



A secondary chemical cue facilitates juvenile-adult postsettlement associations in red sea urchins

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Limnol. Oceanogr., 50(1), 2005, 354-362 | DOI: 10.4319/lo.2005.50.1.0354

ABSTRACT: Responses to predator odors or chemical alarm cues or both from conspecifics in aquatic systems generally involve a single chemical cue. We report a secondary chemical cue, released by adult red sea urchins after they detect primary chemical cues from a predatory sea star. This secondary cue, which is detected by juvenile urchins, leads to the aggregation of juveniles underneath adults for protection. In choice experiments, juvenile *Strongylocentrotus franciscanus* moved toward adults in response to a chemical cue produced by adults held downstream of a predatory sea star (*Pycnopodia helianthoides*), but showed no such response to predators presented in the absence of adults or when adults were held upstream of predators. Furthermore, this response was size dependent and not symmetrical, since larger urchins did not respond to the secondary cue. This secondary chemical cue system may confer a selective advantage for juveniles, allowing them to balance risk of predation versus competition with adults. This result underscores the significance of postsettlement processes in the recruitment of mobile benthic invertebrates, which in the case of red sea urchins involves a unique behavioral strategy.

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