Bering Sea Marine Invasive Species Assessment

Alaska Center for Conservation Science

Scientific Name: *Ectopleura crocea*

Common Name *pink mouthed hydroid*

Phylum	Cnidaria
Class	Hydrozoa
Order	Anthomedusae
Family	Tubulariidae

Final Rank 54.47

Data Deficiency: 5.00

Species Occurrence by Ecoregion

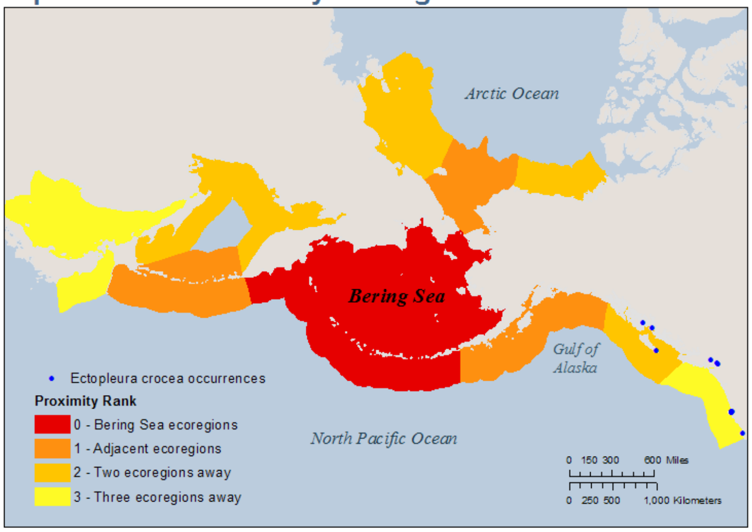

Figure 1. Occurrence records for non-native species, and their geographic proximity to the Bering Sea. Ecoregions are based on the classification system by Spalding et al. (2007). Occurrence record data source(s): NEMESIS and NAS databases.

Category Scores and Data Deficiencies

Category	Score	Total Possible	Data Deficient Points
Distribution and Habitat:	20.5	30	0
Anthropogenic Influence:	4.75	10	0
Biological Characteristics:	19.5	25	5.00
Impacts:	7	30	0
Totals:	51.75	95.00	5.00

General Biological Information

Tolerances and Thresholds

Minimum Temperature (°C)	0	Minimum Salinity (ppt)	23
Maximum Temperature (°C)	30	Maximum Salinity (ppt)	34
Minimum Reproductive Temperature (°C)	12	Minimum Reproductive Salinity (ppt)	31*
Maximum Reproductive Temperature (°C)	26	Maximum Reproductive Salinity (ppt)	34*

Additional Notes

Ectopleura crocea is a colonial hydroid that can grow up to 100-120 mm in height. Colonies are pink and composed of hundreds of unbranched stems with one hydranth per stalk and two whorls of 20 to 24 tentacles. This species lacks a medusa stage. Taxonomy is debated, and there exists many synonyms including Tubularia crocea and Pinauay crocea (see NEMESIS for a complete list). This species is native to the east coast of North America, but has spread to the West Coast, as well as to Europe, Africa, Australia, New Zealand, and the South China Sea. In the Mediterranean Sea, the species has been declining in abundance since ~1980, likely due to warming temperatures (Di Camillo et al. 2013).

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. Thresholds are based on geographic distribution, which may not represent physiological tolerances; moreover, models disagree with respect to their estimates of suitable area. We therefore ranked this question with "High uncertainty".

Background Information:
This species can tolerate temperatures from 0 to 30°C (based on geographic range; Fofonoff et al. 2003). In some regions, this species becomes dormant during the summer (when temperatures exceed ~19-21°C) and regenerates when conditions become suitable again (Di Camillo et al. 2013).

Sources:
Di Camillo et al. 2013   NEMESIS; Fofonoff et al. 2003

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

High uncertainty? ☑

Ranking Rationale:
Salinities required for year-round survival occur over a large (>75%) area of the Bering Sea. Thresholds are based on geographic distribution, which may not represent physiological tolerances; moreover, models disagree with respect to their estimates of suitable area. We therefore ranked this question with "High uncertainty".

