



State of Washington  
**DEPARTMENT OF FISH AND WILDLIFE**

Mailing Address: Post Office Box 43200 Olympia, WA 98504-3200 • (360) 902-2200 • TDD (360) 902-2207  
Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia, WA

June 1, 2023

The Honorable Christine Rolfes  
Chair, Senate Ways and Means  
303 John A. Cherberg Building  
Post Office Box 40466  
Olympia, WA 98504-0466

The Honorable Timm Ormsby  
Chair, House Appropriations  
315 John L. O'Brien Building  
Post Office Box 40600  
Olympia, WA 98504-0600

The Honorable Kevin Van De Wege  
Chair, Senate Agriculture, Water  
Natural Resources, and Parks  
212 John A. Cherberg Building  
Post Office Box 40424  
Olympia, WA 98504

The Honorable Mike Chapman  
Chair, House Rural Development,  
Natural Resources, and Parks  
132B Legislative Building  
Post Office Box 40600  
Olympia, WA 98504

**RE: European Green Crab Quarterly Progress Report – Spring 2023 (January 1 to March 31, 2023)**

Dear Chairs Rolfes, Ormsby, Van De Wege, and Chapman,

In 2021, the Washington Department of Fish and Wildlife (WDFW), tribal co-managers, and partners identified an exponential increase of invasive European green crabs (EGC), *Carcinus maenas*, in the Lummi Nation's Sea Pond within the Salish Sea, and in outer coastal areas including Makah Bay, Grays Harbor, and Willapa Bay.

On Dec. 14, 2021, the WDFW Director submitted an emergency measures request under RCW 77.135.090 for EGC response to Governor Jay Inslee. On Jan. 19, 2022, Governor Inslee issued an emergency proclamation (#22-02) to address the exponential increase in EGC populations across Washington's marine shorelines. The proclamation directed WDFW to eradicate, reduce, or contain EGC in Washington, and to increase coordination with partner agencies and Native American tribes.

The Washington State Legislature approved \$8,568,000 in emergency funding during the 2022 Supplemental Budget to facilitate increased EGC management efforts. In response to the legislative budget proviso directive, this report is the third in a series of ongoing quarterly progress reports (Q3). The Q3 report will outline the successes and challenges of ongoing EGC emergency response efforts in Washington state from January 1 to March 31, 2023.

Trapping activities in Q3 remained relatively low due to cold weather and the expected reduction in EGC activity. Many entities had yet to begin their trapping seasons, though trapping continued in several areas resulting in the removal of EGC throughout Q3. Coordination efforts among co-managers, tribes, and partners were a focus of this relative trapping downtime. WDFW and

EGC Q3 Progress Report

June 1, 2023

Page 2

Washington Sea Grant hosted meetings to discuss lessons learned from 2022, priorities for 2023 and to plan the future of EGC management.

During the Q3 period, the collective effort of all organizations involved in EGC management removed 37,158 additional EGC from Washington state marine waters, with 35,274 from the Coastal Branch and 1,689 from the Salish Sea Branch. Since January 1, 2022, approximately 322,438 EGC have been removed from all Washington state marine waters, with 239,743 removed from the Coast Branch, and 82,695 removed from the Salish Sea Branch. In addition to active removal trapping, Q3 trap deployment occurred in areas where EGC had not previously been detected for early-detection monitoring. EGC has not been detected in the Salish Sea Branch south of the northern Hood Canal. Data on EGC abundance, body size, sex ratios, and reproductive status were collected for future analysis, along with DNA and RNA samples to assess connectivity between EGC populations. While challenges remain, the continued efforts of all parties and the clear organizational structure set in Q3 will allow for continued success in Q4. Additional information on European green crab in Washington and regular updates are available at: [wdfw.wa.gov/species-habitats/invasive/carcinus-maenas](https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas).

Per RCW 77.135.090, the WDFW Director continues to evaluate the effects of the European Green Crab emergency measures, finds that the emergency continues to persist and advises that all emergency measures should be continued.

If you have any questions about this report or the Department's efforts in this area, please feel free to contact Tom McBride, WDFW's Legislative Director, at (360) 480-1472.

Sincerely,



Allen Pleus  
WDFW European Green Crab Incident Commander

cc:

Kelly Susewind, Director, Washington Department of Fish and Wildlife  
Kelly Cunningham, WDFW Fish Program Director  
Ruth Musgrave, Senior Policy Advisor to Governor Jay Inslee

# European Green Crab Quarterly Progress Report – Spring 2023 (January 1 to March 31, 2023)

Washington Department of Fish and Wildlife (WDFW)

---



June 1, 2023

# Table of Contents

<b>Executive Summary .....</b>	<b>1</b>
<b>Background.....</b>	<b>2</b>
European green crab.....	2
History of the European green crab in Washington state .....	4
Emergency Proclamation and Supplemental Funding.....	5
Governor Proclamation 22-02 Directives .....	6
Legislative Proviso.....	6
<b>Successes of European green crab management measures .....</b>	<b>7</b>
Incident Command System implementation .....	7
Coordination with tribal co-managers and partner organizations .....	9
Budget allocation .....	11
European green crab monitoring and removal.....	12
Research Activity.....	14
Public communications and outreach efforts.....	15
<b>Program challenges.....</b>	<b>17</b>
<b>Next steps.....</b>	<b>18</b>
<b>Glossary.....</b>	<b>19</b>
<b>References.....</b>	<b>20</b>
<b>Appendix A .....</b>	<b>22</b>
WAC 220-640-030 - Prohibited level 1 species.....	22
RCW 77.135.040 - Prohibited and regulated species - Required authorization .....	22
RCW 77.135.090 - Emergency measures .....	22
ESSB 5693 (2022 c 297)- Making 2021-2023 fiscal biennium supplemental operating appropriations. 23	
Q1 (March 1 – September 30, 2022) EGC Report.....	23
Q1 Catch data clarification.....	23
Q2 (October 1 – December 31, 2022) EGC Report .....	24
List of Washington European green crab management actions in chronological order for Q3 (January 1 – March 31, 2023) as provided in Situation Reports .....	24
List of media reporting in chronological order related to Washington European green crab management for Q3 (January 1 – March 31, 2023) as provided in Situation Reports .....	31



**Appendix B – Co-manager and partner addendums .....34**

    Shoalwater Bay Tribe Natural Resources Department ..... 34

    Washington Department of Natural Resources..... 36

    Washington Sea Grant Crab Team..... 37

    Washington State Department of Ecology ..... 39

**Appendix C – Additional updates .....41**

    Habitat utilization by European green crab in Willapa Bay as measured with acoustic telemetry: a pilot study..... 41

---

Individuals who need to receive this information in an alternative format, language, or who need reasonable accommodations to participate in WDFW-sponsored public meetings or other activities may contact the Title VI/ADA Compliance Coordinator by phone at 360-902-2349, TTY (711), or email ([Title6@dfw.wa.gov](mailto:Title6@dfw.wa.gov)).

For more information, see <https://wdfw.wa.gov/accessibility/requests-accommodation>.



# Executive Summary

In response to the Engrossed Substitute Senate Bill (ESSB) 5693 (2022 c 297) legislative budget proviso directive, this report has been authored as the third in a series of ongoing quarterly progress reports (Q3). This report will serve to outline the successes and challenges of ongoing European green crab (EGC) emergency response efforts in Washington state from January 1 to March 31, 2023. In addition, this report will put the work during Q3 in the context of the work completed in 2022 (Q1 and Q2).

The previous quarterly progress reports are available at: <https://wdfw.wa.gov/publications> and on WDFW's European green crab [webpage](#).

In 2021, the Washington Department of Fish and Wildlife (WDFW), co-managers, tribes, and partners identified an exponential increase of invasive European green crab (EGC), *Carcinus maenas*, in the Lummi Nation's Sea Pond within the Salish Sea, and in outer coastal areas including Grays Harbor, Makah Bay, and Willapa Bay. On Dec. 14, 2021, WDFW Director Susewind submitted an emergency measures request under Revised Code of Washington (RCW) 77.135.090 for EGC response to Governor Jay Inslee. On Jan. 19, 2022, Governor Inslee issued an emergency proclamation (#22-02) to address the exponential increase in EGC populations across Washington's marine shorelines. The proclamation directed WDFW to eradicate, reduce, or contain EGC in Washington. The Washington State Legislature approved \$8,568,000 in emergency funding during the 2022 Supplemental Budget to facilitate increased EGC management efforts. In response to the legislative budget proviso directive, this report is the third in a series of ongoing quarterly progress reports (Q3). The Q3 report will outline the successes and challenges of ongoing EGC emergency response efforts in Washington state from January 1 to March 31, 2023.

An Incident Command System (ICS) was established to deal with the complexities of the EGC management effort. Support for and coordination with co-managers, tribes and partners is essential, as the scale of the EGC emergency is such that no one entity could ever hope to implement successful statewide management strategies alone. Washington Sea Grant (WSG), the Lummi Nation, the Makah Tribe, the Shoalwater Bay Tribe, shellfish growers and various other entities have continued their ongoing efforts managing EGC populations, closely coordinating with WDFW. The ICS also resulted in the creation and distribution of various updates including reports to the governor every 10 days and Situation Reports (SitReps) based on operational periods (monthly January and February, then bi-weekly until November) to provide information on and ensure transparency regarding management actions taken, grant funding allocations, EGC catch numbers, trapping efforts, media outreach, and other relevant information. These Situation Reports were synthesized for the public, media, and other external audiences in [EGC Public Updates published](#) bi-monthly in January/February and March/April distributed through WDFW's EGC Management Updates email list as well as Department webpages, communications, and social media channels.

Representatives from most entities participating in EGC management have joined the ICS Multi-Agency Coordination (MAC) group. The MAC group provides a forum for these representatives to share information, establish a common operating picture, develop long-term priorities for the EGC emergency, and commit and allocate funding and other resources to enhance emergency measures responses. In Q3, the EGC MAC group continued to meet and review/recommend the new



Washington State Recreation and Conservation Office (RCO) EGC Emergency Measures Fund request for proposals. In addition, the EGC MAC group continued the implementation of the Fiscal Year 2023 EGC Emergency Measures Strategic Action Plan.

Trapping activities in Q3 remained relatively low due to cold weather and the expected reduction in EGC activity. Many entities had yet to begin their trapping seasons, though trapping continued in several areas resulting in the removal of EGC throughout Q3. Coordination efforts among co-managers, tribes, and partners were a focus of this relative trapping downtime. WSG and WDFW hosted meetings to discuss lessons learned from 2022, priorities for 2023 and to plan the future of EGC management.

During the Q3 period, the collective effort of all organizations involved in EGC management removed 37,158 additional EGC from Washington state marine waters, with 35,274 from the Coastal Branch and 1,689 from the Salish Sea Branch. Since January 1, 2022, approximately 322,438 EGC have been removed from Washington state marine waters, with 239,743 removed from the Coast Branch, and 82,695 removed from the Salish Sea Branch. In addition to active removal trapping, Q3 trap deployment occurred in areas where EGC had not previously been detected for early-detection monitoring. EGC has not been detected in the Salish Sea Branch south of the northern Hood Canal. Data on EGC abundance, body size, sex ratios, and reproductive status were collected for future analysis, along with DNA and RNA samples to assess connectivity between EGC populations.

WDFW, WSG, co-managers, tribes, and partners achieved significant progress in EGC management efforts. With the creation of the EGC Research Tasks Force, steps are underway to coordinate with EGC researchers across the Pacific coast of North America to determine research priorities to support EGC management efforts in Washington state and throughout the region. Additional progress was also made on public outreach and community engagement to support EGC awareness, with WDFW representatives engaging more than 2,000 individuals during over a dozen event days and producing a range of new [outreach materials](#). While challenges remain (e.g., completion of a standardized electronic trapping data submission, hiring staff, and creation of the Fiscal Year 2024 Strategic Action Plan), the continued efforts of all parties and the clear organizational structure set in 2022 will allow for continued success during the 2023 emergency response field season.

## Background

### European green crab

The European green crab (EGC), *Carcinus maenas*, is a globally damaging invasive species that poses a threat to the ecological, economic, and cultural resources of Washington state. Native to Western Europe and Northwestern Africa, this hardy and voracious predator has since expanded its range throughout the globe (Carlton and Cohen 2003). Green crabs exploit a variety of different habitat types within intertidal and subtidal zones. Along the Pacific Coast of North America, EGC inhabit protected shorelines in unstructured sandy and muddy bottoms, estuaries, saltmarshes and seagrass beds, as well as utilizing woody debris and rocky substrates (Kern et al. 2002). The European green crab has wide tolerances for salinity (1.4-54 ppt) and temperature (0-35 °C) and can even survive air exposure for several days (Leignel et al. 2014).



In areas where EGC have been able to establish large populations for extended periods of time, they have the potential to negatively impact other species, particularly smaller crabs and bivalves (Jamieson et al. 1998, McDonald et al. 2001). It is estimated that damages to commercial shellfisheries from EGC predation average \$22.6 million per year on the East Coast of the United States (Lovell et al. 2007). Similar losses from EGC predation are possible for Salish Sea shellfish fisheries (Mach and Chan 2013) and Pacific Coast fisheries are also at risk. Predation on oysters by EGC could negatively impact oyster fisheries, as adult EGC can prey upon young oysters (Dare et al. 1983, Poirier et al. 2017) and have been observed cracking and consuming adult oysters in laboratory settings (Forster, personal communication). Lab work has shown that juvenile EGC outcompeted similar-sized Dungeness crabs for food and shelter and juvenile Dungeness may serve as prey for larger EGC, resulting in potential impacts to wild Dungeness populations. Predation by EGC has led to declines in native bivalve and crab populations in invaded habitats (Grosholz et al. 2000). In addition, burrowing by EGC can have significant negative impacts on eelgrass, estuary, and marsh habitats (Malyshev and Quijón 2011, Matheson et al. 2016, Howard et al. 2019).

