Scientific Name: *Polydora cornuta*

Common Name: *whip mudworm*

**Phylum:** Annelida  
**Class:** Polychaeta  
**Order:** Canalipalpata  
**Family:** Spionidae

**Final Rank:** 51.25  
**Data Deficiency:** 0.00

### General Biological Information

#### Tolerances and Thresholds

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Temperature (°C)</td>
<td>-2</td>
</tr>
<tr>
<td>Maximum Temperature (°C)</td>
<td>29</td>
</tr>
<tr>
<td>Minimum Reproductive Temperature (°C)</td>
<td>10</td>
</tr>
<tr>
<td>Maximum Reproductive Temperature (°C)</td>
<td>29</td>
</tr>
<tr>
<td>Minimum Salinity (ppt)</td>
<td>2</td>
</tr>
<tr>
<td>Maximum Salinity (ppt)</td>
<td>75</td>
</tr>
<tr>
<td>Minimum Reproductive Salinity (ppt)</td>
<td>5</td>
</tr>
<tr>
<td>Maximum Reproductive Salinity (ppt)</td>
<td>75</td>
</tr>
</tbody>
</table>

#### Additional Notes

*Polydora cornuta* is a species complex of tube-building polychaete worms. Adult individuals have up to 90 segments, can be between 12 to 32 mm long, and are light tan in color.

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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.
1. Distribution and Habitat

1.1 Survival requirements - Water temperature

**Choice:**

A

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

**Score:**

3.75 of 4

**Ranking Rationale:**

Temperatures 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; we therefore ranked this question with "High uncertainty".

**Background Information:**

This species' temperature range is from -2 to 29°C (based on geographic distribution), though it can probably tolerate warmer temperatures.

**Sources:**

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 4

**Ranking Rationale:**

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

**Background Information:**

This species has been collected in water with salinities between 2 and 75 PSU. It is abundant at salinities above 5 PSU.

**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 4

**Ranking Rationale:**

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

**Background Information:**

This species requires a minimum reproductive temperature of 10°C (based on laboratory experiments; Orth 1971 qtd. in Fofonoff et al. 2003).

**Sources:**

NEMESIS; Fofonoff 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 4

**Ranking Rationale:**

Although upper 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 (31 to 35 ppt). These salinities occur in a large (>75%) portion of the Bering Sea.

**Background Information:**

This species requires a minimum reproductive salinity of 5 PSU.

**Sources:**

NEMESIS; Fofonoff et al. 2003
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 is currently found from California to southern British Columbia.

**Background Information:**  
This species is currently found in southern BC, and in the U.S. Pacific Northwest from WA to CA.

**Sources:**  
NEMESIS; Fofonoff et al. 2003

1.6 Global ecoregional distribution

**Choice:** A  
In many ecoregions globally

**Score:** 5 of 5

**Ranking Rationale:**  
Polydora cornuta has a global distribution. It is found on both coasts of North America, in Europe, South America, parts of Asia, Australia, and New Zealand.

**Background Information:**  
This species is found in cold- to warm-temperate waters around the world. It is considered cryptogenic in eastern North America, where it occurs from Quebec and Newfoundland south to the Caribbean; it is also considered cryptogenic in Atlantic Europe, where it is found in the Netherlands, Germany, and the U.K., south to Portugal. In Europe, it has also been reported in the Mediterranean, Aegean, and Black Seas. In the southern hemisphere, it is found in South America, Australia, New Zealand. In Asia, it occurs from Taiwan to southern Russia (Peter the Great Bay). It is invasive on the western coast of North America, where it occurs from southern British Columbia to Mexico.

**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:**  
Although this species has a widespread distribution, accounts of its geographic spread suggest that its dispersal is likely due to introductions by human vectors.

**Background Information:**  
This species is being introduced worldwide via ballast water and hull fouling, and has been transported extensively as a result of human activities (Radashevsky and Selifonova 2013).

**Sources:**  
Radashevsky and Selifonova 2013

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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

Has been observed using anthropogenic vectors for transport but has rarely or never been observed moving independent of anthropogenic vectors once introduced

Ranking Rationale:
This species can transport by ballast water, hull fouling, and hitchhiking. Its geographic spread is attributed to introduction by humans (Radashevsky and Selifonova 2013).