Background Information:
Based on geographic distribution, E. crocea's salinity range is estimated to range from 23 to 34 ppt (Fofonoff et al. 2003).

Sources:
NEMESIS; Fofonoff et al. 2003

1.3 Establishment requirements - Water temperature

Choice: C Little overlap – A small area (<25%) of the Bering Sea has temperatures suitable for reproduction

Score: 1.25 of 3.75

Ranking Rationale:
Temperatures required for reproduction occur in a limited area (<25%) of the Bering Sea.

Background Information:
Asexual and sexual reproduction have been observed from 12 to 26°C (surface water temperature) (Yamashita et al. 2003).

Sources:
Yamashita et al. 2003

1.4 Establishment requirements - Water salinity

Choice: **A** Considerable overlap – A large area (>75%) of the Bering Sea has salinities suitable for reproduction

Score: 3.75 **of** 3.75

High uncertainty? ☑

Ranking Rationale:
Although salinity thresholds are unknown, this species is a marine organism that does not require freshwater to reproduce. We therefore assume that this species can reproduce in saltwater up to 34 ppt. These salinities occur in a large (>75%) portion of the Bering Sea.

Background Information:
We were unable to find specific information on this species' reproductive salinity requirements. Based on its geographic distribution, this species tolerates salinities from 23 to 34 ppt (Fofonoff et al. 2003).

Sources:
NEMESIS; Fofonoff et al. 2003

1.5 Local ecoregional distribution

Choice: **C** Present in an ecoregion two regions away from the Bering Sea (i.e. adjacent to an adjacent ecoregion)

Score: 2.5 **of** 5

Ranking Rationale:
This species has been reported along the west coast of North America, from CA to Ketchikan, AK.

Background Information:
In 2003, one individual was collected in Ketchikan. It is unknown whether this hydroid is established in Alaska (Ruiz et al. 2006). This species has also been reported in BC and WA, and is established in OR and CA.

Sources:
Ruiz et al. 2006 NEMESIS; Fofonoff et al. 2003

1.6 Global ecoregional distribution

Choice: **A** In many ecoregions globally

Score: 5 **of** 5

Ranking Rationale:
This species has a broad geographic distribution and has been recorded on both coasts of North America, as well as in Europe, Asia, South Africa, Australia, and New Zealand.

Background Information:
Established in cold temperate, warm temperate, and tropical waters. E. crocea is native to the Atlantic coast of North America, from New Brunswick to FL and TX. It is considered cryptogenic in the Caribbean and South America. On the West Coast, established populations have been recorded in CA and OR. Individuals have been detected in WA, BC, and southern AK, but it is unknown whether populations are established there. It has been introduced in Europe and the Middle East, including in France, the Mediterranean Sea (Italy, Turkey, Egypt), and the Red Sea near Israel. It has been recorded in Japan, the China Sea, South Africa, Australia, and New Zealand.

Sources:
NEMESIS; Fofonoff et al. 2003

1.7 Current distribution trends

Choice:		Score:
C	Established outside of native range, but no evidence of rapid expansion or long-distance dispersal	1.75 of 5

Ranking Rationale:

This species has established itself in many regions outside of its native range. However, there have not been reports of rapid spread, and natural dispersal is limited.

Background Information:

One individual was discovered in Ketchikan, AK in 2003, but it has not spread since then. No rapid range expansions have been documented. This species does not have the potential for natural, long-distance dispersal.

Sources:

Ruiz et al. 2006 NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points:	20.5
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: **B** Has been observed using anthropogenic vectors for transport but has rarely or never been observed moving independent of anthropogenic vectors once introduced

Score: 2 of 4

High uncertainty? ☑

Ranking Rationale:
This species can be transported on ships, but its potential for natural dispersal is likely limited.

