How should Washington State Sustainably and Effectively Respond to a Persistent and Predatory Invader, the European Green Crab (Carcinus maenas)?

**Researcher:** Sam Sidders  
**Home College:** Williams College

**Executive Summary**

Five years ago, few Washingtonians had heard of the European Green Crab. By 2021, however, the invasive predator had taken over state waters, threatening native species and destroying critical habitat. In this brief, I consider how the state of Washington can and should respond to a persistent and predatory invader, the European Green Crab (EGC) (Carcinus maenas).

The EGC was first discovered in Washington in 1998, and its populations have since skyrocketed in both coastal and inland waters (the Salish Sea and Puget Sound). EGC hotspots include the Lummi Sea Pond on the Lummi Reservation, Makah Bay on
the Makah Reservation, Gray’s Harbor, and Willapa Bay, which the Shoalwater Bay Nation Reservation borders (see map).

The ECG is a voracious and incredibly destructive predator, consuming large amounts of shellfish, outcompeting local species (such as the iconic Dungeness crab), and decimating eelgrass beds, which provide critical habitat for juvenile salmon and native crabs. As a result, stakeholders in this issue include shellfishers, fishers, consumers of Washington fish and shellfish, Native American tribes in the Pacific Northwest, scientists and conservationists, the state and federal government, and Washington taxpayers.

In response to the invasion, Washington Governor Jay Inslee issued an Emergency Proclamation on January 19, 2022, ordering the Washington Department of Fish and Wildlife (WDFW) to do what was needed to “effect the eradication of or to prevent the permanent establishment and expansion of” the EGC (Emer. Proclamation No. 22-02). The Washington State legislature appropriated $8,568,000 (for the 2022 and 2023 fiscal years) for the WDFW to carry out the Governor’s orders. To date, the WDFW has largely spent this money on an effort to trap EGCs, as trapping is agreed to be the most efficient method of removing EGCs from the environment. However, it is now commonly recognized that eradication of the ECGs is not possible—the WDFW admit that they are now trying to “control” EGC populations and minimize their impact
on locally important environmental, economic, and cultural resources (WDFW website). The current approach to EGC management needs to be changed because it is not economically sustainable in the long run. Since EGCs will never disappear, trapping will have to continue for the foreseeable future, but the costs of trapping cannot continue to be millions of dollars a year.

I recommend that the WDFW redistribute their emergency funding more equitably, remove EGCs from the Prohibited species list, and roll out an updated Green Crab coordinated response plan as quickly as possible.

**Background Information**

European Green Crabs (EGCs) (*Carcinus maenas*) (see image left), native to European and North African coasts, first arrived on the American west coast through either ballast water exchange or a shipment of live bait. Since then, the crabs have spread northwards into Pacific Northwest and British Colombia, and, most recently, Alaska. In Washington, EGCs were first identified in coastal waters in 1989, and populations have since spread due to the transport of planktonic larvae in ocean currents. The crab is now established along the outer coast, in the Salish Sea, and in northern Puget Sound, with hotspots in the Lummi Sea Pond on the Lummi Reservation, Makah Bay on the Makah Reservation, Gray’s Harbor, and Willapa Bay, which the Shoalwater Bay Nation Reservation borders (see map in **Executive Summary**).
EGCs eat primarily shellfish and are voracious predators. According to the USGS, they can eat up to 22 clams per day. Shellfishing is an incredibly important industry in Washington, contributing $270,000,000 annually to the state’s economy and employing more than 3,200 people (WDFW). Thus, shellfisheries, their employees, and the economy are at major risk from the EGC invasion. EGCs also destroy eelgrass beds, which host a plethora of native juvenile fish (including salmon) and Dungeness crabs (Metacarcinus magister). Both salmon and Dungeness crabs, along with other shellfish, are incredibly culturally and economically significant to many Native American tribes along the coast of the Pacific Northwest–for example, the Lummi Nation emphasizes salmon’s importance to subsistence, ceremonial practices, and economic growth (Lummi Nation Natural Resources). Additionally, eelgrass plays a role in trapping sediments, so the EGC’s destruction of eelgrass exacerbates shoreline erosion rates, which are already a concern in Puget Sound in particular (Washington Department of Ecology). In short, EGCs have the potential to disrupt Native foodways and traditional practices, commercial and recreational fishing and shellfishing, job security for fishers and shellfishers, shoreline stability, and the health of aquatic ecosystems.

