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## **Predator-Prey Interactions of Hermit Crabs and Sea Stars of the Salish Sea**

### Abstract

Hermit crabs will react with greater evasive maneuvers to larger sea stars than they will to smaller sea stars in a twenty minute timeframe. This will be studied using six *Pagurus sp.* Hermit crabs collected on San Juan island and three species of sea stars collected from San Juan island: *Evasterias troschelii*, *Mediaster aequalis*, and *Crossaster papposus*.

### Background

Hermit crabs are well known and well researched charismatic creatures of the intertidal zone as are sea stars, however there isn't much written about them interacting with each other. This is odd because many sea stars are predatory, with certain species including the *Crossaster papposus* which is looked at in this experiment eating urchins and limpets, respectively spiky and shelled prey items. This would imply that hermit crabs ought to be a potential food source as their shell would not be a deterrent and neither would their pinching claws. Despite this there is little to no literature on sea stars consuming hermit crabs so this study seeks to examine if sea stars do eat hermit crabs using *Pagurus sp.* and observing how these crabs avoid predations from *Evasterias troschelii*, *Mediaster aequalis*, and *Crossaster papposus*.

### Methods

This experiment was performed from 6 *Pagurus sp.* collected from Cattle point, Deadman's Bay, and Argyle lagoon and three Sea stars (*Evasterias troschelii*, *Mediaster aequalis*, and *Crossaster papposus*) collected in the spring quarter with locations unknown. First two hermit crabs measuring 3.5 cm shell diameter were placed in an empty flow table for twenty minutes to acclimate and gather control data. At this point the *Crossaster papposus* was introduced to the table to record for another twenty minutes. After this it was removed and replaced with the *Evasterias troschelii* for another twenty minutes and then removed and replaced with the *Mediaster aequalis* for 20 minutes. This experiment was then repeated with two hermit crabs measuring about 2.5 cm. For the final third

replicate it was repeated with two hermit crabs measuring 1.5 cm. These videos were then watched through to create tables of most relevant data of times the hermit crabs hid in their shells, got within 30 cm of the sea stars, were almost eaten, times directly interacting with the sea stars, and times spent fighting with each other.

### Results

All replicates of *Pagurus sp.* physically interacted with the medium sized sea star *Crossaster papposus* with no consequences more than the other sea stars. All three replicates of *Pagurus sp.* physically interacted with *Evasterias troschelii* and were subsequently nearly eaten by this largest sea star, and indeed it was the only sea star to almost get a bite of them. After escaping from this sea star was the only time any of the hermit crabs showed behavior of hiding in their shells because of the sea stars. *Pagurus sp.* left *Mediaster aequalis* almost completely alone, barely even approaching it.

### Discussion

The results of this study were somewhat surprising, as the hermit crabs showed no real fear or evasive behaviors towards the sea stars they were placed with until the sea stars reacted with predatory intent towards them. This could indicate that sea stars are not normal predators of hermit crabs but were just extremely hungry from the flow tables and *Pagurus sp.* don't have an adapted or learned fear response of sea stars in the wild. This could also be because two of the three hermit crabs that were nearly caught escaped on their own, the third only escaped because the experimental time ran out, so the sea star was removed from the table, revealing the smallest *Pagurus sp.* underneath it. Additionally, none of the *Pagurus sp.* approached the *Mediaster aequalis* and it was unclear if this was because of that sea star specifically or if they were more cautious because that experiment ran directly after *Evasterias troschelii* which was quite predatory with all of them. More data and research needs to be done on this but preliminarily it can be said that *Pagurus sp.* will choose to run away from sea stars over hiding in their shells.

### References

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# **Hermit Crabs v. Sea Stars**

**Fight!**

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# Background

- ▶ Shell crushing crabs, fish, otters
- ▶ What about the smaller intertidal?
- ▶ Sea stars



<https://www.marlin.ac.uk/species/detail/1169>

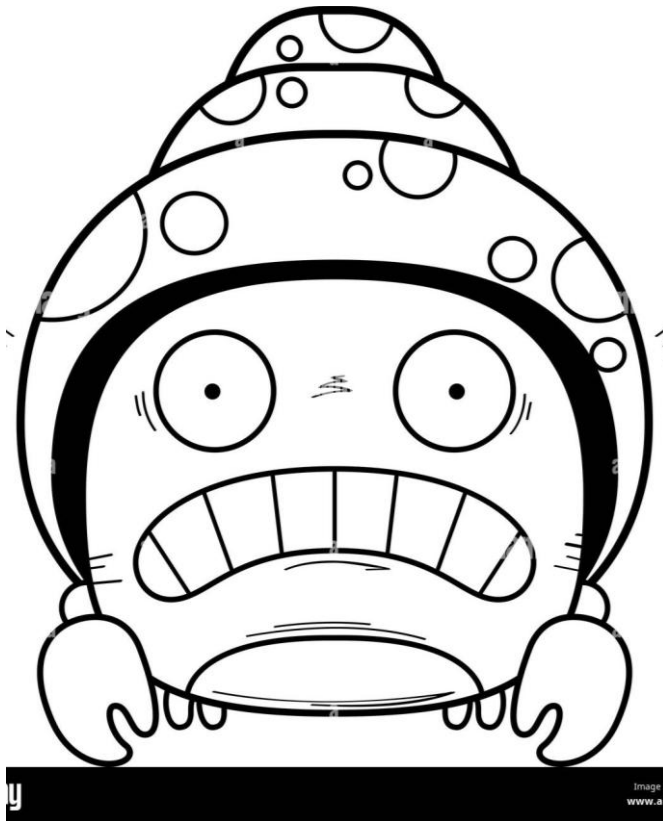
?