Background Information:
E. crocea is a fouling organism that has been found on ships and other anthropogenic structures such as fishing gear. A survey in New Zealand found E. crocea in sheltered areas on ships (e.g., sea chests, propellers) (Cawthron Institute 2010).

Sources:
NEMESIS; Fofonoff et al. 2003 Cawthron Institute 2010

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

Choice: **B** Readily establishes in areas with anthropogenic disturbance/infrastructure; occasionally establishes in undisturbed areas

Score: 2.75 of 4

High uncertainty? ☑

Ranking Rationale:
Surveys of E. crocea suggest that this species may be more prevalent on anthropogenic structures than in natural habitats.

Background Information:
A survey near a shipwreck in Italy did not find E. crocea on natural substrates, though the reasons for this are unknown (Di Camillo et al. 2013). If this is a general trend, it suggests that the potential for establishment is limited to anthropogenic substrates, at least in soft-bottom habitats.

Sources:
Di Camillo et al. 2013

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

Choice: **B** No

Score: 0 of 2

Ranking Rationale:
This species is not currently farmed or cultivated.

Background Information:

Sources:
NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points:	4.75
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:
E. crocea feeds on a range of taxa that are readily available in the Bering Sea.

Background Information:
E. crocea feeds on both planktonic and benthic prey, including diatoms, bivalve larvae, and crustaceans (Di Camillo et al. 2013; Fitridge and Keough 2013). Stomach contents of E. crocea in the Adriatic Sea were found to contain mostly crustaceans (Di Camillo et al. 2013). Di Camillo et al. (2013) suggest that E. crocea is a generalist predator, but Fitridge and Keough (2013) assert that this species preferentially preys upon mussel larvae.

Sources:
Fitridge and Keough   Di Camillo et al. 2013

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: **A** Generalist; wide range of habitat tolerances at all life stages

Score: 5 of 5

Ranking Rationale:
This species can tolerate a broad range of temperatures and salinities. It is most commonly associated with hard substrates, including bivalves and anthropogenic structures.

Background Information:
Thrives in cold water with good movement, and is typically found in estuaries and eutrophic areas (Di Camillo et al. 2013; Piazzola 2015). It lives in low intertidal and subtidal zones, down to 40 m depths (qtd. in Piazzola 2015). This species is readily found on anthropogenic substrates including boats, ship hulls, pilings, and industrial cooling systems (Di Camillo et al. 2013). It does not settle on mud or sand, but is often associated with mussel beds. It can tolerate polluted waters (Schuchert 2010, qtd. in Fofonoff et al. 2003).

Sources:
Di Camillo et al. 2013   Piazzola 2015   NEMESIS; Fofonoff et al. 2003

3.3 Desiccation tolerance

Choice: **U** Unknown

Score: of

Ranking Rationale:
This species' desiccation tolerance is unknown.

Background Information:
No information found.

Sources:
NEMESIS; Fofonoff et al. 2003

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

Score: 5 of 5

Ranking Rationale:

This species exhibits asexual reproduction, external fertilization, and short generation time. Because this is a colonial species, the number of eggs produced depend on colony size, but can be very high.

Background Information:

Colonies are dioecious, and can reproduce both sexually and asexually. Male gonophores release sperm in the water column, which are attracted to female gonophores and result in internal fertilization. Larvae are short-lived, and usually settle on a substrate within ~ 24 hours.

Yamashita et al. (2003) found that the maximum number of released larvae per polyp was 300, meaning that a colony of 300 polyps may release up to 90 000 larvae. Colonies can occur at densities of 10 colonies/m2, with a potential release of 900 000 larvae/m2 (Di Camillo et al. 2003). This species can reproduce year-round in some areas (Fitridge and Keough 2013).

Larvae are released into the water column within 6 to 8 days of egg production (Mackie 1966, qtd. in Piazzola 2015). Juveniles reach sexual maturity within two weeks (Piazzola 2015).

