tiny hands & shattered arms

How kids affect sea star regeneration in touch tanks

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Are you concerned with the health of your touch tank critters?

The University of Georgia Marine Education Center and Aquarium operates an education facility and public aquarium year-round on Skidaway Island near Savannah, Georgia. Each year thousands of K-5th graders participate in a two-hour program, which includes learning about and handling our touch tank animals. The menagerie that is presented to students often includes *Luidia clathrata*, the slender sea star, which is common along the beaches of Georgia. Because *Luidia* feeds well in captivity and is not usually perceived as a threatened species, it is a very suitable touch tank animal for younger students to study.

About 86% of individuals in a wild population of *Luidia* experience arm loss (Lawrence and Dehn 1979), so it is no surprise that our touch tank animals are in varying states of repair when they are first caught. However, even without a full complement of arms, our sea stars feed well.

We wanted to understand the human handling effects on sea stars as they relate to the health of the animals used in our programs. Each sea star can receive daily "attention" from up to 60 pairs of hands during a 30-minute span. If handled too often, sea stars that reside in touch tanks have been known to fall apart in one's hands.

How much stress are we putting on our touch tank animals by handling them, and how can we quantify that stress? If a sea star previously had 3.5 arms, for example, how long would it take to regenerate the arms under continual handling compared to animals in a similar state of repair that were not handled at all? We make the assumption that the measured regeneration rates of non-handled sea stars represent "normal" regrowth. We also assume that stress (i.e. handling) interferes with the "normal" regeneration rate. Thus, we hypothesize that the regeneration rates of sea star arms in non-handled sea stars will be greater compared to the regeneration rates of handled sea stars.

Sea stars collected in Wassaw Sound by our research vessel, the Sea Dawg, were acclimated to an indoor flow-through touch tank system for 81 days. During this time, they were fed fish every Monday, Wednesday and Friday. Once acclimated, the sea stars underwent minor surgery. We cut two

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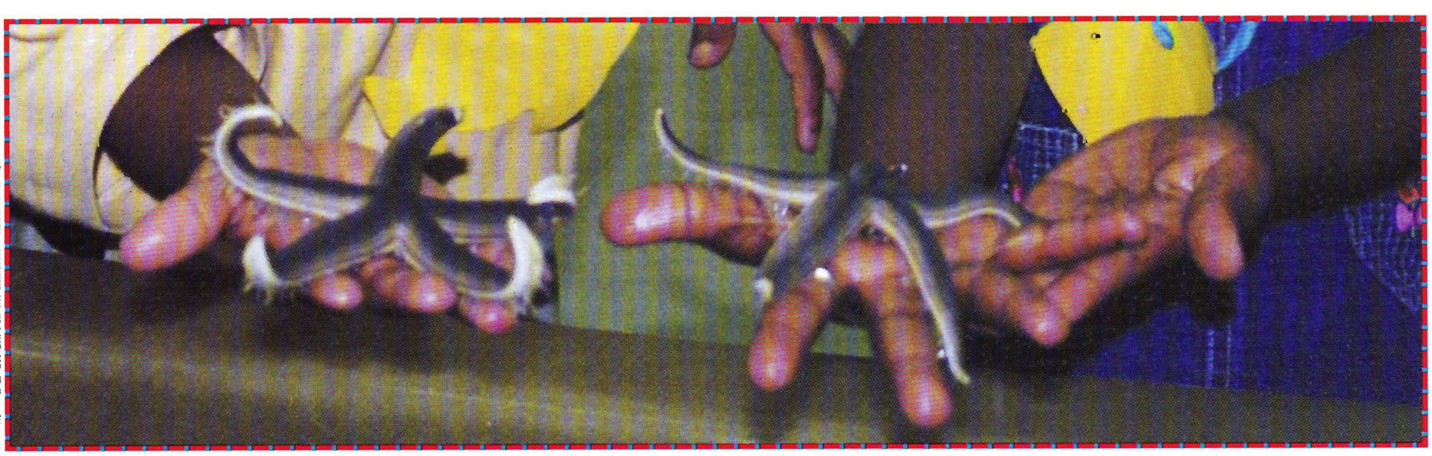

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adjacent arms off each sea star for the purpose of measuring arm regeneration rates in our experiment.

Our experimental design consisted of 32 sea stars in all: 16 controls (non-handled) and 16 "handled" treatments. Each sea star was contained in a separate compartment of the flow-through tank, and fed normally during the three-week experiment. The controls were only handled during arm length measurement once per week. The 16 "handled" sea stars received the daily treatment we call the "Flip and Dip": Volunteers removed each sea star from the water, flipped the animal over in their hands every 30 seconds, then dipped it into the saltwater for five seconds to rehydrate. This procedure was repeated for five minutes. By doing so, we hoped to produce the same kind of stressful situation that the sea stars experience during the handling portion of our touch tank programs. At the week's end, every arm of each sea star was measured and recorded.

What we found was not a shock. During the first week neither the handled nor the control sea stars regenerated new arm tips. Wound healing was observed, however. Organisms began to regenerate new arm tips during week 2. At the end of this week, the average length of the regenerated arm tips of the control animals measured 2.6 mm. Individuals in the control treatment had grown slightly more compared to those in the handled treatment (average regenerated arm length of 2.3 mm); however, this difference was not significant (T-test, $P<0.13$). At the conclusion of the experiment (week 3), the control organisms' average regenerated arm length measured 5.5 mm. This was one millimeter more than the handled treatment (average regenerated arm length of 4.5 mm). Statistical analysis showed a highly significant difference between the length of the arm tips of control and handled organisms for total growth in three weeks (T-test, $P < 0.00$). Growth of the organisms, defined as the average increase in length of regenerated arm tips from week to week, also showed a significant difference from week 2 to 3 for control and handled treatments (T-test, $P < 0.00$). Control organisms grew 0.8 mm more on average than sea stars in the handled treatment.

After concluding the experiment, we continued to feed all experimental animals, but did not touch them for an additional 20 days. After 20 days all sea stars were measured again. Surprisingly, the control group had an average regenerated arm length of 6.61 mm, and the handled sea stars had an average regenerated arm length of 3.34 mm. Is this a delayed stress response? How long, if ever, would it take for the control and handled groups to have equal regeneration rates? We weren't able to find out this time, but the research continues. We have, however, learned how to best rotate sea stars in order to promote rather than inhibit arm regeneration. We now rotate the sea stars out of the touch tank after one week of handling and place them into a retirement home. After one month we may use them again. As in all research, this study has generated further questions regarding ways to keep our animals healthy. We hope this report encourages further research projects on the rotation of touch tank animals.

Lawrence, J.M. and P.F. Dehn, 1979. Biological characteristics of *Luidia clathrata* (Echinodermata: Asteroidea) from Tampa Bay and the shallow waters of the Gulf of Mexico. Florida Science. 42; 9 - 13.

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