Bering Sea Marine Invasive Species Assessment

Alaska Center for Conservation Science

Scientific Name: *Eriochelir sinensis*

Common Name *Chinese mitten crab*

Phylum	Arthropoda
Class	Malacostraca
Order	Decapoda
Family	Varunidae

Final Rank 51.75

Data Deficiency: 0.00

Species Occurrence by Ecoregion

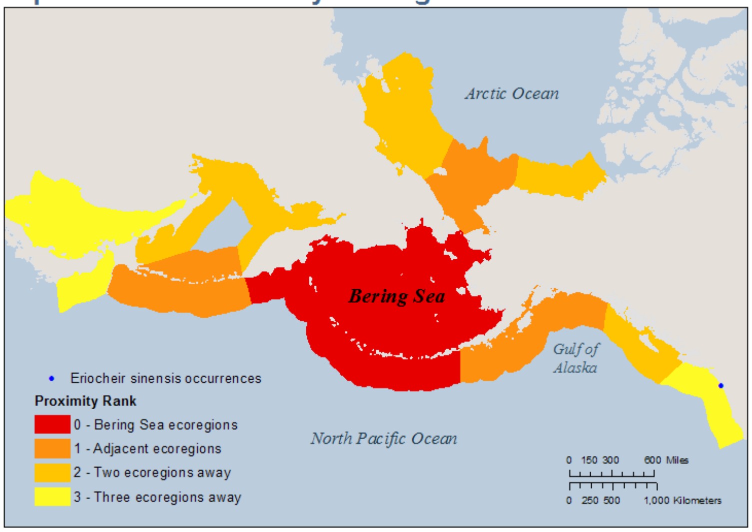

Figure 1. Occurrence records for non-native species, and their geographic proximity to the Bering Sea. Ecoregions are based on the classification system by Spalding et al. (2007). Occurrence record data source(s): NEMESIS and NAS databases.

Category Scores and Data Deficiencies

Category	Score	Total Possible	Data Deficient Points
Distribution and Habitat:	15.75	30	0
Anthropogenic Influence:	6	10	0
Biological Characteristics:	21	30	0
Impacts:	9	30	0
Totals:	51.75	100.00	0.00

General Biological Information

Tolerances and Thresholds

Minimum Temperature (°C)	0	Minimum Salinity (ppt)	0
Maximum Temperature (°C)	30	Maximum Salinity (ppt)	35
Minimum Reproductive Temperature (°C)	12	Minimum Reproductive Salinity (ppt)	15
Maximum Reproductive Temperature (°C)	18	Maximum Reproductive Salinity (ppt)	25

Additional Notes

E. sinensis is a catadromous species that lives most of its life in freshwater but spawns in estuaries. It is native to northern China and Korea, and has been widely introduced in Europe. It is also found on both coasts of North America.

1. Distribution and Habitat

1.1 Survival requirements - Water temperature

Choice: B Moderate overlap – A moderate area (≥25%) of the Bering Sea has temperatures suitable for year-round survival

Score: 2.5 of 3.75

High uncertainty? ✔

Ranking Rationale:
Temperatures required for year-round survival occur in a moderate area (≥25%) of the Bering Sea. We ranked this question with "High Uncertainty" to indicate disagreements in model estimates.

Background Information:
Adult crabs are tolerant of a wide range of temperatures, growing actively at temperatures from 7 to 30°C (Anger 1991; Rudnick et al. 2000). The lower and upper limits for survival are 0°C to 30°C (Vincent 1996 as qtd in CMCWG 2003; Rudnick et al. 2000).

Sources:
Anger 1991 CMCWC 2003 NEMESIS; Fofonoff et al. 2003 Rudnick et al. 2000

1.2 Survival requirements - Water salinity

Choice: A Considerable overlap – A large area (>75%) of the Bering Sea has salinities suitable for year-round survival

Score: 3.75 of 3.75

Ranking Rationale:
Salinities required for year-round survival occur over a large (>75%) area of the Bering Sea.