Given their history as a prolific invasive species, EGC is classified as a Prohibited Level 1 Invasive Species in Washington (Washington Administrative Code [WAC] 220-640-030; Appendix A), meaning they may not be possessed, introduced on or into a water body or property, or trafficked (transported, bought, or sold), without department authorization, a permit, or as otherwise provided by rule (RCW 77.135.040; Appendix A). We are currently not asking the public to kill suspected EGC, which may sound counterintuitive but is intended to protect native crabs from cases of mistaken identity (native crabs continue to be commonly misreported as EGC by the public; Flannery, personal communication). EGC is most accurately identified by the 5 large spines or marginal teeth on either side of their forward carapace, a unique pattern for crabs on the Pacific Coast of North America (Figure 1). Despite their name, coloration of green crabs varies



Figure 1. Image of a European green crab (EGC), *Carcinus maenas*, with distinguishing features highlighted. The main distinguishing feature of EGC are the five spines, or marginal teeth, on each side of the carapace behind the eyes. Additional identifying features are the three lobes, or rostral bumps, between the eyes, and somewhat flattened rear legs.





from bright green to dark orange, thus color is not a reliable feature to use when distinguishing EGC from native crab species.

## History of the European green crab in Washington state

The first detection of EGC in the waters of Washington was in 1998 in Willapa Bay and Grays Harbor (Carlton and Cohen 2003); Table 1; Figure 2). Initial emergency management responses took place but ended after a few years due to a lack of evidence of self-recruitment and fewer EGCs being captured. A population of EGC was discovered in 2012 in Sooke Basin, British Columbia, Canada (Gillespie et al. 2015). In response over concerns of new EGC introductions within the Washington portion of the Salish Sea, WDFW designated Washington Sea Grant (WSG) to lead an early detection monthly monitoring community science network, also known as the Crab Team. This also marked the beginning of increased communication and collaboration with the Department of Fisheries and Oceans Canada (DFO) to explore transboundary EGC management in the Salish Sea. The first detections of EGC in the Washington region of the Salish Sea occurred in 2016 at Westcott Bay on San Juan Island by the WSG Crab Team and in Padilla Bay by staff at the Padilla Bay National Estuary Research Reserve (Grason et al. 2018). There were additional detections of EGC in 2017 in Makah Bay by the Makah Tribe and in Dungeness Spit within the Dungeness National Wildlife Refuge, which is managed by the U.S. Fish and Wildlife Service (USFWS). Since 2018, there have been increasing numbers of EGC detections in the Salish Sea and Pacific coastal regions of Washington. In response to continued EGC presence in the Salish Sea, the Salish Sea Transboundary Action Plan for Invasive European Green Crab was created and signed by representatives of WDFW, WSG, the Puget Sound Partnership, and the DFO in 2019 (Drinkwin et al. 2018).

Table 1 Yearly European green crab captures in Washington from 1998-2022. Data is divided by EGC captured in the Washington state portion of the Salish Sea and EGC captured along the Pacific Coast of Washington. Please note that this data only represents crabs captured, not the effort employed. Catch effort (number of traps deployed, number of locations trapped, frequency of trap recovery) varies greatly across years.

Year	Salish Sea	Pacific Coast	Total
1998	0	364	364
1999	0	507	507
2000	0	235	235
2001	0	142	142
2002	0	167	167
2003	0	24	24
2004	0	4	4
2005	0	115	115
2006 - 2014	0	68	68
2015	0	8	8
2016	5	19	24
2017	101	64	165
2018	77	1,115	1,192



Year	Salish Sea	Pacific Coast	Total
2019	177	1,766	1,943
2020	2,858	3,971	6,829
2021	86,340	16,825	103,165
2022	81,006	204,274	285,280



## Emergency Proclamation and Supplemental Funding

In 2021, WDFW, co-managers, tribes, and partners identified an exponential increase of invasive EGC in the Lummi Nation’s Sea Pond within the Salish Sea, and in coastal areas including Makah Bay, Grays Harbor, and Willapa Bay. It was concluded that this continuing increase in EGC



distribution and abundance posed an imminent threat to Washington’s economic, environmental, and cultural resources. While \$2.3 million was appropriated by the State Legislature for EGC management in the 2021-23 biennium, it was determined to be insufficient to control these exploding populations.

On Dec. 14, 2021, Director Susewind submitted an emergency measures request under RCW 77.135.090 (Appendix A) for EGC response to Governor Jay Inslee. While emergency funding was not immediately available, on January 19, 2022, Gov. Inslee issued an emergency proclamation (#22-02) to address the exponential increase in the EGC population within the Lummi Nation’s Sea Pond and Pacific coastal areas. The proclamation directs WDFW to implement emergency measures as necessary to affect the eradication of or to prevent the permanent establishment and expansion of EGC in Washington. In addition, the Governor urged the Legislature to provide additional emergency funding as requested by the WDFW as soon as possible.

Working with the Office of the Governor, the Office of Financial Management, tribal co-managers including the Lummi Nation, Makah Tribe, and others, along with WSG, WDFW requested \$8,568,000 from the State Legislature during the 2022 supplemental session to control increasing EGC populations. The Legislature fully-funded this request in the 2022 Supplemental Budget, which was signed by Governor Inslee on March 31, 2022.

## **Governor Proclamation 22-02 Directives**

The following text, taken from “Emergency Proclamation by the Governor 22-02 Green Crab Infestation”, outlines the primary directives to WDFW and other state agencies by Governor Jay Inslee regarding EGC management:

“NOW THEREFORE, I, Jay Inslee, Governor of the state of Washington, by virtue of the authority vested in me under RCW 43.06.010(14), as a result of the above-noted situation, and in accordance with RCW 77.135.090, do hereby order the Department of Fish and Wildlife to begin implementation of emergency measures as necessary to effect the eradication of or to prevent the permanent establishment and expansion of European green crab.

FURTHERMORE, I direct the Department of Ecology, and I ask the Department of Natural Resources and the State Parks and Recreation Commission to identify European green crab management as a high priority on their respective state-owned aquatic lands and to facilitate implementing the emergency measures described herein.”

## **Legislative Proviso**

The following text, taken from “ESSB 5693 - Making 2021-2023 fiscal biennium supplemental operating appropriations”, Section 308 (Page 552, Line 16) - outlines the primary directives to WDFW by the Washington State Legislature regarding EGC management:

“Implement eradication and control measures on European green crabs through coordination and grants with partner organizations. Provide quarterly progress reports on the success and challenges of the measures to the appropriate committees of the legislature.”



# Successes of European green crab management measures

The following is an overview of the major successes related to European green crab (EGC) management actions for the third quarter of the emergency, from January 1 to March 31, 2023 (Q3). The success of Q1 and Q2 (March 1 – December 31, 2022) will also be discussed and included for context. A complete list of EGC management actions of Q3 can be found in [Appendix A](#) of this report.

## Incident Command System implementation

The Washington State Emergency Management Division assigned mission #22-1085 on April 18, 2022, for the EGC emergency response. After meeting with other state and federal agencies, the Washington Department of Fish and Wildlife (WDFW) Director Kelly Susewind formally implemented an Incident Command System (ICS) on May 5 in delegating authority to Allen Pleus, WDFW’s Aquatic Invasive Species (AIS) Policy Coordinator, to serve as Incident Commander (Figure 3). This approach provides a clear command structure, as well as standardizing communications and management action implementation across the state.

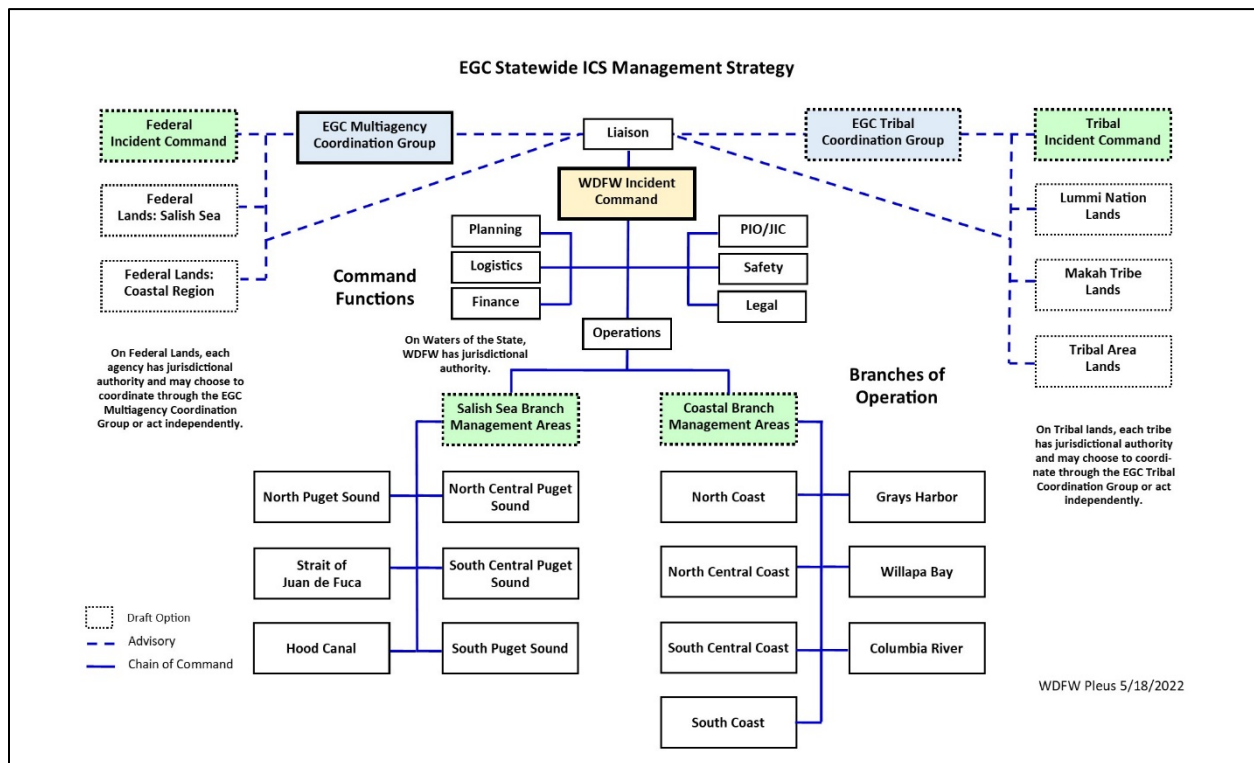


Figure 3 Incident Command System structure for the European green crab emergency response in Washington.



In addition, ICS provides support to federal and tribal participants across the state while they retain their autonomy in EGC management decisions and actions. During Q3, successes of the EGC ICS have included:

- Ensuring that ongoing management actions are guided by the five Incident Objectives developed in Q1:
  - A. Facilitate WDFW implementing Governor’s Emergency Proclamation for statewide emergency measures with respect for tribal sovereignty and federal jurisdictions.
  - B. Health and safety of all participants.
  - C. Reduce or contain EGC populations below levels that result in environmental, economic, and cultural resource harm.
  - D. Collaborative and transparent emergency management.
  - E. Post-emergency transition to long-term EGC management by local tribal co-managers and partners with WDFW oversight.
- Meetings with tribal entities to discuss ICS structure and solicit recommendations on how tribes would like to engage on policy and technical levels.
- Regular reports to the governor every 10 days per RCW 77.135.090 on the effects of emergency measures and advising the governor if all or some emergency measures should be discontinued.
- Creation of ICS Situation Reports (SitReps) based on a two-week operational period summarizing the status of Washington state EGC emergency measures including actions taken, funding allocations, EGC catch numbers, trapping efforts, and other relevant information for dissemination among EGC emergency measure co-managers, tribes, and partners.
  - During months of reduced trapping activity resulting from winter conditions (November - February), SitReps are created on a monthly operational period.
- Creation of monthly and then bi-monthly EGC Public Updates updating on Washington state EGC Emergency measures, highlighting the efforts of agencies, tribes, and partners, and sharing stories from the field for dissemination to the public and media.
- Continued WDFW internal policy coordination meetings.

An important aspect of the EGC ICS structure is the Multi-Agency Coordination (MAC) group. The MAC group consists of representatives from various co-managers, tribes, and partners including state and federal agencies, and shellfish growers (Table 2). The MAC group provides a forum for these representatives to share information, establish a common operating picture, and recommend common long-term priorities for the EGC emergency. In addition, the group is tasked with making recommendations to WDFW for emergency funding and may commit and allocate additional or in-kind funding and other resources to enhance emergency measures response. Since its formation on June 8, 2022, the MAC group has convened eighteen times (five times in Q3). During Q3, the EGC MAC group successes have included:

- Aided in the development of The Washington State Recreation and Conservation Office (RCO) EGC Emergency Measures Fund request for proposals.
- Reviewed and recommended RCO EGC Emergency Measures Fund requests of:
  - \$30,000 Grays Harbor Conservation District funding to procure a boat to assist with conservation district-led trapping efforts.



