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DEPARTMENT OF FISH AND WILDLIFE
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October 1, 2024

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The Honorable Timm Ormsby
Chair, House Appropriations
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The Honorable Kevin Van De Wege
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RE: Comprehensive long-term plan for Washington's response to European green crab

Dear Chairs Robinson, Ormsby, Van De Wege, and Chapman, Ms. Musgrave, and Mr. Cahill,

As directed by Engrossed Senate Bill 5950 - 2023-24 - Making 2023-2025 fiscal biennium supplemental operating appropriations, the Washington Department of Fish and Wildlife (WDFW) has developed a comprehensive long-term [6-Year] management plan for Washington's ongoing response to invasive European green crab which is attached to this cover letter.

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. In response, WDFW initiated a coordinated Incident

Command System (ICS) with goals to reduce or contain EGC populations below levels that result in environmental, economic, and cultural resource harm, as well as collaborative and transparent emergency management.

From January 2022 to August 2024, approximately 905,216 EGC have been removed from Washington state marine waters, with 816,872 removed from the Coast Branch, and 88,344 removed from the Salish Sea Branch. These captures are the result of a highly coordinated early-detection monitoring, rapid response, and removal effort by the state, co-managers, tribes, shellfish growers, and other federal and local agencies and partners. These efforts continue today. More information and regular updates are available online at wdfw.wa.gov/greencrabhub or by request.

Per Engrossed Senate Bill 5950 - 2023-24 - Making 2023-2025 fiscal biennium supplemental operating appropriations, WDFW was directed to develop *a comprehensive long-term plan for Washington's response to European green crab. The plan must identify where permanent trapping efforts should occur, where efficiencies over current operations may be achieved, which agencies, tribes, or organizations require ongoing funding to support the state's eradication and control measures, and the potential for federal funding for control efforts, and include a recommended funding level to implement the plan in the 2025-2027 fiscal biennium. The plan shall be submitted to the governor and legislature by October 1, 2024.*

Over the course of 12 months, WDFW developed this long-term plan for Washington's response to European green crab with more than 40 co-managers, Native American tribes, and partners. The 6-year management plan identifies where permanent trapping efforts should occur, where efficiencies may be achieved, and which agencies, tribes, or organizations require ongoing funding to support the state's eradication and control measure in the 2025-2027 fiscal biennium and beyond.

In summary, recommendations, and funding levels to implement the plan in the 2025-2027 fiscal biennium are as follows:

I. Washington Department of Fish and Wildlife recommends that the Department's current ongoing state funding continue to be appropriated, $6,082,000 of the general fund—state appropriation for fiscal year 2026 and $6,082,000 of the general fund—state appropriation for fiscal year 2027, solely for the department to implement eradication and control measures on European green crabs through coordination and grants with partner organizations as outlined in the long-term management plan.

II. Washington Department of Fish and Wildlife recommends a report to the State Legislature on additional recommendations and funding for new and unanticipated European green crab populations that are identified outside of the scope of the current plan by October 1, 2026.

III. Washington Department of Fish and Wildlife recommends that the Department facilitated European Green Crab Research Task Force develop a prioritized and actionable list of research necessary to inform achievement of long-term control and eradication by October 1, 2026, to inform future state and federal funding requests.

IV. Engrossed Senate Bill 5950 - 2023-24 - Making 2023-2025 fiscal biennium supplemental operating appropriations, provided the University of Washington $174,000 of the general fund—state

appropriation for fiscal year 2025 for genome sequencing and other research to improve control and eradication of the European green crab. Washington Department of Fish and Wildlife recommends that the WDFW and supporting partners, develop and seek funding to continue European green crab genetic research for the purpose of long-term achievement of control and potential eradication of the European green crab using genetic interventions.

V. Washington Department of Fish and Wildlife recommends support for a Washington Department of Natural Resources (DNR) 2025-2027 budget decision package titled *Managing Invasive European Green Crab on State-Owned Aquatic Lands*. DNR is requesting $1,347,500 in Fiscal Year 2026, and $1,195,900 per fiscal year ongoing to manage European green crab populations on state-owned lands to prevent significant negative impacts to biota and critical habitats. The State Legislature provided one-time funding in fiscal year 2025 due to DNR needs exceeding WDFW funding. DNR's proposed actions and budget needs have been incorporated into the long-term management plan. DNR has removed more than 26,000 European green crab to date and are a critical partner in the state's effort to successfully address this issue long-term.

VI. The Washington Department of Fish and Wildlife recommends support for Washington State Department of Ecology's 2025-2027 budget proposal titled *European Green Crab Research and Control.* Ecology is requesting $270,000 per fiscal year to support research into European green crab behavior to inform long-term, strategic management, and monitoring. This critical research cannot be done within existing WDFW funding levels and will help managers understand environmental factors affecting the invasive species' dispersal and predict impacts to coastal resources. This proposed research was identified as a high priority during a workshop including statewide European green crab managers and researchers and has been incorporated into the long-term management plan. This funding will also support ongoing trapping and monitoring efforts in Padilla Bay and adjacent waters.

Additionally, recommendations for federal funding and actions are as follows:

I. In Federal Fiscal Year 2024, Congress directed the U.S. Department of Commerce, National Oceanographic and Atmospheric (NOAA) Fisheries, Administration, Office of Habitat Conservation, Restoration Center to invest $1.5 million for management, intervention, and mitigation of invasive European green crab. In Federal Fiscal Year 2025, the Congressional Senate has proposed an additional $1.5 million for management, intervention, and mitigation of invasive European green crab. The Washington Department of Fish and Wildlife recommends that Congress continue appropriations to NOAA Fisheries to support State of Washington efforts.

II. Historically, U.S. Department of Commerce, National Oceanographic and Atmospheric (NOAA) Fisheries provided national marine invasive species coordination and response through a national Aquatic Invasive Species Program (AISP) that supported informed actions to protect NOAA steward resources from aquatic invasive species. The mission of the NOAA Aquatic Invasive Species Program (AISP) was to protect resources under NOAA's stewardship responsibilities from invasive species threats, and it also emphasized the use of research and outreach to confront these threats. Despite the critical role it played, the NOAA AISP was terminated over 10-years ago because it was mainly funded by earmarks that were discontinued. Much AISP program funding was directed to states as grants for

AIS prevention work that included mitten crab, European green crab, Atlantic salmon and Dreissenid mussel activities. Without this important program, gaps in addressing marine aquatic invasive species have persisted because a federal lead no longer exists. The Washington Department of Fish and Wildlife views reestablishment of the NOAA AISP as a critical component to long-term European green crab control and eradication success and recommends that Congress reestablish the AISP office. Reestablishment of the office is also supported by the 2023 Aquatic Invasive Species Commission Report and Recommendations: Improving the Prevention, Eradication, Control and Mitigation of Aquatic Invasive Species (AIS).

III. The Frank LoBiondo Coast Guard Authorization Act of 2018, Vessel Incidental Discharge Act 16 U.S. Code § 4729 authorized the Coastal Aquatic Invasive Species Mitigation Grant Program and Mitigation Fund for the purpose of improving the understanding, prevention, and mitigation of, and response to, aquatic invasive species in the Coastal Zone and Exclusive Economic Activity Zone. However, Congress has not appropriated funding to this grant program. The Washington Department of Fish and Wildlife recommends that Congress appropriate $5 million annually for the Coastal Aquatic Invasive Species Mitigation Grant Program and Mitigation Fund, which will support European green crab control and eradication, in addition to restoring habitat impacted by the aquatic invasive species.

IV. The Lummi Nation's Lummi Sea Pond, an artificial 750-acre impoundment constructed in 1969 just west of Bellingham and initially built for marine aquaculture purposes, urgently needs significant infrastructure investments. These investments are crucial to prevent the European green crab from spreading into unaffected areas of the Salish Sea. In addition, the Lummi Sea Pond dike wall road is part of the evacuation route that provides safe egress for the Lummi Nation community and public during an emergency such as a tsunami. In State Fiscal Year 2023, the Washington Department of Fish and Wildlife funded a Lummi Nation alternative analysis for infrastructure improvements to the Lummi Sea Pond. The Washington Department of Fish and Wildlife recommends that Congress direct the Federal Emergency Management Agency and other relevant federal agencies to support the Lummi Nation in determining actions and costs to address and improve the Lummi Sea Pond.

V. Washington Department of Fish and Wildlife recognizes that tribal nations exert a critical level of effort in the management of European green crab, and that in many cases this capacity has been built and expanded through funding from a U.S. Department of the Interior Bureau of Indian Affairs annual grant program. Washington Department of Fish and Wildlife recommends that federal appropriations requests include $8 million to the U.S. Department of the Interior Bureau of Indian Affairs Invasive Species Program for Northwestern Region invasive species management priorities, including European green crab. Washington Department of Fish and Wildlife surveyed tribal nations in developing the long-term management plan, identifying a specific need of $1.84 million annually specifically for European green crab control and eradication. Recognizing many invasive species priorities of tribal nations, the Department recommends a total of $8 million be appropriated by Congress to the Bureau of Indian Affairs Invasive Species Program.

VI. On May 9, 2024, the national Aquatic Nuisance Species Task Force (ANSTF) provided final approval of the National European Green Crab Management Plan developed by a multi-agency European Green Crab Working Group for implementation through the ANSTF. The approved national management plan and working group recommended that the accomplish the goals of this plan, that the ANSTF establish a European Green Crab Implementation Team consisting of members of local, state, and federal agencies, Tribal communities, universities, non-governmental organizations, and other relevant stakeholders. The European Green Crab Implementation would evaluate progress towards achieving the goals of the National European Green Crab Management Plan using the best available science and the best use of resources. Washington Department of Fish and Wildlife recommends that Congress request that the ANSTF create and support this implementation team to ensure successful national implementation.

VII. The U.S. Fish and Wildlife Service is provided funding from Congress annually to fund projects that implement priorities identified in the Quagga and Zebra Mussel Action Plan (QZAP 2.0) for the Western United States. Eligible applicants can submit proposals to address priorities such as containment through watercraft inspection and decontamination, prevention programs, compliance with regulations, public outreach, detection and response capabilities, and related research. The grant program falls under the Fish and Wildlife Management Assistance authority, which supports state and interstate aquatic nuisance species management plans. The Washington Department of Fish and Wildlife recommends that Congress appropriate $3 million to the U.S. Fish and Wildlife Service annually for a grant program to implement the National European Green Crab Management Plan, using the successful model of Quagga and Zebra Mussel Action Plan grants for the Western United States.

VIII. Since 2021, the Washington Department of Fish and Wildlife has facilitated a European Green Crab Research Task Force to determine key European research questions and needs to achieve adequate and sustainable European green crab control, and eradication where feasible. Federal scientific expertise and funding is required. The Washington Department of Fish and Wildlife recommends that Congress annually appropriate $800,000 to the U.S. Geological Survey Biological Threats and Invasive Species Research Program for its Western Fisheries Research Center and Alaska Science Center.

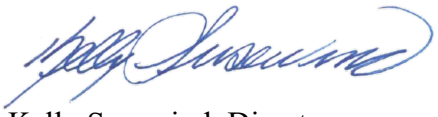
IX. Federal agency action on federally managed lands is critical to the long-term successful control and eradication of European green crab, including management activities performed on U.S. Fish and Wildlife Service Refuges. To support ongoing state actions, the Washington Department of Fish and Wildlife recommends that Congress appropriate $300,000 annually to Willapa National Wildlife Refuge and Dungeness National Wildlife Refuge/Maritime National Wildlife Refuge Complex for implementation of actions in the European Green Crab Long-Term Management Plan.

X. Washington is the nation's leading producer of farmed shellfish with an estimated annual harvest of cultivated shellfish worth more than $100 million and commercial shellfisheries in the hundreds of millions of dollars annually. Shellfish are also a substantial recreational resource for the public and culturally important for tribes. Washington's shellfish growers are on the front lines of potential European green crab impacts and have been contributing substantial effort since 2021 to controlling and eradicating European green crab with support from the Washington Department of Fish and Wildlife. However, federal assistance is required to providing additional and long-term support for shellfish

growers who have been impacted by the spread of European green crab. The Washington Department of Fish and Wildlife recommends that Congress direct the U.S. Department of Agriculture Animal and Plant Health Inspection Service to provide additional support to shellfish growers who have been impacted.

WDFW sincerely appreciates the support and direction from the State Legislature, Governor's Office, Office of Finical Management to address this prohibited aquatic invasive species that poses a threat to native shellfish, eelgrass, and estuary habitat critical for salmon and many other species. The attached long-term management plan contains more information as requested. If you have questions about this management plan, please feel free to contact Tom McBride, WDFW's Legislative Director at 360-902-2226 or thomas.mcbride@dfw.wa.gov.

Respectfully,



Kelly Susewind, Director
Washington Department of Fish and Wildlife

Attachment (1): European Green Crab 2025-2031 Management Plan for Washington

European Green Crab 2025-2031 Management Plan for Washington

Washington Department of FISH & WILDLIFE

September 9, 2024, Final Draft

European Green Crab 2025-2031 Management Plan for Washington

Author

Brian Turner, PhD.

Suggested citation

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Report acknowledgments

This report is the result of a collaboration among co-managers, tribes, and partners involved in green crab management in Washington state. We greatly appreciate their contributions to this document.

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Cover photo: European green crab in eelgrass by WDFW.

Acknowledging the Indigenous People of the Pacific Northwest

Since time immemorial, Indigenous People have lived in the Pacific Northwest and hunted, fished, and gathered natural resources, traditional foods, and medicinal plants to support their diverse cultures. They were the original occupants and stewards of this land that all Washingtonians enjoy today.

The very survival of the Pacific Northwest Tribes is a testament of resiliency of what they have endured and continue to endure throughout generations on this landscape. Through many historical encounters of massacre, renunciation of religious freedom, systemic racism, cultural assimilation of native children through institutional residential schools, and the fight for their inherent rights and liberties, they have prevailed. Throughout this painful history brought by colonization, abrogated treaties, infringement of civil rights, and the salmon protests of the 1960s, the Northwest Tribes and the Washington Department of Fish and Wildlife (WDFW) have founded a commitment of respect, unity, and alliance informed by the realities of the past.

Today, tribal governments and WDFW work collaboratively to conserve and manage aquatic and terrestrial resources statewide and practice sound science to guide management decisions. The Tribes and WDFW work together to ensure the sustainability of fish, wildlife, ecosystems, and culture for the next seven generations and beyond.

Acknowledging contributors

Content from the Management Plan for the European Green Crab developed by the Aquatic Nuisance Species Task Force European Green Crab Working Group, the National Management and Control Plan for New Zealand Mudsnail developed by the New Zealand Mudsnail Working Group, and The State of Washington Interagency Zebra and Quagga Mussel Rapid Response Plan prepared by Four Peaks Environmental Science & Data Solutions was adapted for use in this plan with permission. The Washington Department of Fish and Wildlife is grateful for their collaboration and support.

Executive Summary

The European Green Crab 2025-2031 Management Plan for Washington (hereafter the Plan) has been facilitated by the Washington Department of Fish and Wildlife (WDFW) and developed in collaboration with tribal governments, U.S. federal agencies, Washington state agencies, shellfish growers, and additional partners throughout Washington. The Plan was developed in recognition that European green crab (hereafter, green crab) pose a significant, long-term threat to Washington's coastal ecosystems and species, as well as the economic, cultural, recreational, and subsistence resources of tribes and coastal communities. Management of green crab along the vast coastline of Washington poses a difficult challenge requiring a long-term, collaborative approach emphasizing local management with WDFW oversight as the state lead management agency. Not only must efforts be made to detect and rapidly respond to the introduction of green crab to new locations, but continual control efforts are necessary at locations where established populations threaten priority resources.

Green crab (*Carcinus maenas*) are a highly invasive species whose ecological and economic damage is well-documented on both coasts of North America. On the Pacific coast, green crab were discovered in the late 1980s and spread northward into Washington in the late 1990s. Green crab are a globally notorious invasive species that can tolerate broad temperature and salinity ranges. Individual green crab females can produce hundreds of thousands of larval offspring that can disperse over hundreds of kilometers along coastal regions. The diet of green crab is diverse, including eelgrass, bivalve mollusks, crustaceans, polychaetes (marine worms), and other prey. Green crab are implicated in historic declines and current losses of commercial bivalves in the eastern U.S. and maritime Canada, as well as impacts to native species, including eelgrass habitats along both coasts of North America. While the assessment of the current impacts of green crab in Washington is being determined, many habitats, species, indigenous cultural resources, and coastal community assets are at risk of significant damage.

On January 19, 2022, Governor Jay Inslee issued an emergency proclamation (#22-02) to address the exponential increase in the green crab numbers within the Lummi Nation’s Sea Pond and Pacific coastal areas. The proclamation directed WDFW to implement emergency measures as necessary to affect the eradication of or to prevent the permanent establishment and expansion of green crab in Washington. In December 2023, Governor Inslee, the Office of Financial Management, and the State Legislature directed WDFW to develop a comprehensive long-term plan for Washington’s response to European green crab (Engrossed Substitute Senate Bill 5950 – Operating Budget 2023-2025 Supplemental). While the Plan was already under development at the time of the request, the objectives of the Plan expanded to incorporate specific requirements from the Governor and legislature.

The following fifteen objectives are the focus of the Plan:

1. Establish processes for collaborative and transparent management across the entirety of Washington.
2. Maximize early detection in areas where green crab have not been detected.
3. Maximize reduction or negation of green crab impacts via population reduction or containment.

4. Reduce the risk of human-mediated movement of green crab.
5. Provide clear communication and guidance regarding science-based green crab management strategies and techniques.
6. Establish methods and capacity for long-term monitoring of community structure to observe changes in populations of green crab and native species.
7. Provide clear communication and guidance on necessary data standards and submission to inform management of real-time status and trends.
8. Provide a systematic approach to respond to confirmed detections of green crab in new locations.
9. Establish the capacity for local co-managers, tribes, and partners to transition to long-term green crab management with WDFW support and oversight.
10. Identify research that should be performed or promoted to support management.
11. Identify outreach and communications opportunities to support management and enhance local stewardship.
12. Provide clear communication and guidance about the acquisition and distribution of funding to allow for appropriate long-term planning.
13. Provide procedures for the sustainable and beneficial disposal or use of green crab and other fish waste.
14. Provide safety guidance and training, where feasible, for participants.
15. Outline the objectives of field operations for all co-managers, tribes, and partners, across the state.

The focus of the Plan is to provide guidance and information for current and new participants in green crab management activities, document actions planned by and identify needs of co-managers, tribes, and partners. The initial sections of the Plan focus on providing background information on the green crab emergency in Washington, then provide guidance and information to aid the planning and execution of green crab management actions. The latter sections of the plan lay out the Statewide and Management Area Objectives and the associated actions, and identifies needs (e.g., initial research, funding, and resource gaps) that must be addressed. WDFW utilizes the outlined actions and the associated gaps to inform funding recommendations to the legislature.

The Plan is intended to be a living document, subject to adjustment and change as the green crab situation changes over time. Reviews and updates will be facilitated by WDFW on a regular basis throughout the 2025-2031 period and beyond.

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Acronyms

AIS – aquatic invasive species
AIS Unit – Washington State Department of Fish and Wildlife's Aquatic Invasive Species Unit
ANSTF – Aquatic Nuisance Species Task Force
CA – Coordination Area
CAMA – *Carcinus maenas*
CPUE – catch per unit effort
CW – carapace width
DFO – Department of Fisheries and Oceans Canada
DNR – Washington State Department of Natural Resources
DOI – United States Department of the Interior
eDNA – environmental DNA
EGC – European green crab, *Carcinus maenas*
EGC AC – European Green Crab Advisory Committee
ESA – Endangered Species Act
FEMA – Federal Emergency Management Agency
FEMA EMI - Federal Emergency Management Agency Emergency Management Institute
FLUPSY - floating upweller system
GHCD – Grays Harbor Conservation District
ICS – Incident Command System
LNR – Lummi Natural Resources
MA – Management Area
MB – Management Branch
MLLW – mean low low water
MOU – memorandum of understanding
NGO – nongovernmental organization
NISC – National Invasive Species Council
NWSC – Northwest Straits Commission
OP – Operational Period
Parks – Washington State Parks and Recreation Commission
PBNERR – Padilla Bay National Estuarine Research Reserve
PCD – Pacific Conservation District
PCISM – Pacific County Invasive Species Management
PCR - polymerase chain reaction
PPE – Personal protective equipment
RCO – Washington State Recreation and Conservation Office
ROV – remote-operated vehicle
RTF – European Green Crab Research Task Force
SSR – Summary Status Report
SitRep – Situation Report

SOW – scope of work
U&A – Usual and accustomed areas
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
WDFW – Washington State Department of Fish and Wildlife
WSG – Washington Sea Grant
WGHOGA – Willapa Grays Harbor Oyster Growers Association
YOY – Young of the year

Introduction

The European green crab, *Carcinus maenas*, is a globally damaging invasive species threatening Washington's ecological, economic, and cultural resources. Native to Western Europe and Northwestern Africa, this hardy and voracious predator has since expanded its range throughout the globe (Carlton and Cohen 2003).

The first detection of European green crab (also referred to herein as green crab[1]) in Washington was in 1998 in Willapa Bay and Grays Harbor (Carlton and Cohen 2003). Initial emergency management responses took place but ended after a few years due to a lack of evidence of self-recruitment and fewer green crab captured. In 2015, the Washington Department of Fish and Wildlife (WDFW) learned that a population of green crab had been discovered in 2012 in Sooke Basin, British Columbia, Canada (Gillespie et al. 2015). In response to concerns about new green crab introductions within the Washington portion of the Salish Sea, WDFW designated Washington Sea Grant (WSG) to lead a monthly community science-based early detection and monitoring network known as the Crab Team.

In 2016, the first detections of green crab in the Washington region of the Salish Sea occurred 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 green crab in 2017 in Makah Bay by the Makah Tribe and in Dungeness Spit within the Dungeness National Wildlife Refuge, managed by the U.S. Fish and Wildlife Service. Since 2018, there have been increasing numbers of green crab detections in the Salish Sea and Pacific coastal regions of Washington. At the same time, the abundance of green crab in established populations increased dramatically in Willapa Bay, Grays Harbor, and the Lummi Sea Pond. As of 2024, green crab have been detected in the Salish Sea as far south as northern Hood Canal and southern Whidbey Island. While detection rates are partially the result of increased monitoring and trapping efforts throughout the state, it is undeniable that green crab abundance and range have increased dramatically in recent years (Table 1).

[1] European green crab or green crab may also be abbreviated as EGC in some tables and forms in this plan. Some data collection standards referenced in the appendices use CAMA, a naming convention based on the scientific name *Carcinus maenas.*

Table 1 Yearly green crab captures in Washington from 1998-2023.

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
2019	177	1,766	1,943
2020	2,858	3,971	6,829
2021	86,340	16,825	103,165
2022	81,009	204,274	285,283
2023	6,327	345,966	361,293

Data is divided geographically by green crab captured in the Washington State portion of the Salish Sea and green crab captured along the Pacific Coast. Please note that these data only represent crabs captured, not the effort employed. Catch effort (number of traps deployed, number of locations trapped, frequency of trap recovery, trap types used) varies greatly across years and locations.

In areas where green crab have been able to establish large populations for extended periods, they have the potential to negatively impact other species, particularly smaller crabs and bivalves (Jamieson et al. 1998, McDonald et al. 2001). On the Atlantic coast of the United States, it is estimated that damages to commercial shellfisheries from green crab predation average $22.6 million per year (Lovell et al. 2007). Similar losses from green crab predation are possible for Salish Sea shellfish fisheries (Mach and Chan 2013) and Pacific coast fisheries. Predation on oysters by green crab could negatively impact oyster fisheries, as adult green crab can prey upon young oysters (Dare et al. 1983, Poirier et al. 2017), and green crab have been observed cracking and consuming adult oysters in laboratory settings (Forster 2023). Lab work has shown that juvenile green crab outcompeted similar-sized Dungeness crab for food and shelter and juvenile Dungeness may serve as prey for larger green crab, resulting in potential impacts to wild Dungeness populations (McDonald et al. 2001). Predation by green crab has led to declines in native bivalve and crab populations in invaded habitats (Grosholz et al. 2000). In addition,

burrowing by green crab can have significant negative impacts on eelgrass, estuary, and marsh habitats (Malyshev and Quijón 2011, Matheson et al. 2016, Howard et al. 2019).

Green Crab Emergency Declaration

In 2021, WDFW, co-managers, tribes, and partners identified an exponential increase of invasive green crab in 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 green crab distribution and abundance posed an imminent threat to Washington's economic, environmental, and cultural resources.

