# Chinese Mitten Crab - *Eriocheir sinensis*

The Chinese mitten crab was first reported in San Francisco Estuary in 1992 and is only established in California. Its presence in North America is of particular concern since its prior introduction to and spread throughout Europe had significant adverse impacts.

## Taxonomy

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| **Phylum** | ▪ Arthropoda |
| **Class** | ▪ Crustacea |
| **Order** | ▪ Decapoda |
| **Family** | ▪ Grapsidae |

## General Biology

**Juvenile Morphology**

- Notch between the eyes, with two small spines located on either side (Fig. 1)
- Claws are covered with brown setae ("hairs") by the time the carapace is >25 mm in width; setae minimal or lacking with carapace width of <20 mm
- Four pairs of spines located on the lateral edges of the carapace
- Legs are approximately twice the length of the carapace width
- Light brownish-orange to greenish-brown in color (Fig. 1)

**Adult Morphology**

- Maturity likely reached at 2-4 years in California, 3-5 years in Europe, and 1-2 years in China
- Carapace width 30-100 mm; markedly convex and uneven (Fig. 2)
- Four lateral carapace spines (fourth spine is small) (Fig. 2)
- Legs are approximately twice the length of the carapace width (Fig. 2)
- Notch between the eyes, with two small spines located on either side (Fig. 2)
- Claws, normally equal in size are "hairy", i.e., densely covered with brown setae (Fig. 2) and tend to be fuller on males
- Sex is determined by the structure of the abdomen: females have a wide abdominal flap that extends to the edge of the abdomen when fully mature, whereas males have a narrow abdominal flap (Fig. 3)
- Brownish-orange to greenish-brown in color (Fig. 2)

**Behavior**

- Most individuals spend the greatest proportion of life cycle in freshwater habitats (Fig. 4)
- Adept at climbing and walking on land (Fig. 5) during migration and/or to bypass obstructions
- Juveniles burrow into soft riverbanks to escape predation and desiccation during low tides (Fig. 6)