Sources:

Di Camillo et al. 2013 Fitridge and Keough NEMESIS; Fofonoff et al. 2003 Yamashita et al. 2003 Piazzola 2015

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: **C** Disperses short (< 1 km) distances

Score: 0.75 of 2.5

High uncertainty? ☑

Ranking Rationale:

No specific dispersal distances were found, but several sources claim that this species has limited dispersal potential. Larval stage is short-lived, and larvae usually settle close to the parent colony. Adults are sessile. The longevity of adult fragments and their potential for dispersal under natural conditions is unknown.

Background Information:

Larvae are short-lived (~ 24 hours) and usually disperse only a short distance away from the parent colony (Gili and Hughes 1995; Piazzola 2015), though further distances may be possible if larvae are passively dispersed by water currents (Di Camillo et al. 2013). Adults are sessile, but autotomized hydranths (pieces of the colony which have detached) may have high dispersal potential. Under laboratory conditions, these fragments can survive for 30 days and continue to feed and spawn (Rungger 1969, qtd. in Di Camillo et al. 2013). Similarly, in the absence of a suitable substrate, larvae under laboratory conditions were found to stay in the water column for up two weeks (Yamashita et al. 2003).

Sources:

Di Camillo et al. 2013 Piazzola 2015 Gili and Hughes 1995 Yamashita et al. 2003

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:

This species can disperse during more than one life stage. Modes of dispersal include active swimming (larvae), passive dispersal by water currents (hydranth and larvae), and rafting on floating substrates (adults).

Background Information:

Adults are sessile unless a hydranth is detached. Free-swimming larval phase is short-lived (~24 hours).

Sources:

Di Camillo et al. 2013 NEMESIS; Fofonoff et al. 2003

3.7 Vulnerability to predators

Choice: D Multiple predators present in the Bering Sea or neighboring regions

Score: 1.25 **of** 5

Ranking Rationale:

E. crocea is eaten by several taxa that are found in the Bering Sea.

Background Information:

Predators include sea spiders, nudibranchs, polychaete worms, fishes, and insects (Gili and Hughes 1995; Piazzola 2015).

Sources:

Gili and Hughes 1995 Piazzola 2015

Section Total - Scored Points:	19.5
Section Total - Possible Points:	25
Section Total -Data Deficient Points:	5

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:
This species may affect the growth and recruitment of bivalves through fouling and predation. E. crocea can be a dominant member of the fouling communities, but few impacts have been reported.

Background Information:
E. crocea have been observed feeding on mussel larvae in both natural and laboratory conditions, which may lead to reduced recruitment rates (Fitridge and Keough 2013). Fouling of shells by E. crocea has also been linked to decreased growth (length and weight) in juvenile mussels (Fitridge and Keough 2013). In several parts of its range, E. crocea colonies are known to regress (Okamura 1986; Di Camillo et al. 2013), which may limit its long-term implications on communities.

Sources:
NEMESIS; Fofonoff et al. 2003 Fitridge and Keough Okamura 1986 Di Camillo et al. 2013

4.2 *Impact on habitat for other species*

Choice: **B** Moderate – Causes or has potential to cause changes to one or more habitats

Score: 1.75 of 2.5

Ranking Rationale:
By fouling anthropogenic substrates, E. crocea creates secondary settlement habitat for other species.

Background Information:
E. crocea is often a dominant member of the fouling community. By establishing on toxic substrates (e.g. hulls with anti-fouling paints), it facilitates secondary settlement by other species. On shipwrecks, it can provide a suitable substrate for other species (Di Camillo et al. 2013). E. crocea colonies host a rich assemblage of mobile and sessile species, including amphipods and bacteria (Di Camillo et al. 2012; Di Camillo et al. 2013).

Sources:
Di Camillo et al. 2013 Di Camillo et al. 2012

4.3 *Impact on ecosystem function and processes*

Choice: **D** No impact

Score: 0 of 2.5

Ranking Rationale:
This species is not expected to impact ecosystem function in the Bering Sea.

Background Information:
No impacts have been reported.

Sources:
NEMESIS; Fofonoff et al. 2003

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

Choice: **D**	No impact	**Score:** **0** **of** **2.5**

Ranking Rationale:
This species is not expected to impact high-value species or communities in the Bering Sea.