On Dec. 14, 2021, WDFW Director Susewind submitted an emergency measures request under RCW 77.135.090 for a European green crab response to Governor Jay Inslee. On Jan. 19, 2022, Gov. Inslee issued an emergency proclamation (#22-02) to address the exponential increase in the green crab population within 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 green crab in Washington.

Under the proclamation, the WDFW 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. As a result, the current green crab emergency will continue until the governor, with advice from the WDFW director, discontinues emergency measures.

Given their high fecundity, potential for long-distance larval dispersal, wide tolerances for salinity and temperature, and historical success as an invader throughout the globe (Leignel et al. 2014), green crab populations will likely continue to increase and expand throughout Washington's shoreline habitats. Management of green crab along the vast coastline of Washington poses a difficult challenge requiring a long-term, collaborative approach emphasizing local management. Not only must efforts be made to detect and rapidly respond to the introduction of green crab to new locations, but continual control efforts are necessary at locations where established populations threaten priority resources. These considerations have led to the development of this 6-year Management Plan ("Plan") via collaboration with co-managers, tribes, and partners active throughout the state (Table 2).

Table 2 List of co-managers, tribes, and partners co-involved in creating this management plan.

Co-managers, Tribes, and Partners	
Baywater Shellfish Company	Quinault Indian Nation
Chuckanut Shellfish	Quileute Tribe
Drayton Harbor Oysters	Samish Indian Nation
Grays Harbor Conservation District	Shoalwater Bay Indian Tribe
Hama Hama Oyster Company	Skokomish Tribe
Hoh Tribe	Squaxin Island Tribe
Jamestown S'Klallam Tribe	Stillaguamish Tribe
Lower Elwha Klallam Tribe	Suquamish Tribe
Lummi Nation	Swinomish Indian Tribal Community
Makah Tribe	Taylor Shellfish
Marine Life Center	Tulalip Tribes
Muckleshoot Indian Tribe	United States Fish and Wildlife Service
Nisqually Tribe	United States Geological Survey Western Fisheries Research Center
Nooksack Tribe	United States Navy
Northwest Straits Commission (Washington State Department of Ecology)	Upper Skagit Tribe
Pacific Conservation District	Washington Sea Grant
Pacific County Invasive Species Management	Washington State Department of Natural Resources
Pacific Seafoods	Washington State Parks and Recreation Commission
Padilla Bay National Estuarine Research Reserve (Washington State Department of Ecology)	Washington State Recreation and Conservation Office
Penn Cove Shellfish	Washington State University Extension
Port Gamble S'Klallam Tribe	Washington State Department of Fish and Wildlife
Puget Sound Partnership	Willapa-Grays Harbor Oyster Growers' Association
Puyallup Tribe	

Please note that this list represents the co-managers, tribes, and partners participating in green crab management activities in Washington at the time of writing. Tribes, organizations, and other entities that would like to be involved may join at any time.

Section 1: Overview

Managing green crab along Washington's outer coast and bays and along the extensive and varied coastline of the Strait of Juan de Fuca and Puget Sound is a significant challenge and one that necessitates a long-term, collaborative strategy with a focus on local management and expertise. Addressing invasive species in Washington involves a continuum of efforts across state, tribal, federal, and other jurisdictions. Acknowledging that green crab are a serious concern to Washington's coastal ecosystems and species, this plan recognizes and supports the efforts of the co-managers, tribes, and partners who are already working together to protect Washington's ecological, cultural, and economic resources from the impacts of the green crab. The successful management of green crab requires both investments in effective early detection and rapid response to new introductions as well as extensive, ongoing control measures in areas where established populations already pose a threat to resources, ecosystems, and risk continued spread to new areas.

Plan Purpose

This plan has been developed in recognition that green crab pose a significant, long-term threat to coastal ecosystems and species in Washington, and to the economic, cultural, and recreational/subsistence resources of tribes and coastal communities. The purpose of this plan is to outline how we can best protect these irreplaceable components of the Washington coast, including (but not limited to) the following:

Habitats

- Coastal wetlands
- Eelgrass beds
- Restoration sites
- Shellfish beds
- Estuaries
- Rocky intertidal

Species

- Dungeness crab *Metacarcinus magister*
- Geoduck *Panopea generosa*
- Hairy shore crab *Hemigrapsus oregonensis*
- Kumamoto oyster *Crassostrea sikamea*
- Native littleneck clam *Leukoma staminea*
- Butter clam *Saxidomus gigantea*
- Cockle *Clinocardium nuttallii*
- Horse clam *Tresus capax*

- Manilla clam *Venerupis philippinarum*
- Mussels *Mytilus spp.*
- Olympia oyster *Ostrea lurida*
- Pacific oyster *Magallana gigas*
- Salmonids *Family Salmonidae*
- Softshell clam *Mya arenaria*

Indigenous Cultural Resources

- Resources tied to cultural identity
- Tribal economic interests
- Subsistence and/or traditional food sources
- Access to culturally important resources
- Locations of cultural significance
- Tribal trust responsibilities

Coastal Community Assets

- Subsistence and commercial harvest
- Small-business opportunities
- Climate and habitat resilience
- Threatened and endangered species recovery efforts
- Recreational activities and the overall well-being of residents and visitors

Mission Statement

To develop and undertake measures necessary to achieve the functional or site-specific eradication where green crab are established or to prevent the permanent establishment and expansion of green crab where they are not found. Co-managers, tribes, and partners will collaborate to protect the ecological, cultural, economic, and social resources of Washington from the impacts of green crab.

Plan Objectives

The following is a list of objectives for the Plan:

1. Establish processes for collaborative and transparent management across the entirety of Washington.
2. Maximize early detection in areas where green crab have not been detected.
3. Maximize reduction or negation of green crab impacts via population reduction or containment.
4. Reduce the risk of human-mediated movement of green crab.
5. Provide clear communication and guidance regarding science-based green crab management strategies and techniques.

6. Establish methods and capacity for long-term monitoring of community structure to observe changes in populations of green crab and native species.
7. Provide clear communication and guidance on necessary data standards and submission to inform management of real-time status and trends.
8. Provide a systematic approach to respond to confirmed detections of green crab in new locations.
9. Establish the capacity for local co-managers, tribes, and partners to transition to long-term green crab management with WDFW support and oversight.
10. Identify research that should be performed or promoted to support management.
11. Identify outreach and communications opportunities to support management and enhance local stewardship.
12. Provide clear communication and guidance about the acquisition and distribution of funding to allow for appropriate long-term planning.
13. Provide procedures for the sustainable and beneficial disposal or use of green crab and other fish waste.
14. Provide safety guidance and training, where feasible, for participants.
15. Outline the objectives of field operations for all co-managers, tribes, and partners, across the state.

Co-managers, Tribes, and Partners

The various state and federal agencies, Native American tribes and tribal nations, counties, universities, shellfish producers, tideland owners, and other entities involved in green crab reporting, response, monitoring, and management in Washington state are referred to collectively as co-managers, tribes, and partners.

Most procedures and guidelines in the Plan are informative in nature rather than requirements that must be observed. However, there are a few elements that co-managers, tribes, and partners working in areas under state jurisdiction are required to follow. These elements are:

- Data Standards
- Data Submission
- Safety Protocols and Reporting

Co-managers, tribes, and partners working outside state jurisdiction (e.g., Federal agencies on federal land, tribes on sovereign tribal land, off-reservation trust land, and on usual and accustomed grounds) can consider **all** procedures and guidelines as informative in nature.

Jurisdictional and Cultural Considerations

Efforts to address invasive species in Washington fall along a continuum, varying between state, tribal, federal, and other jurisdictions. The following summaries outline legal authorities and regulations specifically enacted to address green crab in various jurisdictions.

Washington (State)

The European green crab, *Carcinus maenas*, is a Prohibited Level 1 species and 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. (RCW 77.135.040)

wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#regs-seasons

Washington (Tribes)

Shellfish have always been a part of the diet and culture of Western Washington tribes and remain an important commercial, ceremonial, and subsistence harvest resource today. Many, but not all, tribes in Washington state were party to the 1854-1856 Stevens treaties among the tribes and the U.S. federal government and participated in the 1974 U.S. v. Washington ("Boldt Decision"). The Boldt Decision (and subsequent decisions) reaffirmed and interpreted the Stevens treaties to support tribes' right to harvest up to 50% of anadromous fisheries resources that reside in and pass through their Usual and Accustomed Areas. In 1994, Judge Rafeedie confirmed that the treaties also guarantee the tribes the right to shellfish resources. These decisions also establish the treaty tribes as co-managers of fisheries with Washington state. In addition to being legal co-managers, treaty tribal governments in Washington state have been leaders in green crab research, monitoring, and removal efforts. The treaty tribes retain inherent sovereign rights to manage finfish and shellfish resources in their Usual and Accustomed Areas, including decision-making about setting fishing seasons, licensing, gear types, etc. Tribal fisheries and fisheries management decisions are distinct from and not subject to the regulations of Washington state. The treaty tribes should be engaged directly to identify green crab regulations and to develop meaningful coordinated action on green crab management. Additionally, any plans or recommendations should recognize tribal treaty Rights and federal treaty trust responsibilities.

Federal Authorities, Roles, and Responsibilities

Federal authorities, roles, and responsibilities for branches and departments of the federal government, as they pertain to invasive species, are summarized and outlined in Appendix I (page 9) and Appendix III (page 30) of the 2015 Federal Policy Options paper by the Interagency Committee on the Movement of AIS onto and off of Federal Lands and Waters for the National Invasive Species Council (NISC) and the Aquatic Nuisance Species Task Force (ANSTF). This paper is available online through the NISC website in their publications section: doi.gov/invasivespecies/other-publications.

Additional information about the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, and the National Invasive Species Act of 1996 can be found through the Aquatic Nuisance Species Task Force website: fws.gov/program/aquatic-nuisance-species-task-force/about-us.

Laws and policies guiding invasive species management at the Department of the Interior (DOI) are summarized within Appendix E (starting on page 39) within the DOI's Invasive Species Strategic Plan 2021-2025. This summary includes federal laws and administrative policies such as Executive Orders and

Departmental Manuals. The DOI Invasive Species Strategic Plan is available online: doi.gov/sites/doi.gov/files/doi-invasive-species-strategic-plan-2021-2025-508.pdf

Bureau and Office missions and roles in invasive species management within the DOI are summarized in Appendix A (starting on page 26) within the DOI Invasive Species Strategic Plan 2021-2025 available online: doi.gov/sites/doi.gov/files/doi-invasive-species-strategic-plan-2021-2025-508.pdf

Incident Command System

The Incident Command System (ICS) is a standardized approach to incident management developed by the Federal Emergency Management Agency Emergency Management Institute (FEMA EMI). An ICS was initiated as part of the green crab emergency declaration in 2022 (Mission #22-1085) and has proven to be an effective approach to the coordination of statewide green crab management actions. This approach provides a clear command and coordination structure, and standardized communications and management action implementation across the state. In addition, the ICS supports federal and tribal participants across the state while they retain their autonomy in green crab management decisions and actions. ICS training and resources are available from the FEMA EMI ICS Resource Center: (training.fema.gov/emiweb/is/icsresource/).

Situational Reports (SitReps) are used to communicate activities and accomplishments of the ICS for each operational period. Operational period duration is variable and determined by the Incident Commander but has typically been one month over the course of the green crab emergency. SitReps include a summary of actions taken, funding allocations, detection events, sampling efforts, and other relevant information for dissemination among ICS participants, tribal co-managers, state and federal partners, the Governor's Office, and interested state or Congressional Legislators. This information is solicited from co-managers, tribes, and partners participating in green crab management at the conclusion of each operational period using a Status Summary Report template. SitReps are not public-facing reports. Instead, the WDFW's Communications and Public Engagement (CAPE) work unit synthesizes information ascertained from the SitReps into regular European Green Crab Public Updates, which are distributed via a European Green Crab Management Information email list and posted on the WDFW website (wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#conservation).

An important aspect of the green crab ICS structure is the Multi-Agency Coordination (MAC) Group. The MAC Group acts as a policy-level body supporting resource prioritization and allocation while enabling decision-making among elected and appointed officials. Specifically, the MAC Group allows for input from local, state, tribal, and federal agencies that have legal responsibility or resources for the protection of natural resources to establish priorities among multiple competing incidents, provide coordinated decision-making for resource allocation, harmonize agency policies, and offer strategic guidance and direction to support management activities.

The MAC Group consists of representatives from various co-managers, tribes, and partners, including state and federal agencies, and shellfish growers (Table 3). 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 green crab 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. MAC group membership is by invitation from the WDFW Director, but interested potential MAC group members should reach out to WDFW to declare interest and request an invitation review process.

Table 3 List of European green crab Multi-Agency Coordination (MAC) Group members.

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

Representatives of these organizations share information, establish a common operating picture, and develop common long-term priorities for green crab management.

Plan Area

There are approximately 3,500 miles of coastal area encompassing marine and estuarine habitats where green crab could become established in Washington. The following geographic hierarchy has been established to facilitate consistency in communications, planning, operations, and other strategic management response functions.

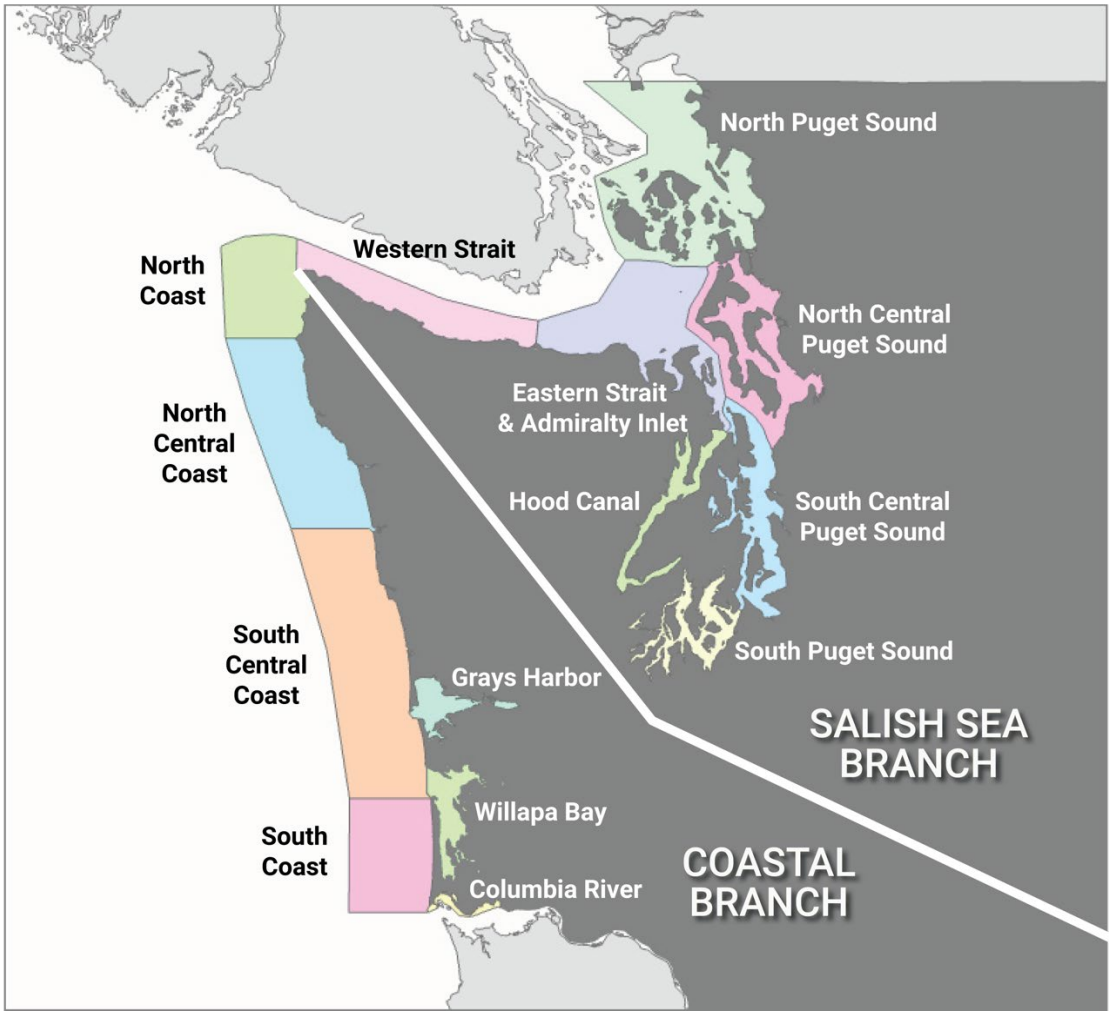
Management Branch

Washington is divided into two Management Branches: the Salish Sea and Coastal Branch (Figure 1). The arrival of the European green crab in coastal estuaries predates that of inland waters by nearly two decades. This earlier arrival is primarily because coastal estuaries are more exposed to larvae transported from populations outside of Washington. As a result, green crab are more established in the Coastal Branch with larger, more widespread populations. In contrast, abundance is much lower in the

Salish Sea branch with fewer, more sparsely distributed populations of green crab with significantly lower larval input from external sources.

The difference in green crab abundance between these two branches influences overall management priorities. Within the Coastal Branch, trapping efforts are more heavily focused on control efforts (i.e., trapping and removing green crab from sites). Except for specific locations in North Puget Sound, trapping in the Salish Sea tends to focus more on early detection (i.e., the detection of green crab at their earliest point in the invasion process). Green crab presence and management priorities vary greatly within each management branch, and this initial split is helpful for looking at statewide green crab management while employing some small amount of nuance.

Figure 1 Map of Washington State European green crab management locations.



The state has been split into two Management Branches (Coastal and Salish Sea) and fourteen Management Areas (North Puget Sound, North Central Puget Sound, South Central Puget Sound, South Puget Sound, Hood Canal, Eastern Strait & Admiralty Inlet, Western Strait, North Coast, North Central Coast, South Central Coast, South Coast, Grays Harbor, Willapa Bay, Columbia River). Coordination Areas, Sites, and Sub-sites (further subdivisions of Management Areas) are not shown.

Management Areas

Washington is further divided into 14 Management Areas guided by WDFW's recreational fishing marine areas, with seven Management Areas within the Salish Sea Branch and seven Management Areas within the Coastal Branch. While conditions vary within Management Areas, they have more similar geographic conditions, management priorities, and green crab abundance/distribution than management branches. Management on this scale is also more manageable due to the smaller geographic area and fewer co-managers, tribes, and partners. Local co-managers, tribes, and partners also have significant local knowledge and a history of collaboration. The smaller geographic area provides a higher resolution on green crab populations and trends and allows for more targeted management actions and resource allocation.

Coordination Areas

Each Management Area is further divided into Coordination Areas to create geographical regions where a single co-manager, tribe, or partner could reasonably implement necessary management actions. These smaller areas can provide higher resolution on green crab populations and trends, which can help communicate more effectively what green crab populations are doing than the larger-scaled Management Areas. Coordination Area naming conventions are based on a place name that best describes the area or may be based on the jurisdictional lead for that area. Delineation of Coordination Areas continues to evolve based on input from local co-managers, tribes, and partners.

Sites and Sub-sites

Sites and sub-sites may be established in Coordination Areas based on a geographic connection area, similar habitat suitability, and access limitations. Green crab management actions can be expressed as representing the whole area. Delineation of sites and sub-sites (specific areas within a site where operational actions take place) continues to evolve based on input from local co-managers, tribes, and partners.

Geographic Area Classification

Geographic area classification is based on the monitoring and detection history of green crab in the geographic area of interest.

- **Status Unknown** – No sampling or monitoring for green crab has occurred.
- **Undetected/Negative** – Sampling or monitoring for green crab has occurred or is ongoing, but no evidence of green crab presence has been detected.
- **Suspect** – Detection of evidence suggesting green crab are likely present in the area (e.g., molt, positive eDNA, larvae) but not confirmation of the presence of post-settlement green crab.
- **Positive** – Detection of living, post-settlement (not megalopa or zoea) green crab.

- **Infested** – Population of green crab that is expected to have a sustained presence based on evidence (i.e., three years of capture of multiple age classes and with increasing or relatively stable abundance irrespective of trapping effort intensity).

The classification is specific to the geographic scale of interest. For example, a Coordination Area classified as **Infested** may contain sites classified as **Status Unknown, Undetected, Suspect, Positive, or Infested**.

In situations where a geographic area was initially verified as **Suspect, Positive**, or **Infested** and subsequent management actions no longer detect green crab the geographic area may be reclassified to **Undetected/Negative** (i.e., de-listed) after additional sampling and/or eradication or suppression has occurred. The protocol to reclassify a geographic area as **Undetected/Negative** depends on the initial geographic area classification and is defined in Table 4.

Table 4 Criteria required to reclassify a geographic area to Undetected/Negative based on the initial geographic area classification

Initial Classification	Criteria for Reclassification to Undetected/Negative
Suspect	Three years of negative testing.
Positive	Five years of negative testing.
Infested	Following a successful eradication or extirpation event as determined by a minimum of five years post-event testing and monitoring with negative results.

Identification

Green crab are most accurately identified by the five large spines, also called marginal teeth, on either side of their forward carapace, a unique pattern for crabs on the Pacific coast of North America (Figure 2). In addition, green crab have three rounded lobes between the eyes and their last pair of legs are somewhat flattened. The carapace is broader than it is long and seldom exceeds 4 inches across. Despite their name, the coloration of green crab varies from bright green to dark orange (Figure 3). Thus, color is not a reliable feature to use when distinguishing green crab from native crab species.

The sex of a green crab can be determined by examining its abdomen on the underside of its body (Figure 4). The abdomen of males is narrower and triangular, whereas that of females is broader and rounder. Distinguishing the sex of smaller juvenile crabs can be difficult because their anatomical structures have not differentiated. Gravid females can be identified by the presence of an egg mass on the underside of their body.

To report the detection of green crab at a new location, or to request specimen identification assistance, please complete the following procedure:

1) Pick up the organism and photograph the dorsal and ventral sides, respectively (Figure 5). Take close pictures of other details (e.g., claws, shell texture) that may aid identification. If possible, photograph with a common item (e.g., a penny) for scale.

2) Check photographs for clarity. Ensure you have at least 1 clear image for each side of the specimen. If necessary, take more photographs to ensure clear images of claws or other markings.
3) Safely release the organism back into the water. If possible, release in cool, protected water to help recovery.
    a. If you are reporting the detection of a green crab and are confident the specimen is a green crab, you may retain and euthanize the crab following standard euthanasia procedures (see Euthanasia and Disposal).
4) Please send pictures and location information (Latitude and Longitude) of where the specimen was found) to WDFW's AIS Unit at ais@dfw.wa.gov.

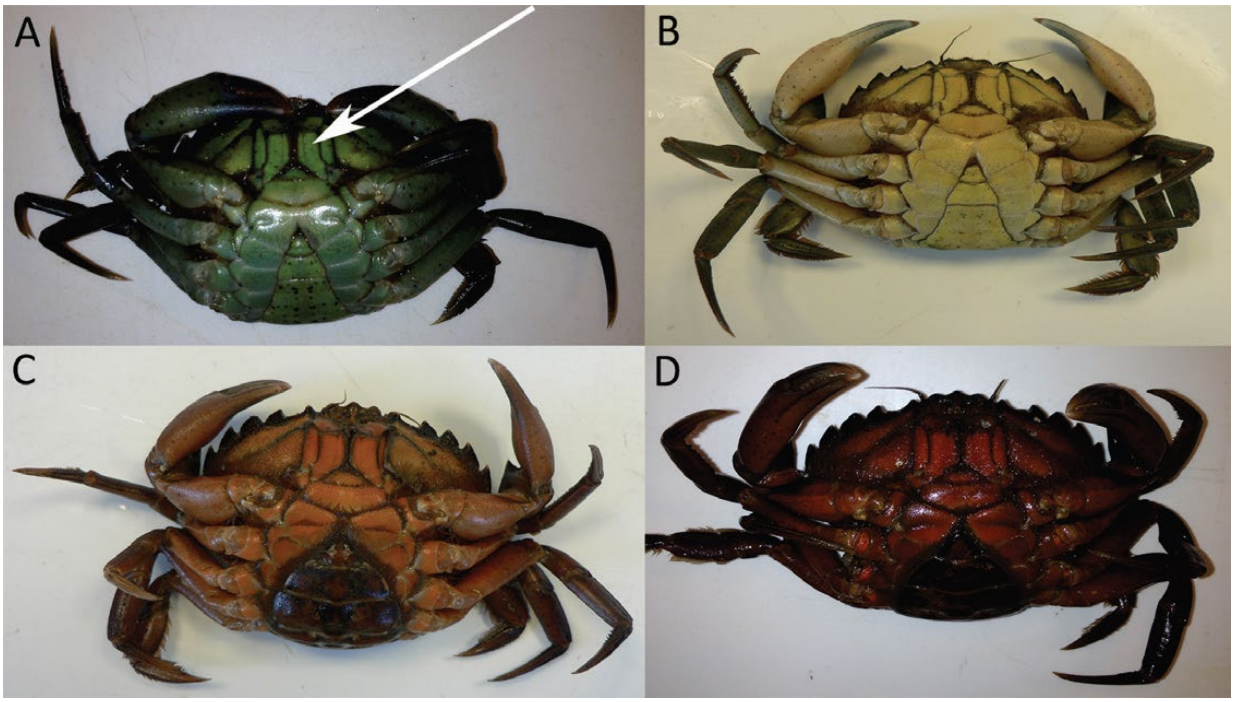
Additional Identification Resources

- Crabs of Washington identification one-pager wdfw.wa.gov/sites/default/files/2023-03/wa-crab-id-flyer-single-page-2023.pdf
- European Green Crab Hub – Report a Sighting wdfw-egc-hub-wdfw.hub.arcgis.com/pages/report-a-sighting
- Washington Sport Fishing Rules – Crab Rules eregulations.com/washington/fishing/crab-rules
- Identifying European Green Crab wsg.washington.edu/crabteam/greencrab/id/

Figure 2 European green crab, *Carcinus maenas*, with distinguishing features highlighted.

