Bering Sea Marine Invasive Species Assessment

Alaska Center for Conservation Science

Scientific Name: *Synidotea laticauda*

Common Name *an isopod*

Phylum	Arthropoda
Class	Malacostraca
Order	Isopoda
Family	Idoteidae

Final Rank 39.45

Data Deficiency: 8.75

Species Occurrence by Ecoregion

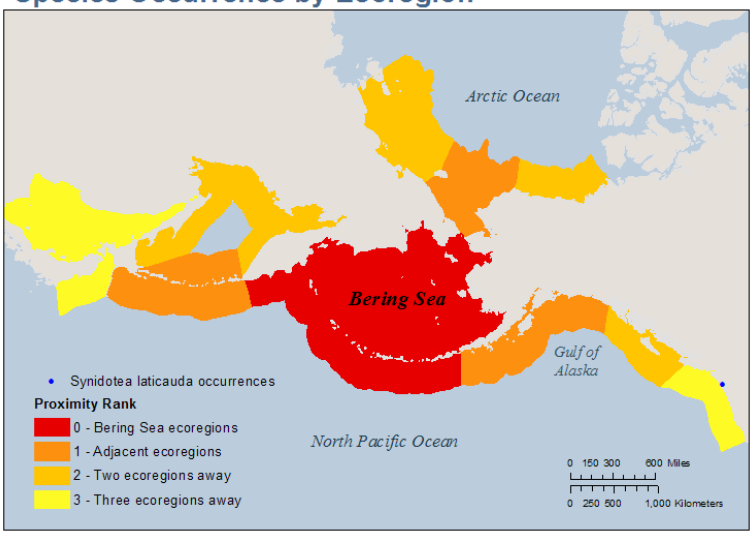

Figure 1. Occurrence records for non-native species, and their geographic proximity to the Bering Sea. Ecoregions are based on the classification system by Spalding et al. (2007). Occurrence record data source(s): NEMESIS and NAS databases.

Category Scores and Data Deficiencies

Category	Score	Total Possible	Data Deficient Points
Distribution and Habitat:	12.5	26	3.75
Anthropogenic Influence:	4.75	10	0
Biological Characteristics:	18	25	5.00
Impacts:	0.75	30	0
Totals:	36.00	91.25	8.75

General Biological Information

Tolerances and Thresholds

Minimum Temperature (°C)	0	Minimum Salinity (ppt)	1
Maximum Temperature (°C)	30	Maximum Salinity (ppt)	35
Minimum Reproductive Temperature (°C)	4	Minimum Reproductive Salinity (ppt)	10
Maximum Reproductive Temperature (°C)	33	Maximum Reproductive Salinity (ppt)	30

Additional Notes

S. laticauda is a small (16-25 mm) isopod with a tan, oval body, large eyes, and a dark brown stripe along its back. Its native range is unknown, but it is considered introduced to North America. The taxonomic identity of this species is unresolved.

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:
Boyd (2008) suggests an optimal temperature range between 10 and 25ºC. No juveniles survived 24-hr exposures to 37ºC, but ~80% of adults survived 48-hr exposures at 30ºC and 15-25 PSU (Boyd 2008). 100% of adults survived 48-hour exposures at 5ºC and 25 PSU (Boyd 2008). This species was reported from the Delaware River, New Jersey where bottom temperatures ranged from ~0 to 28ºC (Bushek and Boyd 2006).

Sources:
Boyd 2008 Bushek and Boyd 2006

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:
Boyd (2008) suggests that the optimal salinity range for this species is between 10 and 30 PSU, but juveniles exposed to 35 PSU for 24 hours exhibited little to no mortality at 25ºC and 10ºC. Less than 1% of adults survived short-term (up to 48 hours) exposure to 0 PSU (Boyd et al. 2008). In France, this species was reported from salinities between 0.1 and 24 ppt (Mees and Fockedey 1993, qtd. in Bushek and Boyd 2006).

Sources:
Bushek and Boyd 2006 Boyd 2008

1.3 Establishment requirements - Water temperature

Choice: U — Unknown/Data Deficient

Score: **of**

Ranking Rationale:
More information needed to determine reproductive temperature requirements.

Background Information:
At high salinity (35 PSU), 100% of juveniles survived 24 hour exposure to 4ºC water (Boyd 2008). No juveniles survived at 37ºC, but a few (10-50%) survived at 33ºC in moderate to high salinity treatments (25 to 35 PSU) (Boyd 2008).

Sources:
Boyd 2008 NEMESIS; Fofonoff et al. 2003

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

High uncertainty? ☑

Ranking Rationale:
Although little information was found on reproductive requirements, the optimal salinity range for juveniles seems to be between 10 and 30 PSU, though some individuals were able to tolerate short-term (24 hr) exposure to 35 PSU. Salinities < 30 PSU do not occur in the Bering Sea.

Background Information:
In laboratory conditions, no juveniles survived 24 h exposure to freshwater. A few survived at 5 PSU. Survival increased to 100% at 10 PSU and remained high at 20 and 30 PSU. Survival dropped to 30% or lower at 35 PSU (Boyd 2008).