Background Information:
E. sinensis spawns in estuaries before migrating upstream into non-tidal portions of rivers and streams. Some crabs have been collected 1000 km from the sea. Early crab stages may spend their first winter in brackish water ranging from 15 ppt to 32 ppt. Adult crabs are tolerant of salinities ranging from 0 ppt to 35 ppt (Anger 1991; Rudnick et al. 2000).

Sources:
Anger 1991 NEMESIS; Fofonoff et al. 2003 Rudnick et al. 2000

1.3 Establishment requirements - Water temperature

Choice: D No overlap – Temperatures required for reproduction do not exist in the Bering Sea

Score: 0 of 3.75

Ranking Rationale:
Temperatures above 12°C do not occur in the Bering Sea. Moreover, this species cannot grow in the Bering Sea because larvae and juvenile require brackish water.

Background Information:
Temperature range for successful larval development is 12°C to 18°C (Anger 1991).

Sources:
NEMESIS; Fofonoff et al. 2003 Anger 1991

1.4 Establishment requirements - Water salinity

Choice: **D**

No overlap – Salinities required for reproduction do not exist in the Bering Sea

Score: 0 of 3.75

Ranking Rationale:
This species cannot grow in the Bering Sea because certain life stages require brackish water.

Background Information:
Adult crabs reproduce in brackish or saline water (Anger 1991; Hymanson et al. 1999). The first larval stage can tolerate marine waters, but subsequent stages require salinities between 5 and 25 ppt (Anger 1991; Rudnick et al. 2000).

Sources:
Anger 1991 NEMESIS; Fofonoff et al. 2003 Hymanson et al. 1999 Rudnick and Resh 2005

1.5 Local ecoregional distribution

Choice: **D**

Present in an ecoregion greater than two regions away from the Bering Sea

Score: 1.25 of 5

Ranking Rationale:
Present in southern California (three ecoregions away from the Bering Sea).

Background Information:
The closest known established population resides in San Francisco Bay (Fofonoff et al. 2003)

Sources:
NEMESIS; Fofonoff et al. 2003

1.6 Global ecoregional distribution

Choice: **A**

In many ecoregions globally

Score: 5 of 5

Ranking Rationale:
Wide global distribution

Background Information:
Native to northern China and Korea, and introduced to Europe and North America. It is widespread in Europe, including northern Europe (Finland, Sweden), central Europe (Germany, Austria, Switzerland, Hungary, Czech Republic), and western Europe (France, the U.K.); it has also been reported from the Black Sea, the Caspian Sea, the Mediterranean Sea and the Persian Gulf (Herborg et al. 2003; Fofonoff et al. 2003; Galil et al. 2002 as qtd. in Fofonoff et al. 2003). In North America, adult specimens have been found on both eastern and western coasts, including Delaware Bay, Hudson River Estuary, the Great Lakes, Chesapeake Bay, and San Francisco Bay (Cohen and Carlton 1997; Rudnick et al. 2003; Fofonoff et al. 2003). Populations are established in San Francisco Bay and in Hudson River (Fofonoff et al. 2003).

Sources:
NEMESIS; Fofonoff et al. 2003 Herborg et al. 2003 Cohen and Carlton 1997 Rudnick et al. 2003

1.7 *Current distribution trends*

Choice:		Score:
B	History of rapid expansion or long-distance dispersal (prior to the last ten years)	3.25 of 5

Ranking Rationale:

Rapid range expansion has been documented in Europe and in North America.

Background Information:

E. sinensis spread rapidly in northern Europe at an average rate of 562 km/year between 1928 and 1938 (Herborg et al. 2003). Similarly high rates of spread occured from 1954 to 1960 in France and from 1997 to 1999 in the U.K. (Herborg et al. 2003; Herborg et al. 2005). E. sinensis was first reported in San Francisco Bay in 1992, and by 1998 had spread inland to Sacramento and San Joaquin (Rudnick et al. 2003). While specimens have been collected from several locations on the East Coast, established populations are only thought to occur in the Hudson River (Fofonoff et al. 2003).