- \$90,000 Pacific Conservation District funding to assist Willapa-Grays Harbor Oyster Growers Association trapping efforts.
- These recommendations are in addition to previous proposals, which includes:
  - \$91,316 U.S. National Oceanographic and Atmospheric Administration
  - \$402,220 State of Washington Department of Natural Resources
  - \$100,000 Lummi Indian Business Council
  - \$99,312 Pacific County Vegetation Management
  - \$75,154 State of Washington Department of Ecology
  - \$32,897 U.S. Fish & Wildlife Service (FWS) Dungeness National Wildlife Refuge (NWR)
  - \$110,240 US FWS Willapa National Wildlife Refuge
  - \$70,517 Washington State University (WSU)/Washington Sea Grant (WSG)
  - See the Q1 and Q2 EGC Legislative Reports for more details
- Completion of the Fiscal Year (FY) 2023 EGC Emergency Measures Strategic Action Plan, including establishing priority tasks to be addressed.
- Began work on development of FY 2024 EGC Emergency Measures Strategic Action Plan (scheduled for completion by June 30, 2023).

Table 2 List of European green crab (EGC) Multi-Agency Coordination (MAC) group member organizations. Representatives of these organizations share information, establish a common operating picture, and develop common long-term priorities for the EGC emergency

Multi-Agency Coordination group member organizations	
Pacific Coast Shellfish Growers Association	Washington Department of Ecology
Lummi Nation Business Council	Washington Department of Fish and Wildlife
Puget Sound Partnership	Washington Department of Natural Resources
Shoalwater Bay Tribe	Washington Emergency Management Division
U.S. Bureau of Indian Affairs	Washington Recreation and Conservation Office
U.S. Environmental Protection Agency	Washington Sea Grant
U.S. Fish and Wildlife Service	Washington State Department of Agriculture
U.S. Geological Survey	Washington State Parks and Recreation Commission
U.S. National Oceanographic and Atmospheric Administration	Willapa Grays Harbor Oyster Growers' Association

## Coordination with co-managers, tribes and partner organizations

Perhaps the greatest success of EGC management in Washington are the efforts, both independent and collaborative, of the many co-managers, tribes, and partners within the state (Table 3). The scope of the EGC emergency is such that no one organization can hope to curtail it alone. For years, co-managers, tribes and partners such as WSG, local, state, federal agencies, shellfish growers have worked with WDFW to implement short- and long-term management actions to support statewide efforts in EGC management. The contributions of all entities involved in EGC control cannot be overvalued. While this report does not go into specifics of the contributions of each group, MAC group member organizations were invited to submit addendums to outline their specific actions and successes in their own words. Addendums submitted to WDFW before publication are included in this document in [Appendix B](#).



Since EGC extend beyond jurisdictional boundaries, management responses require action, collaboration, and coordination between various groups. It is important to note that EGC management is very complex with multiple jurisdictions, varying management priorities, different management types, complex operations, and different resource capacities. Additionally, each organization can have differing goals for sensitive habitats, species protections and aquaculture operation protections. SitReps were disseminated every two weeks based on ICS operational periods to support meeting the collaboration and transparent emergency management objective. During months of reduced trapping activity resulting from winter conditions (November - February), SitReps dissemination was shifted to a monthly operational period. These SitReps included information on management actions taken, grant funding allocations, EGC catch numbers, trapping efforts, media outreach and other relevant information. The first SitRep was disseminated on June 16, 2022, for a total of thirteen for 2022.

During Q3, several large meetings between co-manages, tribes, and partners occurred to discuss past and future EGC management efforts. WSG hosted the EGC Trapper's Summit in January at Suquamish Clearwater Casino. The summit focused on entities that actively trapped EGC in 2022. The meeting provided the opportunity for participants to share observations and learn what other trappers saw in 2022 and are planning for 2023, collaboratively explore the data that we've been individually pulling together, build on each other's technical knowledge of trapping, and identify questions and priorities that might help inform future trapping efforts. WDFW hosted the annual Washington EGC Co-Managers and Partners Meeting in Lacey in February. Participants, including co-managers, other tribal staff, shellfish growers, and staff from other agencies and partners, could join the meeting in person or online via Teams. Presenters from entities participating in the EGC Emergency Response provided updates, including:

- Allen Pleus (WDFW), EGC Incident Commander, provided an update on EGC management in Washington state;
- Chris Waldbillig (WDFW) and Justin Bush (RCO) updated attendees on the availability of grant funding for EGC emergency response efforts;
- Dr. Brian Turner (WDFW) presented on current science around EGC and the newly launched EGC Research Task Force;
- Nicole Burnet (Padilla Bay National Estuarine Research Reserve) presented findings from their EGC larval studies and their plans to develop an identification guide;
- Diana Dishman (National Oceanic and Atmospheric Administration) gave participants guidance on complying with Endangered Species Act permitting;
- and Jessica Ostfeld (WDFW Outreach Specialist) provided an update on EGC outreach and communications, and ways partners and tribes can coordinate to increase community awareness and public reporting of EGC.



Table 3 List of co-managers, tribes, and partner organizations working with WDFW on control and management efforts of the European green crab in Washington. Participants implement short- and long-term management actions to support statewide efforts in EGC control, including independent and WDFW collaborative trapping, outreach and education, field support, and monitoring. These actions are an essential component of the EGC management in Washington.

European green crab management tribal co-managers and partner organizations	
Bay Center Farms	Quinault Indian Nation
Brady's Oysters	Samish Indian Nation
Chuckanut Shellfish	Shoalwater Bay Tribe
Drayton Harbor Oyster Co.	Stillaguamish Tribe of Indians
Elkhorn Oyster Co.	Stillwaters Environmental Center
Goose Point Oysters	Suquamish Tribe
Grays Harbor National Wildlife Refuge	Swinomish Indian Tribal Community
Jamestown S'Klallam Tribe	Taylor Shellfish Farms
Lower Elwha Klallam Tribe	Twin Harbors Waterkeeper Alliance
Lummi Nation	United States Fish and Wildlife Service
Makah Tribe	United States Navy
Northwest Straits Commission	Veterans Corps
Pacific County Vegetation Management	Washington Sea Grant
Pacific Seafoods	Washington State Department of Natural Resources
Padilla Bay National Estuarine Research Reserve	Washington State DNR Puget Sound Corps
Pacific States Marine Fisheries Commission	Washington Conservation Corps
Penn Cove Shellfish	Willapa Bay National Wildlife Refuge
Port Gamble S'Klallam Tribe	Willapa-Grays Harbor Oyster Growers' Association
Quileute Tribe	

## Budget allocation

The \$1,082,364 in funds provided for this report period allowed for the continuation of our management efforts.

- Staff (Salaries + Benefits): \$207,110
  - Funds spent on staff. WDFW field staff remained at Q2 levels, though hiring efforts are underway to increase staffing for the 2023 trapping season.
- Equipment: \$3,722
  - Funds spent on high value equipment.
- Goods & Services: \$24,691
  - Funds spent on general field supplies and gear such as bait and traps.
- Travel: \$10,925
  - Funds spent on motor pool vehicles, per diem and lodging. Aside from trapping efforts, travel funds allowed staff to present at and attend conferences and perform outreach for various stakeholder groups.
- Contractual Services: \$705,084





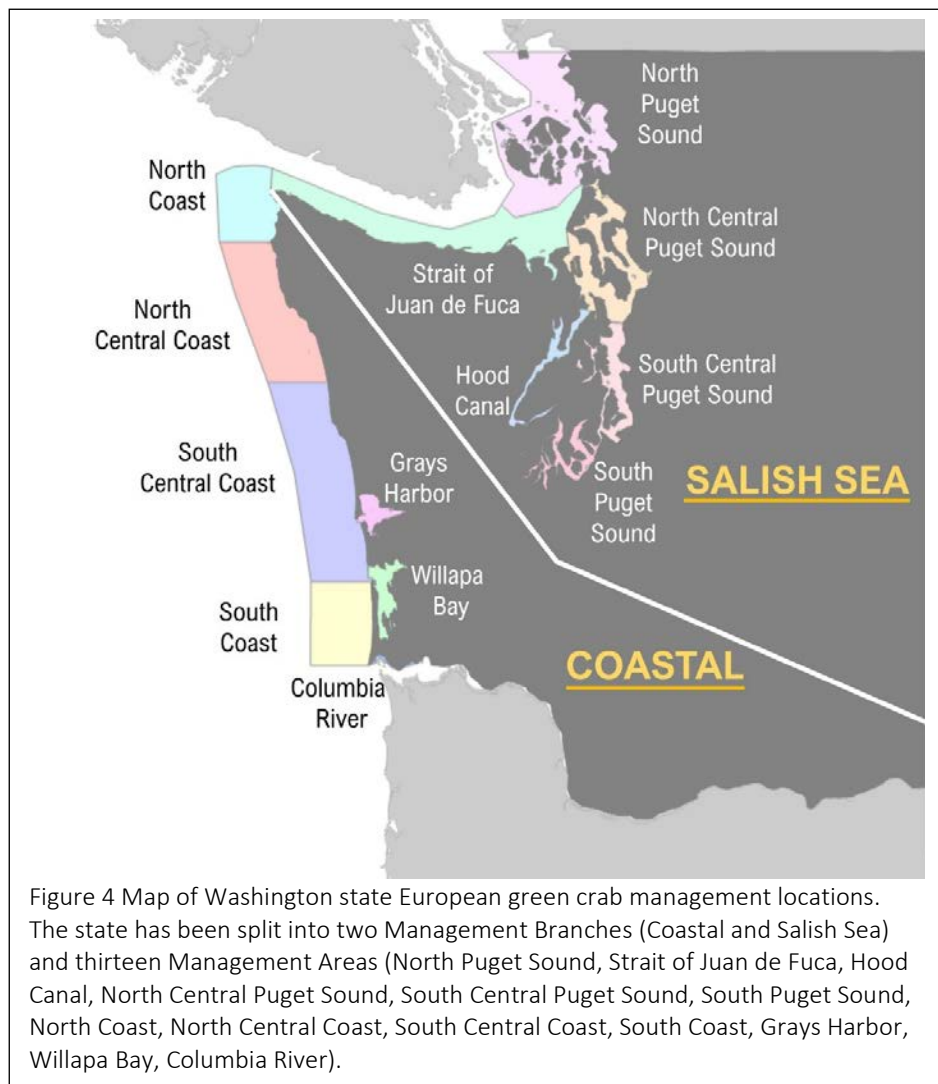
- Funds spent on pass through contracts for our various partners including WSG, Lummi Nation, Makah Tribe, and funding awarded through the WDFW Coastal EGC Local Management Grant and the RCO EGC Emergency Measures Grant programs.
- Pass Through: \$878
  - Fund spent on pass through funding for client services with the Pacific Shellfish Institute.
- Agency Indirect: \$129,953
  - Funds spent on agency-wide, general administration costs.

## European green crab monitoring and removal

The state is divided into Coastal and Salish Sea Management Branches to facilitate effective EGC ICS communications and management (Figure 4). These branches are then further divided into 13 Management Areas based on WDFW recreational fishing marine areas. Trapping efforts across the state were undertaken by WDFW, WSG, co-managers, tribes, and partner organizations. The catch numbers presented for Q3 represent the collective effort of all organizations, and those efforts must be recognized.

During Q3, traps deployment across Washington's Management Areas was heavily reduced due to unsafe field conditions and expected reduction in EGC activity resulting from cold winter weather. Trapping efforts occurred only in North Puget Sound, Hood Canal, and the Strait of Juan de Fuca in the Salish Sea Branch, as well as North Harbor, Grays Harbor, and Willapa Bay in the Coastal Branch. Trapping efforts will resume at all Management Areas in Q4 (April 1 – June 30, 2023).

In total, 37,158 EGC were removed in Q3 from Washington state waters, with 35,469



removed from the Coastal Branch and 1,689 removed from the Salish Sea Branch (Table 4). In the Coastal Branch, the majority of EGC were removed from Grays Harbor (21,479), followed by the Willapa Bay (13,413) and North Coast (577) Management Areas. In the Salish Sea Branch, most EGC were removed from the North Puget Sound (1,687), with a few collected in the Strait of Juan de Fuca (2). While trapping occurred in Hood Canal, no EGC were captured. To date, EGC have not been detected in the Salish Sea Branch south of northern Hood Canal, though early-detection monitoring continues across the southerly Management Areas. Data on EGC abundance, body size, sex ratios, and reproductive status were collected for future analysis, along with DNA and RNA samples to assess connectivity between EGC populations. Removed EGC were euthanized following humane best practices and disposed of within local landfills or, in the case of EGC collected by the Shoalwater Bay Tribe, utilized as fertilizer in their tribal community garden (Pfleeger-Ritzman, personal communication).

Table 4 European green crab capture totals for Q3 (January 1 – March 31, 2023), 2022 (January 1 – December 31, 2022), and All (the duration of the EGC management effort) based on SitRep reported catch and trapping effort. These numbers are presented for each Branch (Coastal and Salish Sea) and Management Area. These totals include not only removal efforts by Washington Department of Fish and Wildlife, but co-managers, tribes, and partners such as the Washington Sea Grant Crab Team, the Lummi Nation, the Makah Tribe, the Shoalwater Bay Tribe, and participating shellfish growers. \* = Pre-Season Status; no trapping occurred in these Management Areas.