Sources:
Boyd 2008

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:
This species has been reported as far north as Willapa Bay, Washington.

Background Information:
On the West Coast of North America, this species has been found in California and Washington.

Sources:
NEMESIS; Fofonoff et al. 2003

1.6 Global ecoregional distribution

Choice: B — In a moderate number of ecoregions globally

Score: 3.25 of 5

High uncertainty? ☑

Ranking Rationale:
This species is considered introduced in western and eastern North America, where it has a relatively restricted range, and in western Europe. Taxonomic confusion within this species' genus makes it difficult to determine its native range and the extent of its distribution.

Background Information:
S. laticauda is considered introduced on both coasts of North America, where it occurs in CA and WA in the west, and from NY to SC in the east. In Europe, it has been reported from Spain to the Netherlands. Because of taxonomic confusion within the Synidotea genus, the native range and geographic extent of this species is unknown.

Sources:
NEMESIS; Fofonoff et al. 2003

1.7 Current distribution trends

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

Score: 1.75 of 5

Ranking Rationale:
This species' disconnected distribution on the east and west coasts of North America suggests a limited ability for long-distance dispersal/colonization in its introduced range.

Background Information:
This species has been reported in CA and from one area (Willapa Bay) in Washington. Though it can reach high densities locally, it has a similar, disconnected distribution on the east coast. We did not find information pointing to a rapid range expansion for this species.

Sources:
NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points:	12.5
Section Total - Possible Points:	26.25
Section Total -Data Deficient Points:	3.75

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

Ranking Rationale:
This species was likely introduced to North America and to Europe by anthropogenic vectors. Its disconnected distribution in North America suggests a limited ability for independent transport.

Background Information:
This species is thought to have been transported via fouling or ballast water (Boyd 2008; Fofonoff et al. 2003).

Sources:
Boyd 2008 NEMESIS; Fofonoff et al. 2003

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

Ranking Rationale:
In its introduced range, this species is more commonly associated with anthropogenic structures.

Background Information:
In Delaware Bay, NJ, S. laticauda was mostly found at sites with anthropogenic structures (Boyd 2008), and was commonly found fouling docks, ropes and buoys (Bushek and Boyd 2006). It has also been found on natural substrates (Bushek and Boyd 2006).

Sources:
Boyd 2008 Bushek and Boyd 2006

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 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:
This species is a generalist and items are readily available in the Bering Sea.

Background Information:
During feeding trials, individuals consumed 9 of the 12 species presented to them (Boyd 2008). This species was found to have a broad diet including bryozoans, algae, and nereid worms (Boyd 2008).

Sources:
Boyd 2008

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 is a habitat generalist that can tolerate a range of temperatures, salinities, and water flows.

Background Information:
This species can tolerate a broad range of temperatures and salinities (Boyd 2008). It was very abundant in the San Francisco estuary, which experiences strong, seasonal variations in water flow, salinity, and temperature (Gewant and Bollens 2005).

Sources:
Boyd 2008 Gewant and Bollens 2005

3.3 Desiccation tolerance

Choice: U

Unknown

Score: **of**

Ranking Rationale:
This species' dessication 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: **B** Moderate – Exhibits one or two of the above characteristics

Score: **3.25** **of** **5**

High uncertainty? ☑

Ranking Rationale:
This species' reproduces sexually and broods its young. Brood size is small, but the total number of broods per female is unknown. Because this species' undergoes seasonal peaks and die-offs in at least parts of its range, it likely has a relatively short generation time.

Background Information:
This species' has separate sexes and reproduces sexually. Eggs are brooded by the female. Females in Delaware Bay had a brood size between 12 to 70 (Boyd 2008). In the San Francisco Estuary, this species undergoes seasonal increases/declines in abundance (Gewant and Bollens 2005).

Sources:
Boyd 2008 Gewant and Bollens 2005

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: **B** Disperses moderate (1-10 km) distances

Score: **1.75** **of** **2.5**

High uncertainty? ☑

Ranking Rationale:
This species undergoes direct development and consequently does not have a planktonic larval stage that may assist in its long-distance dispersal. Dispersal distances (either as a result of active or passive transport) are unknown. Given this species' patchy regional distribution, it likely has limited natural dispersal abilities.

Background Information:
Information on a related (perhaps synonymous?) species, Synidotea laevidorsalis, believes that this species has a limited ability for long-distance dispersal (Chapman and Carlton 1991). For one, it does not have a planktonic larval stage that would promote dispersal, and it has not been reported drifting in the oceans on wood or vegetation. Its disconnected distribution both regionally and globally suggests that this species' dispersal ability is limited without the help of anthropogenic vectors (Chapman and Carlton 1991). This species can move by swimming and crawling (Boyd 2008).

Sources:
Chapman and Carlton 1991 Boyd 2008

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: **B** Moderate – Exhibits one of the above characteristics

Score: **1.75** **of** **2.5**

Ranking Rationale:
This species undergoes direct developement and does not have a larval stage. Eggs are brooded by the female. Although both juveniles and adults are capable of dispersal, the mechansims of dispersal are the same across these different life stages.