Sources:

NEMESIS; Fofonoff et al. 2003   Rudnick et al. 2003   Herborg et al. 2005   Herborg et al. 2003

Section Total - Scored Points:	15.75
Section Total - Possible Points:	30
Section Total -Data Deficient Points:	0

2. Anthropogenic Transportation and Establishment

2.1 Transport requirements: relies on use of shipping lanes (hull fouling, ballast water), fisheries, recreation, mariculture, etc. for transport

Choice: **A**

Has been observed using anthropogenic vectors for transport and transports independent of any anthropogenic vector once introduced

Score: 4 of 4

Ranking Rationale:
Long distance dispersal due to ballast water and illegal purchasing and release. Once introduced, can transport independently of human vectors.

Background Information:
Introductions are probably due to ballast water, and intentionally for seafood markets (CMCWG 2002). In Southern France, E. sinensis may have been accidentally introduced along with oysters (Herborg et al. 2003).

Sources:
NEMESIS; Fofonoff et al. 2003 CMCWC 2003

2.2 Establishment requirements: relies on marine infrastructure, (e.g. harbors, ports) to establish

Choice: **D**

Does not use anthropogenic disturbance/infrastructure to establish

Score: 0 of 4

Ranking Rationale:
Does not require or use marine infrastructure to establish.

Background Information:
Establishes on unstructured, natural bottom substrates.

Sources:
NEMESIS; Fofonoff et al. 2003

2.3 Is this species currently or potentially farmed or otherwise intentionally cultivated?

Choice: **A**

Yes

Score: 2 of 2

Ranking Rationale:
E. sinensis is farmed in Asia. It is illegal to import E. sinensis in the U.S.

Background Information:
E. sinensis is intensively farmed in China (Hymanson et al. 1999) where it is highly valued. In the U.S., importation of this species is banned under the Lacey act to prevent further introductions (CMCWG 2003).

Sources:
Cohen and Carlton 1997 NEMESIS; Fofonoff et al. 2003 Hymanson et al. 1999 CMCWC 2003

Section Total - Scored Points:	6
Section Total - Possible Points:	10
Section Total -Data Deficient Points:	0

3. Biological Characteristics

3.1 Dietary specialization

Choice: **A**

Generalist at all life stages and/or foods are readily available in the study area

Score: 5 of 5

Ranking Rationale:

Preys on numerous taxa readily available in the Bering Sea.

Background Information:

Eriocheir sinensis is an opportunistic omnivore. Juvenile and adult crabs feed on detritus, algae, aquatic plants, invertebrates, and dead or trapped fishes. Stable Isotope, gut contents, and feeding studies in San Francisco Bay indicate that this species feeds heavily on aquatic derived detritus, algae, and invertebrates feeding on the sediment surface (Rudnick et al. 2000; Rudnick and Resh 2005).

Sources:

NEMESIS; Fofonoff et al. 2003 Rudnick et al. 2000 Rudnick and Resh 2005

3.2 Habitat specialization and water tolerances

Does the species use a variety of habitats or tolerate a wide range of temperatures, salinity regimes, dissolved oxygen levels, calcium concentrations, hydrodynamics, pollution, etc?

Choice: **B**

Requires specialized habitat for some life stages (e.g., reproduction)

Score: 3.25 of 5

Ranking Rationale:

Larvae complete their life stage in marine waters, but migrate to freshwater or low salinity systems as juveniles. Adults spend most of their life in freshwater.

Background Information:

Larvae are born at sea, but migrate to freshwater as juveniles (Rudnick et al. 2000). Although adult crabs are tolerant of a wide range of salinities and temperatures (Anger 1991; Rudnick et al. 2000), they are primarily limited to estuaries or freshwater environments. Adults return to sea once (rarely twice) to reproduce (Herborg et al. 2003). E. sinensis can survive in hypoxic conditions and is tolerant to highly polluted water (Fofonoff et al 2003).

