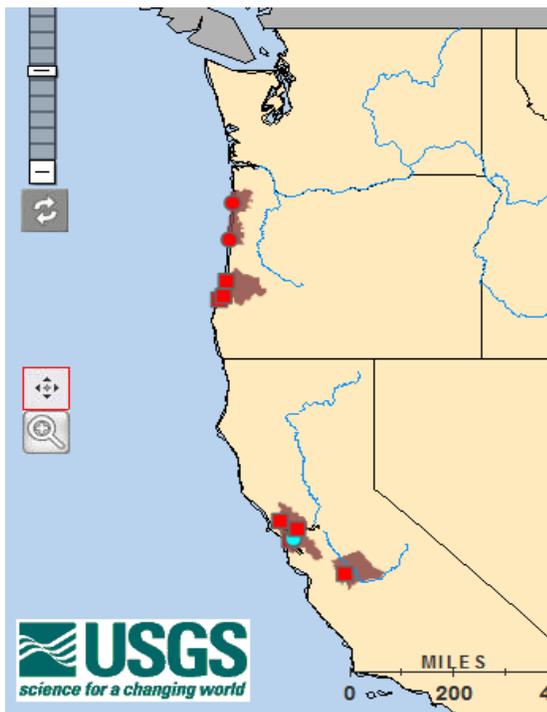
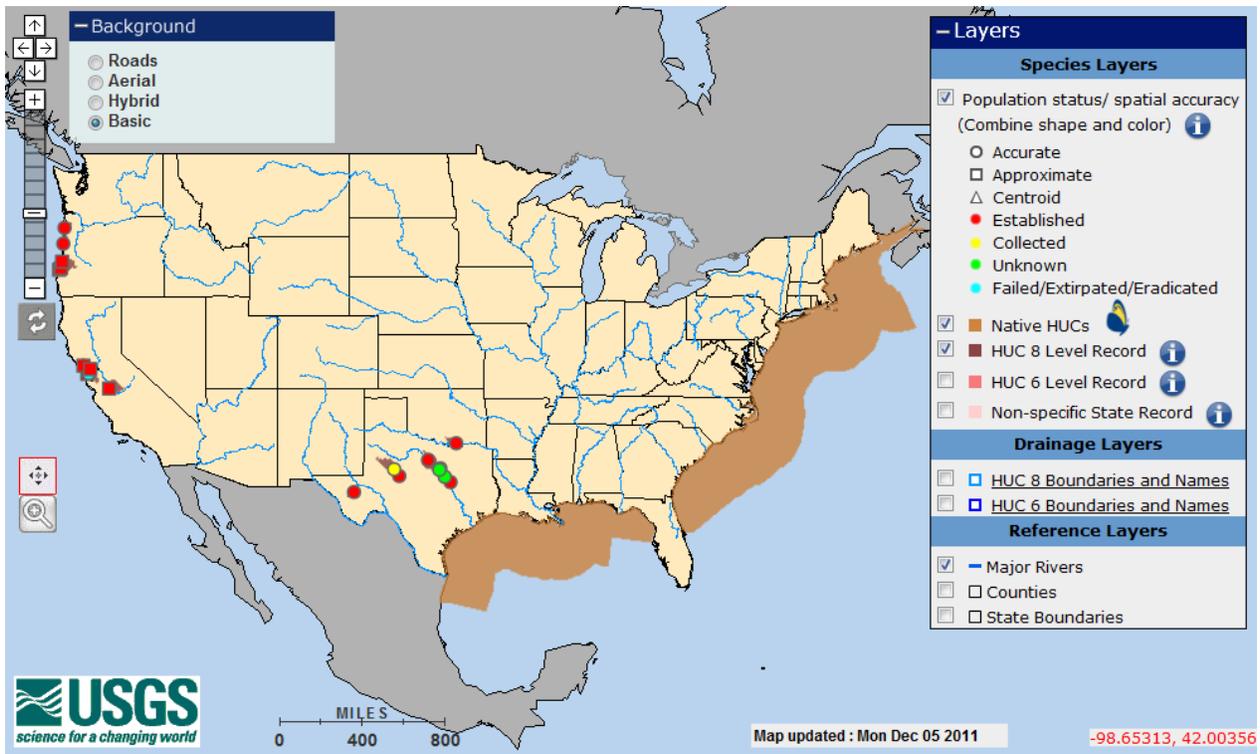


Fig 2. Maps showing where native and introduced areas where *R. harrisii* are found.