Branch	Management Area	Q3 Total EGC Captured	2022 Total EGC Captured	All EGC Captured
Salish Sea	North Puget Sound	1,687	80,900	82,587
Salish Sea	Strait of Juan de Fuca	2	90	92
Salish Sea	Hood Canal	0	16	16
Salish Sea	North Central Puget Sound	*	0	0
Salish Sea	South Central Puget Sound	*	0	0
Salish Sea	South Puget Sound	*	0	0
<b>Salish Sea</b>	<b>All</b>	<b>1,689</b>	<b>81,006</b>	<b>82,695</b>
Coastal	North Coast	577	25,109	25,686
Coastal	North Central Coast	*	0	0
Coastal	South Central Coast	*	34	34
Coastal	South Coast	*	0	0
Coastal	Grays Harbor	21,479	24,264	45,743
Coastal	Willapa Bay	13,413	154,862	168,275
Coastal	Columbia River	*	5	5
<b>Coastal</b>	<b>All</b>	<b>35,469</b>	<b>204,274</b>	<b>239,743</b>
<b>All</b>	<b>All</b>	<b>37,152</b>	<b>285,280</b>	<b>322,438</b>



Direct comparisons of Q3 capture totals for the same time in 2022 are not possible, as the emergency response and its associated data collection efforts did not begin until March 1, 2022. However, one striking observation can be made despite this limitation: the Q3 catch for Grays Harbor (3 months) nearly matches their total catch in 2022. Partners in Grays Harbor greatly increased their trapping efforts in Q2 (October 1 - December 31, 2022) and remained active during Q3, which likely explains Greys Harbor's similar catch numbers for Q3 and 2022 (See the Q2 report for more details).

## Research activity

Effective invasive species management requires a robust understanding of the invader and its impacts. As a prolific global invader, a wealth of research exists regarding EGC. However, many fundamental questions about EGC, particularly regarding their detection, abundance, impacts, and movements in Washington state, have yet to be answered.

On February 13-14, 2023, a two-day EGC Transboundary Research Discussion occurred between WSG, WDFW, WSU, and Department of Fisheries and Oceans Canada (DFO) at WSG in Seattle to discuss research priorities in support of European green crab management. As transboundary colleagues, DFO, WDFW, and WSG have worked together for several years to reconcile our mutual understanding of local green crab status and ecology. With the increasing scale of management action in Washington, the demand for reliable information to guide management practices is also growing, yet data and research gaps remain. This group identified and strategized on topic areas needing additional scientific investigation and started prioritizing these research areas to address management-related questions. Areas of discussion for future research included: population control techniques through an Integrated Pest Management lens, population genetics and genetics tools, predicting dispersal and spread, and understanding habitat use and migration. The work started here will be carried forward by the newly formed EGC Research Task Force (RTF) and enables researchers to leverage each other's capacity, reduce duplicative investigations, and focus on the most-needed information to manage green crabs.

The RTF is an organization of researchers, managers, and experts on EGC from across the Pacific Coast of North America. Membership in the RTF is by invitation. Participants must have active/previous involvement in EGC or similar research and be associated with EGC management efforts along the Pacific Coast of North America. The RTF provides a forum to discuss the current state of EGC research and promote synergy in research efforts. Additionally, the RTF aims to develop a ranked list of needed EGC research with a primary focus on improving the prevention, detection, and management of EGC. One of the primary tasks for the RTF includes developing technical thresholds for EGC impact, including a threshold at which EGC populations no longer harm environmental, economic, or cultural resources. This process includes identifying data requirements for assessing EGC populations and assisting in evaluating EGC population trends and impacts.

On February 15, 2023, Incident Command System (ICS) staff and a consortium of invasive species researchers and managers met with 19th Legislative District's Representative Joel McEntire to discuss innovative long-term solutions to EGC management including exploring the feasibility of genetically modifying traits in the invasive species to manage their populations, creating new



detection tools, and more. The research consortium and ICS staff included participants from the Washington Recreation and Conservation Office (RCO), administrative host of the Washington Invasive Species Council, WDFW, University of Washington, WSG, WSU Extension, and Woods Hole Oceanographic Institution in Massachusetts. Together the consortium discussed the current state of scientific knowledge and abilities including initial steps toward a long-term goal of integrating new tools into the toolbox. Recognizing EGC as a global invasive species, the consortium is also exploring the feasibility of a research summit bringing together the best minds globally to tackle this shared issue.

WDFW received a progress report on an ongoing EGC telemetry study funded by RCO EGC emergency funding. The project, led by the National Oceanographic and Atmospheric Administration (NOAA), Northwest Fisheries Science Center, in partnership with the WDFW Willapa Bay Field Station, and Willapa Grays Harbor Oyster Growers Association, involved tagging four groups of 10 EGC (40 total), and two groups of 8 Dungeness crabs (16 total) with transmitters to test the effectiveness of intertidal acoustic telemetry on crabs (particularly EGC) and compare their inter- and subtidal habitat use. Understanding EGC habitat use across space and time, particularly over seasonal time frames, could be vital to designing effective mitigation strategies. As of March 2023, all receivers were collected, and all 56 crabs were detected. Preliminary results show that most Dungeness crab departed the main detection area within about a week. In contrast, many EGC remained in the study area throughout the monitoring period, with some movement between intertidal sites. The detection data has been sent for analysis, with results expected in Q4 (April 1- June 30, 2023). The full update can be found in Appendix C.

## Public communications and outreach efforts

Communications, public education, involvement, and support are essential for effective invasive species management. No matter the effort of government agencies and managers, they will be limited in their ability to monitor and report on the species spread. Public awareness and reporting can complement professional monitoring and allow for earlier detection of species spread. Media relations, other mass communications, and public awareness also supports effective policymaking and collaboration with local communities, stakeholders, and partners. Q3 saw a dramatic increase in WDFW EGC outreach efforts. Highlights for Q3 have included:

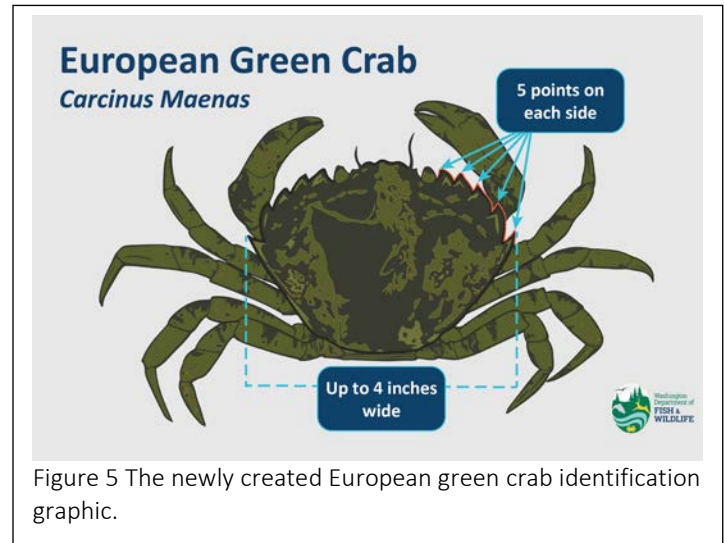
### Focused/Local communication

- Representatives of WDFW presented a public European green crab webinar on February 21, 2023. This event was hosted by the Washington Invasive Species Council as part of Washington Invasive Species Awareness Week (February 20-26, 2023). The “European Green Crab Public Update Webinar” was approximately 1 hour and 15 minutes with 40 attendees and can be viewed [here](#).
- WDFW staff presented at the Western Aquatic Invasive Species Short Course in Missoula, MT and at the Coastal Invasive Species and Exotic Pets Workshop in Astoria, OR.
- Outreach representatives from WDFW were present at numerous events throughout Washington, including the Seattle Boat Show, Penn Cove Mussel Fest, and Storming the Sound. At the Long Beach Razor Clam Festival, WDFW and WSU Extension partnered to operate an EGC outreach booth. Similarly, WDFW and Grays Harbor Conservation District



representatives worked together during the Ocean Shores Razor Clam Festival. More than 2,000 people were reached during these combined outreach efforts.

- WDFW deployed updated outreach materials for 2023, including an [EGC identification graphic](#), [identification outreach sign](#), [plain language talking points](#), and partner recognition sign (Figure 5). Signs, outreach materials, and other resources were shared with county conservation districts, parks, tribes, marinas, boat launches and water access areas, shellfish growers, and other partner groups. More than 1,000 stickers and 200 reporting signs were distributed. [Materials are hosted online here](#). All additional communication and outreach efforts are listed in Appendix A.



#### General public communication

- General information on EGC such as identification and public reporting is posted at: <https://wdfw.wa.gov/greencrab>
- Continued bi-monthly Public Updates regarding Washington State EGC Emergency measures, including updates distributed to relevant media outlets: <https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#conservation>
- Detailed information on EGC ecology and identification, webinar recordings of stakeholder meetings, and an archive of ICS Public Updates are posted on this webpage for EGC practitioners and the general public: <https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas>
- WDFW mailing list for EGC Management updates to provide regular updates and other news regarding coordinated efforts to monitor and control invasive EGC in Washington waters. There are currently ~500 subscribers and average mail traffic is 1-2 emails per month: <https://wdfw.wa.gov/about/lists>
- WSU, in collaboration with WA Sea Grant, initiated the development of an EGC early detection program to engage citizen scientists in EGC control efforts. The program is called EGC Molt Search and will train volunteers in the 12 Puget Sound Counties to survey beaches and report molt findings on a specially designed reporting tool on the MyCoast App. The trainings will occur in May and June 2023.
- Current EGC management efforts have been reported in numerous local and national media outlets (Appendix A).



# Program challenges

WDFW, co-managers, tribes, and partners have achieved significant progress toward the five Incident Objectives in a short timeframe. However, as we progress through the initial stages of the EGC emergency, there are several challenges we must address. These challenges include:

- Hiring, onboarding, and training of new and returning seasonal field staff. The WDFW EGC field crew will be significantly larger than in previous years. New staff will require training in field procedures, data collection, and safety practices. Returning staff will receive a refresher course and training with our new electronic data trapping data submission system (see below).
- Finalization of the WDFW 2023 field season plan. WDFW must use its increased capacity for action in the state must be utilized effectively. Meetings with partners and co-managers, particularly in the Coastal Branch, will help to identify priorities and how WDFW can support their efforts. Internal discussions on prioritizing removal, monitoring, and detection in various locations are ongoing.
- Completion and implementation of a standardized electronic trapping data submission system for use across all participating entities. Working with Esri, a geographic information system (GIS) company, WDFW is developing software to allow direct uploading of catch data in real-time to significantly enhance our data collection capability while also eliminating errors resulting from data transfers from physical to digital formats.
- Completing the creation of the “European green crab hub”, a website that will serve as a go-to resource for all things EGC in Washington. The site is being developed in collaboration with Esri. The public can use the site to learn more about EGC and ongoing management activities, while co-managers, tribes, and partners can use it to submit data for SitReps.
- Completing the FY 2024 Strategic Action Plan (SAP) to meet Incident Objectives and identifying the statewide and Management Area leadership required to implement plan tasks and the necessary resources to support them. The planned completion date is June 30, 2023
- Finalization of an EGC disposal contract between WDFW and Pacific Gro. Pacific Gro is a liquid fertilizer company based in WA and has generously agreed to accept our fish waste (i.e., EGC and used bait) free of charge. This partnership will allow organic material that would otherwise be dumped in landfills to be put to productive use as outlined in HB 1799 (2022). Please note the contract was completed, and crab deliveries have begun at the time of writing but was not accomplished in Q3.
- Establishing research priorities for EGC management in Washington. While the RTF is in the process of creating a rigorous ranked list of EGC research priorities for Washington, there is an immediate need to highlight needed before the field season begins in earnest. To that end, the preparation of an unranked list of priority research is underway to serve as a temporary guide. This unranked list is based on the required research to complete tasks in the FY 2023 SAP and will likely significantly overlap with the final ranked list.



# Next steps

The EGC emergency management priority actions for next quarter (April 1 – June 30, 2023) include:

- Host meetings with co-managers, tribes, and partners in Willapa Bay and Grays Harbor to discuss the state of EGC management efforts, priorities for 2023 and beyond, and how WDFW can best support local efforts.
- Hiring and onboarding for new and returning WDFW 2023 EGC staff.
- Implementing the Fiscal Year 2023 EGC Emergency Measures Strategic Action Plan to fulfill the five Incident Objectives.
- Development of Fiscal Year 2024 EGC Emergency Measures Strategic Action Plan.
- Ongoing MAC group meetings every two weeks until November.
- Continued monthly EGC Research Task Force meetings to develop a priority research list for EGC in Washington and discuss EGC research-related issues.
- Development and distribution of bi-monthly Situation Reports (SitReps).
- Ongoing advocacy for increasing federal partner support and funding.
- Finalization of the Esri EGC data collection tools for use in the field.
- Identifying additional proposals for FY24 emergency measure grants.
- Ongoing outreach to tribal co-managers on policy and technical coordination.