Background Information:
No impacts have been reported.

Sources:
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: **D**	No impact	**Score:** **0** **of** **2.5**

Ranking Rationale:
E. crocea forms species-specific associations with bacteria, but these ecological relationships are not expected to impact the Bering Sea ecoregion.

Background Information:
E. crocea is host to other invertebrates and bacteria (Di Camillo et al. 2012); however, these associations are species-specific symbioses and are not thought to affect the larger community or ecosystem.

Sources:
Di Camillo et al. 2012

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:
This species is not expected to hybridize with native species in the Bering Sea.

Background Information:
No impacts have been reported.

Sources:
NEMESIS; Fofonoff et al. 2003

4.7 Infrastructure

Choice:		Score:
B	Moderate – Causes or has the potential to cause degradation to infrastructure, with moderate impact and/or within only a portion of the region	1.5 of 3

Ranking Rationale:
This species is known to damage infrastructure when it occurs at high densities.

Background Information:
Through fouling, this species can damage water cooling systems or aquaculture infrastructure, especially if it occurs at high densities. Heavy fouling may lead to increased drag on mussel lines and result in lost stock, as the weight pulls mussels off long lines. In field experiments in San Francisco Bay, E. crocea was a dominant species on fouling plates during certain parts of the year, occupying up to 60% of the plates' surface (Okamura 1986).

Sources:
NEMESIS; Fofonoff et al. 2003   Di Camillo et al. 2013   Okamura 1986

4.8 Commercial fisheries and aquaculture

Choice:		Score:
C	Limited – Has limited potential to cause degradation to fisheries and aquaculture, and/or is restricted to a limited region	0.75 of 3

Ranking Rationale:
The shellfish industry in Alaska is estimated at $1 million (PSI Alaska 2017), but only occurs in a limited area in the Bering Sea. Revenues from shellfish are most important in the Gulf of Alaska and in southwest Alaska (Aleutians East through Lake and Peninsula; Mathis et al. 2015).

Background Information:
E. crocea is a nuisance species on shellfish farms. By fouling juvenile mussels, it competes for food and impedes their filter feeding ability, thereby restricting their growth. E. crocea also selectively preys upon mussel larvae, which can decrease settlement and recruitment rates (Fitridge and Keough 2013; Mondon 2015). In Tasmania, black mussels fouled with E. crocea exhibited a 23% reduction in flesh weight (Mondon 2015). At the same time, hydroid stalks can provide a settlement surface for mussel larvae (Fitridge and Keough 2013).

Sources:
Mathis et al. 2015   Fitridge and Keough   Mondon 2015   PSI Alaska 2017

4.9 Subsistence

Choice:		Score:
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	1.5 of 3

High uncertainty? ☑

Ranking Rationale:
This species can negatively affect the growth and recruitment of bivalves through fouling and predation. Given its effects and the importance of subsistence shellfish harvesting in the Bering Sea, it is expected to have a moderate impact on subsistence resources in this region.

Background Information:
By selectively feeding on mussel larvae, this species may affect mussel settlement and recruitment rates (Fitridge and Keough 2013; Mondon 2015). Compared to salmon and finfish, shellfish comprise a smaller percentage of subsistence catch in the Bering Sea (when measured by weight; Mathis et al. 2015). Although shellfish comprised almost 20% of subsistence catch in the Aleutians West, most municipalities in the Bering Sea recorded low percentages (< 5%).

Sources:
Mathis et al. 2015   Fitridge and Keough   Mondon 2015

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

High uncertainty? ☑

Ranking Rationale:
This species may affect recruitment and development of bivalves, but is expected to have limited impacts on recreational harvesting of shellfish in the Bering Sea.

Background Information:
By selectively feeding on mussel larvae, this species may affect mussel settlement and recruitment rates (Fitridge and Keough 2013; Mondon 2015). In Alaska, recreational harvesting of shellfish is discouraged on untested beaches because of the potential for paralytic shellfish poisoning (PSP).