Sources:
NEMESIS; Fofonoff et al. 2003    Radashevsky and Selifonova 2013

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

Readily establishes in areas with anthropogenic disturbance/infrastructure; occasionally establishes in undisturbed areas

Ranking Rationale:
In its introduce range, this species is more commonly associated with anthropogenic substrates than natural habitats.

Sources:
Bumbeer and da Rocha 2016    NEMESIS; Fofonoff et al. 2003    Radashevsky and Selifonova 2013

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

No

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

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

<table>
<thead>
<tr>
<th>Choice</th>
<th>Generalist at all life stages and/or foods are readily available in the study area</th>
</tr>
</thead>
</table>

**Score:** 5 of 5

**Ranking Rationale:**
This species has broad dietary preferences, and foods are readily available in the Bering Sea.

**Background Information:**
Larvae feed on phytoplankton, while adults switch between suspension and deposit feeding, consuming detritus, microalgae, and plankton. Predation on bivalve veligers has also been recorded.

**Sources:**
NEMESIS; Fofonoff et al. 2003

#### 3.2 Habitat specialization and water tolerances

<table>
<thead>
<tr>
<th>Choice</th>
<th>Generalist; wide range of habitat tolerances at all life stages</th>
</tr>
</thead>
</table>

**Score:** 5 of 5

**Ranking Rationale:**
This species exhibits a broad range of habitat and water tolerances.

**Background Information:**
This species can tolerate a wide range of temperatures and salinities, and can establish in disturbed or polluted areas (Radashevsky and Selifonova 2013). It can also tolerate hypoxic conditions and is often exposed to environmental extremes.

**Sources:**
Radashevsky and Selifonova 2013  
NEMESIS; Fofonoff et al. 2003

#### 3.3 Desiccation tolerance

<table>
<thead>
<tr>
<th>Choice</th>
<th>Little to no tolerance (&lt;1 day) of desiccation during its life cycle</th>
</tr>
</thead>
</table>

**Score:** 1.75 of 5

**Ranking Rationale:**
The desiccation tolerance of this species is unknown, but studies on related spionid polychaetes suggests that this group has a low tolerance to air exposure.

**Background Information:**
No species-specific information has been found. In Tasmania, infestation of abalones by two polychaetes (Boccardia knoxi and Polydora hoplura) was significantly reduced when fouled abalones were exposed to air for 3 to 8 hours (Lleonart et al. 2003). On average, less than 4 individuals of B. knoxi survived after being exposed to air for 8 hours.

**Sources:**
Lleonart et al. 2003
3.4 Likelihood of success for reproductive strategy

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

Choice: A

Score: 5

Ranking Rationale:
This species exhibits external fertilization, high fecundity, and short generation time. Reproduction is sexual and sexes are separate.

Background Information:
Sexes are separate. Sperm is released in packets called spermatophores; these packets are then taken by females to fertilize her deposited eggs. Eggs are brooded in tubes built by females (Levin 1984). Females can store sperm, and a single spermatophore packet can fertilize several spawning events (Rice et al. 2008). Although single brood sizes are small (between 50 and 200 eggs; Levin 1984), Rice et al. (2008) estimated that P. cornuta females could produce between 26,000 and >31,000 eggs in 90 days under laboratory conditions. Larvae are planktonic. Development rates are affected by temperature and food supply. At 10°C, larvae settled within 60 days; time to settlement decreased to 16-28 days at 12°C, and 12 days at 28°C (qtd. in Fofonoff et al. 2003). Under laboratory conditions, sexual maturity occurred within 33 days at 18°C. Average adult survival was 13 months under controlled conditions.

Sources:
NEMESIS; Fofonoff et al. 2003; Rice et al. 2008; Levin 1984

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

Score: 2.5

Ranking Rationale:
P. cornuta is considered capable of long-distance dispersal, but no quantitative estimates are provided.

Background Information:
Levin (1984) identified the planktonic larval stage as this species' main mode of dispersal. While she considers P. cornuta as a long-distance disperser, she does not define or estimate "long-distance".