# Glossary

AIS – Aquatic Invasive Species

DFO – Department of Fisheries and Oceans Canada

DNR – Department of Natural Resources

Ecology – Department of Ecology

EDRR – Early Detection Rapid Response

EGC – European green crab (*Carcinus maenas*)

FY – Fiscal Year

ICS – Incident Command System

MAC Group – Multi-Agency Coordination Group

NGO – Non-governmental organizations

NOAA – National Oceanographic and Atmospheric Administration

NWR – National Wildlife Refuge

Q1 – First quarterly phase of EGC emergency response (March 1 – September 30, 2022)

Q2 – Second quarterly phase of EGC emergency response (October 1 – December 31, 2022)

Q3 – Third quarterly phase of EGC emergency response (January 1 – March 31, 2023)

RCO – Recreation and Conversation Office

RCW – Revised Code of Washington

RTF – Research Task Force

SitReps – ICS Situation Reports

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Survey

WAC – Washington Administrative Code

WDFW – Washington Department of Fish and Wildlife

WSG – Washington Sea Grant

WSU – Washington State University





# References

- Carlton, J. T., and A. N. Cohen. 2003. Episodic global dispersal in shallow water marine organisms: the case history of the European shore crabs *Carcinus maenas* and *C. aestuarii*. *Journal of Biogeography* **30**:1809-1820.
- Dare, P. J., G. Davies, and D. Edwards. 1983. Predation on juvenile Pacific oysters (*Crassostrea gigas* Thunberg) and mussels (*Mytilus edulis* L.) by shore crabs (*Carcinus maenas* L.). Ministry of Agriculture, Fisheries and Food Directorate of Fisheries Research.
- Drinkwin, J., A. Pleus, T. Therriault, R. Talbot, E. W. Grason, P. S. McDonald, J. Adams, T. Hass, and K. Litle. 2018. Salish Sea transboundary action plan for invasive European green crab. Puget Sound Partnership.
- Flannery, R. 2022. Personal communication. Washington Department of Fish and Wildlife.
- Forster, Z. 2023. Personal communication. Washington Department of Fish and Wildlife.
- Gillespie, G. E., T. Norgard, E. Anderson, D. Haggarty, and A. Phillips. 2015. Distribution and Biological Characteristics of European Green Crab, *Carcinus Maenas*, in British Columbia, 2006-2013. 1100255354, Fisheries and Oceans Canada, Science Branch, Pacific Region, Pacific ....
- Grason, E. W., P. S. McDonald, J. Adams, K. Litle, J. K. Apple, and A. Pleus. 2018. Citizen science program detects range expansion of the globally invasive European green crab in Washington State.
- Grosholz, E. D., G. M. Ruiz, C. A. Dean, K. A. Shirley, J. L. Maron, and P. G. Connors. 2000. The impacts of a nonindigenous marine predator in a California bay. *Ecology* **81**:1206-1224.
- Howard, B. R., F. T. Francis, I. M. Côté, and T. W. Therriault. 2019. Habitat alteration by invasive European green crab (*Carcinus maenas*) causes eelgrass loss in British Columbia, Canada. *Biological Invasions* **21**:3607-3618.
- Jamieson, G., E. Grosholz, D. Armstrong, and R. Elner. 1998. Potential ecological implications from the introduction of the European green crab, *Carcinus maenas* (Linnaeus), to British Columbia, Canada, and Washington, USA. *Journal of Natural History* **32**:1587-1598.
- Kern, F., E. Grosholz, and G. Ruiz. 2002. Management plan for the European green crab. Aquatic Nuisance Species Task Force. <http://www.anstaskforce.gov/GreenCrabManagementPlan.pdf>.
- Leignel, V., J. Stillman, S. Baringou, R. Thabet, and I. Metais. 2014. Overview on the European green crab *Carcinus* spp. (Portunidae, Decapoda), one of the most famous marine invaders and ecotoxicological models. *Environmental Science and Pollution Research* **21**:9129-9144.
- Lovell, S. J., E. Y. Besedin, and E. Grosholz. 2007. Modeling economic impacts of the European green crab.
- Mach, M. E., and K. M. Chan. 2013. Trading green backs for green crabs: evaluating the commercial shellfish harvest at risk from European green crab invasion. *F1000Research* **2**.
- Malyshev, A., and P. A. Quijón. 2011. Disruption of essential habitat by a coastal invader: new evidence of the effects of green crabs on eelgrass beds. *ICES Journal of Marine Science* **68**:1852-1856.
- Matheson, K., C. McKenzie, R. Gregory, D. Robichaud, I. Bradbury, P. Snelgrove, and G. Rose. 2016. Linking eelgrass decline and impacts on associated fish communities to European green crab *Carcinus maenas* invasion. *Marine Ecology Progress Series* **548**:31-45.
- McDonald, P. S., G. C. Jensen, and D. A. Armstrong. 2001. The competitive and predatory impacts of the nonindigenous crab *Carcinus maenas* (L.) on early benthic phase Dungeness crab *Cancer magister* Dana. *Journal of Experimental Marine Biology and Ecology* **258**:39-54.
- Pfleeger-Ritzman, L. 2022. Personal communication. Shoalwater Bay Tribal Natural Resources Program.



Poirier, L. A., L. A. Symington, J. Davidson, S. St-Hilaire, and P. A. Quijón. 2017. Exploring the decline of oyster beds in Atlantic Canada shorelines: potential effects of crab predation on American oysters (*Crassostrea virginica*). *Helgoland Marine Research* **71**:1-14.

Turner, B. C. 2022. Personal Communication. Washington Department of Fish and Wildlife.



# Appendix A

## **WAC [220-640-030](#) - Prohibited level 1 species.**

The following species are classified as prohibited level 1 species:

- (1) Molluscs: Family Dreissenidae: Zebra and quagga mussels: *Dreissena polymorpha* and *Dreissena rostriformis bugensis*.
- (2) Crustaceans:
  - (a) Family Grapsidae: Mitten crabs: All members of the genus *Erochier*.
  - (b) Family Portunidae: European green crab, *Carcinus maenas*.
- (3) Fish:
  - (a) Family Channidae: China fish, snakeheads: All members of the genus *Channa*.
  - (b) Family Clariidae: All members of the walking catfish family.
  - (c) Family Cyprinidae:
    - (i) Carp, Bighead, *Hypophthalmichthys nobilis*.
    - (ii) Carp, Black, *Mylopharyngodon piceus*.
    - (iii) Carp, Silver, *Hypophthalmichthys molitrix*.
    - (iv) Carp, largescale silver, *Hypophthalmichthys harmandi*.
  - (d) Family Esocidae: Northern pike, *Esox lucius*.

## **RCW [77.135.040](#) - Prohibited and regulated species - Required authorization**

(1) Prohibited level 1, level 2, and level 3 species may not be possessed, introduced on or into a water body or property, or trafficked, without department authorization, a permit, or as otherwise provided by rule.

(2) Regulated type A, type B, and type C species may not be introduced on or into a water body or property without department authorization, a permit, or as otherwise provided by rule.

(3) Regulated type B species, when being actively used for commercial purposes, must be readily and clearly identified in writing by taxonomic species name or subspecies name to distinguish the subspecies from another prohibited species or a regulated type A species. Nothing in this section precludes using additional descriptive language or trade names to describe regulated type B species as long as the labeling requirements of this section are met.

## **RCW [77.135.090](#) - Emergency measures**

(1) If the director finds that there exists an imminent danger of a prohibited level 1 or level 2 species detection that seriously endangers or threatens the environment, economy, human health, or well-being of the state of Washington, the director must ask the governor to order, under RCW [43.06.010](#)(14), emergency measures to prevent or abate the prohibited species. The director's findings must contain an evaluation of the effect of the emergency measures on environmental factors such as fish listed under the endangered species act, economic factors such as public and private access, human health factors such as water quality, or well-being factors such as cultural resources.



(2) If an emergency is declared pursuant to RCW [43.06.010](#)(14), the director may consult with the invasive species council to advise the governor on emergency measures necessary under RCW [43.06.010](#)(14) and this section, and make subsequent recommendations to the governor. The invasive species council must involve owners of the affected water body or property, state and local governments, federal agencies, tribes, public health interests, technical service providers, and environmental organizations, as appropriate.

(3) Upon the governor's approval of emergency measures, the director may implement these measures to prevent, contain, control, or eradicate invasive species that are the subject of the emergency order, notwithstanding the provisions of chapter [15.58](#) or [17.21](#) RCW or any other statute. These measures, after evaluation of all other alternatives, may include the surface and aerial application of pesticides.

(4) The director must continually evaluate the effects of the emergency measures and report these to the governor at intervals of not less than ten days. The director must immediately advise the governor if the director finds that the emergency no longer exists or if certain emergency measures should be discontinued.

## **ESSB 5693 (2022 c 297)- Making 2021-2023 fiscal biennium supplemental operating appropriations**

Section 308. (Page 552, Line 16)

(67) \$2,472,000 of the general fund—state appropriation in fiscal year 2022 and \$6,096,000 of the general fund—state appropriation in fiscal year 2023 are provided solely for the department to implement eradication and control measures on European green crabs through coordination and grants with partner organizations. The department must provide quarterly progress reports on the success and challenges of the measures to the appropriate committees of the legislature by December 1, 2022.23

### **Q1 (March 1 – September 30, 2022) EGC Report**

The Q1 report is available at <https://wdfw.wa.gov/publications/02372> or via this link: [European Green Crab Quarterly Progress Report – Fall 2022](#)

### **Q1 Catch data clarification**

Please note that European green crab (EGC) catch numbers in the Q1 report included EGC caught from January 31 – February 28, 2022. These months fall outside the official duration of Q1 (March 1 – September 30, 2022) but were included to 1) accurately represent EGC removals for 2022 and 2) the submission process for SitRep 1 included co-managers, tribes, and partners submitting catch data from January 1- June 11, 2022, as a single number.



## Q2 (October 1 – December 31, 2022) EGC Report

The Q2 report is available at <https://wdfw.wa.gov/publications/02414> or via this link: [European Green Crab Quarterly Progress Report – Winter 2022](#)

### List of Washington European green crab management actions in chronological order for Q3 (January 1 – March 31, 2023) as provided in Situation Reports

Date	EGC Management Action
1/1-31/2023	WDFW continues ongoing development of online data reporting application and “microsite” with Esri contractor. The product will have both internal and external functions for partners and the public, including data submission, operations support, and maps and public awareness resources.
1/9/2023	WDFW contacts 14 conservation districts and provides EGC outreach resources. Outreach staff also connected with other coastal partners, marinas and marine resources committees offering EGC identification and outreach materials.
1/18/2023	MAC Group meeting: MAC Group representation was discussed, and gaps were identified, notably participation from the shellfish industry, and the Department of Fisheries and Oceans Canada was added as a MAC Group member. Budget was discussed, and presentations were given by Justin Bush on the status of the Recreation and Conservation office grants, and by Chris Waldbillig on the coastal management grants. The FY23 State Action Plan was reviewed by the group and finalized.
1/19/2023	WDFW provides an EGC emergency management update at the annual Shellfish Co-Manager Policy meeting.
1/19/2023	WDFW EGC outreach staff attend Storming the Sound in La Connor and distributes materials to attendees including environmental education organizations.
1/20/2023	EGC State Caucus meeting: WDFW meeting with MAC Group state agency representatives to discuss 2023 planning and resource needs.
1/20/2023	EGC Federal Caucus meeting: WDFW meeting with MAC Group federal agency representatives to discuss 2023 planning and resource needs.
1/24/2023	WA Sea Grant hosts the EGC Trapper’s Summit at Suquamish Clearwater Casino. The summit focused on co-managers and partners that actively trapped EGC in 2022 and was provided to share observations and learn what other trappers saw in 2022 and are planning for 2023, collaboratively explore the data that we’ve been individually pulling together, to build on each other’s technical knowledge of trapping, and identify questions and priorities that might help inform future trapping efforts.
1/27/2023	WDFW EGC outreach staff attend “Illuminight” in Mount Vernon, an event focused on celebrating the Skagit River and community, and has 100+ EGC conversations.



Date	EGC Management Action
1/30/2023	WDFW meeting with Northwest Straits Commission to discuss 2023 planning and resource needs for North Puget Sound Management Area.
1/31/2023	WDFW deploys updated outreach materials, including a <a href="#">EGC identification graphic</a> , <a href="#">EGC identification outreach sign</a> , <a href="#">plain language talking points</a> , and partner recognition sign.
1/31/2023	WDFW completes January distribution of 70+ EGC reporting signs and 700+ EGC stickers to partner organizations and individuals.
2/1/2023	EGC Co-Manager & Partner Meeting: The Washington Department of Fish and Wildlife (WDFW) hosted the annual Washington EGC Co-Managers and Partners Meeting in Lacey. This was a hybrid event, and participants including tribal staff, shellfish growers, and staff from other agencies and partners were able to join the meeting in person or online via Teams. Presenters from entities participating in the EGC Emergency Response provided updates including: Allen Pleus (WDFW), EGC Incident Commander, provided an update on EGC management in Washington state; Chris Waldbillig (WDFW) and Justin Bush (RCO) updated attendees on the availability of grant funding for EGC emergency response efforts; Dr. Brian Turner (WDFW) presented on current science around EGC and the newly launched EGC Research Task Force; Nicole Burnet (Padilla Bay National Estuarine Research Reserve) presented findings from their EGC larval studies and their plans to develop an identification guide; Diana Dishman (National Oceanic and Atmospheric Administration) gave participants guidance on complying with Endangered Species Act permitting; and Jessica Ostfeld (WDFW) provided an update on EGC outreach and communications, and ways partners and tribes can coordinate to increase community awareness and public reporting of EGC.
2/2/2023	EGC MAC Group meeting: The European Green Crab Multi-Agency Coordination (MAC) Group met virtually on February 2, 2023. A research update was provided by Dr. Brian Turner. A safety update was provided by WDFW Safety Officer Scott Loerts and safety officer contacts for all organizations participating in field work were solicited with the intent of attendance at quarterly safety meetings to achieve emergency measures priority objectives. Two proposals were reviewed by the MAC Group. Proposal 9, "GHCD Green Crab Removal Trapping – Boat Purchase" was submitted by the Grays Harbor Conservation District for \$30,000 and recommended for approval by the MAC Group with no dissenting votes. Proposal 10, "Funding to Willapa Grays Harbor Oyster Growers Association" was submitted by the Pacific Conservation District for \$90,000 and recommended for approval by the MAC Group with no dissenting votes. Pending WDFW approval of these agreements, of the \$1.1 million available through Recreation and Conservation Office (RCO) EGC interagency agreements available in FY 2023, approximately \$0 remains unobligated.
2/2-11/2023	Seattle Boat Show: EGC staff provided education and outreach at WDFW's booth, speaking with more than 900 people about EGC, passing out signs, fliers, and other outreach materials. EGC reporting signs were also distributed to industry and attendees.
2/8/2023	Meeting with Senator Jeff Wilson (19th District): Tom McBride (WDFW Legislative Liaison) and Allen Pleus (WDFW EGC IC) met with Senator Jeff Wilson about allocation of EGC funds, specifically to the middle coast of Washington. As follow up to that meeting, DFW provided the overall funding distribution numbers to Senator Wilson.