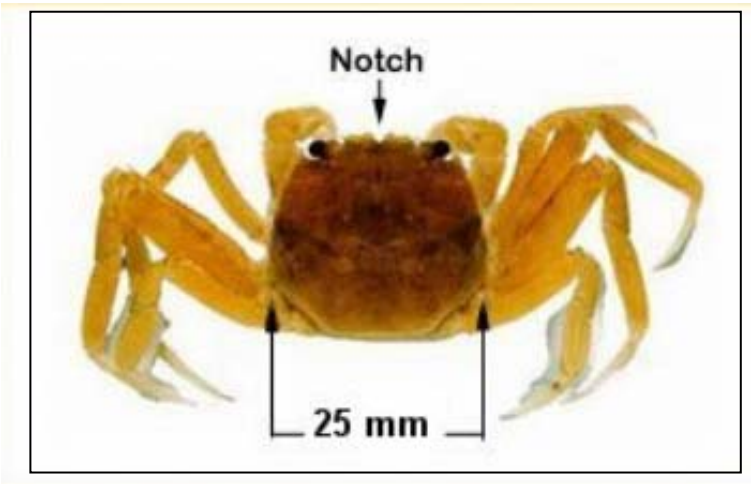


**Fig. 1** Identifying characteristics of the juvenile Chinese mitten crab.[1]

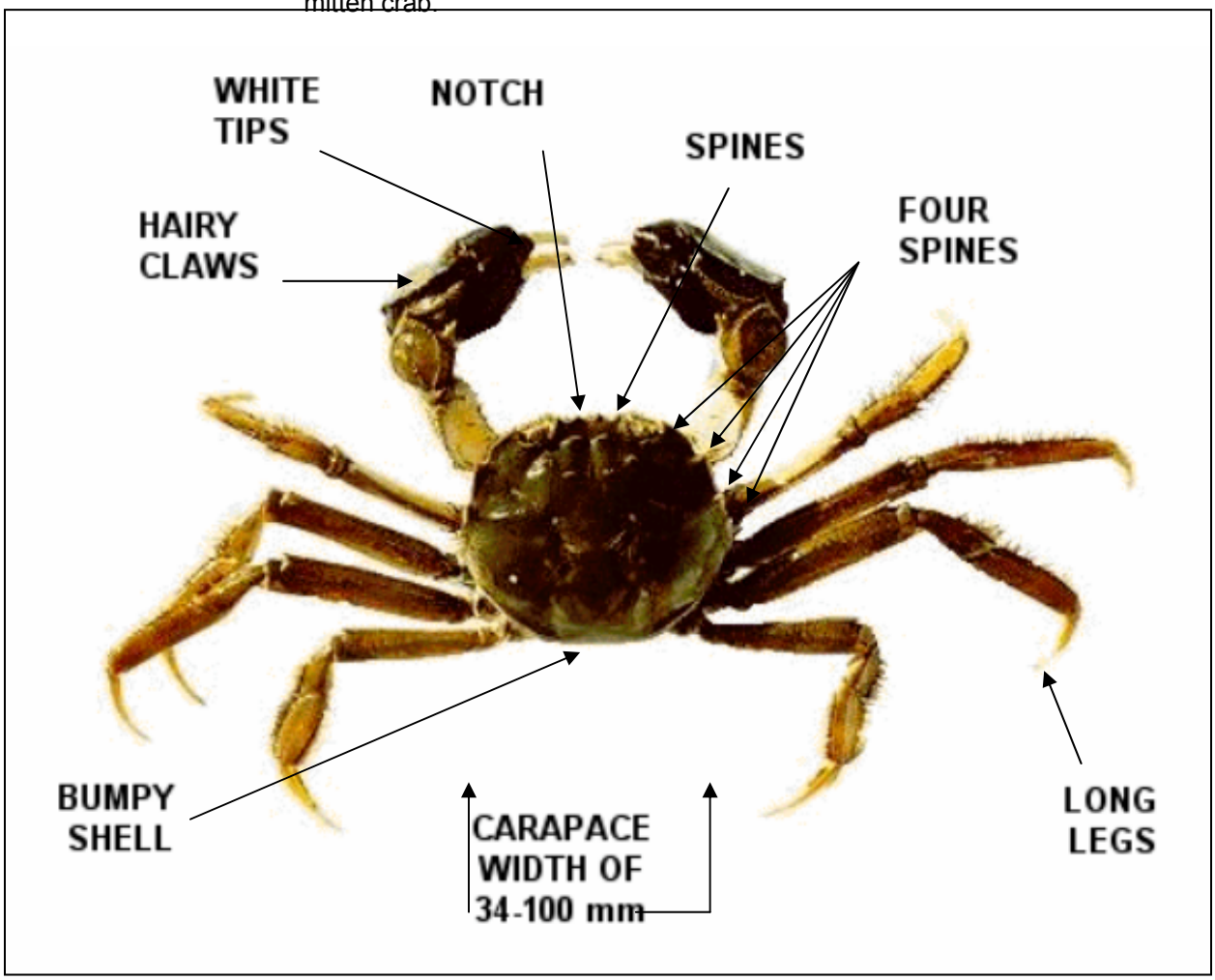


**Fig 2.** The adult Chinese mitten crab is easily identified by the "hairy" appearance of its claws.[2]

[1] Adapted from http://www.delta.dfg.ca.gov/mittencrab/
[2] Adapted from http://www.delta.dfg.ca.gov/mittencrab/

**Fig. 3** Female mitten crabs (upper) have a wide, beehive-shaped abdominal flap and males (lower) have a narrow, bell-shaped one.[3]

**Fig. 4** Approximately 90% of the life cycle is spent in freshwater habitats.[4]

[3] http://www.delta.dfg.ca.gov/mittencrab/
[4] http://www.delta.dfg.ca.gov/mittencrab/