Italy. Its current European range is from the Caspian and Black Sea, through the Mediterranean Sea and European Atlantic, to the Baltic Sea, with patchy distribution along the coast of the Iberian Peninsula (Projecto-Garcia et al. 2010). It can successfully colonize many different habitats such as freshwater lakes, bays, estuaries, ports, and even a tropical lagoon system. Its introduced range is over 45 degrees of latitude and could spread further (Roche et al. 2009).

### History of invasiveness

*R. harrisii* first invaded Europe in the late 1800s, primarily in the Netherlands. Now it is established in 21 different European countries, both American continents and Japan. (Roche et al. 2009). It is assumed that the first European

invasions were the result of animal shipment for aquaculture or through hull fouling, however since then they are most likely spread through ballast water. *R. harrisii* were first found in San Francisco Bay in 1937 and were transported north from there to Oregon in Coos Bay in 1950 and several other Oregon bays in the 1970s. In the 1990s, they were found in Texas and Colorado, and more recently in Panama. They also continue to spread throughout Europe. (Petersen 2006).

### **Invasion Process**

Today, the main invasion pathway for *R. harrisii* to many parts of its invasive habitats is assumed to be ballast water and hull fouling. It is the proposed pathway for the more recently established European populations as well as in Panama. Other possible pathways include oyster shipment, in earlier European populations and by the transcontinental railroad to San Francisco, and fish stocking, live-wells, and bait-buckets in Texas. (Projecto-Garcia et al. 2010, Petersen 2006, Boyle et al. 2010). It is likely that the first European colonizations came from northeastern United States due to Projecto-Garcia's (2010) study on haplotypes shared between the populations. The founder individuals could have likely been brought through several colonization events.

The introduction to the Pacific, however, likely came from one event in San Francisco Bay due to the evidence of a bottleneck. What lacks

genetic evidence is whether the northward expansion of *R. harrisii* to Oregon was human-aided or naturally occurring with the help of the currents. However Petersen (2006) seems to lean toward the idea of human-aided expansion due to several reasons. First it could prove difficult for *R. harrisii* to travel up there as it would require the proper currents. The west coast's waterways are also less connected the way they are on the east coast. Then there is the fact that plenty of other invasive species have not made their way northward from San Francisco Bay. Lastly, the species has the ability to vertically migrate to stay near adult settlement habitat, making it less likely that they would be flushed out of the estuary.

*R. harrisii* have a broad tolerance to environmental variation, especially salinity. It is this ability that has made the species so successful as a global invader (Roche et al. 2009, Petersen 2006). They also have other features that increase the chance of invasion success, such as high genetic diversity, high levels of physiological plasticity, and is an "r-strategist" which is defined as being small in size, short lived, reproductively active early in life, and having high fecundity. They are also very adaptive, a factor that is underrepresented as an invasion success factor and through genetic diversity are able to adapt to new environments more quickly. (Boyle et al. 2009) *R. harrisii* have been identified as one of the top 30 species of concern for invading Australia. Although there is no sure evidence, anecdotal

reports say that they compete with native species, foul pipe systems, and spoil fish catches in gill nets. (Roche et al. 2010) The species is also a carrier of strains of the white spot baculovirus that can cause disease in other crustaceans.

### **Management strategies and control methods**

Preventitive measures can be taken to control the transport in ballast water, the main contemporary vector. An active chemical from a pesticide has been experiemtnally used on the species and is shown to be lethal to hatching larvae by inhibiting chitin synthesis and has been effective. However it lack specificity and in brackish waters can take several weeks to degrade. *Loxothylacus panopaei*, the barnacle parasite, can infect crabs. They would stunt growth and castrate both males and females so that they couldn't reproduce. Experiements have shown that they have a significant effect, but more studies are required to determine if they are a viable candidate of biological control. (Global Invasive Species Database)

### **Literature cited**

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Williams, A.B. 1984. Shrimps, Lobsters, and Crabs of the Atlantic Coast of the Eastern United States, Maine to Florida. Smithsonian Institution Press, Washington, D.C. 550 pp.

### **Expert contact information in PNW**

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### **Other key sources of information**

European Network on Invasive Alien Species

<http://www.nobanis.org/MarineIdkey/Crabs%20and%20lobsters/RhithropanopeusHarrisi.htm>

Integrated Taxonomic Information System

[http://www.cbif.gc.ca/pls/itisca/taxastep?king=every&p\\_action=containing&taxa=Rhithropanopeus%20harrisi](http://www.cbif.gc.ca/pls/itisca/taxastep?king=every&p_action=containing&taxa=Rhithropanopeus%20harrisi)

US Geological Survey

<http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=197>

Global Invasive Species Database

<http://www.issg.org/database/species/ecology.asp?si=1217&fr=>