Date	EGC Management Action
2/9/2023	WDFW Region 4 Co-Manager meeting: Allen Pleus (WDFW EGC IC) provided an update on EGC emergency measures to the Lummi Nation and Nooksack Indian Tribe at their monthly regional meeting with WDFW Region 4 Director Brokes.
2/10/2023	EGC definitions work group meetings: Continuation of meetings between WDFW and WSG to draft consistent definitions for common EGC management terms used in SitReps, reports, data management, and Incident Action Plans. The intent is to have a review draft for dissemination available by March 16.
2/13-14/2023	EGC transboundary meeting: Hosted 2-day Transboundary Research Discussion at WSG joined by WDFW and DFO colleagues. Several partners from WSG, WDFW, WSU and DFO (Science) convened at WSG in Seattle on Feb 13 and 14 to discuss research priorities in support of European green crab management. As transboundary colleagues, DFO, WDFW, and WSG have been working together for several years to reconcile our mutual understanding of local green crab status and ecology. With the increasing scale of management action in Washington, the demand for reliable information to guide management practices is also growing, yet data and research gaps remain. This group identified and strategized on topic areas in need of additional scientific investigation and started the process of prioritizing these research areas to address management-related questions. Areas of discussion for future research included: population control techniques through an IPM lens, population genetics and genetics tools, predicting dispersal and spread, and understanding habitat use and migration. The work started here will be carried forward by the research task force and enables researchers to leverage each other's capacity, reduce duplicative investigations, and focus on the most-needed information to manage green crabs.
2/13-14/2023	Training: WDFW and WSG provided field training for DNR in Grays Harbor.
2/14/2023	EGC State caucus meeting: Review of proposed MAC Group membership requirements by RCO, WDFW, DNR, AGR, ECY, Parks, and EMD. Recommendations were incorporated into a WDFW EGC MAC Group "Composition, Structure & Duties" review draft document for discussion at the next MAC Group meeting.
2/14/2023	EGC Emergency Measures Update: At the request of Senator Wilson at the meeting on February 8th, WDFW provided the "2021-23 Biennium EGC Emergency Measures Budget and Effort Distribution" document.
2/15/2023	Meeting with Representative Joel McEntire (19th District): Incident command staff and a consortium of invasive species researchers and managers met with 19 <sup>th</sup> Legislative District's Representative Joel McEntire to discuss innovative long-term solutions to European green crab (EGC) management including exploring the feasibility of genetically modifying traits in the invasive species to manage their populations, creating new detection tools, and more. The research consortium and incident command staff included participants from the Washington Recreation and Conservation Office, administrative host of the Washington Invasive Species Council, Washington Department of Fish and Wildlife, University of Washington, Washington Sea Grant, Washington State University Extension, and Woods Hole Oceanographic Institution in Massachusetts. Together the consortium discussed the current knowns and scientific abilities including initial steps toward a long-term goal of integrating new tools into the toolbox. As next steps, the consortium will be developing a scope of work, timeline and budget for initial actions including EGC gene mapping followed by EGC gene annotation. Recognizing EGC is a global invasive species, the consortium is also exploring the



Date	EGC Management Action
	feasibility of a genetics summit bringing together the best minds globally to tackle this shared issue.
2/15/2023	EGC MAC Group meeting: The European Green Crab Multi-Agency Coordination (MAC) Group met virtually on February 15, 2023. The purpose and expectations of MAC Group membership were discussed due to an increased interest in membership and identification of gaps in representation. A science management overview was provided by Drs. Brian Turner, Sean McDonald, and Emily Grason. This presentation was a shortened reprisal of the in-depth presentation given at the EGC Co-Managers & Partners hybrid meeting held in Lacey on February 1.
2/16/2023	Willapa-Grays Harbor Estuary Collaborative meeting: The Willapa-Grays Harbor Estuary Collaborative (WGHEC) held a special session dedicated to European green crab on the WA coast during their quarterly winter meeting. Presentations from the Washington Department of Fish and Wildlife (WDFW), the Department of Natural Resources (DNR), the Shoalwater Bay Indian Tribe, Pacific Seafoods, Pacific County Vegetation Management (PCVM), and Washington Sea Grant focused on topics ranging from 2022 trapping and monitoring results, 2023 trapping plans, and management progress to-date. A panel followed, where all presenters were asked questions related to research and management priorities and green crab trends. The goal of the session was to update the core members of the Collaborative on the status of the coastal green crab invasion, to hear from researchers and managers about their work for upcoming year, and to make sure that local perspectives were heard and considered in future planning conversations.
2/17/2023	SitReps: WDFW issues SitRep #14 (January 1 to 31, 2023).
2/21/2023	ICS consultation with state Emergency Management Division: Allen Pleus (EGC Incident Commander), Kirt Hughes (WDF), Justin Bush and Jessica La Belle (RCO) met with Kevin Wickersham of the state Emergency Management Division (EMD) for feedback on implementation of EMD Mission # 22-1085 (EGC emergency measures) Incident Command System (ICS). Mr. Wickersham noted that this is a long-term, complex, and large spatial incident like Highly Pathogenic Avian Influenza (HPAI) emergency situation and that WDFW continues to implement the ICS process in a comprehensive and strategic manner.
2/21/2023	EGC Public Update Webinar: Representatives from the Washington Department of Fish and Wildlife presented a public European green crab webinar on February 21, 2023. This event was hosted by the Washington Invasive Species Council as part of Invasive Species Awareness Week. Allen Pleus, the Incident Commander for the green crab emergency, provided a welcome and overview of the funding and incident command structure. Public Information Officer Chase Gunnell then expounded on this with an in-depth discussion of Washington's European green crab emergency response and communications to date. Future goals and management strategies were also highlighted. Brian Turner then described the current distribution and impacts of the European green crab. The importance of coordination between the state and multiple co-managers and partners was emphasized. EGC Outreach Specialist Jessica Ostfeld covered European green crab identification and ways for the public to get involved. Finally, there was a question-and-answer session with all the speakers. The "European Green Crab Webinar" was approximately 1 hour and 15 minutes with 40 attendees and can be viewed at: <a href="https://youtube.com/playlist?list=PLo22nBM4mjeQwuqRUGKE-9P-8q-l3dLZc">https://youtube.com/playlist?list=PLo22nBM4mjeQwuqRUGKE-9P-8q-l3dLZc</a> .





Date	EGC Management Action
2/21/2023	EGC Science Task Force: 1st meeting held.
2/24-3/2/2023	Willapa Bay and Grays Harbor Incident Action Plan (IAP) Workshop Planning: Based on feedback from multiple forums, WDFW meet with RCO and WSG to begin planning two one-day workshops to support local Willapa Bay and Grays Harbor Management Area (MA) co-managers and partners in developing a 2023 EGC Incident Action Plan. The Willapa Bay MA workshop will occur sometime the last two weeks of April and the Grays Harbor MA workshop sometime the first two weeks of May.
2/27/2023	WDFW EGC Seasonal Tech recruitment: WDFW issues recruitment notice for 2023 EGC seasonal technician trapping and logistics support: European Green Crab Technician - Scientific Technician 2 - 8 Positions - Career Seasonal - *02979-23.
2/28-3/2/2023	Transboundary: Chelsey Buffington (WDFW) provided an EGC update to the Invasive Species Council of British Columbia then spent two days trapping EGC with Canada's Coastal Restoration Society.
2/28/2023	Jan/Feb European Green Crab Public Update <a href="#">issued</a> . This edition covered management actions in January and early February, as well as highlights on work by the Jamestown S'Klallam Tribe and WDFW in Sequim and Discovery Bays, and innovative monitoring tactics by WDFW staff near Seabeck in Hood Canal. Consistent with other EGC Public Updates, highlights were published to WDFW's <a href="#">blog</a> and social media, and an email was sent to the EGC Management Updates listserv. The sign-up for the email is <a href="#">available here</a> .
2/28/2023	WDFW deployed updated outreach materials for 2023, including an EGC identification graphic, identification outreach sign, plain language talking points, and partner recognition sign. Signs, outreach materials, and other resources were shared with county conservation districts, tribes, marinas, boat launches and water access areas, shellfish growers, and other partner groups. More than 1,000 stickers and 150 reporting signs were distributed.
2/28/2023	A letter signed by WDFW Director Kelly Susewind on EGC and Prohibited invasive species to shellfish shippers, dealers was distributed and <a href="#">is available online</a> . This letter is part of follow-up to the December incident involving EGC confiscated from a Seattle market.
3/1/2023	EGC MAC Group meeting: The European Green Crab Multi-Agency Coordination (MAC) Group met virtually on March 1, 2023. A document providing the specifics of the MAC Group composition, structure, and duties was finalized and will be distributed to parties interested in MAC Group membership and used as guidance for qualifying participants. In-person workshops to coordinate EGC management activities in the Willapa Bay and Grays Harbor areas were discussed and an agenda overview with workshop goals was provided. Additionally, Incident Commander Allen Pleus provided an overview of the emergency measures budget and effort distribution with comparisons of coastal, Salish Sea, and statewide funding and efforts.
3/1/2023	Second Quarterly (Q2) EGC progress report: In response to the legislative budget proviso directive in ESSB 5693 (2022 c 297), the second in a series of ongoing quarterly progress reports (Q2) was issued. The report summarizes the successes and challenges of ongoing European green crab (EGC) emergency response efforts in Washington state from October 1 to December 31, 2022. In addition, the report puts the work during Q2 in the context of the work completed in Q1 (March 1 to September 30, 2022). It is available at: <a href="https://wdfw.wa.gov/publications/02414">https://wdfw.wa.gov/publications/02414</a> .



Date	EGC Management Action
3/1/2023	WDFW Staffing: Olympia-based EGC biologist hired and onboarded.
3/9/2023	EGC Definitions Workgroup meeting (WDFW & Washington Sea Grant).
3/9/2023	Updated EGC outreach materials including wallet-sized ID card, rack card, EGC in WA 101 presentation, 2022 detection maps, and more uploaded online at: <a href="https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#resources">https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#resources</a>
3/10/2023	EGC SitRep #15 issued.
3/10/2023	WDFW trap outfitting emphasis work session. Working toward completing the outfitting (tags, rebar weights, entrance restrictions) for remaining shrimp and Fukui traps that will be available for loan.
3/15/2023	European Green Crab Multi-Agency Coordination (MAC) Group meeting: MAC Group composition was discussed, and there is currently one seat available for a tribal nation, two seats available for support entities, one seat open for Salish Sea aquaculture, and one seat open for coastal aquaculture. The upcoming workshops for the Willapa Bay and Grays Harbor Coordination Areas were discussed, including the prep work for participants to complete. The development of the Fiscal Year 2024 (FY24) European Green Crab Strategic Action Plan was also discussed, and a request was made for Fiscal Year 2023 (FY23) task leads to provide task status updates on a worksheet that will be managed by Jessica La Belle. Theresa Thom of the US Fish & Wildlife Service provided an overview of the planning process for the updates to the national European green crab management plan. Developing a contract for the Washington long-term management plan was an additional topic of discussion.
3/15/2023	Federal letters: As part of WDFW's commitment to seek enhanced federal European green crab (EGC) support, WDFW Director Susewind submitted letters to the Washington State congressional representatives and to NOAA Administrator Richard Spinrad. Both these letters were co-signed by state Senator Kevin Van De Wege, Representative Mike Chapman, four additional state agencies, and seven tribes. Copies of the letters are available at <a href="https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#conservation">https://wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#conservation</a> .
3/16/2023	Final Definitions Workgroup meeting.
3/17/2023	WDFW meeting with USGS to explore whether there are any synergies between the work of the USGS Early Detection Rapid Response team and the needs of those working in Washington to tackle the growing presence of European Green Crab.
3/17-19/2023	Grays Harbor Conservation District (GHCD) and WDFW tabled at the Ocean Shores Razor Clam Festival to raise awareness about European green crab infestations on the coast. More than 500 people were reached, and outreach materials were distributed to attendees and local partners.



Date	EGC Management Action
3/21/2023	Second meeting of the European green crab Research Task Force (RTF).
3/21-4/2/2023	Ongoing WDFW data hub/app development with Esri.
3/21-4/2/2023	Design, ordering, and acquisition of EGC retractable, standing banner for use in outreach.
3/22/2023	WDFW EGC policy group meeting/status update.
3/27-31/2023	WDFW support to Jamestown S’Klallam Tribe in preparation of Senator Murray and Representative Kilmer visit on April 5.
3/30/2023	EGC MAC Group meeting: Incident Commander (IC) Pleus provided a review of SitRep #16 with localized updates from Shawn Evenson (Lummi), David Beugli (WGHOGA), Dawson Litle (Makah), Alexa Brown (WDNR) and Larissa Pfleeger (Shoalwater Bay). IC Pleus reviewed the new EGC management definitions with a note on the new term “emphasis response” being added to management types for planned large-scale responses. Meagan West (WDFW) provided an update on agency efforts to seek federal funding for EGC response including the letter sent to the Washington Congressional Delegation and the letter sent to NOAA. Roger Fuller (Padilla Bay NERR), Leah Robison and Allie Simpson (NW Straits Commission) provided and update on work being done in North Puget Sound Management Area. IC Pleus and Jessica LaBelle (RCO) provided an update on the 2023 EGC management planning workshops set for Willapa Bay on April 18 and Grays Harbor on May 4.
3/31/2023	National Aquatic Nuisance Species Task Force European green crab management plan meeting.