Sources:
Levin 1984
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)

<table>
<thead>
<tr>
<th>Choice</th>
<th>High – Exhibits two or three of the above characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>2.5 of 2.5</td>
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</table>

Ranking Rationale:
Larvae are free-swimming and long-lived. Smaller individuals may be dispersed via sediment transport. Adults are sessile and live in tubes; eggs are laid and fertilized in these tubes.

Background Information:
The larval stage is planktonic and long-lived: larvae can remain in the water column for up to 60 days at 10°C, and at least 1 week at 20°C. Levin (1984) considered the larval stage as this species' main dispersal stage, but Shull (1997) documented dispersal of small, recently settled individuals via bedload transport. Adults live in tubes that they build in the substrates, and eggs are deposited and fertilized in these tubes (Rice et al. 2008).

Sources:
NEMESIS; Fofonoff et al. 2003  Rice et al. 2008  Levin 1984  Shull 1997

3.7 Vulnerability to predators

<table>
<thead>
<tr>
<th>Choice</th>
<th>Multiple predators present in the Bering Sea or neighboring regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1.25 of 5</td>
</tr>
</tbody>
</table>

Ranking Rationale:
This species is preyed upon by several species present in the Bering Sea ecoregion.

Background Information:
P. cornuta is preyed upon by fishes and invertebrates including shrimps and crabs.

Sources:
NEMESIS; Fofonoff et al. 2003

Section Total - Scored Points: 23
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

Ranking Rationale:
Although P. cornuta can become a dominant species in certain habitats, its presence has not been linked to the decline or extirpation of other species. At high densities, similar species are known to compete with native polychaetes.

Background Information:
P. cornuta fouls bivalve shells and has been documented feeding on oyster larvae (although species ID is tentative; Breese and Phibbs 1972); however, the effect on oyster fitness and populations is unknown (Fofonoff et al. 2003).

Polydora cornuta is tolerant of polluted sites, and is thus a strong competitor in eutrophic habitats. Once introduced, it can quickly become the dominant species in polluted habitats (Dagli and Ergen 2008; Karhan et al. 2008) and can occur at high densities of several thousand individuals/m2 (Karhan et al. 2008). However, the competitive abilities of P. cornuta in these sites are difficult to determine, because many other polychaetes perform poorly in polluted water (Fofonoff et al. 2003).

A similar tube-building species, Polydora limicola, competed with at least three native species in the Black Sea where it was introduced and became dominant (Losovskaya and Zolotarev 2003).

Sources:
NEMESIS; Fofonoff et al. 2003  Breese and Phibbs 1972  Dagli and Ergen 2008  Karhan et al. 2008  Losovskaya and Zolotarev 2003

4.2 Impact on habitat for other species

Choice: D  No impact

Score: 0 of 2.5

Ranking Rationale:
Impacts on habitat have not been reported for this species.

Background Information:

Sources:
NEMESIS; Fofonoff et al. 2003  Losovskaya and Zolotarev 2003

4.3 Impact on ecosystem function and processes

Choice: D  No impact

Score: 0 of 2.5

Ranking Rationale:
Impacts on ecosystem functions or processes have not been reported for this species.

Background Information:

Sources:
NEMESIS; Fofonoff et al. 2003
4.4 Impact on high-value, rare, or sensitive species and/or communities

**Choice:** C  
Limited – Has limited potential to cause degradation of one more species or communities, with limited impact and/or within a very limited region  

**Score:** 0.75 of 2.5

**Ranking Rationale:**  
Although it may feed on oyster larvae, Polydora cornuta has not been shown to affect population numbers, and no reports exist from natural settings.

**Sources:**  
Breese and Phibbs 1972

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4.5 Introduction of diseases, parasites, or travelers

**Choice:** D  
No impact  

**Score:** 0 of 2.5

**Ranking Rationale:**  
This species is not known to introduce parasites, diseases or hitchhikers.

**Sources:**  
NEMESIS; Fofonoff et al. 2003

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4.6 Level of genetic impact on native species

**Choice:** D  
No impact  

**Score:** 0 of 2.5

**Ranking Rationale:**  
Geographically distinct populations of P. cornuta are able to hybridize under controlled conditions. The ability for P. cornuta to hybridize with other species is unknown, as is the effect of hybridization on populations. Alaska is home to ~50 species of tube-building polychaetes.