The main distinguishing feature of the European green crab is 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.

Figure 3 Variable coloration of European green crab specimens.



The coloration of the European green crab can vary greatly between individuals. Green crab are green after molting, but over time change color to yellow, to orange, and finally red. For consistency, color should be determined using the third maxillipeds (see arrow). Image source Young et al. (2017).

Figure 4 Reproductive status of European green crab.

From left to right: underside of a male green crab, underside of a female green crab, and underside of a gravid female green crab. Note the narrow, triangular abdomen of the male, the wider, rounded abdomen of the female, and the egg mass present on the gravid female. The coloration and size of the egg mass may vary between gravid females.

Figure 5 Sample identification images for European green crab detection reporting.

Clear images of the dorsal (left) and ventral (right) sides of a European green crab. Note the images high resolution and clarity. Distinguishing features utilized for identification, such as carapace spines, carapace shapes, and limbs, are clearly visible.

Section 2: Procedures & Guidelines

The following section details procedures and guidelines for managing green crab. Emphasizing the importance of information sharing and utilizing the best available techniques, this section outlines the rationale for disseminating science-based green crab management strategies and techniques. Providing a comprehensive guide, beginning with permitting and moving through the suite of green crab management actions from prevention and early detection to monitoring and control, will help ensure a systematic approach that incorporates standardized techniques and reporting. This allows for consistent and comparable efforts across multiple management units, fostering collaborative and transparent management practices. Recognizing that this document is not static, it will be regularly updated to reflect new insights and experiences, thereby supporting local stewardship efforts. Moreover, it empowers stakeholders with lived experience by equipping them with practical information and techniques that can be incorporated into existing efforts. Lastly, the plan provides a framework of recommended safety protocols to ensure the health and well-being of all participants.

Permits

This section outlines permits associated with green crab management in Washington state. Permit requirements differ between various management activities. Contact the WDFW AIS unit at ais@dfw.wa.gov for assistance in determining your permit needs.

Aquatic Invasive Species Permit

Aquatic Invasive Species (AIS) Permits are required to collect and kill European green crab in Washington given their status as a Prohibited Level 1 species under RCW 77.135.030(1)(a). This permit, and this permit only, allows for the Permittee to possess green crab under RCW 77.135.040(1) and allows the removal and killing of green crab that is destroying or injuring property, under RCW 77.12.240. This permit also authorizes the Permittee's mutual assistance or cooperation as part of a WDFW monitoring and control program under WAC 220-640-100(3), including the delegated authority to possess and destroy green crab via humane euthanasia without direct Department supervision, as conditioned under the permit.

An AIS Permit is not required by co-managers or tribes conducting green crab trapping efforts within their jurisdictions or on their lands, including within the treaty tribes' respective Usual and Accustomed areas. All other trapping partners must obtain or be added as a sub-contractor to an active AIS Permit.

Please reach out to the AIS Unit with any questions at ais@dfw.wa.gov.

Endangered Species Act Related Permits

An Endangered Species Act (ESA) Section 10(a)(1)(A) research permit or (B) incidental take permit is required to conduct trapping efforts in areas of Washington with the potential to encounter ESA listed

species bycatch. Efforts are underway to streamline coverage for potential interactions with ESA listed species, but for now, all co-managers, tribes, and partners are responsible for obtaining permits if required.

ESA listed species must be handled with the utmost care and documented, photographed, and reported. See Appendix III: WDFW Bycatch Protocol for additional guidance.

For more information, please visit fisheries.noaa.gov/permit/permits-incidental-taking-endangered-and-threatened-species.

Scientific Collection Permit

Scientific Collection Permits from WDFW are required to collect fish, shellfish, or wildlife or their nests and/or eggs for the purpose of research or display. These permits are generally issued to scientists/researchers, educators/educational institutions, and museums, aquariums/zoos. They are NOT issued for collection/take of fish and/or wildlife. As specified in RCW 77.32.240, WAC 220-200-150, and WAC 220-450-030, if the purpose of the trapping effort is collecting organisms, green crab or otherwise, for research or display purposes, then a Scientific Collection Permit is required.

A Scientific Collection Permit is not required by co-managers or tribes to conduct work within their jurisdictions or on their lands, including within the Treaty Tribes' respective usual and accustomed areas. If an entity is working under WDFW's supervision and direction (as an agent of the state), a Scientific Collection Permit is not required.

Visit WDFW's website for more information wdfw.wa.gov/licenses/environmental/scientific-collection or contact scp@dfw.wa.gov

Shellfish Transfer Permits

Shellfish Transfer Permits from WDFW are required for the transfer of shellfish, shellfish aquaculture products (including oyster seed, cultch, and shell), aquaculture equipment (including aquaculture vehicles, vessels, and monitoring/research devices), or any marine organisms adversely affecting shellfish (e.g., when green crab are transferred for research purposes). As specified in WACs 220-340-050 and 220-340-150, it is unlawful to transfer shellfish within Washington State without first obtaining a Washington state Shellfish Transfer Permit.

See the Shellfish Transfer section of this document for additional information regarding the review and issuance of shellfish transfer permits.

Prevention

Prevention refers to activities that reduce the arrival of any AIS, regardless of life stage, resulting from the transport or transfer from one location to another. Prevention is a concern regardless of whether

the species in question is present at the receiving location. This section outlines issues that should be considered to reduce the risk of transporting AIS.

Equipment-Mediated Transfers

Green crab-related activities could result in the unintentional transport and introduction of AIS to new locations through field sampling gear, including boats, nets, waders, and other equipment. Even travel within a Management Area (e.g., Willapa Bay) could result in the unintended transport of AIS, such as New Zealand mudsnails (*Potamopyrgus antipodarum*), to nearby areas that the species would otherwise be unable to access. **We strongly encourage the use of precautionary principles and decontamination procedures outlined below for all field activities to reduce the risk of unintended AIS transport.**

Precautionary Principles

During fieldwork, it is strongly encouraged to apply the following basic precautionary principles to prevent/minimize the introduction or spread of AIS including:

- Be aware of AIS infestations as they occur within your areas of activity.
    - New Zealand mudsnail distribution map: wdfw.wa.gov/species-habitats/invasive/potamopyrgus-antipodarum#desc-range
    - Oyster drill distribution map: arcgis.com/apps/View/index.html?appid=5165e0b1c1af421ab8140bb44b79e9c1
    - For information on the presence of AIS in your area of interest, contact the WDFW AIS Unit at ais@dfw.wa.gov.
- Arrange plans to move from the least likely to the most likely to be contaminated areas.
- For boat-based activities, minimize wading and avoid running boats into sediment.
- Consider the purchase of wading gear and boots with the fewest places for organisms and debris to become attached.
    - Felt soles are one of the largest aquatic pathways for the introduction and spread of invasive species since they are extremely difficult to fully decontaminate. All alternatives should be explored before deciding to use felt soles.
    - Features for minimizing hitchhikers may include one-piece systems with full rubber material and open cleat soles, but safety considerations should drive the selection of appropriate gear.
        - Field staff have reported that one-piece waders can become more easily entrapped in soft-sediment habitats compared to two-piece equivalents. Please utilize the gear that best suits the situation you encounter, but keep in mind that more complex gear requires more effort to properly decontaminate.
- Reduce the amount of sediment, plants, or organisms that are moved from the water into boats or sampling gear.
- Regularly inspect and clean gear while working.
- Dedicated equipment is strongly encouraged when working in areas with known AIS infestations, particularly for species with cryptic propagules (an organism or part of the organism that can grow into new individuals).

    - Examples include New Zealand mudsnails (only 2-6 mm in size, mud-colored, and can reproduce asexually) or *Didemnum vexillum* (a colonial tunicate that can reproduce via fragmentation).
- Clean, drain, and dry all gear after each use, especially if moving between locations. Decontamination protocols for conveyances (see below) are strongly encouraged if operating in areas with known AIS.

Additional information on these and other precautionary principles can be found in the Washington Department of Fish and Wildlife Invasive Species Management Protocols: wdfw.wa.gov/sites/default/files/publications/01490/wdfw01490.pdf.

Decontamination

Decontamination is the application of a treatment to kill, destroy, remove, or otherwise eliminate all known or suspected invasive species carried on or contained within aquatic conveyances (e.g., equipment and vessels) by use of physical, chemical, or other methods. Decontamination treatments may include drying any equipment or vessels for a time sufficient to kill any AIS through desiccation. The proper application of decontamination treatments can greatly reduce the risk of spreading AIS due to green crab-related field activities.

Please note that the precautionary principles outlined above do not replace decontamination procedures. Instead, precautionary principles work in tandem with decontamination treatments to reduce the risk of AIS transport.

Level 1 Decontamination Protocol

Level 1 Decontamination protocols (as defined below) are strongly encouraged whenever leaving the water to travel from one location to another, even within a Management Area. The basic steps in decontamination for all types of aquatic conveyances in all situations are:

- **Clean** off any attached sediment, organisms, or debris from surface areas that were in contact with the water, underwater bottom, or wetted perimeters immediately upon leaving a water body. Use a brush, boot pick, and water of origin to help remove heavy deposits. For multi-piece gear, it is critical to remove attachments and boots to allow for full cleaning coverage.
- **Drain** any water back into the water body from which it came.
- **Rinse** all surface areas with potable water. Rinse water can be kept in a 3-5-gallon (10.5-17.5 L) water tank in your field vehicle (e.g., water cooler, pressurized tank sprayer; solar shower).
- **Dry** aquatic conveyances or allow time to dry before being used at another site. To dry aquatic conveyances completely, either wipe them down with a clean rag/towel, hang them up, or lay them out in a way that allows for drying over time.

Level 1 Decontamination conducted immediately after leaving the water does not require the containment of rinse liquids or removed debris. If Level 1 procedures cannot be done in the field, gear should be placed in a plastic bag or tote for transportation to a proper decontamination station.

Once you have completed a Level 1 Decontamination on aquatic conveyances, clean, rinse, and dry all equipment used for the decontamination itself.

Level 2 Decontamination Protocol

Note that Level 2 Decontamination should always be performed in addition to, not as a replacement for, Level 1 Decontamination.

Level 2 Decontamination protocols are strongly encouraged when traveling between Management Areas, after visiting locations containing AIS other than green crab, and before entering locations with highly sensitive resources (e.g., marine reserves).

There is no uniform Level 2 Decontamination Protocol, but rather a range of physical and/or chemical treatments based on the best available science. Select an appropriate protocol based on the gear or equipment types and best professional judgment. Please use appropriate personal protective equipment (PPE) and caution with each treatment option. Please see Appendix I: Level 2 Decontamination Protocols for a list of decontamination protocols deemed useful to green crab fieldwork, as well as additional resources for selecting appropriate protocols.

Level 1 Decontamination clean and drain protocols must be conducted prior to starting Level 2 protocols to ensure the effectiveness of the Level 2 treatments. Gear and equipment undergoing Level 2 Decontamination do not have to follow the dry step of Level 1 Decontamination before beginning Level 2 protocols.

Additional information on decontamination treatments, including more detailed methods, can be found in the Washington Department of Fish and Wildlife Invasive Species Management Protocols at wdfw.wa.gov/sites/default/files/publications/01490/wdfw01490.pdf

Shellfish Transfers

Shellfish transfers are a potential vector for AIS introductions and spread. Recent studies have shown that the movement of shellfish products and equipment was the likely source of propagules in introducing green crab into the Sooke Basin on Vancouver Island (DFO. 2015). As a result, the potential spread of green crab via shellfish transfers is a significant concern within Washington.

Shellfish Transfer Permits from WDFW are required for the transfer of shellfish, shellfish aquaculture products (including oyster seed, cultch, and shell), aquaculture equipment (including aquaculture vehicles, vessels, and monitoring/research devices), or any marine organisms adversely affecting shellfish (e.g., green crab trapped for research purposes). As specified in WACs 220-340-050 and 220-340-150, it is unlawful to transfer shellfish within Washington without first obtaining a Washington State Shellfish Transfer Permit.

All Shellfish Transfer Permit Applications are reviewed on a case-by-case basis to determine the potential risk of green crab spread into areas considered free of green crab and among areas of known or suspected green crab presence (e.g., European Green Crab Restricted Areas; see below). The source

and destination, the practices and procedures of the applicants, and the materials being transferred are all reviewed. Some shellfish, such as clams and other organisms that must be harvested individually by hand, are considered low risk for green crab transfer, while shellfish in clusters or grown with direct contact with the sea floor, such as cultch, are of the highest concern. When applications for the possession of green crab for research purposes are reviewed, careful consideration is given to the connectivity of holding tanks to water sources and the containment of specimens during transit. All permit applicants engage in consultation with WDFW, and WDFW will conduct site/facility inspections as part of the permit process.

WDFW has the authority to deny the issuance of a Shellfish Transfer Permit should the risk of spreading green crab be deemed unacceptable. While this risk is assessed for each application on a case-by-case basis, there are certain shellfish and related materials that are never permitted for transfer from European Green Crab Restricted Areas into locations where green crab are presumed absent:

- Wild-set cultch: shell and other material placed on the sea floor to serve as a substrate for the attachment or setting of oyster larvae.
    - Tank-set cultch may be considered if the intake water is screened to prevent larval and juvenile green crab from entering the system.
- Bottom cultured oysters: oysters grown using the sea floor as the base.
- Mussel clusters.
- Other aquaculture materials that cannot be separated or split up.

If Shellfish Transfer Permits are approved, applicants should expect permit condition requirements designed to manage the risk of transfer of green crab. Shellfish Transfer Permit requirements are intended to reduce the risk associated with introducing and spreading shellfish disease agents and harmful aquatic pest organisms, including green crab. Shellfish Transfer Permit conditions document transfer vehicles, cleaning and disposal methods, inspection needs, and other preventative measures. Examples of Shellfish Transfer Permit conditions include various extra washing and containment procedures, chlorine treatment, screening of intake water for facilities, preventive equipment maintenance, and/or others depending on the proposed transfer. Permit conditions are issued even when the risk of green crab transfer is deemed relatively low, such as requiring chlorine dips for the transfer of oyster seed from FLUPSYs (floating upweller systems) and floating nurseries.

A moratorium on shellfish transfers from areas of known or suspected green crab presence has been thoroughly considered. Ultimately, it has been determined that a moratorium is not in the best interest of preventing green crab spread via aquaculture. Entities that apply for Shellfish Transfer Permits are willing participants in efforts to reduce the risk of green crab transfers. A moratorium could result in the avoidance of the transfer permit process, which would limit the ability to monitor and control this pathway for green crab introduction or spread. Efforts will continue to refine and develop preventative measures based on the best available science to further reduce the risk of green movement via shellfish transfers.

Under the Shellfish Implementation Plan, WDFW must notify tribes of Shellfish Transfer Permit applications for transfers that would enhance shellfish beds in their usual and accustomed areas. Tribes can review the applications and discuss concerns with WDFW to ensure open communication on these issues. While there is no formal process for public comment on shellfish transfers, permit holders and the public can contact WDFW with questions regarding the shellfish transfer process at shellfishpermits@dfw.wa.gov.

Information on Shellfish Transfer Permits

- Shellfish, aquatic invertebrate, and seaweed health and cultivation permitting information: wdfw.wa.gov/licenses/fishing/shellfish-import-transfer
- Shellfish Transfer Permit application form: wdfw.wa.gov/sites/default/files/2023-11/wdfwshellfishtransferpermitapplication-2023.pdf
- WDFW Transfer Permit Supplemental Information and Guide: wdfw.wa.gov/sites/default/files/2019-08/WDFW_TransferPermit_guidelines_2019.pdf

European Green Crab Restricted Areas

- WDFW European Green Crab restricted area interactive web map: wdfw.maps.arcgis.com/apps/webappviewer/index.html?id=631fab8ffc374f2a86f302ea75c2b923
- WDFW European Green Crab Restricted Area Map (January 2023): wdfw.wa.gov/media/11713

Organisms in Trade

This pathway encompasses both the unintentional and intentional movement of green crab and green crab propagules in the live bait and seafood industries, as well as the aquarium and pet trade (Williams et al. 2013).

Considerable data supports the idea that both live bait and seafood continue to be an unintentional source of new green crab propagules through the movement of contaminated live packing material, such as macroalgae, that generally accompany shipments of bait and seafood (Cohen 2012, Blakeslee et al. 2016). Studies have also shown that there are management options available, including inexpensive osmotic shock treatment (e.g., freshwater dunk) of packing materials and the use of substitute materials, that can reduce the risk of transporting and introducing invasive propagules (Blakeslee et al. 2016).

Commercial seafood harvest targeting green crab can also result in the intentional movement of live green crab. Despite Washington's regulations against the possession or import of green crab, discrepancies among state laws have resulted in the purchase and importation of live green crab into Washington. In 2022, green crab were purchased online, shipped from Massachusetts, and offered for sale in a Seattle market until the seller was notified of their invasive status by WDFW Enforcement (WDFW 2022). There is a clear need to standardize the status of green crab at the state level or at least

limit incentives for moving green crab across state borders, as well as ensure that potential importers of live commercial seafood items such as green crab are aware of relevant regulations.

Shipping

Shipping pathways include commercial and military shipping, mobile marine infrastructure (e.g., drilling platforms, construction barges, floating docks), commercial fishing vessels, and recreational boating. The evidence for long-distance transport of green crab via ships' ballast water is minimal, although long-distance transport between continents suggests this is an important, if rare, pathway. The risk of long-distance transport by ships is further reduced by evolving ballast water management regulations through open sea exchange and ballast water treatment. However, local coastal transport by ships, especially within a single U.S. Coast Guard Captain of the Port Zone, continues to be a risk as ballast water management is generally not required. Historically, solid ballast (rocks and stones) was known to have transported a diverse array of maritime and terrestrial plants and animals and is suspected of being the pathway for initial green crab introduction into the eastern U.S. in the 19th century (Carlton and Cohen 2003). Solid ballast has largely been phased out in favor of ballast water and is unlikely to pose much contemporary risk.

Transport of green crab via marine growth on modern ship hulls (biofouling) is not considered a high risk except in cases of extensive biofouling on the hull or in niche areas such as sea chests. More work needs to be done to assess the risks of green crab transport on mobile marine infrastructure, which often accumulates significant densities of marine growth before being moved to a new location. To date, however, we are not aware of any reports of green crab associated with these pathways.

Additional Pathways

Additional pathways include the transport of marine sediments and debris, marine construction devices, inter-harbor transport of nets and traps, and escape or release from research and education facilities. To date, there are no verified reports of green crab introduction or spread via these pathways, although they still represent a potential risk. Development of risk assessment procedures to address these pathways, particularly the transport of marine sediment and debris, should be undertaken.

Trapping

Trapping is an essential tool for managing green crab populations due to its targeted and efficient approach. Baited traps continue to be the standard tool for detecting, monitoring, assessing, and reducing green crab numbers, with the ability to be set in potential habitats such as the intertidal zone, which limits the bycatch of native species and minimizes ecological impacts (Duncombe and Therriault 2017, Ens et al. 2022). Effective trapping can reduce local green crab populations, collect detailed demographic data, and cause minimal harm to non-target species (Ens et al. 2022). Despite being resource-intensive, trapping allows for the direct removal of invasive crabs and provides critical data on their population dynamics and behavior, aiding broader management strategies and preventing the

establishment of new invasions. When done correctly, trapping is integral to effective green crab management efforts (Tummon Flynn et al. 2023).

This section provides an abridged overview of trapping guidelines for green crab management activities. A more thorough breakdown of these elements can be found in Appendix II: Trapping and Trapping Protocols. Current or potential co-managers, tribes, and partners interested in trapping training contact WDFW's AIS Unit at ais@dfw.wa.gov.

Identifying Sites

The biology of green crab can be utilized to identify sites where they are likely to be present. Along the Pacific coast of North America, green crab 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 presence of larger predatory crabs, such as red rock crab (*Cancer productus*), in subtidal waters can limit green crab presence to higher tidal elevations which are less favorable to red rock crab (Jensen et al. 2007). Evidence suggests that green crab shift sites seasonally (active in shallow water in the summer, move to deeper water and reduce activity in the winter). Using what we know of green crab, we recommend the following guidelines to identify trapping sites:

If trapping in warmer months:

- Tidal Elevation: Intertidal (+1' to +6' MLLW); deeper waters depending on location.
- Near Structure: Pilings, riprap, shell piles, steep muddy embankments, tidal channels, saltmarsh, shoreline vegetation, surf/eelgrass beds, areas of dense algae, woody debris, and logs. They are also often found in creek systems.

If trapping in colder months:

- Tidal Elevation: Shallow subtidal (-1' to +1' MLLW); deeper waters depending on location.
- Near Structure: Pilings, riprap, shell piles, steep muddy embankments, tidal channels, saltmarsh, shoreline vegetation, surf/eelgrass beds, areas of dense algae, woody debris, and logs.

Selecting Traps

There is no universal "best" trap for the collection of green crab. Each has its own strengths and weaknesses and should be chosen based on site conditions, management goals, deployment capacity, and other relevant factors. Below, the three primary categories of traps utilized in Washington for baited trapping of green crab are briefly discussed: Fukui, Minnow, and Shrimp traps. See Appendix II: Trapping and Trapping Protocols for a more thorough evaluation of each trap type and comparison across trap types.

Fukui Traps

Historically, Fukui traps[2] are the primary trap utilized for green crab management (Duncombe and Therriault 2017, Bergshoeff et al. 2019, Ens et al. 2022). Fukui traps are rectangular with two tunnels at either end, where two netting panels form a horizontal ‘‘V’’ with an expandable entry slit at the narrow end. Fukui traps are best suited for shallow or subtidal habitats. Their relatively small footprint allows for deployment in narrow habitats such as channels and marshes. In addition, their lightweight and collapsible structure allows for the transport of numerous traps on foot. While Fukui traps are effective at catching and retaining green crab with > 20 mm carapace width, they are biased against the collection of the smallest green crab. Fukui traps are highly versatile and can be utilized for any trapping effort (e.g., early detection, monitoring, assessment, and control trapping).

Minnow Traps

Minnow traps, also called crayfish traps, are usually cylindrical traps with two inverted conical entrances, one at either end of the trap. Each trap consists of two connected halves which, when separated, allow for easy stacking, transport, and storage. Minnow traps can be deployed in shallow habitats, and their small footprint allows for deployment in even the narrowest channels. The entrances of minnow traps are small (25 mm diameter), which prevents the entry of larger crabs but can catch and retain smaller crabs. However, one can easily expand the openings if desired. These traps are ideal to deploy at the mouths of estuaries and salt marsh channels where more young of the year (YOY) crabs are present. Minnow traps are useful for early detection, monitoring, and assessment trapping.

Shrimp Traps

A variety of shrimp traps and variable mesh types are currently used for green crab management in Washington. While not historically used for green crab trapping, shrimp traps have become the predominant trap among many co-managers, tribes, and partners in recent years. The most common type are box traps, which have four tunnel openings and a built-in bait tunnel in the center. Shrimp traps can be deployed in a range of habitats provided some water remains at low tide, including intertidal sites, salt marsh channels, river sloughs of adequate width, main river channels if properly secured, and subtidal habitats. Shrimp traps are highly versatile and can be utilized for any trapping effort (e.g., early detection, monitoring, assessment, and control trapping). Shrimp traps are also the best option for boat-based trapping since they are heavier and sturdier.

[2] Please note that Fukui is a specific brand of this style of collapsible box trap. In Washington and this Plan, the term Fukui is used as a catchall for all traps of this type.

Additional Traps

While more limited in their use, other trap designs are utilized for green crab trapping. See Appendix II: Trapping and Trapping Protocols for more information on additional trap types.