## List of media reporting in chronological order related to Washington European green crab management for Q3 (January 1 – March 31, 2023) as provided in Situation Reports

Date	Outlet	Headline	URL
1/5/2023	The CW11 KSTW	Department of Fish & Wildlife recently confiscated live European Green Crabs sold illegally	<a href="https://www.cbsnews.com/seattle/video/department-of-fish-wildlife-recently-confiscated-live-european-green-crabs-sold-illegally/">https://www.cbsnews.com/seattle/video/department-of-fish-wildlife-recently-confiscated-live-european-green-crabs-sold-illegally/</a>
1/6/2023	The Cordova Times	Prohibited live European green crabs confiscated in Washington	<a href="https://www.thecordovaitimes.com/2023/01/06/prohibited-live-european-green-crabs-confiscated-in-washington/">https://www.thecordovaitimes.com/2023/01/06/prohibited-live-european-green-crabs-confiscated-in-washington/</a>
1/11/2023	Sequim Gazette	Invasive green crab presence remains on Olympic Peninsula	<a href="https://www.sequimgazette.com/news/invasive-green-crab-presence-remains-on-olympic-peninsula/">https://www.sequimgazette.com/news/invasive-green-crab-presence-remains-on-olympic-peninsula/</a>
1/17/2023	Northwest Treaty Tribes	Fight in “brushfire mode” against invasive crab	<a href="https://nwtreatytribes.org/fight-in-brushfire-mode-against-invasive-crab/">https://nwtreatytribes.org/fight-in-brushfire-mode-against-invasive-crab/</a>
1/21/2023	The Astorian	Guest Column: All hands on deck to slow spread of European green crab	<a href="https://www.dailystorian.com/opinion/columns/guest-column-all-hands-on-deck-to-slow-spread-of-european-green-crab/article_c0489a3a-978c-11ed-9985-ef025d60fcca.html">https://www.dailystorian.com/opinion/columns/guest-column-all-hands-on-deck-to-slow-spread-of-european-green-crab/article_c0489a3a-978c-11ed-9985-ef025d60fcca.html</a>
1/24/2023	SMEA UW Currents	RAVING MAD CRAB	<a href="https://smea.uw.edu/currents/raving-mad-crab/">https://smea.uw.edu/currents/raving-mad-crab/</a>
1/27/2023	The Daily World	Fish and houseguests: Shoalwater Bay Tribe pushes back against green crab	<a href="https://www.thedailyworld.com/news/fish-and-houseguests-shoalwater-bay-tribe-pushes-back-against-green-crab/">https://www.thedailyworld.com/news/fish-and-houseguests-shoalwater-bay-tribe-pushes-back-against-green-crab/</a>
2/11/2023	The Narwhal	The worst house guests: European green crabs are invading B.C. waters	<a href="https://thenarwhal.ca/invasive-european-green-crabs/">https://thenarwhal.ca/invasive-european-green-crabs/</a>
2/13/2023	Washington Stormwater	E&O Effort Aims to Mobilize Volunteers Against Invasive Species	<a href="https://www.wastormwatercenter.org/eo-effort-aims-to-mobilize-volunteers-against-invasive-species/">https://www.wastormwatercenter.org/eo-effort-aims-to-mobilize-volunteers-against-invasive-species/</a>
2/13/2023	Recreation and Conservation Office	Governor Proclaims the Week of February 20 as Invasive Species Awareness Week	<a href="https://rco.wa.gov/invasive-species-awareness-week/?utm_source=rss&amp;utm_medium=rss&amp;utm_campaign=invasive-species-awareness-week">https://rco.wa.gov/invasive-species-awareness-week/?utm_source=rss&amp;utm_medium=rss&amp;utm_campaign=invasive-species-awareness-week</a>



Date	Outlet	Headline	URL
2/14/2023	Fox 11 41	Invasive species awareness week	<a href="https://www.fox41yakima.com/invasive-species-awareness-week/">https://www.fox41yakima.com/invasive-species-awareness-week/</a>
2/21/2023	Undercurrent News	Battle against European green crab infestation underway off Canadian coast	<a href="https://www.undercurrentnews.com/2023/02/21/battle-against-european-green-crab-infestation-underway-off-canadian-coast/">https://www.undercurrentnews.com/2023/02/21/battle-against-european-green-crab-infestation-underway-off-canadian-coast/</a>
2/22/2023	MyNorthwest	WA preparing to protect marine life against invasive green crab	<a href="https://mynorthwest.com/3837843/state-prepares-protect-local-marine-life-invasive-green-crab/">https://mynorthwest.com/3837843/state-prepares-protect-local-marine-life-invasive-green-crab/</a>
2/23/2023	Q13 Fox News	Invasive species pose serious threat to Washington state	<a href="https://www.q13fox.com/news/invasive-species-pose-serious-threat-to-washington-state">https://www.q13fox.com/news/invasive-species-pose-serious-threat-to-washington-state</a>
2/24/2023	Kitsap Daily News	Volunteers sought for invasive green crab monitoring	<a href="https://kitsapdailynews.com/news/volunteers-sought-for-invasive-green-crab-monitoring/">https://kitsapdailynews.com/news/volunteers-sought-for-invasive-green-crab-monitoring/</a>
2/25/2023	Bollyinside	Washington State is seriously threatened by invasive species	<a href="https://www.bollyinside.com/news/latest-science-news/washington-state-is-seriously-threatened-by-invasive-species/">https://www.bollyinside.com/news/latest-science-news/washington-state-is-seriously-threatened-by-invasive-species/</a>
2/28/2023	The Everett Post	The Invasive Species of Washington and What the Community Can do to Help	<a href="https://www.everettpost.com/local-news/the-invasive-species-of-washington-and-what-the-community-can-do-to-help">https://www.everettpost.com/local-news/the-invasive-species-of-washington-and-what-the-community-can-do-to-help</a>
3/6/2023	WSG Blog	WSG receives \$1.59 million to boost Puget Sound habitat	<a href="https://wsg.washington.edu/wsg-receives-1-59-million-to-boost-puget-sound-habitat/">https://wsg.washington.edu/wsg-receives-1-59-million-to-boost-puget-sound-habitat/</a>
3/6/2023	Chinook Observer	Green menace: Scientists hopeful tracking study will reveal green crab secrets	<a href="https://www.chinookobserver.com/news/green-menace-scientists-hopeful-tracking-study-will-reveal-green-crab-secrets/article_ff658eb6-bc63-11ed-862e-835b5d78920b.html">https://www.chinookobserver.com/news/green-menace-scientists-hopeful-tracking-study-will-reveal-green-crab-secrets/article_ff658eb6-bc63-11ed-862e-835b5d78920b.html</a>
3/13/2023	WSG Blog	A Code to Crab By	<a href="https://wsg.washington.edu/crabbers_code_launch/">https://wsg.washington.edu/crabbers_code_launch/</a>
3/14/2023	Inergency	Invasive Green Crabs Pose Threat to Washington's Shellfish Industry and Tribal Culture	<a href="https://inergency.com/amp/invasive-green-crabs-pose-threat-to-washingtons-shellfish-industry-and-tribal-culture-2/">https://inergency.com/amp/invasive-green-crabs-pose-threat-to-washingtons-shellfish-industry-and-tribal-culture-2/</a>



Date	Outlet	Headline	URL
3/16/2023	Seattle's Child	Exciting adventures on the Guillemot Cove Trail	<a href="https://www.seattleschild.com/guillemot-cove-trail/">https://www.seattleschild.com/guillemot-cove-trail/</a>
3/27/2023	Chinook Observer	Willapa Bay crabbers deliver record haul	<a href="https://www.chinookobserver.com/news/willapa-bay-crabbers-deliver-record-haul/article_208b4ae2-cccf-11ed-b016-f7116b25e41e.html">https://www.chinookobserver.com/news/willapa-bay-crabbers-deliver-record-haul/article_208b4ae2-cccf-11ed-b016-f7116b25e41e.html</a>
3/29/2023	United States Senate Committee on Appropriations	At Hearing with Secretary of the Interior, Senator Murray Highlights How Conservation Keeps Our Economy Strong, Families Safe, and Nation Globally Competitive	<a href="https://www.appropriations.senate.gov/news/majority/at-hearing-with-secretary-of-the-interior-senator-murray-highlights-how-conservation-keeps-our-economy-strong-families-safe-and-nation-globally-competitive">https://www.appropriations.senate.gov/news/majority/at-hearing-with-secretary-of-the-interior-senator-murray-highlights-how-conservation-keeps-our-economy-strong-families-safe-and-nation-globally-competitive</a>
3/29/23	The Bulletin	Willapa Bay crabbers deliver record haul	<a href="https://www.bendbulletin.com/willapa-bay-crabbers-deliver-record-haul/article_a7ad57f8-8f55-5f98-b794-fc907ee560aa.html">https://www.bendbulletin.com/willapa-bay-crabbers-deliver-record-haul/article_a7ad57f8-8f55-5f98-b794-fc907ee560aa.html</a>



# Appendix B – Co-manager and partner addendums

## Shoalwater Bay Tribe Natural Resources Department



Shoalwater Bay Indian Tribe Legislative Report

January 1, 2023, through March 31, 2023

### Introduction

The Shoalwater Bay Tribe Natural Resources Department (SBDNR) has been trapping European green crab (EGC) steadily since 2020. The Tribe's Natural Resource Department was contacted by Washington Sea Grant in 2020 to pursue a sentinel site for monitoring. EGC were observed in Willapa Bay in the late 1990's, Shoalwater did not hear of rediscovery in 2015 by Washington Department of Fish and Wildlife. SBDNR started trapping during fall of 2020 with little results from sentinel site methods. It wasn't until varied site assessment trapping with shrimp pots and other trap types was explored, that more than 534 EGC were removed during trapping in September of 2020, clearly indicating a larger population. In 2021 5,965 EGC were removed and as a result in January of 2022, Shoalwater Bay Tribal Council declared a State of Emergency centered on the threat to Tribal cultural and natural resources. SBDNR did not have EGC program funding in FY2020-2021, SBDNR and Pacific County Vegetation Management trapped and collaborated on efforts in Willapa Bay. SBDNR had yearend and a full proposal funded through the BIA in FY2022. In 2022 SBDNR removed 42,708 EGC from Tribal aquatic lands and the Reservation. SBDNR and the Tribe did request direct funding through the supplemental legislative request in FY22, and that request was denied. SBDNR currently funds the entirety of EGC work with Bureau of Indian Affairs Invasive Species Program funding.

### Current work/ supplies/ staff/ research

Currently SBDNR does not have full-time staff dedicated to only EGC removal and research. SBDNR staff from varying fields (biologists, foresters, equipment operators, agricultural techs) spend a few hours each week setting and retrieving shrimp pots. SBDNR's approach is pragmatic and targeted. SBDNR has deployed camera traps to review trap and bait efficacy, analyze crab interactions, assess site populations. SBDNR also added water quality monitoring to trapping sites. We have implemented mark/ recapture efforts in two trapping sites. SBDNR has also tested traps and methodologies exhaustively to pursue the most efficient setup. SBDNR has used modified oyster bags, collected from beach then added entry tunnels, weight, line and buoy, these can work as well



as some more expensive traps. SBDNR has also used Frabill, minnow, crawdad, fukui, ladiner, folding metal fukui, collapsible crab and shrimp pots, and top entry traps. In Willapa Bay smaller traps needed to be staked as usually they rolled with tides, Fukui traps broke because of weight of crabs, and small entry pots do not seem to work well for SBDNR even to capture young of the year crab. The most effective trap has been a 1" and/or ½" 24x24x10 shrimp pot, as CPUE ratio was exceptional, all size classes were attracted, bait lasts longer, and the traps for the most part can handle Willapa Bay tide cycles.

All SBDNR trapping is currently by land access only. Traps are set and retrieved within 2 hours of low tides. All traps are checked within 24 hours, and no traps are left out permanently. Traps are moved constantly following the population of EGC. Currently SBDNR's program does not support trapping during high tides, Willapa Bay tide cycles are volatile and unsafe for most sites during a high tide. SBDNR's program will acquire an airboat with funding from BIA and has two staff who have completed MOCC, making trapping windows and tides not an issue soon. SBDNR has trapped year-round since 2022. Tribal tidelands have a very high population of EGC that does not seem to be affected by current trapping efforts.

### **1<sup>st</sup> quarter FY23 Efforts**

From January 1, 2023, through March 31, 2023, SBDNR removed 5,355 EGC. Numbers removed are averaging higher than 2022 for the same period, SBDNR has set 442 more traps for the same period this year than last and removed 2,147 more EGC than 2022 for same period. The numbers of gravid females captured are also 45% greater than 2022. SBDNR is not seeing a reduction in population or presence during the winter, when most other entities stop trapping or have little crab present. SBDNR areas remain inundated with EGC year-round. All SBDNR captured and removed crab have been composted in the Tribe's community garden since 2021.