Sources:

Anger 1991 NEMESIS; Fofonoff et al. 2003 Rudnick et al. 2000 Herborg et al. 2003

3.3 Desiccation tolerance

Choice: **B**

Moderately tolerant (1-7 days) during one or more stages during its life cycle

Score: 3.25 of 5

Ranking Rationale:

Background Information:

Adult crabs can move on land to avoid obstacles (e.g. dams). They can survive 31 to 70 hours out of the water depending on temperature and humidity (Fialho et al . 2016).

Sources:

NEMESIS; Fofonoff et al. 2003 Fialho et al. 2016

3.4 *Likelihood of success for reproductive strategy*

i. Asexual or hermaphroditic   ii. High fecundity (e.g. >10,000 eggs/kg)   iii. Low parental investment and/or external fertilization   iv. Short generation time

Choice: **B** Moderate – Exhibits one or two of the above characteristics

Score: 3.25 of 5

Ranking Rationale:
Sexual reproduction, high fecundity, moderate parental investment and moderate generation time.

Background Information:
Females are capable of producing 100,000-1,000,000 eggs per brood (Czerniejewski and Marcello 2013). The females will carry the eggs under their abdomens until they hatch. Larvae eventually molt into the first crab stage and settles to the seafloor. This occurs 18 to 24 days after hatching (Anger 1991). These juvenile crabs then migrate to freshwater where they grow into adults. Maturity is reached at 2 to 4 years. Adults typically die after spawning (Hymanson et al. 1999; Rudnick et al. 2005a).

Sources:
Anger 1991   NEMESIS; Fofonoff et al. 2003   Czerniejewski and Marcello 2013   Hymanson et al. 1999   Rudnick et al. 2005a

3.5 *Likelihood of long-distance dispersal or movements*

Consider dispersal by more than one method and/or numerous opportunities for long or short distance dispersal e.g. broadcast, float, swim, carried in currents; vs. sessile or sink.

Choice: **A** Disperses long (>10 km) distances

Score: 2.5 of 2.5

Ranking Rationale:
Can migrate up to 18 km per day.

Background Information:
Adult crabs typically move by swimming, but can survive out of water for several hours and can move on land to avoid obstacles (e.g. dams; Fialho et al . 2016). Juveniles migrate from the sea to freshwater, and can travel more than 1000 km during this migration (Dan et al. 1984, qtd. in Rudnick et al. 2000). They can migrate up to 18 km per day.

Sources:
NEMESIS; Fofonoff et al. 2003   Fialho et al. 2016

3.6 *Likelihood of dispersal or movement events during multiple life stages*

i. Can disperse at more than one life stage and/or highly mobile ii. Larval viability window is long (days v. hours) iii. Different modes of dispersal are achieved at different life stages (e.g. unintentional spread of eggs, migration of adults)

Choice: **A** High – Exhibits two or three of the above characteristics

Score: 2.5 of 2.5

Ranking Rationale:
Can disperse at numerous life stages, are highly mobile, and larval viability window is long.

Background Information:
Adult crabs typically disperse by swimming, but can move on land to avoid obstacles (Fialho et al . 2016). The larval stage lasts 18 to 42 days, depending on temperature (Anger 1991). Juveniles migrate from the sea to freshwater, and can travel more than 1000 km during this migration (Dan et al. 1984, qtd. in Rudnick et al. 2000).

Sources:
Fialho et al. 2016   Anger 1991   NEMESIS; Fofonoff et al. 2003   Rudnick et al. 2000

3.7 Vulnerability to predators

Choice: D	Multiple predators present in the Bering Sea or neighboring regions	Score: 1.25 of 5

Ranking Rationale:
Numerous predators, many of which exist in the Bering Sea.

Background Information:
Predators may include: raccoons, bullfrogs, fishes, and birds (Fofonoff et al. 2003).