<https://www.marlin.ac.uk/species/detail/1192>

# Hypothesis

- ▶ Hermit crabs will react with greater evasive maneuvers to larger sea stars than they will to smaller sea stars in a three-hour timeframe.
- ▶ Hermit crabs are predicted to show most caution towards larger predators such as *Evasterias troschelii* which are not known to eat *Pagurus sp.*
- ▶ *Pagurus sp.* are expected to show differing reactions to *Crossaster papposus* which is the medium size but the most predatory
- ▶ *Pagurus sp.* are predicted to react the least to *Mediaster aequalis* which is the smallest



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# Methods

- ▶ **Specimen Collection**
  - ▶ *Pagurus sp.*, *Evasterias troschelii*,
  - ▶ *Mediaster aequalis*, *Crossaster papposus*
- ▶ **Experiment set up**
  - ▶ Flow table, Cassy's tripod
- ▶ **Data collection**
  - ▶ 3 Sea stars, 6 hermit crabs
  - ▶ **Setback: Storage**
  - ▶ Three hours -> one hour -> twenty minutes

Time within 30 cm of seastar	Control	<i>Crossaster papposus</i>	<i>Evasterias troschelii</i>	<i>Mediaster aequalis</i>
Large <i>Pagurus sp.</i>	N/A	1.5 minutes	10 minutes	1 minute
Medium <i>Pagurus sp.</i>	N/A	4 minutes	9 minutes	6 minutes
Small <i>Pagurus sp.</i>	N/A	6 minutes	20 minutes	0 minutes

# Results

Times <i>Pagurus</i> touched sea star	Control	<i>Crossaster papposus</i>	<i>Evasterias troschelii</i>	<i>Mediaster aequalis</i>
Large <i>Pagurus</i> sp.	N/A	2 times	1 time extended	1
Medium <i>Pagurus</i> sp.	N/A	2 times	2 times	1 time
Small <i>Pagurus</i> sp.	N/A	0 times	Extended touching, 5 times	0 times

Times almost eaten	Control	<i>Crossaster papposus</i>	<i>Evasterias troschelii</i>	<i>Mediaster aequalis</i>
Large <i>Pagurus</i> sp.	0 times	0 times	1 time	0 times
Medium <i>Pagurus</i> sp.	0 times	0 times	1 time	0 times
Small <i>Pagurus</i> sp.	0 times	0 times	1 time	0 times

# Results

Time spent hiding in shell	Control	<i>Crossaster papposus</i>	<i>Evasterias troschelii</i>	<i>Mediaster aequalis</i>
Large <i>Pagurus</i> sp.	0 minutes	0 minutes	2 minutes	0 minutes
Medium <i>Pagurus</i> sp.	2.5 minutes	13.5 minutes	1 minute	0 minutes
Small <i>Pagurus</i> sp.	0	0 minutes	1 minute	0 minutes

Time spent infighting	Control	<i>Crossaster papposus</i>	<i>Evasterias troschelii</i>	<i>Mediaster aequalis</i>
Large <i>Pagurus</i> sp.	0 minutes	0 minutes	0 minutes	0 minutes
Medium <i>Pagurus</i> sp.	1 minute	13.5 minutes	0 minutes	0 minutes
Small <i>Pagurus</i> sp.	0 minutes	0 minutes	0 minutes	0 minutes

# Conclusions

In all but one near fatal incident the Sea star was provoked

Hermit crabs will not stop fighting for a better shell in the presence of a sea star

*Evasterias troschelii* was the most effective

As predicted, *Pagurus sp.* had the most varied reactions to *Crossaster papposus*

*Mediaster aequalis* was of the least concern to *Pagurus sp.*



# Next Steps

- ▶ Repeat this experiment with known shell crushing predators
- ▶ Repeat with different species of Sea Stars
- ▶ Attempt observation of behavior in intertidal to see if this changes things
- ▶ Take this into other projects to further understand uncommon predator-prey interactions in the intertidal

# Acknowledgements & References

- ▶ Friday Harbor Labs
- ▶ Cassy Deblois
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