**Fig. 5** Walking stance of the mitten crab.[5]

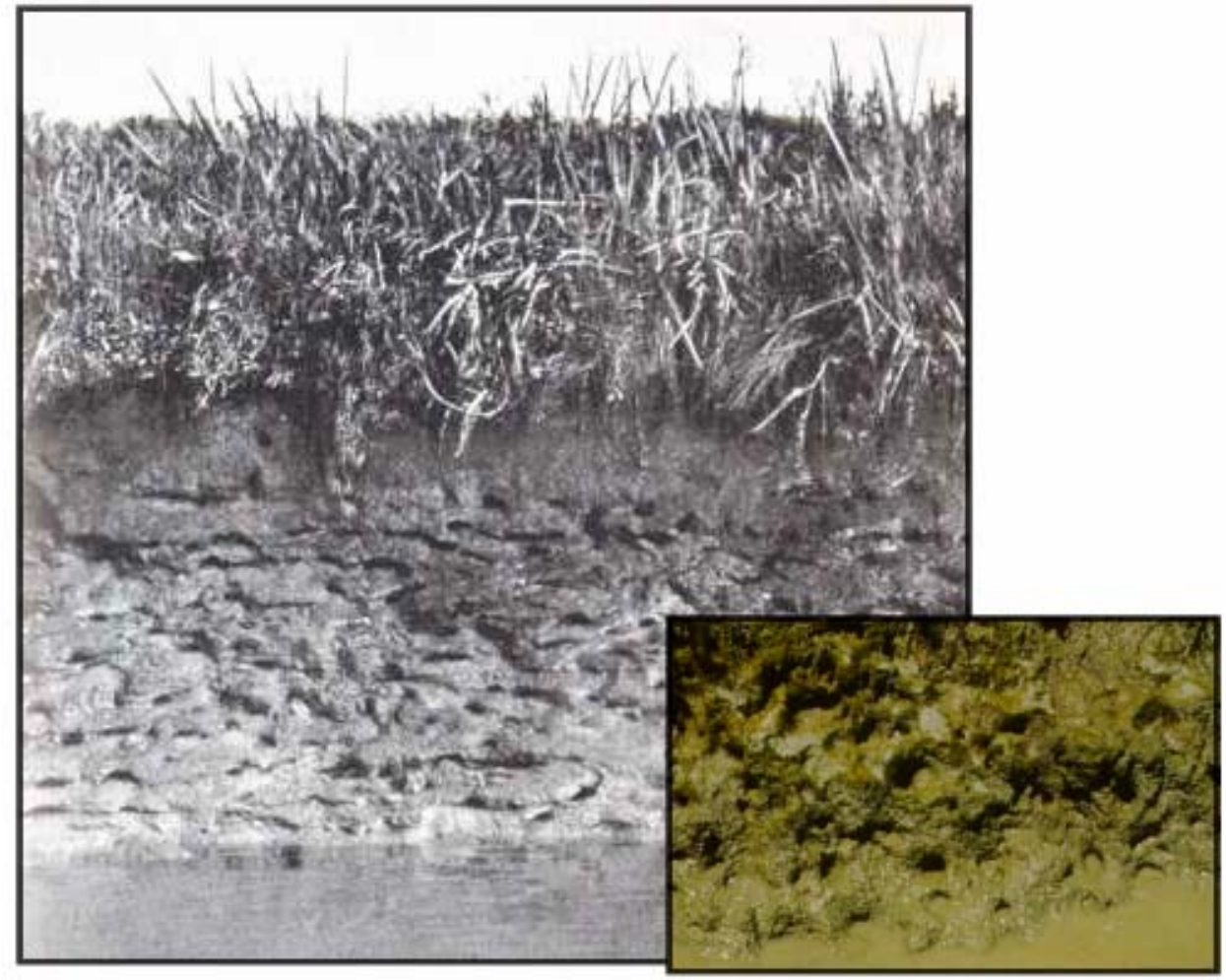

**Fig. 6** The burrowing activity of the Chinese mitten crab has the potential to seriously erode the banks of streams, rivers, and levees.[6]

[5] http://www.delta.dfg.ca.gov/mittencrab/
[6] Adapted from http://www.delta.dfg.ca.gov/mittencrab and Panning (1938)

## Identification

**Distinguishing Characteristics**

- Adult *Eriocheir* spp. are easy to identify by the extensive mitten-like covering on the claws
- Shape of the carapace is different from other brachyuran crabs in North America (it is markedly convex and very uneven, with four sharply edged epigastric lobes)

## Life Cycle

**Eggs**

- Females are capable of producing 100,000-1,000,000 eggs per brood
- Sperm is believed to be stored by female for multiple broods
- Fertilized eggs adhere under abdominal flap until hatching occurs
- Hatching may occur from winter through summer

**Larvae**

- Planktonic for approximately 1-2 months, developing in marine waters (Fig. 7)
- Pass through five zoeal stages before metamorphosis to the megalopal stage
- Suspended in the water column until late winter to early summer when they settle to the bottom and begin upstream migration

**Juveniles**

- Young juvenile mitten crabs are found in tidal brackish and fresh water areas
- Older juveniles are found further upstream
- Tidal currents in estuaries may be used for upstream migration