Bait Selection

The broadly recommended bait options for green crab management are mackerel, herring, anchovy, or any other oily, smelly fish. These fish are relatively cost-efficient, readily available, and effective at attracting green crab. In general, these fish are more effective than less pungent baits (e.g., squid, mussels). See Bait Selection in Appendix II: Trapping and Trapping Protocols for more details.

Recording Data

There are two options for recording data: physical data sheets and mobile apps. For any questions about or assistance with the use of these options please contact WDFW's AIS Unit at ais@dfw.wa.gov. For more information on data submission and management, please see Data Standards, Collection & Reporting.

Co-managers, tribes, and partners can record data on datasheets and then transfer that information into an electronic format for submission. While the exact datasheets used are up to each co-manager, tribe, and partner, care must be taken to ensure the necessary data is recorded. WDFW utilizes (and recommends) the use of the following datasheets related to green crab trapping (examples of these datasheets and an explanation of data fields can be found in Appendix II: Trapping and Trapping Protocols).

- Trap Deployment Datasheet
  This datasheet provides details on trap deployment and location.
- Trap Effort Datasheet
  This datasheet provides details on all organisms captured in each trap.
- EGC Biometrics Datasheet
  This datasheet provides details on individual green crab captured in each trap.
- Trap Label – Simple
  This label provides details on the number, sex, and reproductive status of the green crab collected from an individual trap. It is placed in a plastic bag along with the collected crab.
- Trap Label – Detailed
  This label provides detailed information on individual green crab from a particular trap. It is placed in a plastic bag along with the collected green crab.

Two mobile apps related to green crab trapping are publicly available and free, but access must be granted to use the content specifically designed for the European Green Crab Emergency. WDFW can provide logins for co-managers, tribes, and partners to utilize these apps if they don't have ArcGIS access.

- ArcGIS Quick Capture
  This app is used to record details on trap deployment and individual trap information (i.e., trap type, number, location, bait type, site, personnel).
- ArcGIS Survey 123
  This app is used to record catch information for each individual trap deployed (i.e., green crab counts, bycatch).

Bycatch

In the context of green crab management, bycatch refers to any animal species collected in traps other than the target species (e.g., green crab). While bycatch is unavoidable, every effort should be made to maximize the bycatch survival rate. Proper trap placement, regular trap checks, and proper bycatch handling can significantly increase the chance of bycatch survival. In addition, simple trap modifications can greatly reduce bycatch rates of larger organisms. See Appendix II: Trapping and Trapping Protocols for more details on proper trap placement and trap modifications.

Bycatch data can provide valuable insight into local community structure, assess changes in community structure over time, and evaluate the impacts of green crab. As a result, it is essential to strike a balance between proper documentation of bycatch and ensuring the safe release of these organisms. See Appendix III: WDFW Bycatch Protocol for guidelines on bycatch documentation and handling.

Trapping Protocols

Always check tides and expected weather conditions prior to going into the field. This will affect when you can deploy, check, and retrieve traps. Safety is the number one priority and should be considered during all aspects of field operations.

There is a high degree of variability among and within field sites. While the detailed methods outlined in Appendix II: Trapping and Trapping Protocols can serve as the basis for trapping efforts, they will not be a perfect fit for every location and situation. As you become familiar with trapping protocols and fieldwork, you will be able to adjust to improve the effectiveness of your trapping and trap deployment.

- Set traps near existing structure (<20 m).
- Select locations where, ideally trap is >50% submerged during the entire deployment.
- Set traps at least 10 m apart for different trap types (20 m if using the same trap type).
- Consider water temperature when timing retrieval. Low temperatures in winter and high temperatures in summer can cause increased bycatch mortality, particularly for fish bycatch.
- To reduce the potential for trap loss, avoid high flow or scour areas and steep slopes.
- Avoid areas that will be 100% freshwater at low tide.
- Release organisms in cool, protected water to help recovery.
- Reduce opening size of Fukui traps using zip ties to make it hard for mammals to enter.
- Use extra weight and PVC stakes in higher energy areas or tide flats.
- Pin trap securely to substrate. Crabs are reluctant to enter unstable traps.

Handling

Green crab collected in the field should be placed in a covered cooler with newspaper or other inert material saturated with local seawater. The cooler should have one pint-size frozen cold pack per cubic foot of cooler space to maintain a low temperature without freezing the crabs. Cold packs should be wrapped in newspaper to avoid direct contact with the crabs. When individual specimens need to be segregated, place a small amount of saturated newspaper, a specimen label, and the crab into a zip-top plastic bag before putting it into the cooler. Cold packs should be disinfected and re-frozen between uses.

Euthanasia and Disposal

The following methods are approved for euthanizing green crab:

- Place crabs into a freezer for a minimum of 72 hours to ensure they are fully frozen or
- Cool in a freezer or a salt/ice slurry until insensible. The crabs must then either be:
    - Spiked to destroy the ganglia (de Souza Valente 2022) or
    - Placed in boiling water for 15 minutes (Reilly 2001).

All partners requiring a European Green Crab Collection Permit must dispose of dead crabs using one of the following procedures:

- Seal euthanized specimens in a durable bag tagged or marked with your permit number and dispose of them in a municipal landfill.
- Coordinate with WDFW for the collection of specimens to be processed into organic fertilizer.
- Any alternate disposition of specimens approved by WDFW prior to disposal.

Co-managers and tribes working outside of state jurisdiction (e.g., Federal agencies on federal land, tribes on sovereign tribal land, off-reservation trust land, and Usual and Accustomed areas) may dispose of dead crabs in the manner they see fit.

Early Detection

Early detection refers to field operations in geographic areas classified as Undetected/Negative (see Geographic Area Classification) with the intent to detect green crab at the earliest point in the invasion process. This section outlines issues that should be considered when planning early detection efforts and various approaches that may be utilized to detect green crab.

General Strategies and Considerations

Early detection efforts should be designed to have the greatest chance of detecting whether green crab are present in the area and target habitat where conditions are most suitable for green crab (see Identifying Sites for additional info). Similarly, early detection efforts should occur when green crab are

most active and likely to be detected. The timing and location of early detection efforts will vary depending on the approach utilized. For example, if searching for adults, deploying traps for a 24-hour period in the intertidal near structure in the summer is appropriate. In contrast, molt searches can occur anywhere you have safe and legal access to the shoreline during a medium to low tide.

The use of multiple early detection tools will increase the chances of detecting green crab and should be implemented when feasible.

Many early detection efforts will fail to detect green crab. Green crab may have yet to arrive in the area being searched. It is also possible that green crab are present, but they were not detected (e.g., trapped in the wrong spot, trapped at the wrong time, wrong age class for the sampling approach used, bad luck). Repeated early detection efforts may detect the arrival of green crab at a later date, or successfully detect an already established (but not detected) population.

Early Detection Best Practices

- Target high-quality green crab habitat.
- Sample when green crab are more likely to be present. Consider the time of day and season.
- Use more than one approach when feasible.
- Repeat efforts occasionally.

Life Stage Targeting

Zoea and Megalopa:

Zoea and megalopa are the pelagic larval stages of green crab. They are small (100 µm to ~ 1mm) and must be collected in the water column. These larvae have successfully been collected via plankton tows. Light traps have proven effective at collecting Dungeness crab larvae (see the Pacific Northwest Crab Research Team at pnwcrab.com/about), and this same design is being tested across Washington to determine their efficacy at capturing green crab larvae.

Identifying green crab larvae is difficult compared to their later life stages. Researchers at the Padilla Bay National Estuarine Research Reserve (PBNERR) have developed zoeal identification tools and hosted larval identification workshops. Researchers from the United State Geological Survey (USGS) are testing the use of eDNA to detect green crab larvae within larger planktonic samples.

Young of the Year

Young of the year (YOY) are juvenile green crab (< 30 mm carapace width) and the most recent cohort to recruit into the population. Newly settled YOY have been collected using benthic samplers in their native range (Paula et al. 2006, Amaral and Paula 2007). Efforts are ongoing to test the efficacy of benthic samplers in Washington.

Beach seines are effective in detecting YOY green crab. However, their use may add a variety of difficulties, such as high levels of bycatch and long processing times. Additionally, beach seines are not viable in areas with lots of structure, such as submerged aquatic vegetation and woody and rocky debris.

YOY can also be collected using the same techniques used for adults. Traps with smaller mesh sizes will retain smaller crabs. YOY can be collected in pitfall traps (a passive trapping technique with a container buried into the sediment), provided they are open during periods of green crab recruitment. While labor and time-intensive, hand capture is a reliable method for collecting YOY.

Adults

The methods described in Appendix II: Trapping and Trapping Protocols primarily target adult green crab. They use Fukui, Minnow, and Shrimp traps, though other methods can also be effective.

eDNA

Environmental DNA (eDNA) is rapidly becoming one of the most valuable new additions to the biodiversity monitoring toolkit (Deiner et al. 2021). Given the method's potential sensitivity and cost-effectiveness, it has been explored as a means of detecting invasive species, particularly when they are newly introduced or at the edges of an expanding invasion front. Methods are being developed to use eDNA to estimate population densities of green crab, therefore offering the potential to support ongoing monitoring and management of existing invasions.

Research reconciling observations from eDNA sampling and trapping efforts in terms of both early detection capabilities and population assessment will be crucial to the successful integration of eDNA tools into existing monitoring programs (Crane et al. 2021). For example, by conducting eDNA sampling alongside existing trapping efforts, (Keller et al. 2022) developed a model to compare detection probabilities across sampling regimes and calculate the sensitivity and specificity of the assay. This eDNA assay showed comparable sensitivity to traps in detecting populations of green crab at a moderate density. Their model results also suggested that adding eDNA data to trapping observations generally increased the certainty around estimates of green crab presence and population density, but this gain was most valuable at sites with low population densities or where trapping observations were sparse.

Based on the results of Keller et al. (2022), eDNA could be used somewhat interchangeably with trapping to support early detection efforts, and thus, managers might choose the tool or sampling regime that is most practical and resource-efficient for their context and management goals. However, (Keller et al. 2022) also offered a cautionary case study in which green crab eDNA was detected at a site beyond an invasion front, at which subsequently no adults were found to have successfully recruited, and the eDNA signal did not persist. Thus, the detection was interpreted as likely having come from larvae that ultimately did not establish a local population. Together, these findings offer a few guidelines for the potential utility of eDNA monitoring in the green crab surveillance toolkit.

eDNA Sampling Protocols

Currently, there is no standardized protocol for collecting green crab eDNA samples. The procedure outlined in Appendix IV: eDNA Sampling Protocols is derived from (Keller et al. 2022) and WDFW zebra and quagga mussel eDNA monitoring protocols. It can serve as a starting point for eDNA sampling efforts until such time as a standardized protocol has been vetted and made available for use.

Molt Surveys

Like eDNA, molts (exoskeletons shed by crabs as part of their growth) can provide information on the presence and absence of green crab without requiring the collection of a living animal. While the molts will break down over time, the carapace of the crab is durable and hosts the five marginal teeth utilized to identify European green crab. The presence of a molt can serve as an early indicator of the presence of green crab in new areas.

WSG and WSU Extension have developed a volunteer-based green crab early detection program known as Molt Search. The program's primary goal is to support broader participation in early detection along inland Washington's shorelines by teaching volunteers what to look for and how to report the presence of green crab molts. Additionally, Molt Search collects data on Dungeness crab molts, which can provide useful information on this important native species.

Given the low cost, straightforward procedures, and active network of participants, Molt Search can serve as a starting point for developing early detection efforts or as a supplement for already established programs. Molt Search can also be an effective outreach and education tool, as minimal training is required for participants. The Molt Search program is continuing to expand through the training and recruitment of additional trainers and program leaders. A list of approved trainers across Washington is being developed to allow local training opportunities. While formal trainings are recommended, the protocols are straightforward and well-defined to be easily utilized by co-managers, tribes, and partners experienced with green crab or the public with little to no green crab experience.

Molt Search reports are submitted via the MyCoast app (available for Android and Apple devices) or online at mycoast.org/wa/crab/report. Reports are publicly accessible and may provide useful insight into green crab distribution.

Molt Search Resources:

- Molt Search Website
  wsg.washington.edu/crabteam/moltsearch/
- Protocol handbook
  wsg.washington.edu/wordpress/wp-content/uploads/Molt-Search-Protocol.pdf
- Identification guide
  wsg.washington.edu/wordpress/wp-content/uploads/Molt-Search-ID-Guide_v2.pdf
- Molt Search Report Archive
  mycoast.org/search-reports?state=wa

Other Early Detection Tools

Snorkel and SCUBA surveys have been utilized to assess green crab abundance and could be used as an early detection tool (Grosholz et al. 2000, Jensen et al. 2007, Blakeslee et al. 2010). However, these surveys require low turbidity, properly certified staff, and proper equipment to be feasible.

Remote underwater video systems have successfully detected green crab in their native range (Rhodes et al. 2020). Although remote underwater video systems can be limited by poor visibility, they are potentially less damaging to seafloors than other approaches. While remote underwater video systems have yet to be used in early detection efforts, they may be a viable tool in areas of high green crab suitability.

Other tools, such as green crab detection dogs, have been proposed as potential early detection methods. However, these methods are still in the early stages of development. As novel detection methods arise, proper vetting and standardizations are required.

Monitoring

Monitoring refers to a systematic and designed sampling effort for information-gathering purposes that is implemented consistently and on a routine schedule. Monitoring protocols are well-defined and are relatively stable to evaluate changes over space and time. This section outlines issues that should be considered when planning monitoring efforts.

General Strategies and Considerations

The critical consideration for monitoring efforts is consistency. Ideally, monitoring efforts allow the comparison of conditions across space and time. If monitoring methodologies change (e.g., switching between bait types, changing locations, changing trap types), you are introducing new sources of variability in the data. As a result, you cannot distinguish what changes result from environmental factors (e.g., temperature, green crab recruitment) or management actions (e.g., local green crab removal efforts) and what changes result from inconsistent monitoring methods.

Monitoring efforts should occur on a consistent schedule. However, the frequency and duration of monitoring efforts will vary depending on the nature of the monitoring effort.

Monitoring efforts capture a wealth of information at specific sites, but that information does not necessarily represent conditions across the larger geographic area.

Monitoring Best Practices

- Consistent methodology (e.g., bait use, trap placement, deployment duration).
- Consistent equipment (e.g., trap type).
- Consistent locations.

- Consistent data collection approach.
- Consistent sampling schedule across seasons/years.

Assessment

Assessment refers to periodic checking of geographic areas to assess the presence, geographic scope, and numerical scale of a green crab population at a relatively comprehensive scale. This section outlines issues that should be considered when planning assessment efforts.

General Strategies and Considerations

As mentioned above, consistency in methodology, equipment, and data collection allows for detecting changes in green crab populations and other variables of interest over time. Like monitoring efforts, assessments require these consistencies to reduce variability across sampling efforts but may not be consistent with location or sampling schedule.

Assessments attempt to estimate the status of conditions in a geographic area at a given time. While this geographic area could be a site, assessments typically cover a larger area to offer a more comprehensive snapshot. A balance must be struck between covering sufficient ground to represent the geographic area as a whole and managing the inherent variability of conditions across locations. Urquhart and Kincaid (1999) suggest that a mixture of a small number of consistent sites (e.g., sample every year) and a larger number of alternating (e.g., sample a subset each year, rotate so all sites sampled once every 4 years) is most suitable for detecting trends on a larger geographic scale.

Assessment scheduling can be consistent (e.g., once per year) or more infrequent (e.g., when capacity allows). However, assessments should occur at the same time of year for direct comparison across sampling events.

Assessment Best Practices

- Consistent methodology (e.g., bait use, trap placement, deployment duration).
- Consistent equipment (e.g., trap type).
- Consistent data collection approach.
- Some variability in sampling locations to increase geographic coverage (e.g., a few repeated locations and additional alternating locations).
- Consistent timing of season.

Control

Control refers to field activities within a given Positive or Infested geographic area that aim to reduce that area's green crab population size. Note that control may itself relate to a range of possible

management goals, including reduction of local impacts or reduction of regional population size, growth, or spread. This section outlines issues that should be considered when planning control efforts.

General Strategies and Considerations

Control management actions should be based on the data collected from early detection, monitoring, and assessment efforts outlined in the previous section. Just as crab abundance differs by location, so too does the appropriate effective and efficient approaches available for controlling the population. Information on green crab population status, the status of the resources at risk, green crab population thresholds, the potential for spread to new areas, and the extent of the impacts are all essential for determining management actions.

Management actions can affect short-term reductions in local populations of green crab. However, these reductions in abundance are expected to be highly localized and impermanent and the extent to which green crab will recolonize sites where population reduction has taken place will depend on local and regional green crab dispersal patterns and interannual variability in green crab survival and recruitment.

Identifying high-priority locations is a crucial aspect of green crab control efforts. Determining these areas should be based on ecological, economic, and cultural resources prioritized by co-managers, Tribes, and partners involved in these efforts. Clearly identifying the geographic boundaries where actions will be implemented, as well as the benefits intended to be gained, will help ensure that control effectively actions target these high-priority locations.

The efficacy of green crab control efforts is also expected to be duration-dependent. While local trapping efforts can reduce local populations, cessation of these efforts may allow the local population to recover (e.g., recruitment of larvae and immigration of nearby adults). Proper monitoring in and around high-priority areas can assist in determining if a reduction of control efforts is warranted.

The establishment of specific, measurable, and achievable goals should occur prior to the initiation of control efforts. A specific, measurable goal will assist in focusing limited resources to achieve a desired outcome and allows determination of the ongoing efficacy of control efforts and if any adjustments may be warranted. The determination of control targets should include policy considerations of social, economic, ecological, and cultural factors where possible. Green and Grosholz (2021) suggest a control target of 10-20 green crab per trap to balance between reducing impacts and potential overcompensatory recruitment (an increase in recruitment of juveniles into a population resulting from an increase in mortality). This number was modeled based on starting populations that are generally much larger than observed in many parts of Washington and while this target might reduce impacts on some species of interest, the relationship between green crab relative abundance and impacts has not been well characterized in Washington or for many species of potential interest. Managing populations at such a number would certainly not reduce population growth and spread on a regional level in areas where populations are smaller, sparsely distributed, and localized. This would not be a useful target abundance for geographies where early detection is still a goal.

Eradication (the complete removal or destruction of an entire population of green crab from a specified geographic location) at either a local or regional scale is a tempting goal but is likely unfeasible on a long timescale. Regional eradication (i.e. statewide or Pacific coast) is certainly beyond the scale of resources available at the present. Even on a local scale, several factors make permanent local eradication nearly impossible to achieve. In large and hydrologically open systems, advection of larvae from nearby populations can rapidly result in recolonization (Tummon Flynn et al. 2023), and in hydrodynamically restricted locations, the effect of larval retention likely swamps the effect of protection from nearby source populations (Grosholz et al. 2021) creating potential for overcompensatory dynamics. Furthermore, complete eradication of marine organisms has only been achieved under a handful of very specialized circumstances such as the black-striped mussel *Mytilus sallei* (Bax 1999), the abalone parasite *Terebrasabella heterouncinata* (Culver and Kuris 1999), and the green alga *Caulerpa taxifolia* (Williams and Grosholz 2008).

Eradication is not a recommended goal for green crab unless the population is geographically or can be physically isolated from adjacent water bodies and the likelihood of repopulation by natural larval dispersal or human-mediated pathways is low. In these situations, eradication can be attempted but will remain challenging. While current approaches (i.e., trapping) may reduce green crab populations to levels approaching eradication, the risk of overcompensatory reproduction could undermine eradication efforts (Grosholz et al. 2021). Overcompensatory reproduction in green crab can occur when the removal of adults via trapping results in reduced cannibalism of recruits. This reduced control of new recruits can result in a surge in recruitment and increased population size in the following year (Grosholz et al. 2021). It should be noted that thus far overcompensatory reproduction by green crab has only been observed in Seadrift Lagoon, CA, a single small, semi-enclosed embayment (~2 km long) with limited, seasonal hydrological connection to an outer lagoon via a tide gate (Grosholz et al. 2021). The isolated nature of Seadrift Lagoon likely increased larval retention and enhanced the potential for overcompensation to occur. Other approaches, such as specialized trapping strategies, the use of chemical methods or physical methods like desiccation or exposure to heat or cold temperatures, may negate overcompensatory reproduction but are far less feasible and further research into impacts to native species and habitats are required.

Instead of eradication, a more effective goal can be controlling or suppressing established populations. **Functional eradication, for the purposes of this plan, means reducing a population of green crab below levels that cause unacceptable ecological effects.** To establish targets for functional eradication at high-priority sites where ecosystem resources are at risk, previously collected data can be used to establish the relationship between local green crab densities (based on catch per unit effort or CPUE), the damage to habitat elements of concern such as shellfish, eelgrass, etc. (see Green and Grosholz 2021) .

Even if functional eradication is not achievable at a high-priority site, sustained control efforts may result in beneficial outcomes. Heavily trapped locations in Atlantic Canada showed significantly smaller increases in green crab abundance compared to control areas during high recruitment years (Tummon Flynn et al. 2023). Trapped sites have shown decreases in the carapace width of green crab over time (Duncombe and Therriault 2017, Tummon Flynn et al. 2023), which should serve to reduce predation

pressure on some local species or segments of their populations. Reduction in local green crab abundances should also reduce the potential spread of larvae to additional locations.

Control Best Practices

- Establish specific, measurable, and achievable goals.
- Identify and focus efforts on high priority locations.
- Repeat efforts frequently.
- Apply sustained pressure and monitoring, even as local abundance declines.

Tools

This section serves as a brief overview of various potential tools for the control of green crab and their status as viable tools for use in Washington.

Control Trapping

The standard tool to reduce green crab populations continues to be the use of extensive networks of baited traps used for capture and removal (Duncombe and Therriault 2017, Ens et al. 2022). When implemented effectively, large-scale, intensive, and sustained trapping efforts can reduce local scale abundances of green crab (Tummon Flynn et al. 2023), facilitate the collection of detailed demographic information (e.g., size, sex, etc.), and cause minimal harm to non-target species. Trapping is a resource-intensive practice in terms of labor, gear, time, and money and requires a significant investment over the long term.

While trapping is currently the best available tool for green crab control, optimization of practices and protocols for efficiency, as well as improvements to existing technologies, are key aspects of making trapping a more viable tactic for population control. Assessment of trap efficiencies for existing trap designs, development and testing of new trap designs, and research into more effective baits/attractants could further enhance the efficacy and efficiency of trapping as a control tool. The development of strategies or tools for the effective trapping of high value targets (e.g., females to reduce larval output) is also a high priority.

Chemical Control

The use of chemical methods for green crab control is currently not a viable option, primarily due to the lack of a permitted, species-specific control agent. Lindane and carbaryl have been suggested as potential chemical controls for green crab (Hanks 1961, Kern et al. 2002), but are unlikely to be approved for use due to their impacts on non-target species such as Dungeness crab (Washington Department of Fisheries and Washington Department of Ecology 1992, EPA 2006, 2024). While further investigation into chemical control tools may yield new potential agents, it should be noted that the broad application of any arthropocide will likely result in extensive mortality to non-target species, including those of commercial importance. Chemical control should only be considered if it can be

determined with a high degree of confidence that impacts on non-target organisms will be minimal and that impacts to green crab populations will be maximized.

Biological Control

There are no promising or viable biological control agents for green crab currently available or under consideration. In fact, biological control methods, despite demonstrating safety and efficacy in some terrestrial systems, have not been used in a marine system to date due in large part to concerns about the safety of releasing agents into open and connected ocean systems. Parasites, including rhizocephalan barnacles like *Sacculina carcini*, which infects and castrates green crab in their native range, have been considered as a possible control agent for green crab (Kuris and Lafferty 1992, Thresher et al. 2000). However, these have never been used outside of the laboratory and may pose a risk to native species, including commercially or culturally important species. Studies have demonstrated that *S. carcini* can crabs native to Washington and, in fact, causes greater mortality in native crabs than in green crab (Goddard et al. 2005), making it inviable as a biocontrol option. Any biocontrol agents should be considered only with the utmost caution and due diligence to prevent unintended harm to native and other local species.

Gene-Based Control

While research is currently underway on genetically engineered population controls for invasive species, these approaches are still highly experimental. Very little of this work has advanced to the field trial stage (Wedell et al. 2019), and no work has taken place in marine systems. For example, gene drive technology makes use of the CRISPR-Cas9 approach to selectively cut a specific region of the genome and insert additional genetic material (Bier 2022). This inserted genetic material can spread throughout a population much more quickly than a natural mutation (Bier 2022). In theory, gene drives can be designed to interfere with many aspects of a species' biology to reduce survival rates or increase susceptibility to environmental agents such as chemical controls. In practice, most research in using gene drives as a management tool for biological invasions is focused on manipulating sex ratios (e.g., to ensure that all offspring are male or that all females are sterile).

