

Summary of the use of sex pheromones to control the invasive green crab, *Carcinus maenas*. Sylvia Yamada yamadas@oregonstate.edu Feb 2024.

Sylvia Yamada has been working with Dr. Joerg Hardege of the University of Hull in the United Kingdom for several years to test the feasibility of using sex pheromones to control green crabs in the field. Joerg is a chemical ecologist who isolated the green crab sex pheromone, or molting hormone. Male crabs are highly attracted to this chemical in a lab setting. For example, if a golf ball is coated with this pheromone, the males will try to mate with it. The chemical cues are so strong that they appear to override both tactile and visual cues.

Joerg produced the pheromones in his lab, embedded them into gel capsules, freeze dried them and shipped them to me via FedEx. We have had some positive results, for example, in 2018 we showed that pheromones attract crabs in the field significantly more than no scent controls, and at the same rate as tuna bait. (See attached progress report.)

Subsequently, we were not as successful. We had problems with the formulations. Once Joerg's student helper made the concentration too weak. The other time the formulation was too strong, and all the treatments collected a similar number of green crabs. We compared these results to entering a room where one person is wearing a lot of perfume, or after-shave. The whole room smells, and one cannot locate the person who is actually wearing the scent. The last time Joerg's lab tried to send pheromones, the shipment was lost. That is when I decided not to pursue this project any longer.

Here are the bottle necks that need to be overcome:

- I recommend that this project can only be pursued if the pheromone can be produced locally. Shipping of the pheromone was a major problem. Once the shipment was held up by US Customs for days. Once the US experienced a heatwave and the pheromone denatured during shipment. In 2021 the shipment was lost.
- There is only a small window in time when pheromones can be used to attract crabs. Crabs must be in reproductive condition, e.g. water temperatures need to be ≥ 15 deg C. Also, the pH must be around 8. If it is too acidic the pheromone changes its 3-dimensional shape and the crabs do not respond to it.
- While we have shown that pheromones under the right conditions, attract significantly more crabs than no-scent controls, this is not enough. Pheromones need to work at least an order of magnitude greater than tuna bait to be a useful control for green crabs in the field.
- The pheromone attracts males and females. It is the females that need to be targeted if our goal is to reduce the breeding population.
- Joerg also developed a deterrent that I did not get to test. A deterrent that repels green crabs, without affecting prey populations, could be used to keep green crabs out of shellfish and eel grass beds.

In summary, there is promise in using chemicals to alter the behavior of green crabs by either attracting them to traps or repelling them from sites we want to protect. The use of pheromones to control insects and lamprey have a long history. It took ≥ 5 decades and millions of dollars before pheromones could be used to control insect pests in the field. To my knowledge, pheromones have not been successful in controlling lampreys in the Great Lakes.

If anyone is interested in pursuing pheromone control in the future, Sylvia and Shon Schooler of SSNERR Shon.SCHOOLER@dsl.oregon.gov are willing to share their proposal with them.