

Anticipatory antipredator behaviors of *Cucumaria frondosa* (orange-footed sea cucumber) in response to chemical cues from *Asterias rubens* (common sea star)

Sea cucumbers inhabit benthic regions of the North Atlantic Ocean and perform a valuable ecosystem service by recycling nutrients from sunken detritus. Although most sea cucumbers are sediment-feeders, the orange-footed sea cucumber, *Cucumaria frondosa*, is capable of filter-feeding from the water column. Filter-feeding sea cucumbers use their feeding arms, in combination with organs in their body wall, to detect the presence of predators such as the purple sunstar, *Solaster endeca*, and mount defensive behaviors to protect themselves. Another echinoderm inhabiting the Gulf of Maine alongside the orange-footed sea cucumber is the common sea star, *Asterias rubens*. Common sea stars have been reported to prey on sea cucumbers, but not with the same frequency as the purple sunstar. This laboratory study observed 30 orange-footed sea cucumbers using a timelapse camera to record their behavior and analyze their behavioral stress levels on a scale from 0-3 when exposed to chemical cues from common sea stars compared to a control without sea stars present. The highest behavioral score observed during the experiment was 1.0, low stress. Orange-footed sea cucumbers exposed to chemical cues from common sea stars had an average behavioral score five times higher than the control without sea stars. Orange-footed sea cucumbers exposed to common sea stars chemical cues also spent 41% less time with their feeding tentacles extended, and their average behavioral score decreased by 50% after 150 min of treatment. The results of this experiment suggest that orange-footed sea cucumbers experiences low levels of stress when exposed to common sea star chemical cues and provides evidence of adaptive stress responses such as habituation in sea cucumbers.

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