In addition to considerable technical hurdles described below, using gene drives and related approaches for invasion management raises several unresolved ethical concerns (Oye et al. 2014, Webber et al. 2015, Esvelt and Gemmell 2017). A major concern is the possibility that the genetically engineered DNA will make its way into non-target species or populations through either hybridization with other species or introgression with native-range populations (Rode et al. 2019, Wedell et al. 2019). The consequences of "escaped" gene drives are poorly understood but potentially catastrophic. To date, research into gene drives is almost entirely focused on terrestrial species, primarily mosquitoes and rodents. Green crab and similar marine species with extensive larval dispersal likely pose additional complications for designing an appropriate gene drive and effectively limiting its spread.

Genomic tools are revolutionizing our understanding of invasions and how to control them. In green crab management, this work is significantly hampered by the lack of a high-quality, chromosome-scale reference genome. Thanks to the efforts of Washington State Representative Joel McEntire, funding has

been allocated for the initial sequencing and annotation of the green crab genome. Researchers from Woods Hole Oceanographic Institution, with support from WDFW and WSU, have begun the initial steps of the process. Upon completion, the genome will be made publicly available for other researchers to build upon.

Commercial and Recreational Harvest

The commercial harvest of green crab has been suggested as a potential control mechanism for the species. While commercial harvest may have economic benefits for those involved, it is unlikely to result in substantial reduction of green crab populations. Population reduction often involves intensive and longer-term trapping at specific sites to produce a reduction in green crab abundance and impacts. This often means trapping populations down to a level at which the relative abundance of green crab would likely be lower than would sustain a commercially viable fishery. By contrast, commercial trapping would involve moving fishing efforts to focus on populations that were the most abundant (and most cost-effective) with the highest CPUE.

For commercial and recreational fisheries to be effective, there needs to be a demand for green crab. While efforts have been made to establish a market for green crab on the east coast of the North America, they have been relatively unsuccessful except for use as bait and niche culinary demands such as soft-shell crabs (Crosby 2023). While there are existing (compost, processing into fertilizer) and potential (use of green crab to create liquid protein) uses for green crab in Washington, these currently exist as methods to productively dispose of crabs collected during management actions rather than profitable economic ventures.

As a Prohibited Level 1 invasive species, live European crabs 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. Under Washington state regulations (WAC 220-640-120), prohibited invasive species may be killed and retained if the person is certain about species identification and assumes responsibility for correct identification and adherence to state rules and fishing regulations. More information is available at: eregulations.com/washington/fishing/crab-rules

Bounty Program

The implementation of a green crab bounty system is a commonly proposed method of control. Bounty systems have successfully reduced populations of aquatic species. The Northern Pikeminnow Sport-Reward Program (pikeminnow.org/) aimed to reduce the abundance of the native northern pikeminnow (*Ptychocheilus oregonensis*) to reduce predation on salmon and steelhead juveniles. An assessment by the Oregon Department of Fish and Wildlife Columbia River Coordination Program suggests that this bounty program successfully reduces predation on juvenile salmonids by northern pikeminnow (Winther et al. 2024). Notably, this program's goal was to reduce northern pikeminnow abundance by 10-20%, which was predicted to increase juvenile salmonid survival by as much as 40% (Winther et al. 2024).

The potential success of a green crab bounty system would be dependent on several factors. The price of the bounty must be sufficient to entice trappers to target green crab. Additionally, trappers must reduce green crab number sufficiently to reduce impacts to the ecosystem alone or in tandem with other trapping efforts. A green crab bounty system is in place in parts of Massachusetts, and further review will occur to assess the program's efficacy.

Other Control Tools

Other control methods, such as remote-operated vehicles (ROVs) or abiotic alterations (e.g., draining, freshwater additions) have been proposed. However, these methods are either purely theoretical (e.g., ROVs) or they are likely only feasible in a few highly specific circumstances (e.g., draining). Any novel control method should be vetted prior to implementation to ensure that impacts to non-target organisms will be minimal and that impacts to green crab populations will be maximized.

Data Standards & Reporting

Data Standards

The purpose of this section is to outline the data requirements and data standards for green crab captures. The goals and implementation of trapping can vary substantially, and thus, three standards are provided that offer a scale of data resolution. Using of these standards enables those working on green crab management in Washington to compare and communicate findings efficiently. This standard only outlines data related to green crab and any bycatch captured. This document does not cover standards for data related to trapping effort (e.g., number, type, and arrangement of trap deployments irrespective of captures).

Co-managers, tribes, and partners under state jurisdiction are required to follow the standards outlined in this section. Co-managers, tribes, and partners working outside of state jurisdiction (e.g., Federal agencies on federal land, tribes on sovereign tribal land, or off-reservation trust land) are asked to follow these guidelines to ensure consistency and allow the efficient comparison and communication of findings among co-managers, tribes, and partners.

Data collection standards for green crab trapping can vary from the minimum data required (e.g., control trapping) to the highest standard (e.g., monitoring). Assessment trapping can scale between the medium and highest standards depending on the goals of the assessment. For example, if the goal is to monitor age class distribution and potential community impacts at a particular site several times a year, trappers should follow the highest standard for green crab and bycatch. If the goal is to obtain a snapshot or sample of a site, adhering to the medium standard or a combination of medium and high standard might be more appropriate. Please note the importance of recording data consistently over time, particularly if the goal is to contribute data at the highest standard. Before a trapping effort begins, trappers should be clear on their goals for the effort and use that to inform their data collection strategy to ensure that all necessary data is collected.

Please note that for the data standards the word "all" is meant to denote "all possible under a given situation for that data standard." It is expected that, despite the best efforts of everyone involved, errors will occur, some crabs may escape or be lost during management actions, or unexpected events (e.g., extreme weather conditions) may hinder the collection of data.

Trapping Effort - Data Standards

Regardless of trapping effort type and green crab catch, the following data must be collected for each trap to compile a complete picture of management actions taking place and to conduct status and trends analyses. Note: traps that do not contain green crab are just as valuable as traps that do.

TRAP LEVEL DATA REQUIRED:

- Trap deployment date
- Trap check date
- Trap type
- Trap ID number
- Location (latitude/longitude in decimal degrees with at least 5 decimal places)
    - Assessments may have a reduced resolution set to a site (see medium standard)
    - Control efforts may have a coarser resolution set to the site/shellfish bed level (see Minimum Standard)
- Green crab (male/female/gravid/total) count (zero is a count)

Green Crab - Highest Data Standard

The Highest Data Standard provides a very high-resolution picture of how green crab use a site. This is the data standard required for all monitoring efforts. Co-managers, tribes, and partners can learn about the population structure of green crab by knowing their age (sex, size, color) and health (limb damage and epibionts). This can tell co-managers, tribes, and partners whether the site might be a source or a sink population and will help inform recommendations on timing, frequency, and scope of trapping that will, in turn, support effective local and regional population management.

SPATIAL AND TEMPORAL RESOLUTION:

All crabs must have capture date and trap-level data associated (see trap-level data required).

CRAB BIOMETRIC DATA FIELDS:

- Collected for all individual crabs:
    - Size (CW)
    - Sex
    - Gravid (Y/N)
    - Bonus fields (may be added for desired goals/research purposes):
        - Color
        - Limb damage

- Epibionts/barnacles
- Egg mass staging (+/- eyes) (for gravid individuals)

Green Crab - Medium Data Standard

The Medium Data Standard, which consists of consistent measurement of green crab sizes at various times throughout the year, provides a haphazard size distribution of green crab at a site. This data standard is required for early detection and assessment. Using this data, co-managers, tribes, and partners can learn about recruitment success and population structure, which can inform trapping strategies and management goals. This data can also inform co-managers, tribes, and partners about the seasonality and timing of green crab population dynamics. If collected consistently year after year, it can also show changes over time.

SPATIAL AND TEMPORAL RESOLUTION

All crabs must have a capture date and associated trap-level data (see trap-level data required). A centralized location for a "site" is acceptable. However, **caution** should be used as a site should not be too large as it could mute spatial data important for tracking populations.

CRAB BIOMETRIC DATA FIELDS

- If the crab count per day, per site, is >100 crabs, subsample 100 crabs or 20% of the total catch for that site on each day (whichever is higher) and collect:
  - Size (CW)
  - Sex
  - Gravid (Y/N)
- Examples
  - Check day # at site X = 40 crabs, measure all crabs (total catch is <100)
  - Check day # at site X = 200 crabs, measure 100 crabs (20% = 40, which is <100)
  - Check day # at site X = 1000 crabs, measure 200 crabs (20% = 200, which is >100)
- When subsampling, please follow this procedure:
  - Select a trap containing green crab.
  - Measure all crabs associated with the selected trap regardless of whether the target amount has been reached.
  - If insufficient crabs are within a single trap to complete the subsample, repeat the process with as many traps as necessary until the target number of crabs is measured and any remaining crabs within a selected trap.
  - Note: If using a variety of trap types, it is preferred to sample catch from a decent representation of the trap types used.
  - Example: Trapping effort included 10 minnows, 10 Fukui's, and 10 shrimp pots. Alternate measuring crabs from each trap type until the subsample target number is reached.

Green Crab - Minimum Data Standard

The Minimum Data Standard provides a coarse level of data that can be used to track overall crab removal at a site. It can help co-managers, tribes, and partners track sex ratios and gravid counts, but not much else. It is insufficient for assessment, early detection, or monitoring.

SPATIAL AND TEMPORAL RESOLUTION

All crabs must have a capture date and trap-level data associated with them (see trap-level data required). As with the Medium Data Standard, a centralized location for a "site" (e.g., shellfish bed) is acceptable. However, caution should be used, as a site should not be too large or the spatial data important for tracking populations can be muted.

CRAB BIOMETRIC DATA FIELDS

No additional biometric data is collected at the Minimum Data Standard.

Acceptable Data Standard Levels Based on Action Type

To meet data standards, you must at least collect data using the lowest applicable standard, as represented in the chart below. You may collect data using a higher standard but not a lower one. For example, any of the three data standards is acceptable if performing control actions, but only the Highest Data Standard is acceptable for monitoring actions.

Table 5 Acceptable data standard levels for European green crab (EGC) based on action type.

EGC Action Type	Highest Standard	Medium Standard	Minimum Standard
Assessment	+	+	
Control	+	+	+
Early Detection	+	+	
Emphasis Response	+	+	+
Monitoring	+		

Table 6 Summary of trap and European green crab (EGC) data required by data standard.

	Data Collected	Highest Standard	Medium Standard	Minimum Standard
Trap Details	Trap deployment date	+	+	+
	Trap check date	+	+	+
	Trap type	+	+	+
	Trap ID number	+	+	+
	Location	+	+	+
	EGC count (M/F/G)	+	+	+
EGC Details	Sex (M/F)	+	+	+
	Gravid (Y/N)	+	+	+
	Size (CW)	+	+	
	Color	+		
	Limb damage	+		
	Epibionts/barnacles	+		
	Egg mass staging (+/- eyes)	+		

Italicized items are strictly bonus data and can be recorded at the discretion of the co-manager, tribe, or partner collecting the data.

Bycatch Data Standards

In the context of catch data, bycatch is defined as any animal species collected in traps other than green crab. **While trappers are not required to record bycatch, these data can provide essential information for understanding the impacts of green crab.** Trappers should carefully consider the goal of trapping efforts when deciding on the standard for bycatch data they choose to utilize.

Please note that, as with green crab data, bycatch data must have a capture date and associated trap-level data (see trap-level data required).

Bycatch Highest Data Standard:

- All aquatic species and counts in each trap.
    - In conjunction with green crab data, these data provide a very high-resolution picture of how green crab and other species are using the site, how crabs are impacted by each other and by other species (limb damage, bycatch), and how green crab could be impacting other species.

Bycatch Medium Data Standard:

- All aquatic species and counts in each trap at minimum once per month per site.

- Optional: Presence/absence for all other efforts.
    - Collecting a subset of quantitative bycatch data can help track community structure and impacts in line with the green crab invasion.

Bycatch Minimum Data Standard:

- No data collection.
    - Provides no information on changes in community structure or impacts.

- Optional: Presence/absence of all aquatic species.
    - Collecting a subset of quantitative bycatch data can help track community structure and impacts in line with the green crab invasion.

Data Submission

This section outlines the various methods by which data relating to green crab is submitted to WDFW. WDFW, as the state lead agency for managing aquatic invasive species in Washington and charged by Governor Jay Inslee to lead emergency measures, has developed a centralized hub for green crab data for use statewide and by federal agencies and tribal nations if desired.

Public Reports

Reports of green crab detections from members of the public are reported through several methods. WDFW encourages the public to submit reports of potential detections via ais@dfw.wa.gov or using form at wdfw.wa.gov/greencrab, and that these reports contain accurate geospatial data (latitude and longitude of the detection) and high-quality images of the specimen in question. AIS Staff reviews these reports to identify the specimens, with support from external experts if necessary. Reports of potential green crab detections submitted to WDFW via phone calls are followed up by AIS Unit staff. WDFW receives copies of reports of green crab detections submitted to the Washington Invasive Species Council (WISC) via their invasive species app or invasivespecies.wa.gov/report-a-sighting/invasive-animals/ and to the Molt Search Program via the MyCoast app (mycoast.org/wa). All confirmed detections of green crab in a new water body are directly communicated to relevant local co-managers, tribes, and partners.

Co-manager, Tribe, and Partner Reports

Co-managers, tribes, and partners under state jurisdiction must complete and submit a European Green Crab Emergency Measures Status Summary Report (SSR) for each operational period (See Appendix V: Green Crab Forms). The duration of operational periods is at the discretion of the Incident Commander but is typically one month in duration. No additional reporting of catch data is required unless previously determined.

Co-managers, tribes, and partners working outside of state jurisdiction (e.g., Federal agencies on federal land, and Tribes on sovereign tribal land or off-reservation trust land) are asked to complete an SSR and submit it to WDFW. Suspected green crab detections by co-managers, tribes, and partners should be

reported to WDFW via ais@dfw.wa.gov. Any additional data submission requests will be managed on a case-by-case basis with respect to data sovereignty concerns.

WSG submits annual catch data reports to WDFW as part of their long-term monitoring program.

The European Green Crab Trap Effort and Data Collection Apps are available for use by any co-managers, tribes, and partners as part of their trapping efforts. See Recording Data for more information.

Data Usage

Data submitted to WDFW via SSRs is utilized for:

- Annual assessments of trends and patterns
- Creation of SitReps and quarterly status reports, and other WDFW publications and presentations wdfw.wa.gov/species-habitats/invasive/carcinus-maenas
- Creation of annual green crab detection maps: wdfw.wa.gov/sites/default/files/2023-03/egc-2022-detections-map-031423.pdf

Data Retention

Data submitted using the European Green Crab Data Collection Apps are stored in a database hosted by WDFW. As database host and app manager, WDFW has access to all recorded data. Otherwise, data reported via these apps is only accessible by the submitting party (e.g., Washington Department of Natural Resources (DNR) can access DNR records). A memorandum of understanding (MOU) is currently being developed to outline the key responsibilities of WDFW and co-managers, tribes, and partner signatories regarding green crab datasets, data applications, and green crab Hub access and interactions. To support continued collaboration, coordination, communication, and transparency, the MOU gives a brief overview of processes for database back-ups and standard workflows for interacting with the data collection applications and green crab hub.

SSRs and other records submitted to WDFW are stored on the AIS Unit SharePoint drive for a minimum of six years. These records are not shared with other units or entities without the express permission of the submitting party. However, please note that **all** SSRs, app records, and communications to and from the Washington Department of Fish and Wildlife are subject to public disclosure requests per the Washington Public Records Act (Chapter 42.56 RCW).

Detection Reporting

This section outlines the procedure for reporting and determining the appropriate response to potential Detections, new Detections, or Localized Detections of green crab.

Reporting Detections

To report the detection of a green crab at a new location or to request specimen identification assistance, please complete the following procedure:

1) Pick up the organism and photograph the dorsal and ventral sides, respectively. Take close pictures of other details (e.g., claws, shell texture) that may aid identification.
    a. See Identification for more information and examples.
2) Check photographs for clarity. Ensure you have at least one clear image for each angle of the specimen. If necessary, take more photographs to ensure clear images of claws or other markings.
3) Safely release organism back into the water. If possible, release in cool, protected water to help recovery.
    a. If you are reporting the detection of green crab at a new location and are confident the specimen is a green crab, you may retain and euthanize the crab following standard euthanasia procedures (see Euthanasia and Disposal in Appendix II: Trapping and Trapping Protocols)
4) Please send pictures and location information (Latitude and Longitude) of where the specimen was found) to WDFW's AIS Unit at ais@dfw.wa.gov.

Suspected green crab detections by co-managers, tribes, and partners or members of the public should be reported immediately to WDFW via ais@dfw.wa.gov. AIS Unit staff will work with the reporting party to complete a European Green Crab Detection Report (Appendix V: Green Crab Forms), determine if the detection is positive, and share reports of positives detections. The Detection Report documents the detection and is the first step in determining the appropriate management response. WDFW will perform assessments in response to positive detections and will solicit assistance and input from local co-managers, tribes, and partners.

Currently, the detection reporting procedure is designed for detections of green crab molts, or post-settlement green crab (dead or alive). These procedures will be updated in future revisions of the Plan to incorporate other potential detection methods (e.g., eDNA, larvae) once the implications of these detections are more understood. Currently, WDFW requests co-managers, tribes, and partners with suspected eDNA or larval detections of green crab to contact WDFW via ais@dfw.wa.gov immediately. WDFW can assist in the genetic analysis of samples to determine if they are green crab.

While co-managers, tribes, and partners working outside of state jurisdiction (e.g., Federal agencies on federal land, tribes on sovereign tribal land, off-reservation trust land, and usual and accustomed areas) are not required to notify WDFW of new detections, WDFW encourages notification to ensure comprehensive and accurate records of the presence of green crab across the entirety of Washington.

Determining a Response

Upon completion of a green crab detection report, AIS Unit staff will utilize the European Green Crab Detection Decision Tree (Appendix V: Green Crab Forms) to determine an appropriate management

response type for the detection. The response type serves as a starting point for determining the response time and spatial scope of the assessment resulting from the detection.

Utilizing the detection decision tree, there are seven possible response types: Response Types I-IF (defined by a baseline response time and spatial scope for the response).

Table 7 Response types defined by response times and the spatial scope of the response.

Response Type	Baseline Response Time	Baseline Scope
IF	If feasible	Site
VI	2 months	Site
V	1 month	Site
IV	2 weeks	Site
III	2 months	CA
II	1 month	CA
I	2 weeks	CA

Once a response type is defined, WDFW will consider the specific characteristics of the detection and, working with local co-managers, tribes, and partners, determine if adjustments to the response time and scope of assessment are warranted. Examples of attributes of a detection that may trigger further refinement of a response include, but are not limited to:

- The distance to the nearest green crab detection. A detection could occur within a new Coordination Area but be only a short distance from the next nearest detection. In these situations, detecting green crab at a new site is not unexpected and may warrant a smaller-scale or less rapid assessment.
- The proximity of the detection to nearby economic, environmental, and cultural resources. Protecting these irreplaceable components of the Washington coast is the primary purpose of green crab management actions in WA. The detection of green crab near resources of concern may warrant more rapid assessment and additional consultation with co-managers, tribes, and partners.
- The size distribution of green crab collected. If the sample contains primarily a single cohort, this could indicate a recruitment-limited population (e.g., the site may not receive a consistent influx of recruits), meaning that the site may be a potential candidate for targeted eradication efforts, thus warranting a more rapid assessment response.
- The season during which the detection occurs. If a new detection occurs in the winter or late fall, poor weather conditions and low staff availability will hinder a rapid or large-scale response effort. Delaying the planned response or refining the response to focus on a smaller spatial area may be prudent in these situations.

The appropriate co-managers, tribes, and partners will determine the appropriate response for detections outside of state jurisdiction. WDFW will offer advisory and field support if requested.

Field Safety Protocols and Incident Reporting

This section provides guidance for all co-managers, tribes, and partners to ensure the safety of all participants involved in green crab management activities. The safety of all participants is the highest priority and requires certain preparation prior to the initiation of field activities.

Training

Proper safety training can greatly reduce the risk of accidents and improve responses should incidents occur. It is recommended that **all** participants in green crab management activities, regardless of position, receive adequate safety training. If co-managers, tribes, or partners have difficulties in arranging for training, WDFW will support as capacity and resources allow. While there is no universal standard for adequate training, the following training should be considered:

- CPR/First Aid: recommended for all staff.
- Wilderness First Aid: recommended for staff active in field operations.
- Motorboat Operator Certification Course: recommended for staff operating or working on watercraft.
    - Additional specific training is recommended pursuant to the type of watercraft your organization utilizes.

Equipment

While there is no universal standard for safety equipment, **all emergency equipment and supplies should be checked regularly to ensure they are up-to-date and functional**. Suggested safety equipment includes:

- Garmin satellite communicator or similar device for communication if out of cell phone range.
- First Aid kits. Kits vary greatly so consider your specific circumstances and needs.
- Extra water and electrolyte tablets.
- Personal Floatation Devices.

Field Safety Protocols

The establishment of field safety protocols can remove uncertainties surrounding field activities and reduces the risk of potential harm to participants. All co-managers tribes, and partners should have written field safety protocols field communications, including check-in and check-out procedures, and potential environmental hazards encountered during green crab management activities include, but are not limited to:

- Heat
- Cold
- Lightning
- Wildfires
- Air Quality
- Wildlife

For examples of field safety protocols, see Appendix VI: WDFW Field Safety Communication Protocols and Appendix VII: WDFW Environmental Hazards Protocols.

Injury, Incident, and Near Miss Reporting

While field safety protocols provide clear guidance to reduce the risk of injury under adverse conditions, injuries, incidents, or near misses will occur. The documentation and dissemination of injuries, incidents, or near misses provide essential information to revise existing protocols and inform other co-managers, tribes, and partners of potential hazards at specific locations. As a result, WDFW plans to lead the development, in coordination with other co-managers, tribes, and partners, of a standardized injury, incident, and near-miss reporting system that does not include sensitive information but will allow for operational improvements and sharing of lessons learned with all co-managers, tribes, and partners. Please note that the intent is to disseminate information to promote the safety of all co-managers, tribes, and partners while ensuring any information the reporting co-manager, tribe, or partner deems sensitive (e.g., identity of victims) is not disclosed.

Section 3: Objectives

This section details the management objectives, strategies, and actions for addressing European green crab infestations across Washington State. It covers both statewide objectives, which apply universally across the state, and specific management actions tailored to geographic Management Areas. Statewide strategies emphasize transparent communication to maintain trust and long-term stakeholder participation. Furthermore, these objectives also highlight the necessity of collaboration due to the diverse management priorities and resource capacities that inform the complex, multi-jurisdictional nature of green crab management. Other examples of statewide objectives include prevention, early detection, long-term management, outreach, and research.

Further, this section outlines specific management actions planned by Washington's co-managers, tribes, and partners for different Management Areas and Coordination Areas. Documenting these actions in this plan will increase transparency and facilitate coordinated planning among stakeholders. The outlined strategies and actions are crucial for addressing the diverse challenges posed by green crab, ensuring the protection of sensitive habitats, species, and aquaculture operations. These management actions, provided by active participants in the plan development, are non-binding and can be adjusted or removed by any co-managers, tribes, and partners as needed.

Please see Acronyms for a full list of abbreviated words used in this section.

Statewide Objectives

This section addresses objectives that apply to the entirety or majority of Washington and are not restricted to a specific management basin or Management Area.

Management Transparency

Transparent and open communication with all participants about the goals, status, and outcomes of green crab management efforts is incumbent on participants to maintain trust that results in long-term participation and success. This section outlines strategies for the transparent management of green crab in Washington.

Objective MT.1: Keep co-managers, tribes, and partners informed of green crab-related activities.

Strategy MT.1.1: Publish Situation Reports every operational period.

> Action MT.1.1.1: Active co-managers, tribes, and partners complete and submit a Summary Status Report (SSR) to WDFW every Operational Period. Operational Period duration may vary, but at the time of writing, it is one month.

Action MT.1.1.2: WDFW consolidates the submitted SSRs into Situation Reports (SitReps) each Operational Period to provide information on and ensure transparency regarding management actions taken, grant funding allocations, green crab catch numbers, trapping efforts, media outreach, and other relevant information.

Performance Measures:
PM MT.1.1A: Submission of SSRs by the deadline for each Operational Period.

PM MT.1.1B: Publication and distribution of SitRep to co-managers, tribes, and partners each Operational Period.

Strategy MT.1.2: Create European Green Crab Quarterly Progress Reports.

Action MT.1.2.1: WDFW creates progress reports every three months that serve to outline the successes and challenges of ongoing green crab emergency response efforts in Washington state.