Understanding these possible impacts, Washington Governor Jay Inslee passed an Emergency Proclamation on January 19th, 2022 at the request of the Washington Department of Fish and Wildlife (WDFW) after the population of EGCs on the coast of Washington and in Puget Sound increased by almost 5,500% between 2019 and 2021 (see graph) (USGS). In his proclamation, Inslee acknowledged the seriousness of the possible impacts of the EGC and ordered the WDFW to “begin implementation of
emergency measures as necessary to effect the eradication of or to prevent the establishment and expansion of the European green crab.” (Executive Proclamation 22-02). In response, the Washington state legislature appropriated a two-year fund of $8.568 million to the WDFW to carry out the governor’s orders.

Today, the WDFW is working closely with groups such as Washington Sea Grant and tribal communities to trap EGCs, as they consider trapping to be the best option for removing the crabs from the surrounding environment. Trapping efforts, however, are limited to approved agencies. EGCs are classified as “Prohibited Level 1” in Washington, which means they are illegal to possess (RCW 77.135.030).

Therefore, no civilians can assist in controlling ECG populations through independent trapping efforts.

**Analysis of Current and Proposed Policy**

**Introduction**

Washington’s current methods of crab removal—spending millions of dollars annually on the WDFW and Sea Grant’s trapping efforts—are not economically sustainable. However, giving up on controlling EGC populations would be disastrous both to coastal ecosystems and to all relevant stakeholders. I list proposed possible policy solutions below.
Re-distribution of emergency funds for FY 2023 and beyond

In a published Zoom recording of a “stakeholder meeting,” the WDFW revealed the breakdown of their appropriated $8.6 million in funding (WDFW 2:22:22). They gave ~$2 million to the Lummi Nation and $500,000 to the Makah Tribe. Indeed, both the Lummi Reservation and the Makah Reservation have seen shockingly high numbers of EGCs. However, so have other tribes, such as the Shoalwater Bay Indian Tribe (SBIT), to which the WDFW denied funding. Larissa Ritzman, an employee of the Shoalwater Bay tribe, has been cited in an NPR saying, “I don’t think Willapa Bay and Shoalwater Bay Indian Tribe are being given respect” (Lombard). In a WDFW published Stakeholder meeting, Ritzman noted that lack of funding is making it difficult for them to “ramp up” trapping efforts this year (WDFW 38:40). The WDFW did suggest that coastal tribes look for grant funding from sources outside the WDFW (such as NOAA) (2:38:35).

Removal of crabs from Prohibited Species list

Removing EGCs from the Prohibited species list would allow for two policy options, listed, and explained below.

a. Creation of a fishery

In Oregon, another state faced with an EGC invasion, the ODFW has chosen to combat the crab by creating a fishery for it. Rather than prohibiting people from possessing EGCs, as Washington has done, they have a daily catch limit of 35 per person, which was recently increased from 10 in August of 2022. Indeed, creating a fishery for the EGC in Washington would reduce trapping costs for the state, as they would not have to pay members of the public for their “work.” The added hands to the trapping effort would help remove more EGCs from their environments more quickly.
Plus, people want to get involved in the effort. User “WillFish4Food51” on an ifish.net forum claimed that if the WDFW “put out the call for volunteers they could have 1000 boats and 10,000 pots to remove and document where the crabs are at or aren't,” and announced that he would fish for EGCs himself regardless, “and if they catch me they can write me a ticket for illegal fishing [...] I will take my chances with a judge” (ifish.net).

Allen Pleus, the Aquatic Invasive Species Coordinator at the WDFW, voiced concerns about creating a fishery for the EGC. First among them was incorrect species identification—EGCs look very similar to native crabs such as the Dungeness, which could be overfished if continually mistaken for EGCs (see images below for comparison).

Pleus also cited safety concerns: EGCs inhabit mud plains and are essentially impossible to access without an airboat (see image right, from Ryan). He claimed that inexperienced shellfishers might not be prepared for the treacherous conditions, and liability could fall on the WDFW. Finally, Pleus also noted that EGCs tend to be smaller
and have far less meat than the often-eaten Dungeness crab, so, for many people, the reward of eating EGCs is not at all worth the effort.

b. *Creation of a bounty system for EGCs*

Pleus mentioned that some have suggested a bounty system be created to control EGC populations. A bounty system would certainly keep the public motivated to trap EGCs, as they would be financially rewarded for each crab trapped, but, Pleus noted, there are many concerns. The misidentification and safety concerns that might arise in a fishery would also be present in a bounty system. Further, such a system might become expensive for the state. Finally, the WDFW has concerns about people intentionally introducing EGCs in other areas so as to increase their catch, and, therefore, financial gain.¹

