# Pairing Behavior in Thick-Clawed Porcelain Crabs

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## Introduction

The Thick-Clawed Porcelain Crab, *Pachycheles rudis*, is an Anomurans Decapod of the family Porcellanidae. It has three pairs of walking legs and a pair of proportionally large chelopeds for its size, up to ¾ inches wide in terms of carapace [1]. These crabs are found under rocks, usually in pairs, and among empty burrows of rock-dwelling clams or sheltered low intertidal to sub-tidal (to 95 feet deep) waters [1]. These animals range from Kodiak, Alaska all the way south to Baja, California [2]. They are also known filter feeders, utilizing specialized mouthparts to strain out plankton and other microscopic food morsels [3]. Male and female *P. rudis* grow to the same size, which is unusual and certainly uncommon in many crab species [4]. Porcelain crabs are commonly noted as possessing large, asymmetrical chelopeds and posterior portions of their carapace, consisting of multiple pieces separated by membranous tissues [5]. The most interesting descriptive characteristic as far as this exploratory is concerned is the fact that *P. rudis* is almost always found in pairs. This fact itself is just random trivia, but what if the pairing of these crabs is not quite as random. I propose that this pairing is important in terms of reproductive effort, and further believe that these individuals making up the pairs can relocate their mate when separated over a reasonable distance.

**Methods**

All 11 specimens examined were collected from Coos County, Oregon. They were collected at several locations to minimize local variables that were out of experimental control. In addition, the specimens were all of similar size, allowing the elimination of another variable in effective individual recognition. Each crab was marked with an easily identifiable coat and pattern of nail polish on their carapace. Multiple colors were also utilized to make the identification process much simpler. The crabs were then set up in a large open Tupperware container, able to accommodate 15-20 rocks of different sizes, textures, and mineral compositions, taken from the environments the crabs were found in. The rocks were laid out in the container to maximize environmental variability factors, including rocky surfaces out of contact with water, sheltered crevices, rock-nestled clam holes, and flat surfaces among others. The container was filled halfway with seawater to allow some rocks to break the water surface, and an air stone was added to the experimental environment. The container did not have holes in the side, so a water hose was not left in the container to circulate water. Instead, the water was changed at least every 24 hours during the entire course of the experiment. Each initial pair of *P. rudis* collected was then separated on opposite sides of the container, with the rocks creating multiple barriers to both visual identification and chemical cue transmission. Observations were then noted at 30-minute intervals in blocks of no less than 3 hours over the course of 3 days. The crabs were relocated back to opposing sides of the container after each observation.

## Results

There were 20 different trials of pairing behavior observed over the course of 3 days. The complete results can be found within the table in the appendix. Of 100 possible pairing opportunities of the more than 200 individual observations made, the crabs were found to be in pairs 78% of the time. The selected *P. rudis* were also identified as being part of the initially noted pairs 39% of the time. The 11$^{th}$ crab included in the trials made a complete pairing off of all included test subjects impossible. After the third day's worth of testing periods, one of the test subjects was found dead, and further testing was discontinued.

## Discussion

The results strongly suggest that *P. rudis* strongly prefers the paired dynamic when choosing a living situation. Almost 80% of the time, the crabs were found to be part of a pair, in contact or within 5 cm of another crab. This is strong evidence, supported by many of the consulted reference materials, that these crabs are behaviorally adapted to this living situation. Of these paired crabs, half of them chose their initial partner, the one they were found with and captured with in the field. This suggests that *P. rudis* very well might have a method for distinguishing individuals apart from one another. The exploratory methods did not allow for determination of how exactly *P. rudis* accomplishes this identification. There is a strong chance that there are visual as well as chemical cues that allow for individual identification among these Thick-Clawed Porcelain Crabs. Further exploration is needed to determine which of these methods are used, or if both are, how exactly they are utilized in conjunction with one another. There is also a chance that the results may have been influenced by unintentional experimental error. During the course of experimental observation, 9 of the 11 crabs lost their distinguishing nail polish marks. Before painting, however, individual features and unique characteristics were noted about each crab, as a preventative measure in case the primary identification markers were lost. There is a chance that some crabs may have been misidentified by human error, but I believe that chance is fairly remote as most of the crabs had strong identifying characteristics including, but not limited to, marks on chelopeds, missing walking legs, missing chelopeds, scars on the dorsal surface of the carapace, and tiny barnacles encrusted on the carapace and legs. While the results are by no means conclusive and definitive proof that *Pachycheles rudis* can identify its mate within its environment, even when separated, that assertion is supported substantially by this work. It would be beneficial to test this theory with a much increased sample size out in a more controlled region of open water that can be easily observed over time, and that would be the logical next step for this hypothesis.

**References**


1. Sept, J. Duane. The Beachcomber's Guide to Seashore Life in the Pacific Northwest. Madeira Park, BC, Canada: Harbour Publishing, 1999.

2. Lamb, Andy, and Bernard P. Hanby. Marine Life of the Pacific Northwest: A Photographic Encyclopedia of Invertebrates, Seaweeds and Selected Fishes. Madeira Park, BC, Canada: Harbour Publishing, 2005.

3. MacGinitie, G.E.. "Notes on the Natural History of Several Marine Crustacea." American Midland Naturalist 18. 1031-1037.