**Sources:**  
Rice et al. 2008  
AFSC 2016

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**Background Information:**  
Breese and Phibbs (1972) claimed that P. cornuta ate significant amounts of oyster larvae in a hatchery facility. However, the identification of the polychaete worm was uncertain.

---

**Background Information:**  
Breese and Phipps (1972) claimed that P. cornuta ate significant amounts of oyster larvae in a hatchery facility. However, the identification of the polychaete worm was uncertain.
4.7 Infrastructure

| Choice: | Score: 
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>B</td>
<td>1.5</td>
</tr>
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</table>

**Ranking Rationale:**
P. cornuta is a common fouling organism. Fouling organisms impose substantial economic costs for shipping and other marine industries.

**Background Information:**
P. cornuta is a common and abundant fouler of docks, ships, and other infrastructure. Fouling organisms cost the U.S. Navy over $50 million a year in fuel costs due to drag (Cleere 2001).

**Sources:**
NEMESIS; Fofonoff et al. 2003  Cleere 2001

4.8 Commercial fisheries and aquaculture

| Choice: | Score: 
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>0</td>
</tr>
</tbody>
</table>

**Ranking Rationale:**
This species is not predicted to impact commercial fisheries in the Bering Sea.

**Background Information:**
Although P. cornuta feeds on oyster larvae (Breese and Phibbs 1972), impacts to the fishing or shellfish industry have not been reported (Fofonoff et al. 2003).

**Sources:**
Breese and Phibbs 1972  NEMESIS; Fofonoff et al. 2003

4.9 Subsistence

| Choice: | Score: 
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>D</td>
<td>0</td>
</tr>
</tbody>
</table>

**Ranking Rationale:**
This species is not predicted 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: | Score: 
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>D</td>
<td>0</td>
</tr>
</tbody>
</table>

**Ranking Rationale:**
This species is not predicted to impact recreational activities in the Bering Sea.

**Background Information:**
No impacts have been reported.

**Sources:**
NEMESIS; Fofonoff et al. 2003
### Ranking Rationale:
This species is not predicted to impact human health or water quality in the Bering Sea.

### Background Information:
No impacts have been reported. This species is considered a pollution indicator because of its ability to tolerate polluted areas.

### Sources:
NEMESIS; Fofonoff et al. 2003

<table>
<thead>
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<th>Section Total - Scored Points:</th>
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</tr>
<tr>
<td>Section Total - Data Deficient Points:</td>
<td>0</td>
</tr>
</tbody>
</table>
5. Feasibility of prevention, detection and control

5.1 History of management, containment, and eradication

**Choice:** Attempted; control methods are currently in development/being studied

**Background Information:**
Several methods to control Polydora worms have been tested, including exposure to air and freshwater, chemical methods, and physical removal (Haskin and Calvo 2014).

**Sources:**
Haskin and Calvo 2014

5.2 Cost and methods of management, containment, and eradication

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

**Background Information:**
Control of Polydora sp. infestation on oyster farms requires a moderate investment sustained over time. To date, treatment methods are not fully effective at controlling infestations.

**Sources:**
Haskin and Calvo 2014

5.3 Regulatory barriers to prevent introductions and transport

**Choice:** Regulator oversight, but compliance is voluntary

**Background Information:**
This species is transported by numerous 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.

**Sources:**

5.4 Presence and frequency of monitoring programs

**Choice:** No surveillance takes place

**Background Information:**
We did not find any information to suggest that Polydora cornuta is being monitored in Alaska.

**Sources:**
None listed
5.5 Current efforts for outreach and education

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

**Ranking Rationale:**
We did not find any information on outreach or education programs for this species.

**Sources:**
None listed
Literature Cited for *Polydora cornuta*


- 33 CFR § 151.2050 Additional requirements - nonindigenous species reduction practices