Background Information:
This species undergoes direct development and eggs are brooded (qtd. in Fofonoff et al. 2003). Adults and juveniles can swim and crawl (Boyd 2008).

Sources:
NEMESIS; Fofonoff et al. 2003 Boyd 2008

3.7 Vulnerability to predators

Choice: **D**

Multiple predators present in the Bering Sea or neighboring regions

Score: **1.25** **of** **5**

Ranking Rationale:

This species is eaten by several fish species in its introduced range. We expect that fish in the Bering Sea would predate upon S. laticauda as well.

Background Information:

Several fish species eat S. laticauda including perch, catfish, and eel (Boyd 2008).

Sources:

Boyd 2008

Section Total - Scored Points:	18
Section Total - Possible Points:	25
Section Total -Data Deficient Points:	5

4. Ecological and Socioeconomic Impacts

4.1 Impact on community composition

Choice: D — No impact

Score: 0 of 2.5

Ranking Rationale:

Background Information:
No ecological impacts have been reported for this species.

Sources:
NEMESIS; Fofonoff et al. 2003

4.2 Impact on habitat for other species

Choice: D — No impact

Score: 0 of 2.5

Ranking Rationale:
Based on its biology, we do not expect this species to affect habitat in the Bering Sea.

Background Information:
No ecological impacts have been reported for this species.

Sources:
NEMESIS; Fofonoff et al. 2003

4.3 Impact on ecosystem function and processes

Choice: D — No impact

Score: 0 of 2.5

Ranking Rationale:

Background Information:
No ecological impacts have been reported for this species.

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:

Background Information:
No ecological impacts have been reported for this species.

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:
This species is not known to transport diseases, parasites, or hitchhikers.

Background Information:
No ecological impacts have been reported for this species.

Sources:
NEMESIS; Fofonoff et al. 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:
This species is not expected to hybridize with native species in the Bering Sea.

Background Information:
No ecological impacts have been reported for this species.

Sources:
NEMESIS; Fofonoff et al. 2003

4.7 Infrastructure

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

Score: 0.75 of 3

Ranking Rationale:
Although no impacts have been reported, this species is known to foul docks, ships, and fishing equipment, and may have an impact if it occurs at high densities.

Background Information:
This species is known to foul anthropogenic structures, including equipment used for oyster cultivation (Bushek and Boyd 2006). No economic impacts have been reported. Where present, this species can reach high densities (Bushek and Boyd 2006).

Sources:
NEMESIS; Fofonoff et al. 2003 Bushek and Boyd 2006

4.8 Commercial fisheries and aquaculture

Choice: D — No impact

Score: 0 of 3

Ranking Rationale:
This species is not expected to impact commercial fishing in the Bering Sea.

Background Information:
No impacts have been reported.

Sources:
NEMESIS; Fofonoff et al. 2003

4.9 Subsistence

Choice: D — No impact

Score: 0 of 3

Ranking Rationale:
This species is not expected to impact subsistence resources in the Bering Sea.

Background Information:
No impacts have been reported.

Sources:
NEMESIS; Fofonoff et al. 2003

4.101 Recreation

Choice: D — No impact

Score: 0 of 3

Ranking Rationale:
This species is not expected to impact recreational opportunities in the Bering Sea.

Background Information:
No impacts have been reported.

Sources:
NEMESIS; Fofonoff et al. 2003

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:	0.75
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 [ ]

Ranking Rationale:
No species-specific management plans are in place for controlling this species. However, methods to reduce the spread of invasive species that are transported by ballast water and hull fouling are being studied.

Background Information:

Sources:
Ruiz and Reid 2007

5.2 Cost and methods of management, containment, and eradication

Choice: A — Major long-term investment, or is not feasible at this time

Score: [ ] of [ ]

Ranking Rationale:
This species is transported by ballast water and fouling. While methods to control the spread of invasive species via these vectors are being developed, they require major long-term investments.

Background Information:

Sources:
CFR 2017 Hagan et al. 2014 Zagdan 2010

5.3 Regulatory barriers to prevent introductions and transport

Choice: B — Regulatory oversight, but compliance is voluntary

Score: [ ] of [ ]

Ranking Rationale:
This species is transported by multiple vectors and no species-specific regulations are currently in place. Although there are federal regulations for both ballast water and hull fouling, compliance with federal fouling regulations remains voluntary.

Background Information:

Sources:
Hagan et al. 2014 CFR 2017

5.4 Presence and frequency of monitoring programs

Choice: A — No surveillance takes place

Score: [ ] of [ ]

Ranking Rationale:
No surveillance is taking place for this species.

Background Information:
No information found.

Sources:
None listed

5.5 Current efforts for outreach and education

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

Score: _____ **of** _____

Ranking Rationale:
No education or outreach programs are in place for this species.

Background Information:
No information found.

Sources:
None listed

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

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Literature Cited for *Synidotea laticauda*

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- Chapman, J. W., and J. T. Carlton. 1991. A test of criteria for introduced species: the global invasion by the isopod Synidotea laevidorsalis (Miers, 1881). Journal of Crustacean Biology 11(3): 386-400.

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