Sources:
Fitridge and Keough   Mondon 2015

4.11 Human health and water quality

Choice: **D**

No impact

Score: 0 of 3

Ranking Rationale:
This species is not expected to impact human health or water quality in the Bering Sea.

Background Information:
No impacts have been reported.

Sources:
NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points:	7
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: **C** Attempted; control methods are currently in development/being studied

Score: of

High uncertainty? ✔

Ranking Rationale:
No attempts have been made to control E. crocea. This species fouls sheltered areas on vessels such as sea chests and propellers; methods and best practices are currently being developed to control the spread of species by these and other vectors.

Background Information:
We did not find any management plans that were specific to this species. E. crocea is tolerant to copper (found in anti-fouling paints) (Crooks et al. 2011), which suggest that traditional methods for controlling fouling organisms may not be successful in controlling E. crocea. A survey on a New Zealand vessel collected E. crocea from sheltered parts of the ship (e.g., sea chests) (Cawthron Institute 2010). Sea chests are known vectors for transporting non-indigenous species and methods to control the spread of species by sea chests are being investigated (Frey et al. 2014).

Sources:
Crooks et al. 2011 Cawthron Institute 2010 Frey et al. 2014

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:
To our knowledge, control of E. crocea has not been attempted. Methods for successfully controlling the spread of antifouling organisms are being studied. Current technologies that clean ships of fouling species require purchasing of specialized equipment and regular cleaning.

Background Information:
According to Franmarine Underwater Services (2013), the cost of dry docking (including cleaning and "loss of business" costs) varies from AUD $62 200 to more than $1.3 million, depending on vessel size. In-water cleaning costs range from AUD $18 800 to $255 000+ (for offshore cleaning of large vessels), with cleaning times estimated between 16 to 48 hours. The Franmarine cleaning system, which collects, treats, and disposes of biological waste (e.g., organisms) has a purchasing cost between AUD ~ $500 000 to $750 000, depending on vessel size. Hagan et al. (2014) proposed similar estimates for the cost and time of in-water cleaning.

Sources:
Franmarine 2013 Hagan et al. 2014

5.3 Regulatory barriers to prevent introductions and transport

Choice: **B** Regulatory oversight, but compliance is voluntary

Score: of

Ranking Rationale:
Although there are regulations to control the spread of ship fouling species, compliance is largely voluntary.

Background Information:
In the U.S., Coast Guard regulations require masters and ship owners to engage in practices that will reduce the spread of invasive species, including cleaning ballast tanks and removing fouling organisms from hulls, anchors, and other infrastructure on a “regular” basis (CFR 33 § 151.2050). Failure to remove fouling organisms is punishable with a fine (up to $27 500). However, the word “regular” is not defined, which makes the regulations hard to enforce. As a result of this technical ambiguity, compliance with ship fouling regulations remains largely voluntary (Hagan et al. 2014).

Cleaning of recreational vessels is also voluntary, although state and federal programs are in place to encourage owners to clean their boats. Boat inspection is mandatory on some lakes (e.g. Lake Tahoe in CA/NV, Lake George in NY). In summer 2016, state and federal agencies conducted voluntary inspections for aquatic invasive species on trailered boats entering the state of Alaska (Davis 2016).

Sources:
CFR 2017 Hagan et al. 2014 Davis 2016

5.4 Presence and frequency of monitoring programs

Choice: **A** No surveillance takes place

Score: of

Ranking Rationale:
No surveillance takes place for this species.

Background Information:
No information found.

Sources:
NEMESIS; Fofonoff et al. 2003

5.5 Current efforts for outreach and education

Choice: **A** No education or outreach takes place

Score: of

Ranking Rationale:
Little information is available on E. crocea in general, and no information is targeted towards the general public.

Background Information:
We did not find any information on outreach or education programs for this species.

Sources:
None listed

Section Total - Scored Points:
Section Total - Possible Points:
Section Total -Data Deficient Points:

Literature Cited for *Ectopleura crocea*

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