Sources:
NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points:	21
Section Total - Possible Points:	30
Section Total -Data Deficient Points:	0

4. Ecological and Socioeconomic Impacts

4.1 Impact on community composition

Choice: **C** Limited – Single trophic level; may cause decline but not extirpation

Score: 0.75 of 2.5

High uncertainty? ✔

Ranking Rationale:
Largest impacts have been documented in freshwater or brackish systems. Impact to marine community is less likely. Because juvenile and adult crabs are largely restricted to freshwater or brackish ecosystems, we do not expect E. sinensis to have strong negative impacts on marine communities in the Bering Sea.

Background Information:
E. sinensis consumes surface-dwelling invertebrates and may cause a decrease in the abundance of surface invertebrates, shifting invertebrate populations deeper (Hymanson et al. 1999; Rudnick et al. 2000; Rudnick and Resh 2005).

Can cause fish mortality through crowding and clogging of irrigation facility diversion passageways. They also may prey upon fish eggs in spawning streams (Rudnick et al. 2000; CMCWG 2003).

E. sinensis may also compete with local crabs such as the Blue Crab (Callinectes sapidus) for food and space.

Sources:
CMCWC 2003 Bovbjerg 1970 NEMESIS; Fofonoff et al. 2003 Hymanson et al. 1999 Rudnick et al. 2000 Rudnick and Resh 2005 Rudnick et al. 2000

4.101 Recreation

Choice: **C** Limited – Has limited potential to cause degradation to recreation opportunities, with limited impact and/or within a very limited region

Score: 0.75 of 3

Ranking Rationale:
Because juvenile and adult crabs are largely restricted to freshwater or brackish ecosystems, we do not expect E. sinensis to have strong negative impacts on recreation in the Bering Sea.

Background Information:
Recreational fishing opportunities have been impacted in some areas of San Francisco Bay and Europe because of bait stealing by E. sinensis (CMCWG 2003).

Sources:
CMCWG 2003 NEMESIS; Fofonoff et al. 2003

4.11 Human health and water quality

Choice: **C** Limited – Has limited potential to pose a threat to human health, with limited impact and/or within a very limited region

Score: 0.75 of 3

Ranking Rationale:
Carries Asian lung fluke in some locations; this relationship is limited to areas with an Asian host snail.

Background Information:
In its native range, E. sinensis is a secondary host for the Asian lung fluke Paragonimus westermani. For a human to get infected they would have to eat a raw or inadequately cooked infected crab (Center for Disease Control 2006 as qtd. in Fofonoff et al. 2003). Only one host snail is established in the U.S., and the fluke has not yet been detected in Californian populations of E. sinensis (CMCWG 2003). Because of its role as predator, E. sinensis bioaccumulates contaminants that can be transferred to consumers when eaten (Che and Cheung 1998).

Sources:
CMCWC 2003 NEMESIS; Fofonoff et al. 2003 Che and Cheung 1998

4.2 *Impact on habitat for other species*

Choice: C Limited – Has limited potential to cause changes in one or more habitats

Score: 0.75 of 2.5

Ranking Rationale:
Burrowing acitvities by juvenile crabs have been linked to increased erosion and deterioration of river banks and associated sediments. Juveniles are largely restricted to freshwater or brackish ecosystems, and the only life stage that is fully marine is the planktonic larval stage. Thus, we do not expect this species to have strong negative impacts on habitat in the Bering Sea.

Background Information:
Juveniles create burrows in tidal portions of stream that retain water during low tide. This burrowing activity results in increased erosion, slumping, and possible collapse of river banks. In some places, these burrows removed up to 5.7% of stream bank sediment (Rudnick et al. 2005b).

Sources:
NEMESIS; Fofonoff et al. 2003 Rudnick et al. 2005b

4.3 *Impact on ecosystem function and processes*

Choice: C Limited – Causes or potentially causes changes to food webs and/or ecosystem functions, with limited impact and/or within a very limited region

Score: 0.75 of 2.5

Ranking Rationale:
Has the potential to cause changes to the ecosystem function, however, these changes are likely limited to estuary or stream environments.