**Maturity**

- After spending 1-4 years in fresh or brackish water, males and females migrate downstream and reach sexual maturity in brackish waters of the estuary
- The downstream or spawning migration occurs during late summer and into the fall
- Males reach the brackish water zone of the estuary first and mating begins as soon as the females arrive

**Reproduction**

- Mating and fertilization occurs in late fall and winter, generally at salinities ≥18‰
- Mated females move into deeper water
- Eggs are spawned approximately 24 hr after mating, but are affixed beneath the abdominal flap throughout the winter
- Females over-winter in the deeper waters while the eggs slowly develop, returning to brackish water in the spring

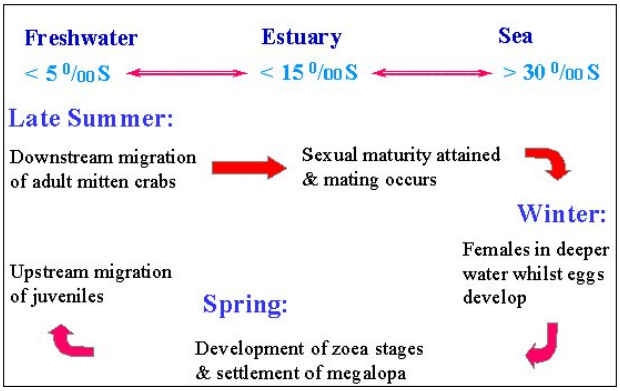


**Fig. 7** The life cycle of the Chinese mitten crab is catadromous (i.e., they live mainly in freshwater habitats, but migrate to the sea for reproduction).[7]

## Habitat Characteristics

**Preferred Environment**

- Late larval stages exist in the upper levels of the water column and are carried toward the mouths of the estuaries on currents
- Megalopal stages settle to the floor of marine coastal areas or embayments and develop into juvenile crabs
- Juveniles begin upstream migration via main river channels where they enter smaller channels with slower-moving waters
- Adults inhabit the bottoms and banks of freshwater rivers and estuaries before migrating to the brackish and salt waters of estuaries for reproduction

**Temperature**

- 15-18°C range is optimal for larval stages
- 24-28°C range is optimal for juveniles

**Salinity**

- Catadromous; life cycle is characterized by migrations in waters with changing salinities (Fig. 7)
- Larvae in the first zoeal stage are exceptionally tolerant of a wide range of salinities

## Distribution

**Native Range**

- South-East Asia from southern China to the Korean Peninsula

**North American Distribution**

- Well established populations in the San Francisco Bay area (Fig. 8)
- Reported, but not established, in the Detroit River, Mississippi River, Great Lakes, and Columbia River near Portland, Oregon

[7] Adapted from http://www.nhm.ac.uk/zoology/crab/lifecycle.html

**Probable Means of Introduction**

- Transport of larvae and small crabs in ship ballast
- Adult crabs clinging to ship hulls and barges (very unlikely means of introduction into California)
- Deliberate release to establish a fishery or local food resource