### **Challenges/ concerns**

Throughout the reporting period SBDNR continues to address challenges and mitigate EGC problems head on. Data sovereignty and Tribal sovereignty is an ongoing and concerning subject. SBDNR has found shrimp pot openings too small for large crab (90mm+), we are having new traps constructed that are modified to mitigate the problem. Pot security and seasonal tides are always an ongoing issue in the area SBDNR traps. Staff time and funding with BIA, currently SBDNR is looking at other opportunities for long term, perpetual funding. SBDNR and the Tribe are looking for answers regarding the impacts to Dungeness crab in the Willapa (season take was exceptionally high, the age class of Dungeness from commercial harvest, connection to EGC population dynamics, larval spread, gravid concentration) and on Willapa ecosystem, eel grass beds, clams, oysters, and other resources important to the Tribe. SBDNR also recognizes that while our efforts are sustained and consistent for our region, the entire bay and other areas need to maintain consistent trapping pressure and be utilizing the best available trapping practices consistently.





# Washington Department of Natural Resources



## Washington Department of Natural Resources (DNR) – Addendum for the Operational Period of January 1<sup>st</sup> – March 31<sup>st</sup>, 2023, under IAA #22-1970 for European Green Crab Emergency Measures.

- 1) DNR hired an EGC coordinator for the Salish Sea (Puget Sound) Region on March 1<sup>st</sup> to join our Coastal Region EGC Coordinator hired in October 2022. The DNR EGC Coordinators have been equipped and trained to WDFW EGC management protocols and integrated into the Aquatic Resources Division’s Invasive Species and Aquatic Reserves Programs.
- 2) DNR EGC Coordinators developed a work plan for its managed lands in March. This detailed work plan was shared and reviewed in collaboration with RCO, WDFW, WA Sea Grant and other affected programs and stakeholders. The DNR work plan was then presented for review and comment by the partners involved in the EGC Incidental Command framework through our continued participation within the Multi Agency Coordination (MAC) Group. DNR management actions include development of new monitoring sites in or near Aquatic Reserves, assessment trapping at sensitive habitats such as DNR managed Natural Areas and control trapping throughout the Coastal Region as presented in the work plan. DNR implemented its trapping and assessment efforts detailed in its work plan. DNR worked with our Coastal Region partners including Pacific County Vegetation Management, the Shoalwater Bay Tribe, and Pacific Seafood on trapping efforts. DNR completed trapping of all our priority sites in the Coastal Region for the first time as of April. Additionally, DNR staff efforts have resulted in 133 EGC captured this operational period within DNR Natural Areas in Grays Harbor and Willapa Bay.
- 3) DNR is sharing an existing agency boat and an airboat to support EGC management activities for the DNR EGC Coordinators efforts while dedicated resources are secured with IAA funding. DNR has purchased a 24’ landing craft to be used primarily in the Puget Sound to monitor EGC on our Natural Area Preserves and Aquatic Reserves. The boat is being outfitted with safety gear and bottom paint and will be ready for use in June. DNR ordered an airboat for EGC assessment and control measures on the coast and is awaiting delivery before outfitting and placing it in operation.



## Washington Sea Grant Crab Team



### **WSG Crab Team - Addendum for the Operational Period of January 1st – March 31st, 2023, under WDFW contract 20-15421**

#### **Hiring**

WSG Crab Team completed hiring and onboarding of a full-time Program Coordinator - a position vacant on the team since July 2022. The position is embedded in WSG as a Community Science Specialist and Lisa Watkins brings substantial experience to the team in this area. The Program Coordinator for the Crab Team monitoring network will undertake training, recruitment/retention, and coordination of the 68-site monitoring network (including both coastal and inland sites).

#### **Trappers Summit**

WSG Crab Team convened ~50 staff from federal and state agencies, and Washington tribes at the second Trapper's Summit in Suquamish on January 24, 2023. WSG hosts this annual meeting of technical staff involved in green crab control trapping from across Washington with the following goals:

- Debrief on data and observations from 2022 trapping season, collecting site-level information of green crab trapping effort and captures to build a shared understanding of the ongoing status and trends of the European green crab invasion in Washington.
- Create pathways, workflows, and relationships that facilitate ongoing data and information sharing and rapid dissemination of best practices across an expanding and distributed landscape of trapping professionals.
- Identify gaps in knowledge, and technical information needs to inform research efforts and resource sharing.
- Provide continuing education on green crab history, biology and research, to advance professional development and scientific expertise among technical staff conducting control trapping. This builds the overall statewide capacity to interpret the invasion and implement efficient management strategies.

This year was the second meeting of this group, building on two virtual meetings held after the 2021 trapping season (1 inland, 1 coastal). The in-person meeting was vital to information sharing and relationship building. Groups in attendance presented their 2022 findings in summary form. In addition, WSG shared a presentation on green crab biology and how to interpret demographic data of crabs (specifically size/age) from captures. Lastly, breakout sessions enabled attendees to share semi-structured discussion space on several topics including:

- Data management best practices
- Synthesizing observations into regional status and trends
- Trapping and population suppression approaches



- Green crab habitat use and migration patterns

Notes from this discussion were shared out with summit attendees to provide a resource for reference.

### **Monitoring Season Launch**

January through March, WSG conducts the annual launch of the monitoring network, to mobilize monitors across all 68 sites statewide in initiating monthly green crab monitoring starting in April. This starts with assessing site monitor needs, recruitment, permitting, planning and executing training events for both new and returning participants. This year, WSG Staff worked to:

- Hold **4** virtual and **6** in person sessions for **72** new monitors. These workshops introduce individual volunteers, and staff from partner groups to background on the green crab invasion, protocols, and species ID.
- Hold **6** continuing education workshops for **69** returning monitors. These sessions include some review of protocols, but largely engage experienced monitors in enriched content. This year, topics included handling ESA-listed species and advanced sculpin identification.
- Deliver a total of **42.5** training hours to new and experienced monitors combined.

### **Regional and National Management Support**

Members of WSG participate in several regional and national efforts related to green crab management planning. During this period, WSG continued to support statewide and coastwide national management efforts through participation of several staff in the Aquatic Nuisance Species Taskforce re-writing of the National European Green Crab Management Plan. Green crab biologists from Crab Team participated in the new WDFW research task force, and WSG hosted colleagues from WDFW, DFO and WSU for a two day research working meeting to start to identify gaps and opportunities for green crab research in support of management efforts. WSG participated in planning meetings for training workshops in Alaska, aimed at increasing scope and efficiency of early detection efforts which is an urgent priority in the region given the first detections in AK in summer 2022.

### **Trapping consultations and trainings offered**

Washington Sea Grant continued to pilot a new “Trapping Program Framework” in conjunction with WDFW, whereby new trappers who are interested in larger trapping efforts (e.g. assessment or removal) work with both parties on a full suite of trainings, designed to help them initiate, plan, and execute their own field efforts. The Trapping Program Framework begins with a consultation phase, where groups meet together with WSG and WDFW to discuss trapping goals and resources. From there, WSG and WDFW work together to deliver the necessary trainings to help them achieve their goals. In this quarter, WSG either led or participated in these types of sessions with several groups across inland and coastal geographies, including:

- Two initial consultations: one each with Hama Hama Oysters and Jorstad Oyster
- Three Site scouting visits: two with DNR (one each in Willapa Bay and Grays Harbor) and one with the Grays Harbor Conservation District
- Delivered a virtual training on how to plan a large scale field effort to 5 DNR staff
- In collaboration with WDFW, delivered a field training to WDFW and DNR technicians at Ocean Shores (5 new technicians, and 4 returning staff)



- Provided field support (1 FTE) to DNR staff for an assessment at the Grays Harbor National Wildlife Refuge

### **Communications and Outreach Support**

With WSG's history of experience and scientific expertise on green crab, program staff support statewide efforts through presentations that interpret and synthesize status and trends of green crab populations and invasion management as the data permit. This information is extremely important to enable managers to track and understand the status of the invasion on a regional scale and understand notable trends or changes. This year, Crab Team provided such presentations at the following events:

- WDFW Annual Statewide Update meeting (2/1/23)
- MAC Group presentation (2/15/23)
- Washington Coastal Estuary Collaborative (2/16/23)

Outreach is an ongoing role WSG plays in engaging and educating members of the public in green crab efforts. During this period, WSG provided outreach presentations in the following venues:

- Coastal Interpretive Center Glimpses Lecture Series (1/19/23)
- Stories in Marine Biology (UW Lecture series) (2/7/23)
- Salish Sea Stewards Training (2/23/23)
- Friday Harbor Labs Seminar Series (3/30/23)

## **Washington State Department of Ecology**



### **Addendum for the Operational Period of January 1<sup>st</sup> – March 31<sup>st</sup>, 2023, under IAA contract 22-2007 for European Green Crab Emergency Measures.**

The Department of Ecology has two programs that address the European green crab emergency, Padilla Bay National Estuarine Research Reserve (PBNERR) and the Northwest Straits Commission (NWSC). PBNERR manages 11,966 acres including one of the largest eelgrass meadows in the United States. Eelgrass is a habitat favored by European green crabs (EGC) and because of this, PBNERR has prioritized EGC management since 2001 when we began an annual program of early detection monitoring. Planning efforts during the recent quarter (January through March 2023) have focused on testing boat-based trapping, hiring staff and interns for the new trapping season, training, and acquiring critical equipment such as a larger bait freezer. Trapping activities included boat-based trapping with shrimp traps, and in March we began the new season's land-based prospecting using a mix of minnow, Fukui, and shrimp traps. No EGC were captured during the first



quarter of the year. During this quarter, four PBNERR staff and one AmeriCorps member from Washington Service Corps participated in trapping.

EGC captures in Padilla Bay last year increased sharply late in the season and as a result this past winter we began testing boat-based trapping to enable us to trap year-round, improve access to remote sites, trap deeper channels near EGC hot spots, and prospect for EGC in our eelgrass meadow. Our pilot testing of boat-based trapping proves that it can be a valuable new tool in Padilla Bay as EGC numbers increase. However, significant scheduling bottlenecks included a lack of trained boat drivers, competing programmatic needs for our shallow-draft research boat, and too few staff funded to work on EGC control during the winter. As a result we enrolled several staff in a Motorboat Operator Training Course offered by Shannon Point Marine Center, and we developed plans to refurbish an older moth-balled shallow-draft boat and return it to service as an EGC trapping boat in FY24. We have also been adjusting our EGC workplan, as well as staff and budget projections to address the sharp increase in EGC. The strong support from the Legislature for emergency EGC control has been greatly appreciated and critical to preventing EGC from establishing new, local breeding populations. Continued eradication of EGC from Padilla Bay will require ongoing support from funders.

During the recent quarter, both PBNERR and NWSC provided EGC presentations during the Washington Trappers' Summit on Jan 24<sup>th</sup>, to Skagit County's Salish Sea Stewards on Feb 28<sup>th</sup>, and to the EGC MAC Group on March 30<sup>th</sup>.

The NWSC provides training, funding, and support to seven county based Marine Resources Committees and manages regional conservation projects such as local coordination for EGC monitoring and control efforts. Since 2020, NWSC has coordinated local EGC trapping efforts in Drayton Harbor (Whatcom County) and expanded its geographic scope in 2022, to include trapping and local coordination across both Whatcom and Skagit Counties. From January through March 2023, NWSC developed training materials, coordinated with local partners and landowners, and updated the Quality Assurance Project Plan (QAPP) in preparation for trapping beginning in April and ongoing outreach activities. During this quarter, NWSC did not conduct any trapping activities. NWSC's outreach and coordination efforts in 2023 have been led by two staff who will be leading trapping efforts with the support of Washington Conservation Corps members, WDFW technicians, a Veterans Conservation Corps intern (currently hiring), volunteers, Salish Sea Conservation Corps members, and other partner staff. Additionally, NWSC has continued collaborating with local and regional partners including PBNERR, WA Sea Grant, WA Department of Fish and Wildlife, Taylor Shellfish, Drayton Harbor Oyster Co., Northwest Straits Foundation, Marine Resources Committees, and many private landowners.



# Appendix C – Additional updates

**Addendum for the Operational Period of January 1st – March 31st, 2023, under IAA contract 22-1995 for European Green Crab Emergency Measures.**

**Habitat utilization by European green crab in Willapa Bay as measured with acoustic telemetry: a pilot study.**

Study update Oct – March 2023

G Curtis Roegner, National Oceanic and Atmospheric Administration

Zach Forster, Washington Department of Fish and Wildlife

David Beugli, Willapa-Grays Harbor Oyster Growers Association

This pilot study was designed to test effectiveness of intertidal acoustic telemetry and compare the inter- and subtidal habitat use of European green crab (EGC) at Nahcotta in Willapa Bay. We deployed arrays of acoustic receivers (Vemco VR2AR) at intertidal and subtidal locations to establish an acoustically connected network, potentially allowing for fine-scale movements of EGC across the tidal gradient. One site was a bivalve aquaculture venture, the other an eelgrass-oyster-burrowing shrimp complex we recently mapped with imagery from uncrewed aerial vehicles. In addition to our receivers, an existing green sturgeon receiver network spread throughout Willapa Bay could also detect crab transmitters.

We tagged four groups of 10 EGC with V9-2x-BLU-1 transmitters on 13 October 2022. There was an equal sex ratio; no females had extruded eggs. Treatments were released at high tide at inter- and subtidal locations. We also tagged two groups of 8 Dungeness crab and released them at the subtidal locations.

All receivers were successfully recovered and the data downloaded on 1 March 2023. Preliminary analysis indicates good connectivity between inter- and subtidal receivers, necessary for the position calculations. We detected all 56 tagged crabs and noted differential habitat use between species. Most Dungeness crab departed the main detection area within about a week, and several were located on the Willapa Bay green sturgeon array (mostly down estuary). In contrast, many EGC remained in the study area throughout the monitoring period, with some movement between intertidal sites. The detection data has been sent for analysis, with results expected in ~ 9 weeks.

[Report End]