Action MT.1.2.2: Co-managers, tribes, and partners encouraged to author addendums for inclusion in the progress report to highlight individual management actions taken, with particular emphasis on successes and challenges.

Performance Measures:
PM MT.1.2A: Progress reports distributed to co-managers, tribes, and partners for review.

PM MT.1.2B: Co-managers, tribes, and partners provide feedback on draft and supply addendums.

PM MT.1.2C: Quarterly Progress Reports published and distributed. Reports are also posted on the WDFW publications page: wdfw.wa.gov/publications.

Objective MT.2: Keep public informed of green crab-related activities.

Strategy MT.2.1: Provide webinars and other public presentations.

Action MT.2.1.1: WDFW to present a European Green Crab public webinar annually in conjunction with Washington Invasive Species Week.

Performance Measures:
PM MT.2.1A: WDFW hosts and records green crab public webinars, annually.

PM MT.2.1B: WDFW posts recordings to a publicly available video archive.

Strategy MT.2.2: Create regular Green Crab Public Updates.

Action MT 2.2.1: WDFW creates regular (e.g., bi-monthly or quarterly) green crab public updates.

Performance Measures:
PM MT.2.2A: Publication of green crab public updates.

Strategy MT.2.3: Maintain and update publicly accessible online resources.

Action MT.2.3.1: WDFW maintains and updates European Green Crab Hub (wdfw-egc-hubwdfw.hub.arcgis.com/) and European Green Crab Aquatic Invasive Species Page (wdfw.wa.gov/species-habitats/invasive/carcinus-maenas).

Action MT.2.3.2: WSG maintains and updates WSG Crab Team website. (wsg.washington.edu/crabteam/) and WSG Crab Team Monitoring Site website (public.tableau.com/app/profile/matt.chadsey/viz/CrabTeamV2_5/Summary_Program?publish=yes).

Action MT.2.3.3: Additional co-managers, tribes, and partners maintain and update online green crab information resources, if applicable.

Performance Measures:
PM MT.2.3A: Websites remain operational, accessible to the public, and up to date.

Collaborative Management

Green crab management is highly complex and expands across multiple jurisdictions, with varying management priorities, different management types, complex operations, and different resource capacities. Washington's co-managers, tribes, and partners can have differing goals for sensitive habitats, species protections, and aquaculture operation protections. Additionally, green crab management does not stop at Washington's borders, requiring coordination and collaboration with other states (e.g., California, Oregon, Alaska) and Canada. This section outlines strategies for collaboration among co-managers, tribes, partners, and entities outside of Washington.

Objective CM.1: Collaboration of Multi-Agency Coordination Group.

Strategy CM.1.1: The Green Crab Multi-Agency Coordination Group (MAC) prioritizes actions and resources.

Action CM.1.1.1: WDFW, with support from the Washington State Recreation and Conservation Office (RCO) and designees from co-managers, tribes, and partners, schedules and holds green crab MAC Group meetings to maintain situational awareness and prioritize both actions and resources.

Action CM.1.1.2: The green crab MAC Group meets to review and discuss situation reports for the purpose of prioritizing actions and resources and advising the WDFW incident command.

Performance Measures:

PM CM.1.1A: Documentation of meetings and recommendations are available to all co-managers, tribes, and partners through agendas and meeting notes.

Objective CM.2: Ensure success of Long-Term European Green Crab Management Plan for Washington.

Strategy CM.2.1: Review and revise the European Green Crab Management Plan for Washington.

Action CM.2.1.1: WDFW, in coordination with the MAC Group and other co-managers, tribes, and partners, develop procedures to document successes, challenges, and lessons learned throughout the performance period of the European Green Crab Management Plan for Washington, including revisions and updates.

Action CM.2.1.2: WDFW, with input from the MAC Group and other co-managers, tribes, and partners, establishes a set schedule for reviewing and revising the European Green Crab Management Plan for Washington to ensure it represents current conditions and aligns with statewide and local objectives.

Action CM.2.1.3: The MAC Group and co-managers, tribes, and partners review draft and identify necessary updates, including gaps in current management actions and funding.

Action CM.2.1.4: WDFW to review MAC Group and other co-managers, tribes, and partners' feedback, and discuss potential changes and funding issues with co-managers, tribes, and partners. WDFW will update the plan as necessary and identify funding needs.

Performance Measures:
PM CM.2.1A: Procedures for tracking implementation and developing Management Plan revisions completed.

PM CM.2.1B: Schedule created for Management Plan review and revision.

Strategy CM.2.2: Report on the progress of Management Plan actions.

Action CM.2.2.1: Co-managers, tribes, and partners provide a summary of progress on actions outlined in the Management Plan. These summaries can be provided on a quarterly, semi-annually, or annual basis.

Action CM.2.2.2: WDFW will compile and publish updates submitted each quarter as addendums in the green crab quarterly report. WDFW will also include a general summary of progress in a dedicated section of each quarterly report.

Performance measures:
PM CM.2.2A: Inclusion of summaries in green crab quarterly reports.

Objective CM.3: Create venues for collaborative review and discussion of management actions.

Strategy CM.3.1: WSG to host European Green Crab Trappers Summit.

Action CM.3.1.1: WSG hosts the European Green Crab Trapper Summit. This is a venue for co-managers, tribes, and partners involved in green crab trapping efforts to gather to share their experiences over the previous calendar year. Attendees can learn about trapping in other regions of the state. In addition, the summit will serve as a venue to exchange ideas, examine trends, voice concerns and address issues relating to green crab management.

Performance Measures:
PM CM.3.1A: Notes outlining major takeaways and discussions.

Strategy CM.3.2: WDFW to host European Green Crab Management Symposium.

Action CM.3.2.1: WDFW hosts the European Green Crab Management Symposium. This is a venue for co-managers, tribes, and partners and the public to gather to hear updates on green crab management in Washington state. In addition, the symposium will serve as a venue to exchange ideas, offer training, discuss if current management actions align with current statewide objectives, and address issues relating to green crab management.

Performance Measures:
PM CM.3.2A: Notes outlining presentations and discussions and the decisions on changes to ongoing management actions. This record must be available to co-managers, tribes, and partners.

PM CM.3.2B: Evaluate the efficacy of training efforts relating to the symposium (e.g., greater use of apps after training is provided).

Strategy CM.3.3: Formation of Regional Coordination Groups to review conditions and management actions for each Management Area.

Action CM.3.3.1: WDFW will initiate development of regional coordination groups representing, at minimum, green crab management within a Management Area.

Action CM.3.3.2: Co-managers, tribes, and partners will facilitate regional coordination groups where a local coordinating entity is identified.

Performance Measures:
PM CM.3.3A: Record of the major points of discussion from each meeting.

Strategy CM.3.4: Creation of forums to share lessons learned in the field.

Action CM.3.4.1: Co-managers, tribes, and partners create forums, not including annual meetings, to share practical on-the-ground experience and techniques.

Performance Measures:
PM CM.3.4A: Creation and use of forums.

Strategy CM.3.5: Representatives of Washington, Alaska, Oregon, California, and British Columbia discuss green crab management and status.

Action CM.3.5.1: WDFW and the Multi-Agency Coordination (MAC) Group coordinates with representatives of Washington, Alaska, Oregon, California, and British Columbia to schedule meetings to discuss green crab management and status along the Pacific coast of North America.

Performance Measures:
PM CM.3.5A: Record of the major points of discussion from each meeting. This record will be available to all co-managers, tribes, and partners.

Strategy CM.3.6: Recommend the creation of a National Green Crab Advisory Committee.

Action CM.3.6.1: Consistent with the National European Green Crab Management Plan, WDFW recommends the Aquatic Nuisance Species Task Force establishes a European Green Crab Advisory Committee (EGC AC) consisting of members of local, state, and federal agencies, Tribal communities, universities, NGOs, and other relevant stakeholders. The EGC AC should meet to evaluate progress towards achieving the goals of the National European Green Crab Management Plan using the best available science and the best use of resources.

Performance Measures:
PM CM.3.6A: Establishment of EGC AC.

Human-Mediated Dispersal

Careful consideration of the human-mediated transport or transfer of green crab from one location to another is essential to stopping or reducing the spread of green crab in Washington. This section outlines statewide objectives for preventing the unintentional dispersal of green crab from human activities.

Objective HMD.1: Reduce the risk of human-mediated dispersal of green crab through prevention best practices.

Strategy HMD.1.1: Follow and promote green crab prevention best practices.

Action HMD.1.1.1: Co-managers, tribes, and partners review existing decontamination and prevention best practices, such as those outlined in WDFW Invasive Species Management Protocols: wdfw.wa.gov/sites/default/files/publications/01490/wdfw01490.pdf

Action HMD.1.1.2: Co-managers, tribes, and partners review permitting requirements for green crab-related activities and ensure compliance with permit regulations.

Action HMD.1.1.3: WDFW and other co-managers, tribes, and partners to educate the public on existing decontamination and prevention best practices, in addition to regulations pertaining to the status of green crab (a Prohibited level 1 species) in Washington as outlined in RCW 77.135.040.

Action HMD.1.1.4: WDFW develops messaging around best practices, integrating information into the WDFW and Washington Invasive Species Council's Safeguard Our Shellfish campaign.

Performance Measures:
PM HMD.1.1A: List of identified gaps in messaging.

Strategy HMD.1.2: Ensure availability of infrastructure and equipment necessary for perform of decontamination best practices.

Action HMD.1.2.1: WDFW develops a survey for co-managers, tribes, and partners to determine gaps which will inform recomendations and targeted investments of WDFW funds.

Action HMD.1.2.2: Co-managers, tribes, and partners identify gaps in infrastructure, equipment, and other resources to properly perform decontamination best practices.

Performance Measures:
PM HMD.1.2A: List of identified gaps in infrastructure and messaging.

Strategy HMD.1.3: Utilize Hazard Analysis and Critical Control Point (HACCP) Planning to assess potential green crab vectors.

Action HMD.1.3.1: WDFW arranges HACCP training event.

Action HMD.1.3.2: WDFW and other co-managers, tribes, and partners participate in HACCP trainings.

Action HMD.1.3.3: Participating co-managers, tribes, and partners discuss best implementation of HACCP planning to reduce risk of green crab spread.

Performance Measures:
PM HMD.1.3A: Participation in HACCP training.

PM HMD.1.3B: Documentation of outcomes of post-HACCP training discussions.

Objective HMD.2: Address knowledge gaps regarding risk of green crab spread.

Strategy HDM.2.1: Promote or perform research to address identified knowledge gaps regarding green crab spread.

Action HDM.2.1.1: WDFW and other co-managers, tribes, and partners promote research to address knowledge gaps identified in the Research Task Force's assessment regarding relative risk of green crab spread via commercial shipping and currents.

Action HDM.2.1.2: WDFW and other co-managers, tribes, and partners promote or perform research to address knowledge gaps related to the relative risk of green crab spread via shellfish transfers and the efficacy of shellfish transfer treatments on green crab.

Action HDM.2.1.3: WDFW and other co-managers, tribes, and partners promote research to address knowledge gaps related to the relative risk of green crab spread through other human-mediated pathways (e.g., sediment dredging).

Performance Measures:
PM HDM.2.1A: Dissemination of document summarizing knowledge gaps.

Detection Response

This section outlines statewide objectives related to the development and implementation of a clear and standardized process for reporting and responding to detections or localized detections of green crab in Washington.

Objective DR.1: Establish a standardized process for reporting and response to detections or localized detections of green crab in Washington.

Strategy DR.1.1: Establish formal protocols for reporting, assessment, and dissemination of information regarding detections of green crab.

Action DR.1.1.1: WDFW, with input from other co-managers, tribes, and partners finalize formal protocols for reporting, assessing, and responding to detections of green crab. WDFW will also establish clear procedures for co-managers, tribes, and partners and public notifications of new detections.

Action DR.1.1.2: WDFW to develop documentation (e.g., PowerPoint slide, handout) clearly outlining green crab reporting protocols and distribute to co-managers, tribes, and partners.

Action DR.1.1.3: WDFW and other co-managers, tribes, and partners include guidance on green crab reporting during related outreach events.

Performance Measures:
PM DR.1.1A: Formal documentation of new detections and determined response.

PM DR.1.1B: Distribution of documentation of green crab reporting protocols.

PM DR.1.1C: Formal after-action report following up on assessments.

Transition to Long-Term Local Management

While green crab management is a statewide problem, the goals and challenges can vary for co-managers, tribes, and partners in different regions of the state. While WDFW is the lead entity for green crab management statewide, local entities with longstanding relationships among local co-managers, tribes, and partners and greater local cognizance are best suited to coordinate local management over the long term with WDFW oversight. This section outlines strategies to facilitate the transition to long-term local management.

Objective LTM.1: Establish local coordinators.

Strategy LTM.1.1: Establish the position of local coordinator to coordinate, under WDFW oversight, green crab management activities among local co-managers, tribes, and partners.

Action LTM.1.1.1: WDFW creates local coordinator Scope of Work (SOW), including negotiating funding for the local coordinator or local coordination organization.

Action LTM.1.1.2: WDFW works with other co-managers, tribes, and partners to identify suitable organizations to serve as local coordinators or fills the role of local coordinators.

Performance Measures:
PM LTM.1.1A: Creation of local coordinator SOW.

PM LTM.1.1B: Identification of local coordinator(s).

Outreach and Education

This section outlines objectives related to outreach that apply to the entirety of Washington rather than focusing on a specific area.

A successful effort to manage green crab will only be possible if an effective outreach and education campaign is implemented as part of the management response. Successful communications efforts begin by establishing who the target audiences are, what the desired outcome is from these audiences, where these audiences will be reached, and how to reach them. Four primary audiences have been identified for these outreach efforts.

- Resource allocators – These are key individuals that can provide the financial and human resources needed to advance green crab management efforts (e.g., state legislators). These individuals are (typically) not scientists and do not want to receive detailed specifics about the organism. Rather, they are concerned about how green crab fit into a larger picture. Resource allocators want to know what the threat is, what the consequences of various actions are, what

environmental and economic impacts the species might have, how it will affect the public, and why the species should be prioritized. To effectively reach this audience, outreach messaging needs to directly address their concerns and be delivered in a brief fashion, usually through personal contacts.

- Co-manager, tribal, and partner administrators – These are individuals with the role of establishing priorities and policies for their organization or government. These individuals need to be fully informed about green crab and often seek a higher level of detailed information than resource allocators. It is important to establish the need for action followed by suggestions for management options and strategies.

- Natural resource management implementers – These are individuals who work in the field. These individuals might be biologists, researchers, shellfish growers, fisherman, businesses or retailers, or others who undertake the actions identified as part of the strategy.

- Other relevant communities and public – This is everyone else, with an emphasis on the Emphasis on the Washington Pacific Coast and Salish Sea regions. Although each segment of the public will receive messaging through different venues, the basic objective is the same for all: identify and report potential detections of green crab **without** harming native crab species.

Green crab outreach materials, including informational documents, graphics, and environmental education resources and curriculum, can be found at:

- WDFW European green crab site: wdfw.wa.gov/species-habitats/invasive/carcinus-maenas#resources

Objective O.1: Maintain engagement and support for green crab management from resource allocators.

Strategy O.1.1: Provide updates on local and statewide green crab management actions to resource allocators.

Action O.1.1.1: WDFW creates and distributes green crab quarterly progress reports to the legislature and governor.

Action O.1.1.2: WDFW creates reports to the governor every 10 days for the duration of the green crab emergency.

Performance Measures:
PM O.1.1A: Reports are created and distributed on schedule.

Strategy O.1.2: Emphasize concerns and consequences of green crab for individuals and communities to resource allocators.

Action O.1.2.1: WDFW and other co-managers, tribes, and partners invite resource allocators to meetings/events.

Action O.1.2.2: WDFW to include personal stories from individuals and communities, and tangible impacts (e.g., financial loss projections based on fact) in outreach to resource allocators.

Performance Measures:
PM O.1.2A: Resource allocator attendance at meetings/events.

Objective O.2: Ensure co-manager, tribal, and partner administrators can make educated management decisions.

Strategy O.2.1: Provide co-manager, tribal, and partner administrators with information necessary to make educated management decisions.

Action O.2.1.1: WDFW creates and publishes a geospatial map of green crab presence in Washington, guidance to other co-managers, tribes, and partner administrators on permitting requirements, information regarding training events, and resources available for green crab management activities.

Action O.2.1.2: WDFW compiles and distributes a list of labs able to perform green crab eDNA analysis.

Performance Measures:
PM O.2.1A: Publication of materials and event information.

PM O.2.1B: Distribution of list of labs able to perform green crab eDNA analysis.

Objective O.3: Ensure that natural resource implementors can ID green crab and report potential detections.

Strategy O.3.1: Train natural resource implementors in green crab identification and proper green crab detection reporting procedures.

Action O.3.1.1: WDFW and other co-managers, tribes, and partners provide outreach materials or direct training on identification procedures for green crab.

Action O.3.1.2: WDFW provides outreach materials or direct training on green crab detection reporting.

Performance Measures:
PM O.3.1A: Publication of materials and hosting of training.

Objective O.4: Ensure activities by natural resource implementors minimize risk of green crab spread.

Strategy O.4.1: Perform outreach to ensure natural resource implementors not affiliated with co-managers, tribes, and partners are informed about decontamination procedures.

Action O.4.1.1: WDFW performs outreach activities and distributes materials to educate natural resource implementors not affiliated with co-managers, tribes, and partners on decontamination procedures.

Performance Measures:
PM O.4.1A: Information on materials distributed and count of events, to include number of individuals reached per event.

Strategy O.4.2: Perform outreach to ensure natural resource implementors not affiliated with co-managers, tribes, and partners are informed of permit requirements.

Action O.4.2.1: WDFW performs outreach activities and distributes materials to educate natural resource implementors not affiliated with co-managers, tribes, and partners on permit requirements for activities that may relate to green crab (e.g., research, shellfish transfers).

Performance Measures:
PM O.4.2A: Information on materials distributed and count of events, to include number of co-managers, tribes, and partners reached per event.

Objective O.5: Provide co-managers, tribes, and partners with resources for public education and outreach.

Strategy O.5.1: Creation and distribution of tactile or engaging materials for green crab outreach and education.

Action O.5.1.1: WDFW creates and distributes green crab specimens preserved in resin or other tactile/real materials (e.g., 3-D printed models, molt viewing boxes).

Action O.5.1.2: WDFW creates and distributes green crab outreach kits and other physical materials, including coloring sheets, stickers, I.D. wallet cards, I.D., signage, brochures, and native/invasive crab I.D. sheets.

Action O.5.1.3: WDFW crafts and disseminates social media posts for use by other co-managers, tribes, and partners.

Action O.5.1.4: WDFW creates and disseminates green crab PowerPoint slides for use by other co-managers, tribes, and partners.

Action O.5.1.5: WDFW distributes existing outreach and education resources.

Action O.5.1.6: WDFW performs outreach to schools, libraries, and other institutions about available resources.

Performance Measures:
PM O.5.1A: Distribution of materials and tracking of numbers distributed.

Objective O.6: Ensure the public can ID, report, and respond appropriately to potential green crab detections.

Strategy O.6.1: Distribution of green crab identification and reporting materials.

Action O.6.1.1: WDFW distributes physical and digital outreach materials with clear guidance on green crab identification and reporting protocols.

Performance Measures:
PM. O.6.1A: Number of materials distributed and number of site visits or downloads for digital versions.

Strategy O.6.2: Clear and consistent messaging on what the public should do with green crab specimens and the rationale.

Action O.6.2.1: WDFW provides talking points to co-managers, tribes, and partners outlining green crab legal status in Washington state, i.e., that we are asking the public NOT to kill green crab currently, and the rationale for this choice.

Action O.6.2.2: Co-managers, tribes, and partners operating within Washington state jurisdiction will use these talking points when discussing what the public should do if they capture suspected green crab.

Action O.6.2.3: Land managers outside of state jurisdiction may use the talking points to inform messaging and actions within their jurisdictions.

Performance Measures:
PM O.6.2A: Distribution of talking points.

Research

This section outlines objectives related to research that apply to the entirety of Washington rather than focusing on a specific geographic area.

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 green crab. However, many fundamental questions about green crab, particularly regarding their detection, abundance, impacts, and movements in Washington, have yet to be answered. Co-managers, tribes, and partners are working towards addressing knowledge gaps regarding green crab in Washington (see Management Area Objectives section). Yet, there is a lack of resources and capacity to address the wide variety of knowledge gaps.

Given the wide range of potential research and the limited resources available, it is beneficial to focus research efforts on those that will have the most significant benefit for regional green crab management. To this end, in 2023, the European Green Crab Research Task Force (RTF) was formed. The RTF is an organization of researchers, managers, and experts on green crab from across the Pacific coast of North America. The RTF provides a forum to discuss the current state of green crab research and promote synergy in research efforts. Additionally, the RTF aims to develop a ranked list of needed green crab research with a primary focus on improving the prevention, detection, and management of green crab. Membership in the RTF is by invitation. Participants must have active/previous involvement in green crab or similar research and be associated with green crab management efforts along the Pacific coast of North America.

The establishment of dedicated funding for research would also benefit regional green crab research. The current system requires researchers to submit applications for green crab emergency management funds, and this is only possible when funds remain after allocation for management activities. With an established research fund, proposals focusing on identified high priority green crab research could be broadly solicited and would allow for a larger pool of researchers and create consistency in funding over time.

Objective R.1: Promote synergy in research efforts along the Pacific coast of North America.

Strategy R.1.1: Regular meetings of the European green crab RESEARCH TASK FORCE (RTF).

Action R.1.1.1: WDFW to host virtual meetings of the RTF at regular intervals.

Action R.1.1.2: WDFW to promote and facilitate in-person and hybrid meetings of RTF.

Performance Measures:
PM R.1.1A: Record meeting notes and progress updates.

PM R.1.1B: Dissemination of meeting summaries in SitReps.

Strategy R.1.2: Create list of high priority green crab research topics.

Action R.1.2.1 RTF to compile and maintain list of high priority research topics.

Performance Measures:
PM R.1.2A: Creation and distribution of priority research list.

Strategy R.1.3: Ensure researchers have access to existing green crab research, local support contacts, and historical data.

Action R.1.3.1: RTF to compile and maintain archive of green crab research, which can be accessed by researchers upon request.

Action R.1.3.2: WDFW to compile and maintain a contact list for co-managers, tribes, and partners that have volunteered to facilitate green crab research efforts.

Action R.1.3.3: WDFW to compile and maintain archive of historical green crab data for researcher use. WDFW will coordinate with other co-managers, tribes, and partners to ensure data sovereignty concerns are properly addressed and only approved data are included.

Performance Measures:
PM R.1.3A: Creation and maintenance of research archive.

PM R.1.3B: Creation and maintenance of Washington research facilitation contact list.

PM R.1.3C: Creation and maintenance of research archive.

Objective R.2: Identify research priorities to improve existing or develop new green crab management methods.

Strategy R.2.1: Assess existing or potential green crab early detection methods, identifying knowledge gaps and necessary foundational research.

Action R.2.1.1: RTF assesses potential early detection methods. Early detection methods to be evaluated include, but are not limited to, trapping, molt/beach searches, eDNA, larval tows, light traps, settlement substrates, dive surveys, cameras, detection canine surveys, and automated or remote aquatic drones.

Performance Measures:
PM R.2.1A: Dissemination of summary documents.

Strategy R.2.2: Assess existing or potential green crab control methods, identifying knowledge gaps and necessary foundational research.

Action R.2.2.1: RTF assesses potential research control methods. Control methods to be evaluated include, but are not limited to, trapping, attractants, pesticides, biocontrol, sterilization, genome editing, bounties, fisheries, public trapping initiatives, and automated or remote aquatic drones.

Performance Measures:
PM R.2.2A: Dissemination of summary documents.

Objective R.3: Identify research priorities to expand understanding of impacts by green crab on species and habitats in Washington.

Strategy R.3.1: Assess existing research on green crab impacts, identifying knowledge gaps and necessary foundational research.

Action R.3.1.1: RTF performs an assessment of research on or documentation of green crab impacts, with an emphasis on species and habitats found in Washington.

Performance Measures:
PM R.3.1A: Dissemination of summary documents.

Strategy R.3.2: Assess existing research on green crab impact thresholds, by identifying knowledge gaps and necessary foundational research.

Action R.3.2.1: RTF performs an assessment of research on or documentation of green crab impact thresholds, with an emphasis on species and habitats found in Washington.

Performance Measures:
PM R.3.2A: Dissemination of summary documents.

Objective R.4: Develop standardized assessment protocols of conditions in Washington.

Strategy R.4.1: Develop standardized assessment protocols for assessment of green crab populations in Washington.

Action R.4.1.1: RTF develops long-term monitoring protocols for green crab populations.

Action R.4.1.2: RTF works with outside researchers in refining green crab population estimation procedures.