Background Information:
Through predation, can reduce the abundance of surface-dwelling invertebrates (Hymanson et al. 1999; Rudnick et al. 2000; Rudnick and Resh 2005).

Sources:
NEMESIS; Fofonoff et al. 2003 Clark et al. 2009 Hymanson et al. 1999 Rudnick et al. 2000 Rudnick and Resh 2005

4.4 *Impact on high-value, rare, or sensitive species and/or communities*

Choice: D No impact

Score: 0 of 2.5

Ranking Rationale:
Because juvenile and adult crabs are largely restricted to freshwater or brackish ecosystems, we do not expect E. sinensis to have strong negative impacts on species in the Bering Sea.

Background Information:
E. sinensis can occur in such high densities that, as a possible fish egg predator, they are a concern in spawning streams (CMCWG 2003).

Sources:
CMCWC 2003 NEMESIS; Fofonoff et al. 2003

4.5 Introduction of diseases, parasites, or travelers

What level of impact could the species' associated diseases, parasites, or travelers have on other species in the assessment area? Is it a host and/or vector for recognized pests or pathogens, particularly other nonnative organisms?)

Choice: **C**

Limited – Has limited potential to spread one or more organisms, with limited impact and/or within a very limited region

Score: **0.75** **of** **2.5**

Ranking Rationale:
Secondary host for the Asian lung fluke Paragonimus westermani. The fluke requires a host snail species that is not currently found in the Bering Sea, and no infected crabs have been found in California.

Background Information:
E. sinensis is a secondary host for the Asian lung fluke Paragonimus westermani. The fluke requires host snail species that are currently established in California and Florida. The fluke has not yet been detected in California crabs (CMCWG 2003).

Sources:
NEMESIS; Fofonoff et al. 2003   CMCWC 2003

4.6 Level of genetic impact on native species

Can this invasive species hybridize with native species?

Choice: **D**

No impact

Score: **0** **of** **2.5**

Ranking Rationale:
To date, no hybridization has been reported for E. sinensis.

Background Information:
No information available in the literature.

Sources:
NEMESIS; Fofonoff et al. 2003

4.7 Infrastructure

Choice: **B**

Moderate – Causes or has the potential to cause degradation to infrastructure, with moderate impact and/or within only a portion of the region

Score: **1.5** **of** **3**

Ranking Rationale:
Damages infrastructure in freshwater and estuaries, but no impacts to marine infrastructure have been reported.

Background Information:
E. sinensis can cause erosion and riverbank collapse in canals and shipping channels. During migration, large numbers of these crabs have clogged power plants, irrigation, and water diversion systems in freshwater and estuaries in California (CMCWG 2003).

Sources:
CMCWC 2003   NEMESIS; Fofonoff et al. 2003

4.8 Commercial fisheries and aquaculture

Choice: B

Moderate – Causes or has the potential to cause degradation to fisheries and aquaculture, with moderate impact in the region

Score: 1.5 **of** 3

Ranking Rationale:

E. sinensis steals fish bait, interferes with nets, traps, and aquaculture pods, and competes for resources with harvested species.

Background Information:

E. sinensis has direct impacts on fisheries by bait stealing, interfering with traps, and competition. They steal bait indiscriminately from anglers and commercial fishermen alike making fishing in some areas impossible. In large numbers, they clog, break, and eat the fish found in traps, nets, and aquaculture pods (CMCWG 2003). E. sinensis also competes for resources with commercially important species such as crayfish, shrimp, and other crabs.

Sources:

CMCWC 2003 NEMESIS; Fofonoff et al. 2003

4.9 Subsistence

Choice: B

Moderate – Causes or has the potential to cause degradation to subsistence resources, with moderate impact and/or within only a portion of the region

Score: 1.5 **of** 3

Ranking Rationale:

Directly interferes with subsistence species and activities.