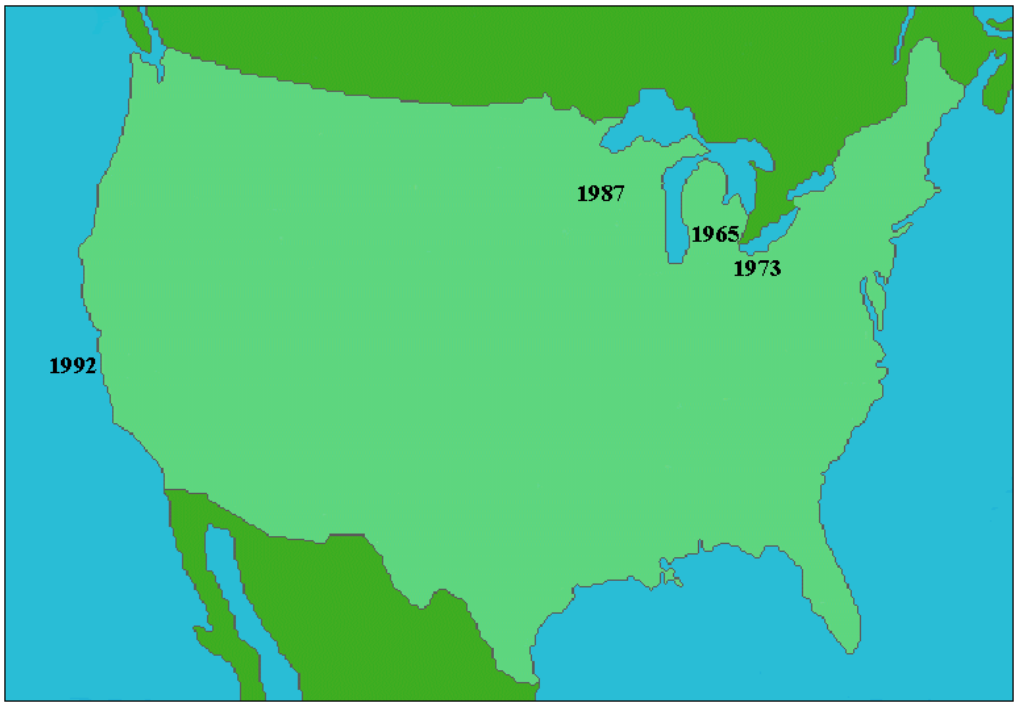


**Fig. 8** Although the Chinese mitten crab has been reported in several North American locations, it is successfully established only on the west coast.[8]

## Diet

**Juveniles and Adults**

- Omnivorous and opportunistic
- Consume a wide variety of plant and animal material, including algae, macrophytes, terrestrially derived detritus, invertebrates (both hard and soft-shelled) and will scavenge fish carcasses; also steal a wide range of bait from fishermen
- Predation on small invertebrates increases with size

[8] http://www.nhm.ac.uk/zoology/crab/northamerica.html

## Impacts

**Negative**

- Interference with operation at water facilities and pumping stations; entrainment during fish salvage operations results in large losses of fish (see Videos 1-3 below)
- Burrowing activities cause damage to dykes, coastal protection systems, harbor installations, and soft sediment banks when populations reach high abundance; damage to soft sediment banks has the potential to affect flooding events, thus increasing erosion and repair expenses
- Feeding on fish in nets has the potential to reduce harvest of fishing industry
- Spiny carapace and legs of crabs damage fish catch
- Crabs get entangled in gear, increasing handling time
- Causes damage to fishing nets
- Are intermediate hosts of the mammalian lung fluke of the genus *Paragonimus*
- Have the potential to damage rice crops by consuming the young rice shoots
- Have become nuisances to commercial shrimp trawlers
- Large populations have the potential to reduce populations of native invertebrates through predation, thereby altering the structure of fresh and brackish water benthic invertebrate communities

**Positive**

- Potential food source for predatory fishes (e.g., pike, eel, brown trout, white sturgeon, striped bass, largemouth bass, large sunfish), bullfrogs, loons, egrets and other wading birds, river otters, and raccoons

| Chinese Mitten Crab Video 1.avi |
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| Chinese Mitten Crab Video 2.avi |
| Chinese Mitten Crab Video 3.avi |

**Videos 1-3** A sudden and large mitten crab population wreaked havoc on the operational success of the Tracy Fish Salvage Facility (California) during the 1998-1999 season.[9]

## Management

**Control Measures**

- In Germany, traps placed on the upstream side of dams captured juvenile crabs as they migrated upstream
- Installation of traveling screens and trash racks, in conjunction with collection and disposal efforts, has the potential to drastically reduce a large portion of the mitten crab population during migration events; this is most effective if done at a place where the river is entirely contained by a regulatory structure (e.g., dam, fish facility)
- A National Management Plan, created in 2002, reviews strategies and methods for population control and management (see website below: The Chinese Mitten Crab Invasion of California: A Draft Management Plan for the Genus *Eriocheir*)

[9] Claws 2. Tracy Fish Salvage Facility, California.

## Literature

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## Web Sites

http://www.seerecht.org/wegelein/course/group/crab3.htm#Management%20Recommendations
Chinese mitten crabs (Eriocheir sinensis) - A threat to Washington State waters - Recommendations

http://www.nhm.ac.uk/zoology/crab/
The Natural History Museum, Department of Zoology, London UK: The Chinese Mitten Crab

http://www.anstaskforce.gov/Chinese-mitten-crab-plan2-02.pdf
The Chinese Mitten Crab Invasion of California: A Draft Management Plan for the Genus *Eriocheir*

http://www.delta.dfg.ca.gov/mittencrab/
Delta Chinese Mitten Crab: California Department of Fish and Game

http://www.iep.ca.gov/report/newsletter/2002winter/IEPNewsletterWinter2002.pdf
The Effects of Chinese Mitten Crabs on Commercial Fisheries in California

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