Performance Measures:
PM R.4.1A: Creation and distribution of protocols.

Strategy R.4.2: Develop standardized assessment protocols for habitats and ecological communities in Washington.

Action 4.2.1: RTF to develop standardized protocols for assessment of ecological communities and habitats (e.g., native and non-native eelgrass beds). These protocols can be used to assess conditions prior to green crab detection or over time in infested areas.

Performance Measures:
PM R.4.2A: Creation and distribution of protocols.

Objective R.5: Assess potential uses of harvested green crab.

Strategy R.5.1: Assess existing work on green crab uses.

Action R.5.1.1: WDFW performs an assessment of research and documentation of green crab uses.

Performance Measures:
PM R.5.1A: Dissemination of summary documents.

Objective R.6: Complete research to address knowledge gaps and identified high-priority topics.

Strategy R.6.1: Promote research to address knowledge gaps and identified high-priority topics.

Action R.6.1.1: WDFW and other co-managers, tribes, and partners promote research focusing on knowledge gaps identified by the RTF and high-priority topics identified by co-managers, tribes, and partners and the RTF. These high-priority topics include, but are not limited to, the following:

- Increasing trapping efficacy, including trap design, attractants, trap placement, and deployment timing.
- Development of control methods aside from trapping.
- Determining the impacts of management actions on green crab mortality rates.
- Early life stage (e.g., pelagic larvae and early settler) monitoring.
- Green crab impacts on species of economic, ecological, and cultural significance in Washington. Species include, but are not limited to, Dungeness crab, geoducks, hairy shore crab, Kumamoto oysters, native littleneck clams, butter clams, horse clams, cockles, Manila clams, mussels, Olympia oysters, Pacific oysters, green sturgeon, and salmonids.

- Green crab impacts on habitats of economic, ecological, or cultural significance in Washington. Habitats include but are not limited to, shellfish beds, eelgrass beds, and salmonid habitats.
- Comparing the costs related to green crab management and the predicted economic impacts on green crab.
- Adult green crab movement, including seasonal migration and habitat fidelity.
- Larval transport of green crab within embayments and throughout the Washington coast and the Salish Sea.
- Identification of optimal green crab habitat, including settlement locations for larvae.

Performance Measures:
PM R.6.1A: Research actions implemented, supported, or funded by WDFW and other co-managers, tribes, and partners.

Strategy R.6.2: Perform research to address knowledge gaps and identified high-priority issues.

Action R.6.2.1: Co-managers, tribes, and partners review knowledge gaps and identified high-priority topics.

Action R.6.2.2: Co-managers, tribes, and partners will identify the capacity, if any, to perform research to advance work relating to knowledge gaps, identify high-priority issues, and perform the research.

Action R.6.2.3: RTF to serve in an advisory capacity for research.

Performance Measures:
PM R.6.2A: Research actions implemented, supported, or funded by WDFW and other co-managers, tribes, and partners.

Strategy R.6.3: Create a research grant for projects dedicated to priority research topics.

Action R.6.3.1: WDFW advocates for dedicated funding to establish a research grant program.

Action R.6.3.2: WDFW, in consultation with the RTF, other agencies, and other co-managers, tribes, and partners, establish procedures for the grant program.

Performance Measures:
PM R.6.3A: Funding for grant program approved.

PM R.6.3B: Grant program established.

PM R.6.3C: Funding issues and research completed.

Field Safety Protocols and Indecent Reporting

The health and safety of every individual involved in green crab management activities is the highest priority for all co-managers, tribes, and partners. Field safety protocols provide clear guidance to reduce the risk of injury under adverse conditions. When injuries, incidents, or near misses occur, documentation and dissemination of these events provide essential information to revise existing protocols and inform other co-managers, tribes, and partners of potential hazards at specific locations. This section outlines strategies for the creation and documentation of field safety protocols, safety preparedness, and the creation of a health and safety reporting system.

Objective HS.1: Field safety protocol creation and documentation.

Strategy HS.1.1: Documentation of field safety protocols.

Action HS.1.1.1: Co-managers, tribes, and partners submit copies of existing field safety protocols to WDFW for archival. These protocols should cover, at minimum, communication, and environmental hazard protocols. Any sensitive data may be omitted from protocols by the submitting co-managers, tribes, and partners.

Performance Measures:

PM HS.1.1A: Archive of field safety protocols.

Strategy HS.1.2: Creation of field safety protocols if none exist.

Action HS.1.2.1: Co-managers, tribes, and partners create written field safety protocols if none exist.

Action HS.1.2.2: WDFW assists in the creation of field safety protocols upon request.

Performance Measures:

PM HS.1.2A: Archive of field safety protocols.

Objective HS.2: Safety preparedness.

Strategy HS.2.1: Ensure access to safety training resources for co-managers, tribes, and partners.

Action HS.2.1.1: WDFW and other co-managers, tribes, and partners distribute information on training programs and instructors for others to utilize.

Action HS.2.1.2: WDFW to offer safety training for other co-managers, tribes, and partners as capacity allows.

Performance Measures:

PM HS.2.1A: Submission and dissemination of injury, incident, and near-miss reporting to co-managers, tribes, and partners.

Strategy HS.2.2: Ensure adequate safety awareness of field participants (e.g., staff, volunteers, guests).

Action HS.2.2.1: WDFW and other co-managers, tribes, and partners require field participants to review safety protocols and check-in procedures. Field participants are informed that no participant should conduct work beyond what they are comfortable with.

Performance Measures:

PM HS.2.2A: Confirmation of review of safety materials by field participants.

Objective HS.3: Injury, incident, and near miss reporting.

Strategy HS3.1: Reporting and dissemination of injuries, incidents, or near misses among co-managers, tribes, and partners.

Action HS.3.1.1: Using WDFW template Safety and Security Incident Report (SSIR) as an example, WDFW creates an injury, incident, and near miss reporting template for all co-managers, tribes, and partners.

Action HS.3.1.2: Develop protocols for the submission of injury, incident, and near miss reporting to WDFW.

Action HS.3.1.3: Develop a procedure for dissemination of injury, incident, and near miss reporting to all co-managers, tribes, and partners, with the omission of data the reporting co-managers, tribes, and partners designates as sensitive.

Performance Measures:

PM HS.3.1A: Submission and dissemination of injury, incident, and near miss reporting to co-managers, tribes, and partners.

Funding

This section outlines objectives and processes related to the acquisition and distribution of ongoing funding for green crab management provided to WDFW by the State Legislature. WDFW assumes that $6,082,000 each year of the state biennium is available as ongoing funding from the State Legislature.

In transitioning to long-term locally led management with WDFW oversight, WDFW intends to allocate this baseline funding to co-managers, tribes, and partners to accomplish the actions identified in this plan. Additionally, with the transition to long-term local led management, WDFW intends to allocate funding for the development of local management plans and for the coordination of local operations. WDFW, with assistance from RCO will annually develop and execute agreements to distribute those funds to co-managers, tribes, and partners, local coordinating entities, in addition to management and

research funds to co-managers, tribes, and partners in support of state and local operations. This baseline state funding will not cover all external existing sources of green crab funding to other organizations or the use of yet-to-be-received additional federal financial assistance.

Baseline funding dedicated to the implementation of the long-term management plan is not adequate to address unforeseen cases of rapid response or emergency measures required if green crab are detected in new locations. In the event resource needs are exceeded due to continued spread, WDFW will consider additional budget requests or use of emergency measures authorities in Revised Code of Washington (RCW) 77.135.100.

Per Engrossed Substitute Senate Bill 5950, effective March 29, 2024, WDFW has developed a recommended level of state funding to implement the plan in the 2025-2027 biennium, which includes additional state agency budget requests. Additionally, WDFW has developed recommendations for federal funding to support the state's eradication and control measures, which will inform federal appropriation requests. To inform state recommendations, WDFW worked with co-managers, tribes, and partners to identify:

- What actions are being undertaken by each co-manager, tribe, and partner for which they are receiving adequate funding?
- Sources for current funding
    - This does not need to be especially specific (e.g., general classifications such as state or federal funding is fine) and entities outside of state jurisdictions will not be required to divulge these sources.
- What funding gaps exist between planned/proposed actions and current funding levels?

This compiled information allows for a clear understanding of funding gaps and determines possible avenues for acquiring additional resources.

WDFW intends to perform a similar funding analysis, which will inform recommendations to the state legislature every two years during long-term management, with federal funding opportunities and needs communicated annually.

Objective F.1: Allocation of current green crab management funds.

Strategy F.1.1: Allocate and distribute current funding provided by Washington state legislature for green crab management.

Action F.1.1.1: WDFW allocates funding for the development of local management plans and for coordination of local operations.

Action F.1.1.2: WDFW, with assistance from RCO annually develops and executes agreements to distribute funds to co-managers, tribes, partners, and local coordinating entities and distribute those management and research funds in support of state and local operations.

Performance Measures:

PM F.1.1A: Execution of contracts and distribution of funds.

PM F.1.1B: Quarterly reports on activities and expenses.

Objective F.2: Ensure co-managers, tribes, and partners receive necessary funding to perform planned and future green crab management actions.

Strategy F.2.1: Determine funding needs for co-managers, tribes, and partners.

Action F.2.1.1: WDFW works with co-managers, tribes, and partners to identify the following:

- What actions are being undertaken by each co-manager, tribe, and partner for which they are receiving adequate funding?
- Sources for current funding
- What funding gaps exist between planned/proposed actions and current funding levels?

Action F.2.1.2: WDFW performs the above actions in relation to WDFW management actions.

Performance Measures:

PM F.2.1A: Determination of funding needs for co-managers, tribes, and partners.

Strategy F.2.2: Develop funding recommendations for state and federal legislatures.

Action F.2.2.1: WDFW develops and communicates funding recommendations to the state legislature every two years during long-term management.

Action F.2.2.2: WDFW develops and communicates federal funding needs and opportunities annually through federal appropriation requests.

Performance Measures:

PM F.2.1A: Issuance of WDFW recommendations and needs to the State Legislature and Congress.

Management Area Objectives

This section outlines management actions that co-managers, tribes, and partners plan to complete in each Management Area and Coordination Area. Documenting these actions within the Plan increases transparency of ongoing actions and allows co-managers, tribes, and partners to plan their own activities with other actions in mind. The actions below are listed by Management Area. For a complete list of management actions listed by individual co-managers, tribes, and partners, please see Appendix VIII: Management Area Actions by Entity.

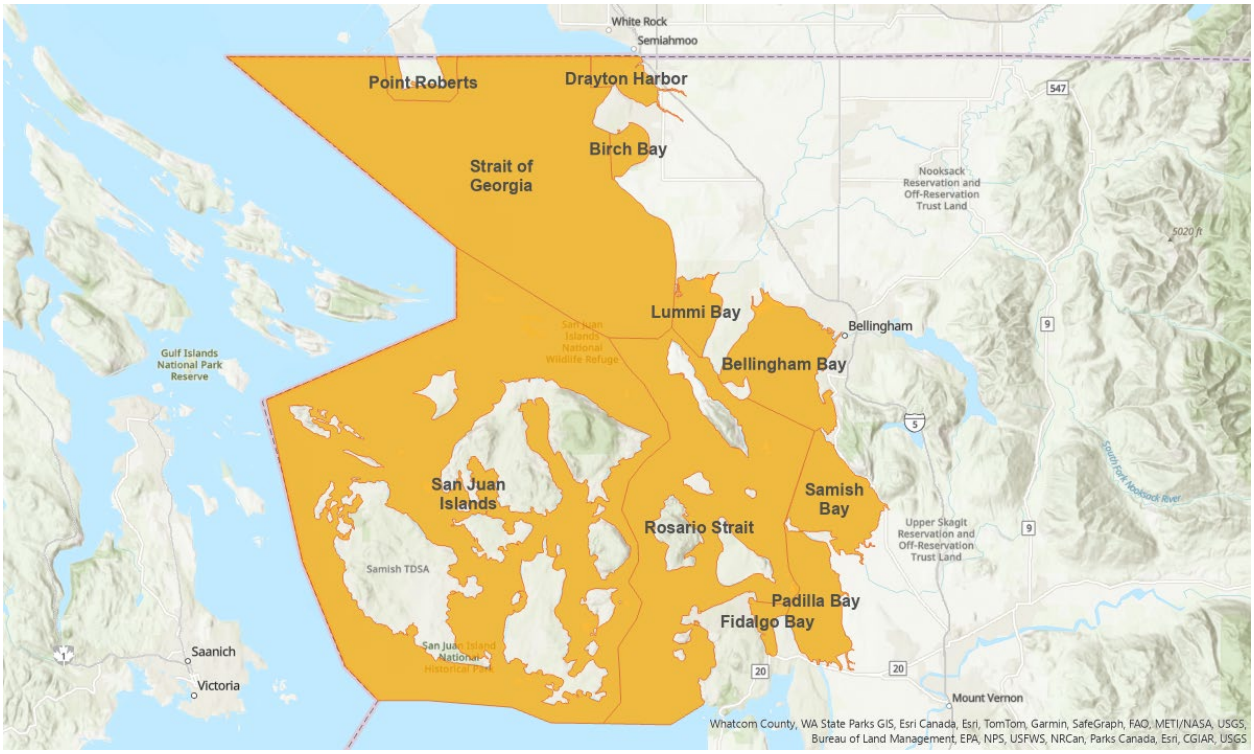
Please note that the management actions outlined in this section are non-binding and are only for documentation of planned actions. Any co-manager, tribe, or partner may adjust or remove their listed actions from the Plan at any time for any reason with no consequences.

Table 8 Complete list of Management Area objectives

Objective Number	
OBJECTIVE MA.1	Early Detection of Green Crab in New Geographic Areas
OBJECTIVE MA.2	Rapid Response Planning
OBJECTIVE MA.3	Support and Assist with Management Activities
OBJECTIVE MA.4	Assess Green Crab Distribution and Abundance
OBJECTIVE MA.5	Long-Term Monitoring of Green Crab and Other Species
OBJECTIVE MA.6	Reduce Local Green Crab Abundance
OBJECTIVE MA.7	Reduce Spread of Green Crab
OBJECTIVE MA.8	Determine the Extent of Potential Green Crab Habitat
OBJECTIVE MA.9	Sustainable Disposal of Collected Green Crab and Fish Waste
OBJECTIVE MA.10	Education and Outreach Related to Green Crab
OBJECTIVE MA.11	Research Related to Green Crab

North Puget Sound

Figure 6 Map of North Puget Sound Management Area.



North Puget Sound is split into 11 Coordination Areas (Point Roberts, Drayton Harbor, Strait of Georgia, Birch Bay, Lummi Bay, Bellingham Bay, San Juan Islands, Rosario Strait, Samish Bay, Padilla Bay, and Fidalgo Bay).

The North Puget Sound Management Area consists of the Washington coastline and waters of the Salish Sea north of Rosario Beach. The North Puget Sound Management Area is home to the Lummi Nation, Samish Indian Nation, and the Swinomish Indian Tribal Community and shares its northern border with Canada. Coordination and collaboration between tribal, state, federal, Canadian, and First Nations governments are essential for effective management in the region. In addition, North Puget Sound Management Area contains marine protected areas, tribal usual and accustomed areas (U&As), aquatic reserves, restoration sites, and other sites of cultural and ecological importance. Commercial, tribal, and recreational shellfish fisheries are also active in the region.

Green crab were first detected in North Puget Sound Management Area, 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 Estuarine Research Reserve (Grason et al. 2018). Catch numbers in North Puget Sound are relatively low (in the hundreds annually for Drayton Harbor and Samish Bay, double or single digits annually for other Coordination Areas), apart from Lummi Reservation Coordination Area.

The Lummi Natural Resource staff first detected green crab on the Lummi Reservation in 2019 (Mueller and Jefferson 2019). The Lummi Reservation waters and tidelands consist of Lummi Bay, Portage Bay, and a portion of Bellingham Bay from Portage Bay to the eastern side of the Nooksack River delta.

Lummi Bay is home to the Lummi Sea Pond a 750-acre artificial aquaculture pond built into the shoreline of Lummi Bay and fully enclosed by a 3-mile-long dike road (Heath et al. 1975). The water level in the Lummi Sea Pond is controlled by a series of tide gates along the dike, though the gates are not currently fully functional. The Lummi Sea Pond, a crucial location, was designed to support aquaculture operations by controlling for a consistent water level. In 1964, the tide gates were designed to allow for six-and-a-half inches of water exchange during the tidal cycle. Today, there is only two-and-a-half inches of water exchange. The Lummi Sea Pond is eight feet deep at its deepest points and terminates at the Red River delta. Previously seeded clams served as a source population for Lummi Bay, and the Shellfish and Finfish Hatcheries also currently use the Lummi Sea Pond.

In 2021, the Lummi Natural Resource AIS team, with the assistance of partners and volunteers, captured ~86,000 green crab. In 2023, extensive trapping pressure resulted in a recruitment failure in the green crab population, with only ~6,000 green crab captured despite using the same trapping scheme. Despite the successful reduction in green crab abundance in the Lummi Sea Pond, the Lummi Natural Resource AIS team will continue control efforts to prevent the recovery of green crab in the green crab population. While individual animals have been captured in Portage Bay and the Bellingham Bay side of the Lummi Reservation, a population of green crab have yet to establish. The Lummi Natural Resource AIS team is actively setting traps in an early detection effort in this area and will continue to monitor for any changes in the green crab population.

The North Puget Sound Management Area remains a high priority for green crab management. While green crab numbers are relatively low, control efforts for existing populations are ongoing to reduce the risk of further spread. Monitoring efforts are ongoing to detect potential new populations and monitor long-term trends in the region.

Objective NPS.1: Early detection of green crab in new geographic areas.

Strategy NPS.1.1: Perform early detection monitoring.

Action NPS.1.1.1: DNR performs early detection monitoring trapping at sites in Fidalgo Bay and Cherry Point Aquatic Reserve.

Action NPS.1.1.2: LNR AIS team performs early detection monitoring in the Sandy Point, Portage Bay, and on the Nooksack River Delta.

Action NPS.1.1.3: Marine Life Center performs early detection monitoring trapping at a site in the Bellingham Bay Coordination Area.

Action NPS.1.1.4: PBNERR performs early detection monitoring trapping.

Action NPS.1.1.5: Swinomish Indian Tribal Community incorporates green crab monitoring into existing larval and juvenile Dungeness crab survey work.

Action NPS.1.1.6: Swinomish Indian Tribal Community coordinates with other local co-managers, tribes, and partners to expand monitoring within already established programs.

Action NPS.1.1.7: WDFW performs early detection monitoring trapping in the San Juan Islands Coordination Area.

Performance Measures:
PM NPS.1.1A: Collection of the highest standard green crab and bycatch data resulting from trapping efforts.

Strategy NPS.1.2: Perform haphazard early detection monitoring efforts.

Action NPS.1.2.1: Penn Cove Shellfish performs haphazard early detection efforts during normal operations.

Performance Measures:
PM NPS.1.2A: Collection of molts, photographs, or other evidence for confirmation of green crab detection.

Objective NPS.3: Support and assist with management activities.

Strategy NPS.3.1: Support and assist with management activities.

Action NPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action NPS.3.1.2: WDFW assists NWSC with assessment trapping in Drayton Harbor and Samish Bay Coordination Areas.

Action NPS.3.1.3: WDFW assists LNR and NWSC with control trapping in Drayton Harbor, Samish Bay, and Lummi Bay Coordination Areas.

Action NPS.3.1.4: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM NPS.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM NPS.3.1B: Documentation of support activities.

Objective NPS.4: Assess green crab distribution and abundance.

Strategy NPS.4.1: Perform assessment trapping.

Action NPS.4.1.1: LNR AIS team performs assessment trapping in Lummi Bay and inside the Lummi Sea Pond.

Action NPS.4.1.2: NWSC coordinates standardized assessment trapping at sites in Drayton Harbor and Samish Bay Coordination Areas.

Action NPS.4.1.3: NWSC coordinates assists with assessment trapping at Coordination Areas in the North Puget Sound Management Area other than Drayton Harbor and Samish Bay as capacity allows.

Action NPS.4.1.4: PBNERR performs assessment trapping at sites.

Action NPS.4.1.5: Taylor Shellfish performs assessment trapping.

Action NPS.4.1.6: WDFW performs assessment trapping in Bellingham Bay, Birch Bay, and San Juan Islands Coordination Areas.

Performance Measures:
PM NPS.4.1A: Collection of medium standard or higher green crab and bycatch data resulting from trapping efforts.

Strategy NPS.4.2: Perform monitoring trapping.

Action NPS.4.2.1: Samish Indian Nation acquires necessary resources to perform monitoring trapping.

Action NPS.4.2.2: Samish Indian Nation performs monitoring trapping.

Action NPS.4.2.3: NWSC coordinates monitoring efforts through trapping in Drayton Harbor and Samish Bay Coordination Areas.

Performance Measures:
PM NPS.4.2A: Acquires resources to develop a trapping program.

PM NPS.4.2B: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Strategy NPS.4.3: Perform molt searches.

Action NPS.4.3.1: Samish Indian Nation performs systematic and haphazard Molt Search events.

Performance Measures:
PM NPS.4.3A: Collection of molts, photographs, or other evidence for confirmation of green crab detection during Molt Search events.

Strategy NPS.4.4: Expand local trapping capacity.

Action NPS.4.4.1: NWSC recruits and trains new entities, groups, and individuals to become involved with green crab trapping efforts.

Action NPS.4.4.2: NWSC increases local access via increased collaboration with local landowners.

Action NPS.4.4.3: PBNERR recruits and trains new entities, groups, and individuals to become involved with green crab trapping efforts.

Action NPS.4.4.4: PBNERR increases local access via increased collaboration with local landowners.

Action NPS.4.4.5: PBNERR restores boat to usable condition to increase in-house capacity.

Performance Measures:
PM NPS 4.4A: Collection of medium standard or higher green crab and bycatch data resulting from trapping efforts.

PM NPS.4.4B: PBNERR boat is restored to usable condition for trapping needs.

Objective NPS.5: Long-term monitoring of green crab and other species.

Strategy NPS.5.1: Perform long-term monitoring at WSG crab team sites.

Action NPS.5.1.1: DNR will perform long-term monitoring using WSG monitoring protocols in the Cypress Island Aquatic Reserve.

Action NPS.5.1.2: PBNERR will perform long-term monitoring using WSG monitoring protocols at established monitoring sites.

Action NPS.5.1.3: Samish Indian Nation performs long-term monitoring using WSG monitoring protocols at established monitoring sites.

Action NPS.5.1.4: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.

Performance Measures:
PM NPS.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Strategy NPS.5.2: Perform long-term monitoring trapping (non-WSG sites).

Action NPS.5.2.1: WDFW performs assessment trapping in Bellingham Bay, Birch Bay, and San Juan Islands Coordination Areas.

Performance Measures:
PM NPS.5.2A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective NPS.6: Reduce local green crab abundance.

Strategy NPS.6.1: Identify green crab hotspots.

Action NPS.6.1.1: LNR AIS team identifies hotspots of green crab abundance.

Performance Measures:
PM NPS.6.1A: Maintain records of green crab hotspots for internal use.

Strategy NPS.6.2: Perform control trapping.

Action NPS.6.2.1: DNR assists with control trapping efforts at Birch Bay, Henry Island, and Roche Harbor as capacity allows.

Action NPS.6.2.2: LNR AIS team performs control trapping at green crab hotspots and other locations within the in the Lummi River, Lummi Bay, and the Lummi Sea Pond.

Action NPS.6.2.3: LNR cultivates a dynamic core of AIS staff with the experience and knowledge to operate throughout the entirety of the Lummi Nation's waters and the modularity and flexibility to reallocate resources and effort as necessary.

Action NPS.6.2.4: NWSC performs control trapping at sites in Samish Bay and Drayton Harbor Coordination Areas.

Action NPS.6.2.5: PBNERR performs control trapping.

Action NPS.6.2.6: Taylor Shellfish participates in control trapping in support of larger efforts.

Performance Measures:
PM NPS.6.2A: Collection of Minimum Standard or higher green crab and bycatch data resulting from trapping efforts.

Objective NPS.7: Reduce spread of green crab.

Strategy NPS.7.1: Prevent unintentional spread of green crab via aquaculture activities.

Action NPS.7.1.1: Taylor Shellfish staff implement best management practices to prevent accidental green crab transport.

Performance Measures:
PM NPS.7.1A: Documentation of implementation of best practices.

Strategy NPS.7.2: Reduce emigration of green crab larvae.

Action NPS.7.2.1: LNR AIS team determines and implements the most appropriate solution to the issue of the damaged Lummi Sea Pond tide gate.

Performance Measures:
PM NPS.7.2A: Lummi Sea Pond tide gate repaired or otherwise altered to resolve the issue.

Objective NPS.10: Outreach and education related to green crab.