*Alternative methods of removal*

Some, especially members and employees of the Lummi Nation, are considering alternative methods of EGC removal, both physical and chemical. Members of the Lummi Nation are considering using rotenone, a powerful chemical, to wipe out all EGCs in the Lummi Sea Pond (LSP), which is a hotspot. They are also considering doing a bottom-trawl of the LSP. These methods save both time and energy, which makes them appealing. However, rotenone and other herbicides can only be used in areas that can be completely sectioned off from the open waters because they must

¹ All opinions from Allen Pleus originate from personal communication with him.
maintain a certain concentration of poison for it to be effective. Members of the Lummi Nation understand that areas subjected to either herbicide or a bottom trawl must also be cut off from open waters to avoid re-exposure to EGC larvae. The LSP has gates that, if repaired, could section off the LSP from the surrounding waters, which would allow for rotenone or a bottom trawl. Repairing the gates could also allow for aquaculture practices to resume in the LSP, which was its intended purpose. However, repairing the gates would be costly, and both methods would either remove all living organisms in the pond. Therefore, Lummi Nation members understand that these methods are a last resort.

These alternative methods are only being considered for the LSP at the moment. Trapping is the only known effective method for open waters.

*Redistribution of management*

According to Allen Pleus, the WDFW wants to shift the management of EGC trapping efforts to smaller, more local groups. The department itself would oversee these efforts but would not be spearheading all the trapping efforts with its own (and affiliated) staff. In 2019, when EGC numbers were still low, the WDFW published a “Salish Sea Transboundary Action Plan” on how to tackle the invasion. The document is now outdated, and stakeholders, especially the SBIT, are “waiting for the department of fish and wildlife to really have a plan” (Ritzman in Lombard interview). The details of this plan are unclear, but Pleus has assured that the WDFW is “working on it.” Presumably, shifting trapping efforts to local groups would reduce costs for the state while granting local communities more autonomy over their respective responses to the invasion. However, it is difficult to know for sure, as a plan has not been published.
Recommendations for Change

I recommend the following policy changes:

*Redistribute emergency funds more equitably*

The WDFW should equitably redistribute its emergency funds for the 2023 fiscal year. I believe it is unfair to directly fund two impacted tribes while denying funding from others and telling them to find money elsewhere. The WDFW should either fund all heavily hit tribes or cut all tribal funding, encouraging all to seek external grants. If they choose to fund all tribes, they will have to face the challenge of determining how much money each tribe gets, based on a variety of factors.

*Remove EGCs from Prohibited species list and create a fishery*

Both Oregon and California have opened a fishery for EGCs and have done so without any safety incidents or reported issues with misidentification with Dungeness crabs. Washingtonian fishers and shellfishers want to get involved in controlling EGC populations for their own benefit, and I do not believe the state should prevent them from doing so. Those who own crabbing equipment are most likely able to correctly identify crab species, so species identification mishaps should be few and far between. Additionally, there are no endangered crab species in the state, so misidentifications would not be putting any species at immediate risk for survival. I do not believe a bounty system should be implemented, mainly due to the risk of fraud and the financial expense to the state.

*Err on the side of caution with rotenone and bottom trawling*

As emphasized by members of the Lummi Nation, rotenone and bottom trawling should only be deployed in the LSP and other hotspots (if they exist) that can be
completely cut off from larval inflow, and only in a last-resort situation. The cost to rebuild the enclosure gates for the LSP is likely large, and the poison will kill everything in the pond. Additionally, if the poison/bottom trawling methods are used, they must keep the gates shut indefinitely to not allow larval reentry. This opinion is in line with that of the Lummi Nation, as they understand the risks and costs of these methods.

Create and release a comprehensive plan for EGC management as soon as possible

The WDFW needs to release its plan for EGC management to its stakeholders as soon as possible. Even if the plan is not polished, I recommend they inform stakeholders of its components or key takeaways. The stakeholders are waiting for a clear idea of what the future of the coordinated EGC response looks like, and the stakes are too high to delay any further.

Acknowledgments:

Thank you to Allen Pleus (WDFW), Dr. Andrew Cohen, Mr. Karl Mueller, Mr. Shawn Evenson, Ms. Abigail Keller, and Dr. Sylvia Yamada for meeting with me and sharing their insights and knowledge on the European green crab and Washington’s response to the invasion.

Thank you to Catherine Hall, my professor, for her help, advice, and support at all stages of this project.

Works Cited


Washington Department of Fish and Wildlife. “European Green Crab Stakeholder/Partner Meeting (Salish Sea) Feb. 15, 2022.” https://www.youtube.com/watch?v=thrv-MDiQf0.
