***Pycnopodia helianthoides* response to feeding in various light intensities**

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Introduction:

The 20 rayed sun star, *Pycnopodia Helianthoides* , is a predatory sea star that lives in the low inter-tidal zone and out to as deep as 400m or more. It feeds on nearly anything it can catch, often eating large crustaceans and clams (Sept, 1999). It is one of the most affective predators and nearly all animals that live on the sea floor are often the lower limiting factor in many intertidal species (Hunter, 2008). *P. helianthoides* shows a strong preference to staying out of direct UV-light exposure from the sun (Kjerskog-agersborg, 1918). It does this both by both passive and active measures, actively staying out of the light. This is why it is difficult to see a *P. helianthoides* unless at a very low tide. Even then *P. helianthoides* is usually still underwater or in crevasses.

The efficiency at which it can over take prey does not mean that *P. helianthoides* is strictly a predator, and has been shown to display scavenger characteristics. In fact, like most carnivores, feeding on dead or weakened animals will be preferred(Brewer, 2005). This is due to energetic costs of associated with hunting, and killing the live prey. This lead to the question, will the *P. helianthoides* enter a brightly lit area to attack injured prey over healthy prey that is in the dark. I hypothesized that it will not enter the lit areas, and will move away from the light regardless of the prey choice associated with each.

Materials and methods:

For this experiment I collected one *P. helianthoides* from Cape Blanco State Park, Oregon. For ease of transport and other logistic issues just one was taken, and it was an adolescent, measuring 25cm in diameter. For prey items cockles, *Lolium temulentum,* were used. A total of 14 cockles were collected from the portside mudflats, in Charleston, OR.

The first set of trials was performed in broad daylight, where two groups of cockles were placed in a water table in the open tank room and the OIMB. There were 3 cockles in each of the two groups and they were placed approximately .5m apart. Then the *P. helianthoides* was placed in the middle of the two groups. It was recorded as "a choice" if the star touched any member of either group. The *P. helianthoides* was then taken out of the tank completly and a minimum of three minutes was given between trials. This was repeated 5 times. The second set of trials, also performed in broad daylight was with one group of healthy cockles and one group of injured cockles. The injured cockles were placed on one side of the tank and the healthy cockles were placed near each other on the opposite side of the tank. The *P. helianthoides* was then placed between them and choices were rendered in the same fashion.

The final three sets of trials were performed at night. The first set was performed with a pile of injured cockles placed in the corner of the tank with a bright light suspended approximately 15cm above the tank. This caused just the injured cockles to be in bright light and the healthy cockles, which were placed on the opposite side of the tank in near dark conditions. The *P. helianthoides* was placed half way in between and choice was rendered in the same way, for 5 repetitions. The next trial was exactly the same except the piles were switched, having the healthy cockles in the light and the injured in the dark. "no choice" was determined when the *P. helianthoides* went away from all prey items, but in all cases

away from the prey was also away from the light. The final trail was performed completely in the dark, having both the group of injured cockles and the group of healthy cockles in the dark.

Results:

P. helianthoids choice in all light conditions

	P. helianthoids choice	Average time
Healthy Cockle	1	1:35
Injured Cockle	2	1:40
No choice	2	1:30

P. helianthoids choice with injured Cockles in light

	P. helianthoids choice	Average time
Healthy Cockle	2	:45 sec
Injured Cockle	0	N/A
No choice	3	:45 sec

P. helianthoids choice with healthy Cockles in light

	P. helianthoids choice	Average time
Healthy Cockle	1	2:00
Injured Cockle	1	:45 sec
No choice	3	:48 sec

P. helianthoids choice in all dark conditions

	P. helianthoids choice	Average time
Healthy Cockle	0	N/A
Injured Cockle	1	:22 sec
No choice	4	1:23

Discussion:

The *P. helianthoids* overall showed a significant lack in response to dead or injured cockles. In a total of 20 trials the *P. helianthoids* chose the injured cockles just four time, 20% of the time. This is significantly different than the literature that showed the *P. helianthoids* would feed on injured prey at a rate greater than 80% when given the choice of injured or healthy (Brewer, 2005). This could have been

due to a number of different sources of error. First, this was performed in a open water tank with flowing water so the chemoreceptive ability may have been negated by new water coming in the tank, thus the *P. helianthoids* would have a more difficult time making a choice based upon the state of the cockle. A second source of error in the experiment could be from the fact that it is unknown when the *P. helianthoids* last feed. It stayed in the open tank room for approximately 6 days before the experiment, but due to slow metabolic rates it could simply have not been hungry. Overall the *P. helianthoids* showed almost affinity for feeding on injured prey, but it did not show a preference for healthy cockles. The *P. helianthoids* toward the healthy cockles a total of 5 times, just 25% of the total trials. Neither of these feeding strategies was shown to be strongly favored by the *P. helianthoids.* Overall the only real choice that the *P. helianthoids* seemed to show was the dislike of being exposed to direct light when the choice of darkness was available.

During the 10 trials that were performed with the cockles in the dark with a light spot in the tank only once did the *P. helianthoids* choose to move into the light. This is the strongest set of data this exploratory showed, with the *P. helianthoids* showing a very strong preference to move away from the light. This seemed like a predictable response based upon the biology and natural distribution of the *P. helianthoids*. Another key factor is the average time it took the *P. helianthoids* to make a choice. In all of the trials that were performed at night the average time it took for a decision was about half as long as when replicated in all light conditions. It seemed that during the day, when there is strong light from all sides the *P. helianthoids* has a tougher time making decisions, but at night it decisively moved away from light. Based upon the time it took and the rate that it moved, which was not recorded other than personal observation, the light seems to be much more of a motivating factor in the behavior of the *P. helianthoids.*

If this exploratory could be done again I would have done it in a few different ways. First I would use more than one individual. This could help to eliminate some errors, such as the state of hunger in the predator. Also, the lighting could be performed in different ways, such as with the use of a barrier, or using natural light funneled into particular region. This is not to say that this data does not show any preference in behavior in the *P. helianthoids.* All in all it does appear that they *P. helianthoids* does have a strong preference to avoiding light, and atleast in this trial there is no preference to eating dead or injured animals.

Works cited:

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