4. Jensen, Gregory. Pacific Coast Crabs and Shrimps. Monterery, CA: Inter Print, 1995.

5. Rodriguez, IT, G Hernandez, I Magan, JA Bolanos, DL Felder. "Larval Development of Pachycheles Serratus Under Laboratory Conditions With Notes on the Larvae of the Genus." Journal of Crustacean Biology 24(2004): 291-308.


Typical pair arrangement
plate magnification 3X
(1cm above = 3cm true measurement)

# Appendix

Initial Pairs (subsequent matches of initial pairs in bold)

| 1st crab | 2nd crab |
|---|---|
| **purple dot** | **normal crab** |
| **purple all over** | **white** |
| **orange all over** | **teal dot** |
| **orange stripe** | **teal stripe** |
| **pink glitter** | **normal w/o left chelo** |
| **butt purple** | **N/A** |

7/27/07 1420 PDST

| 1st crab | 2nd crab |
|---|---|
| **orange all over** | **teal dot** |
| **white** | **purple all over** |
| teal stripe | normal w/o left chelo |

7/27/07 1450 PDST

| 1st crab | 2nd crab |
|---|---|
| orange all over | purple dot |
| teal dot | normal crab |
| teal stripe | purple all over |
| **normal w/o left chelo** | **pink glitter** |

7/27/07 1520 PDST

| 1st crab | 2nd crab |
|---|---|
| orange all over | purple dot |
| teal dot | pink glitter |
| purple all over | normal crab |
| orange stripe | normal w/o left chelo |

7/27/07 1550 PDST

| 1st crab | 2nd crab |
|---|---|
| pink glitter | white |
| normal w/o left chelo | purple dot |
| orange stripe | butt purple |
| **teal dot** | **orange all over** |

7/27/07 1620 PDST

| 1st crab | 2nd crab |
|---|---|
| teal stripe | orange all over |
| **purple dot** | **normal crab** |
| **pink glitter** | **normal w/o left chelo** |
| purple all over | orange stripe |

7/27/07 1650 PDST

| 1st crab | 2nd crab |
|---|---|
| **purple dot** | **normal crab** |
| orange all over | purple all over |
| orange stripe | pink glitter |
| butt purple | normal w/o left chelo |

7/28/07 1055 PDST

| 1st crab | 2nd crab |
|---|---|
| butt purple | teal stripe |
| **normal crab** | **purple dot** |
| **purple all over** | **white** |
| **orange all over** | **teal dot** |
| pink glitter | orange stripe |

7/28/07 1125 PDST

| 1st crab | 2nd crab |
|---|---|
| **pink glitter** | **normal w/o left chelo** |
| **orange stripe** | **teal stripe** |
| **orange all over** | **teal dot** |

7/28/07 1155 PDST

| 1st crab | 2nd crab |
|---|---|
| butt purple | teal stripe |
| **purple dot** | **normal crab** |
| **white** | **purple all over** |
| **orange all over** | **teal dot** |

7/28/07 1225 PDST

| 1st crab | 2nd crab |
|---|---|
| **white** | **purple all over** |
| **orange all over** | **teal dot** |
| **orange stripe** | **teal stripe** |
| **purple dot** | **normal crab** |

7/28/07 1255 PDST

| 1st crab | 2nd crab |
|---|---|
| **purple dot** | **normal crab** |
| **orange stripe** | **teal stripe** |
| **orange all over** | **teal dot** |
| **white** | **purple all over** |

7/28/07 1325 PDST

| 1st crab | 2nd crab |
|---|---|
| **purple dot** | **normal crab** |
| **white** | **purple all over** |
| butt purple | pink glitter |
| **orange all over** | **teal dot** |

7/28/07 1355 PDST

| 1st crab | 2nd crab |
|---|---|
| **purple dot** | **normal crab** |
| **white** | **purple all over** |
| butt purple | pink glitter |
| **orange all over** | **teal dot** |

## Appendix

7/29/07 800 PDST

| 1st crab | 2nd crab |
|---|---|
| purple all over | normal crab |
| **orange all over** | **teal dot** |
| white | teal stripe |
| pink glitter | orange stripe |

7/29/07 830 PDST

| 1st crab | 2nd crab |
|---|---|
| **white** | **purple all over** |
| **orange all over** | **teal dot** |
| butt purple | pink glitter |

7/29/07 900 PDST

| 1st crab | 2nd crab |
|---|---|
| **teal stripe** | **orange stripe** |
| **teal dot** | **orange all over** |
| **pink glitter** | **normal w/o left chelo** |

7/29/07 930 PDST

| 1st crab | 2nd crab |
|---|---|
| white | pink glitter |
| orange all over | orange stripe |
| teal dot | butt purple |
| purple all over | normal crab |

7/29/07 1000 PDST

| 1st crab | 2nd crab |
|---|---|
| butt purple | teal dot |
| **normal w/o left chelo** | **pink glitter** |
| **orange stripe** | **teal stripe** |
| purple dot | orange all over |

7/29/07 1030 PDST

| 1st crab | 2nd crab |
|---|---|
| teal dot | butt purple |
| **normal w/o left chelo** | **pink glitter** |
| normal crab | orange stripe |
| orange all over | purple dot |

7/29/07 1100 PDST

| 1st crab | 2nd crab |
|---|---|
| pink glitter | teal stripe |
| orange all over | white |
| butt purple | teal dot |
| orange stripe | purple dot |