Background Information:

Impacts on subsistence resources are similar to those on fisheries. In addition to bait-stealing, dense populations also interfere with traps and nets by clogging and breaking them, and eating the trapped fish (CMCWG 2003). Mitten Crabs can also interfere with subsistence resources by competing for food and shelter of fished species, such as crayfish and shrimp in San Francisco Bay (CMCWG 2003), or potentially with crab fisheries.

Sources:

CMCWC 2003 NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points:	9
Section Total - Possible Points:	30
Section Total -Data Deficient Points:	0

5. Feasibility of prevention, detection and control

5.1 *History of management, containment, and eradication*

Choice: **A** Attempted; control methods are not successful

Score: of

Ranking Rationale:
So far, no effective management approach has been developed and all eradication efforts have shown limited efficiency.

Background Information:
Due to its high abundance, high reproductive rates, and its wide range of tolerances, management of E. sinensis is difficult. In Germany, traps were installed on the upstream side of dams to capture migrating juvenile crabs. When used in conjunction with collection and disposal efforts this has the potential to drastically reduce the crab population during migration events. In California, management is focusing on preventing the spread of the crab to new areas. E. sinensis is listed as injurious wildlife under the Federal Lacey Act making it illegal to import, export, or transport between states in the U.S. without a permit.

Sources:
CMCWC 2003 NEMESIS; Fofonoff et al. 2003

5.2 *Cost and methods of management, containment, and eradication*

Choice: **B** Major short-term and/or moderate long-term investment

Score: of

Ranking Rationale:

Background Information:
So far, no effective management approach has been developed and eradication efforts have shown limited efficiency.

Sources:
NEMESIS; Fofonoff et al. 2003

5.3 *Regulatory barriers to prevent introductions and transport*

Choice: **E** Transport and trade are illegal

Score: of

Ranking Rationale:

Background Information:
Importation of the crab to the U.S. was banned under the Lacey Act in 1989 (Cohen and Carlton 1997; Hymanson et al. 1999).

Sources:
NEMESIS; Fofonoff et al. 2003 Cohen and Carlton 1997 Hymanson et al. 1999

5.4 Presence and frequency of monitoring programs

Choice: **B**

Surveillance takes place, but is largely conducted by non-governmental environmental organizations (e.g., citizen science programs)

Score: of

Ranking Rationale:

Monitoring for Green Crab occur throughout Alaska during which mitten crab would be identified.

Background Information:

Eriocheir sinensis was listed by the Invasive Species Specialist Group of the World Conservation Union (IUCN) as one of the ‘100 worst invasive species’. It has had economic and ecological impacts throughout its introduced range.

Several watch groups have formed in California, Oregon, and Washington aimed at fishermen who may encounter crabs in their nets. The East Coast and Great Lakes have similar groups.

The Prince William Sound Regional Citizens' Advisory Council considers Chinese Mitten Crabs as a Non-Indigenous Aquatic Species of Concern for Alaska.

The Smithsonian Environmental Research Center began efforts to monitor European Green Crab (Carcinus maenas) in Alaska in 2000. Currently trapping is done in Kachemak Bay, Prince William Sound and in Southeast Alaska and is a cooperative effort overseen by the Kachemak Bay Research Reserve, Prince William Sound Regional Citizens Advisory Council, and National Marine Fisheries in Juneau. Where possible, monitoring occurs monthly throughout the summer months at each site. These efforts could also be used to detect Chinese Mitten Crabs but no specific information on Eriocheir sinensis found.

Sources:

NEMESIS; Fofonoff et al. 2003   DAISIE 2009

5.5 Current efforts for outreach and education

Choice: **D**

Programs and materials exist and are readily available in the Bering Sea or adjacent regions

Score: of

Ranking Rationale:

Background Information:

Programs and materials exists for California including species watch cards, species reports and management plans (CMCWG 2003).

Sources:

CMCWC 2003   NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points:

Section Total - Possible Points:

Section Total -Data Deficient Points:

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