Strategy NPS.10.1: Conduct outreach and education events.

Action NPS.10.1.1: DNR conducts outreach and education events with coordination from Aquatic Reserve Citizen Stewardship Committees (CSCs) and local green crab co-managers, tribes, and partners, highlighting AIS and the stewardship of Aquatic Reserves.

Action NPS.10.1.2: LNR AIS hosts interns from Northwest Indian College and local Lummi youth during the summer youth work program as part of outreach efforts.

Action NPS.10.1.3: Marine Life Center conducts outreach and education events including in-house discussions, classroom tours, and special events.

Action NPS.10.1.4: NWSC conducts outreach and education events to increase public awareness and knowledge of green crab through presentations, molt search training events, social media engagement, and outreach booths.

Action NPS.10.1.5: PBNERR provides green crab education and outreach materials for visiting college classes, tours, and for the public through the Padilla Bay Interpretive Center programs.

Action NPS.10.1.6: Samish Indian Nation performs outreach efforts focused on Samish tribal members and other local communities and organizations.

Action NPS.10.1.7: Swinomish Indian Tribal Community conducts outreach and education events including molt search events as capacity allows.

Performance Measures:
PM NPS.10.1A: Documentation of event and attendance.

Strategy NPS.10.2: Perform outreach to local communities.

Action NPS.10.2.1: LNR AIS team performs outreach efforts focused on local communities and organizations.

Action NPS.10.2.2: NWSC performs outreach efforts focused on shoreline landowners and other local communities through engagement with local county Marine Resources Committees.

Action NPS.10.2.3: NWSC generates general interest for sustained green crab management through interviews with local media as opportunities allow.

Action NPS.10.2.4: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Performance Measures:
PM NPS.10.2A: Maintain record of outreach efforts and media engagement.

Objective NPS.11: Research related to green crab.

Strategy NPS.11.1: Assess local green crab populations.

Action NPS.11.1.1: Lummi collaborates with Woods Hole Oceanographic Institution and WSG, collecting samples for RNA analysis.

Performance Measures:
PM NPS.11.1A: Dissemination of assessment results.

Strategy NPS.11.2: Assess trap designs and efficiencies.

Action NPS.11.2.1: Lummi collaborates with Tulalip in a proof-of-concept study using none baited habitat traps to remove green crab.

Performance Measures:
PM NPS.11.2A: Dissemination of trapping results.

Strategy NPS.11.3: Conduct research on larval green crab.

Action NPS.11.3.1: LNR conducts larval recruitment and larval timing monitoring using light traps inside and outside the Lummi Sea Pond.

Action NPS.11.3.2: Lummi collaborates with USGS in the collection and analysis of samples from light traps for DNA and eDNA testing.

Action NPS.11.3.3: PBNERR conducts research and monitoring on the behavior, dispersal, and habitat use of larval and early settler life stages of green crab and environmental factors influencing spread.

Action NPS.11.3.4: PBNERR convenes annual larval workshop to discuss current larval research and provide larval identification training.

Performance Measures:
PM NPS.11.3A: Dissemination of research results.

PM NPS.11.3B: Disseminate major points of discussion from annual workshops.

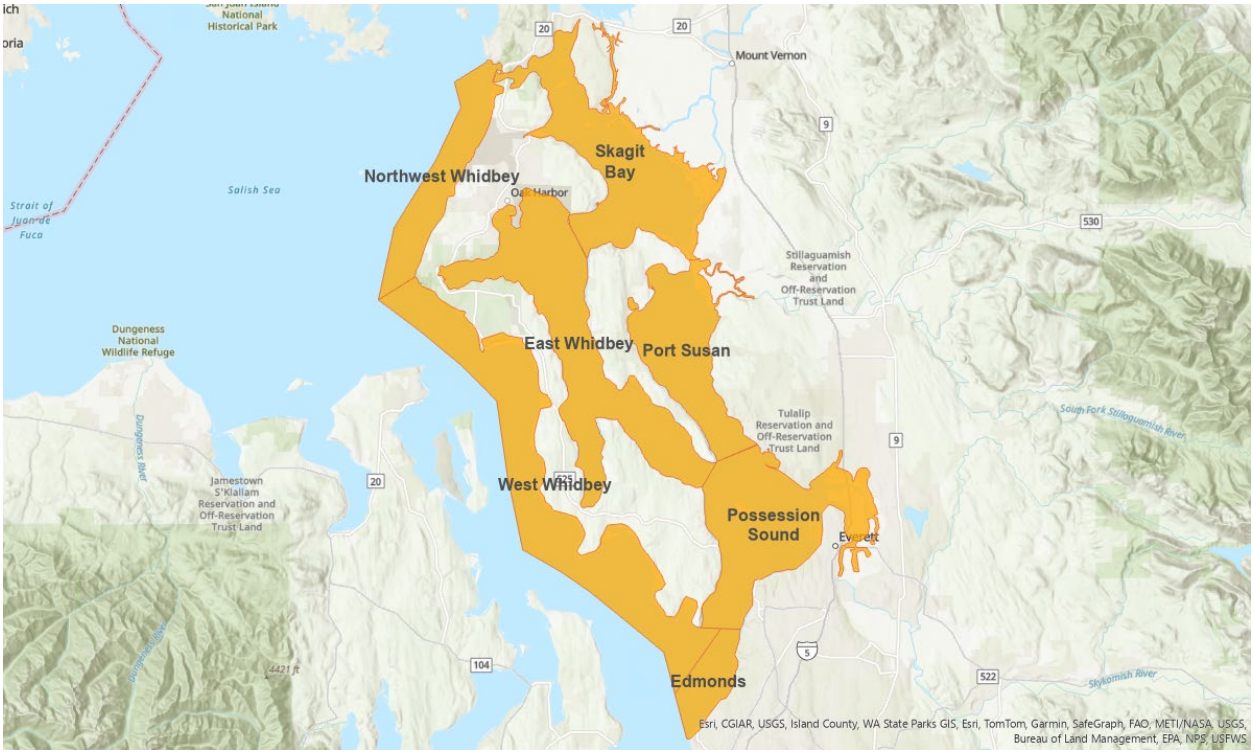
Strategy NPS.11.4: Assess green crab impacts.

Action NPS.11.4.1: Lummi assesses the impacts of green crab on reservation eelgrass beds by completing the mapping of all current eelgrass beds within reservation boundaries.

Performance Measures:
PM NPS.11.4A: Dissemination of assessment results.

North Central Puget Sound

Figure 7 Map of North Central Puget Sound Management Area.



North Central Puget Sound is split into seven Coordination Areas (Skagit Bay, Northwest Whidbey, East Whidbey, Port Susan, West Whidbey, Possession Sound, and Edmonds).

The North Central Puget Sound Management Area consists of the Washington coastline and waters of the Salish Sea from Rosario Beach south to Edwards Point, and westward to include Camano Island and Whidbey Island. The North Central Puget Sound Management Area is home to the Swinomish Indian Tribal Community, the Stillaguamish Tribe of Indians, and Tulalip Tribes. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, the North Central Puget Sound Management Area contains tribal usual and accustomed areas (U&As), aquatic reserves, restoration sites, and other sites of cultural and ecological importance. Tribal and recreational shellfish fisheries are also active in the region.

Green crab were first detected in the North Puget Sound Management Area in 2017 by WSG's Crab Team Monitoring Network. The last green crab caught in North Puget Sound Management Area was in 2021, despite continued and expanding monitoring efforts. In total, only four green crab were collected between 2017 and 2021.

The North Central Puget Sound Management Area is a high priority for green crab management. North Central Puget Sound Management Area is at the very edge of the green crab invasion front, providing an opportunity to act before green crab become well-established. Monitoring efforts are ongoing to detect potential populations and monitor long-term trends in the region.

Objective NCPS.1: Early detection of green crab in new geographic areas.

Strategy NCPS.1.1: Perform early detection monitoring.

Action NCPS.1.1.1: DNR performs early detection monitoring trapping at sites within and near the Whidbey Island Aquatic Reserve and assists partners trapping within Skagit Bay.

Action NCPS.1.1.2: Tulalip Tribes perform early detection monitoring trapping.

Action NCPS.1.1.3: Tulalip Tribes performs Molt Search surveys.

Action NCPS.1.1.4: Stillaguamish Tribe of Indians performs early detection monitoring trapping.

Action NCPS.1.1.5: Stillaguamish Tribe of Indians performs Molt Search Surveys on tribal tidelands.

Action NCPS.1.1.6: Swinomish Indian Tribal Community incorporates green crab monitoring into existing larval and juvenile Dungeness crab survey work.

Action NCPS.1.1.7: Swinomish Indian Tribal Community coordinates with other local co-managers, tribes, and partners to expand monitoring within already established programs.

Action NCPS.1.1.8: Swinomish Indian Tribal Community performs early detection monitoring trapping at sites in the Swinomish Channel.

Action NCPS.1.1.9: WDFW performs early detection monitoring trapping in all Coordination Areas.

Performance Measures:
PM NCPS.1.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

PM NCPS.1.1B: Collection and appropriate dissemination of Molt Search data.

Strategy NCPS.1.2: Expand local trapping capacity.

Action NCPS.1.2.1: Tulalip Tribes acquires resources to expand capacity (e.g., boat, staff) to increase in-house trapping capacity.

Action NCPS.1.2.2: Stillaguamish Tribe of Indians acquires resources to expand trapping capacity.

Action NCPS.1.2.3: Swinomish Indian Tribal Community acquires resources to expand trapping capacity.

Performance Measures:
PM NCPS.1.2A: Increased early detection monitoring.

Objective NCPS.2: Rapid response planning.

Strategy NCPS.2.1: Develop a rapid response plan(s).

Action NCPS.2.1.1: Stillaguamish Tribe of Indians develops a rapid response plan.

Action NCPS.2.1.2: Swinomish Indian Tribal Community develops a rapid response plan.

Action NCPS.2.1.3: Tulalip Tribes develops a rapid response plan.

Action NCPS.2.1.4: WDFW develops rapid response plans for new detections.

Performance Measures:
PM NCPS.2.1A: Internal publication of rapid response plan.

Objective NCPS.3: Support and assist with management activities.

Strategy NCPS.3.1: Support and assist with management activities.

Action NCPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action NCPS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM NCPS.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM NCPS.3.1B: Documentation of support activities.

Objective NCPS.5: Long-term monitoring of green crab and other species.

Strategy NCPS.5.1: Perform long-term monitoring at WSG crab team sites.

Action NCPS.5.1.1: Stillaguamish Tribe of Indians performs long-term monitoring using WSG monitoring protocols at established monitoring sites.

Action NCPS.5.1.2: Swinomish Indian Tribal Community performs long-term monitoring using WSG monitoring protocols at established monitoring sites.

Action NCPS.5.1.3: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.

Performance Measures:
PM NCPS.5.1A: Collection and appropriate dissemination of highest standard green crab and bycatch data resulting from trapping efforts.

Objective NCPS.10: Outreach and education related to green crab.

Strategy NCPS.10.1: Perform outreach to local communities and organizations.

Action NCPS.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Action NCPS.10.1.2: Stillaguamish Tribe of Indians performs outreach efforts focused on local classrooms and other local communities and organizations.

Action NCPS.10.1.3: Swinomish Indian Tribal Community conducts outreach and education events including molt search events as capacity allows.

Action NCPS.10.1.4: Tulalip Tribes conducts outreach and education events including molt search events as capacity allows.

Performance Measures:
PM NCPS.10.1A: Maintain record of outreach efforts.

Objective NCPS.11: Research related to green crab.

Strategy NCPS.11.1: Assess trap designs and efficiencies.

Action NCPS.11.1.1: Tulalip Tribes assess efficacy of new (i.e., crab slab) and traditional trap designs.

Performance Measures:
PM NCPS.11.1A: Dissemination of trapping results.

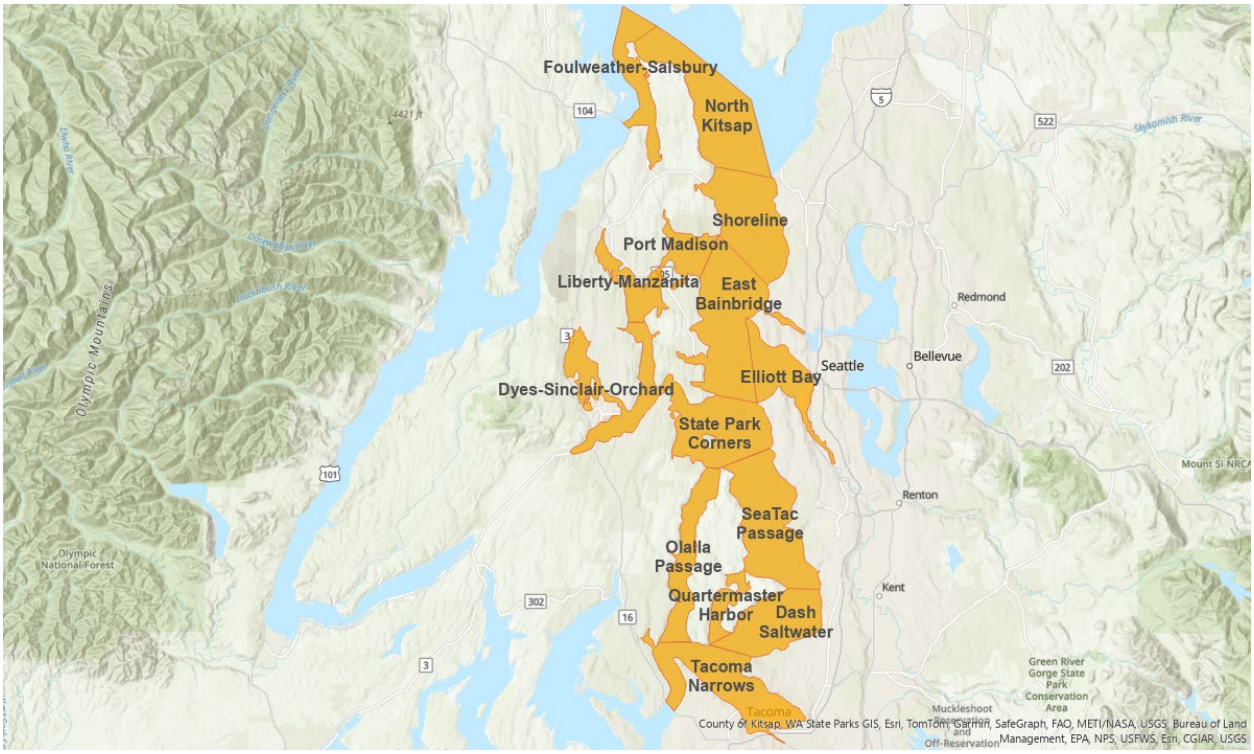
Strategy NCPS.11.2: Assessing efficacy of early-life history stage monitoring tools.

Action NCPS.11.2.1: Swinomish Indian Tribal Community monitors for larval presence in light traps.

Performance Measures:
PM NCPS.11.2A: Dissemination of trapping results.

South Central Puget Sound

Figure 8 Map of South Central Puget Sound Management Area.



South Central Puget Sound is split into 14 Coordination Areas (Foulweather-Salsbury, North Kitsap, Shoreline, Port Madison, Liberty-Manzanita, East Bainbridge, Elliot Bay, Dyes-Sinclair-Orchard, State Park Corners, Olalla Passage, SeaTac Passage, Quartermaster Harbor, Dash Saltwater, and Tacoma Narrows).

The South Central Puget Sound Management Area consists of the Washington coastline and waters of the Salish Sea from Edwards Point to the east and Apple Cove Point south to the Tacoma Narrows Bridge. In addition, South Central Puget Sound Management Area incorporates the northern end of Kitsap Peninsula, from Hood Canal Floating Bridge on the western shore to Apple Cove Point on the eastern shore. South Central Puget Sound Management Area is home to the Muckleshoot Indian Tribe, Port Gamble S'Klallam Tribe, Puyallup Tribe, and Suquamish Tribe. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, South Central Puget Sound Management Area tribal usual and accustomed areas (U&As), aquatic reserves, restoration sites, and other sites of cultural and ecological importance. Tribal and recreational shellfish fisheries are also active in the region.

There are no recorded detections of green crab of any status (alive, dead, or molts) or any life stage (larvae, megalopa, juvenile, or adult) in the South Central Puget Sound Management Area. Early detection monitoring efforts by WSG's Crab Team Monitoring Network began in 2016, with additional co-managers, tribes, and partners contributing to the effort over time.

Although no green crab have been detected thus far, conditions in South Central Puget Sound Management Area are suitable for green crab to become established should they be introduced. It is essential to continue and expand early detection monitoring in the region.

Objective SCPS.1: Early detection of green crab in new geographic areas.

Strategy SCPS.1.1: Perform early detection monitoring.

Action SCPS.1.1.1: DNR performs early detection monitoring at the Maury Island Aquatic Reserve and assists partners trapping within Port Gamble.

Action SCPS.1.1.2: Muckleshoot Indian Tribe acquires necessary resources to perform early detection monitoring efforts.

Action SCPS.1.1.3: Port Gamble S'Klallam Tribe acquires resources to perform early detection monitoring at sites in Port Gamble Bay.

Action SCPS.1.1.4: Puyallup Tribe acquires necessary resources to perform early detection monitoring efforts.

Action SCPS.1.1.5: WDFW performs early detection monitoring trapping in all Coordination Areas.

Performance Measures:
PM SCPS.1.1A: Acquisition of necessary resources.

PM SCPS.1.1B: Collection of the highest standard green crab and bycatch data resulting from trapping efforts.

Objective SCPS.2: Rapid response planning.

Strategy SCPS.2.1: Develop rapid response plan(s).

Action SCPS.2.1.1: Muckleshoot Indian Tribe acquires resources to develop and implement a rapid response plan.

Action SCPS.2.1.2: Port Gamble S'Klallam Tribe acquires resources to develop and implement a rapid response plan.

Action SCPS.2.1.3: Puyallup Tribe acquires resources to develop and implement a rapid response plan.

Action SCPS.2.1.4: WDFW develops rapid response plans for new detections.

Performance Measures:
PM SCPS.2.1A: Acquisition of necessary resources.

PM SCPS.2.1B: Internal publication of rapid response plan.

Objective SCPS.3: Support and assist with management activities.

Strategy SCPS.3.1: Support and assist with management activities.

Action SCPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action SCPS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM SCPS.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM SCPS.3.1B: Documentation of support activities.

Objective SCPS.5: Long-term monitoring of green crab and other species.

STRATEGY SCPS.5.1: Perform long-term monitoring at WSG crab team sites.

Action SCPS.5.1.1: Port Gamble S'Klallam Tribe will perform long-term monitoring using WSG monitoring protocols at monitoring sites.

Action SCPS.5.1.2: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.

Performance Measures:
PM SCPS.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective SCPS.10: Outreach and education related to green crab.

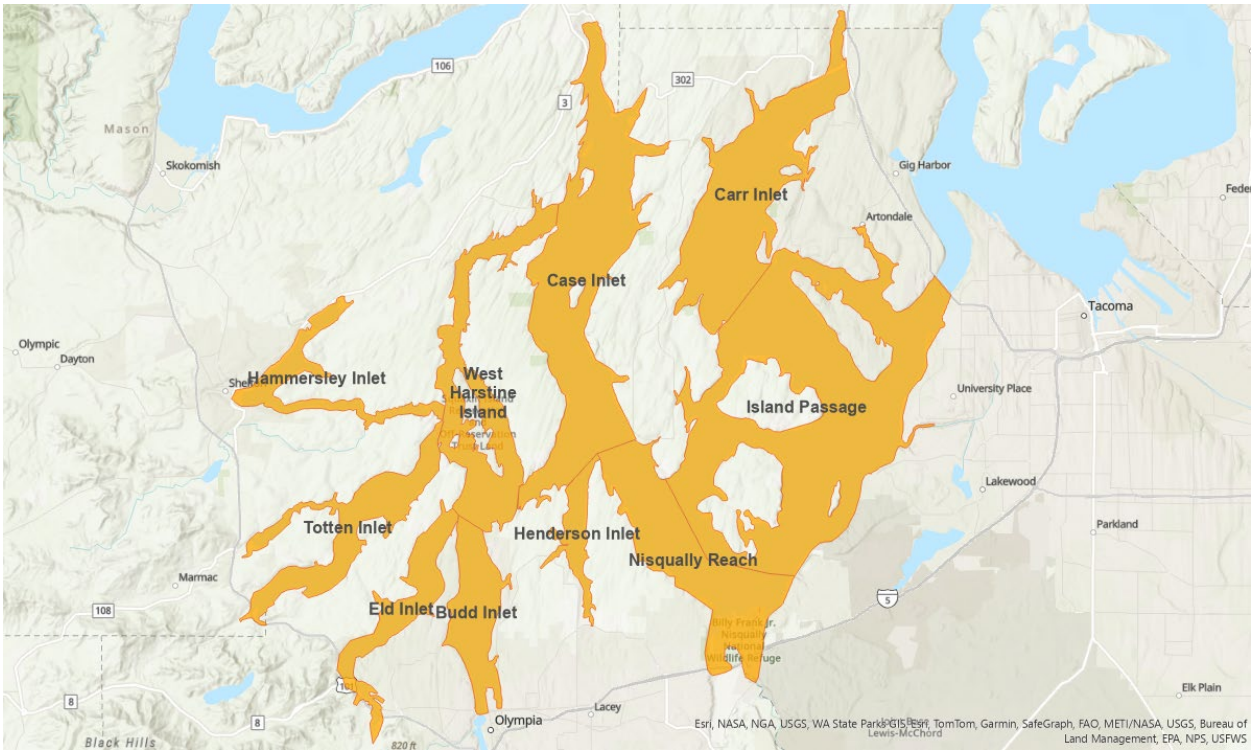
Strategy SCPS.10.1: Perform outreach to local communities and organizations.

Action SCPS.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Performance Measures:
PM SCPS.10.1A: Maintain record of outreach efforts.

South Puget Sound

Figure 9 Map of South Puget Sound Management Area.



South Puget Sound is split into nine Coordination Areas (Hammersley Inlet, West Harstine Island, Case Inlet, Carr Inlet, Island Passage, Totten Inlet, Eld Inlet, Budd Inlet, Henderson Inlet, Nisqually Reach).

The South Puget Sound Management Area consists of the Washington coastline and waters of the Salish Sea located south of the Tacoma Narrows Bridge. South Puget Sound Management Area is home to the Nisqually Indian Tribe, Puyallup Tribe, and Squaxin Island Tribe. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, South Puget Sound Management Area contains tribal U&A's, aquatic reserves, restoration sites, and other sites of cultural and ecological importance. Tribal and recreational shellfish fisheries are also active in the region.

There are no recorded detections of green crab of any status (alive, dead, or molts) or any life stage (larvae, megalopa, juvenile, or adult) in the South Puget Sound Management Area. Early detection monitoring efforts by WSG's Crab Team Monitoring Network began in 2015, with additional co-managers, tribes, and partners contributing to the effort over time.

Although no green crab have been detected thus far, conditions in South Puget Sound Management Area are suitable for green crab establishment. It is essential to continue and expand early detection monitoring in the region.

Objective SPS.1: Early detection of green crab in new geographic areas.

Strategy SPS.1.1: Perform early detection monitoring.

Action SPS.1.1.1: DNR performs early detection monitoring trapping at sites within the Nisqually Reach and Woodard Bay Natural Resource Coordination Areas.

Action SPS.1.1.2: Squaxin Island Tribe performs early detection monitoring.

Action SPS.1.1.3: Squaxin Island Tribe acquires resources to ensure long-term capacity for early detection monitoring.

Action SPS.1.1.4: WDFW performs early detection monitoring trapping in all Coordination Areas.

Performance Measures:
PM SPS.1.1A: Acquisition of necessary resources.

PM SPS.1.1B: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective SPS.2: Rapid response planning.

Strategy SPS.2.1: Develop rapid response plan(s).

Action SPS.2.1.1: WDFW develops rapid response plans for new detections.

Performance Measures:
PM SPS.2.1A: Acquisition of necessary resources.

PM SPS.2.1B: Internal publication of rapid response plan.

Objective SPS.3: Support and assist with management activities.

Strategy SPS.3.1: Support and assist with management activities.

Action SPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action SPS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM SPS.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM SPS.3.1B: Documentation of support activities.

Objective SPS.5: Long-term monitoring of green crab and other species.

Strategy SPS.5.1: Perform long-term monitoring at WSG crab team sites.

Action SPS.5.1.1: DNR will perform long-term monitoring using WSG monitoring protocols in the Nisqually Reach Aquatic Reserve.

Action SPS.5.1.2: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.

Performance Measures:
PM SPS.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective SPS.10: Outreach and education related to green crab.

Strategy SPS.10.1: Perform outreach to local communities and organizations.

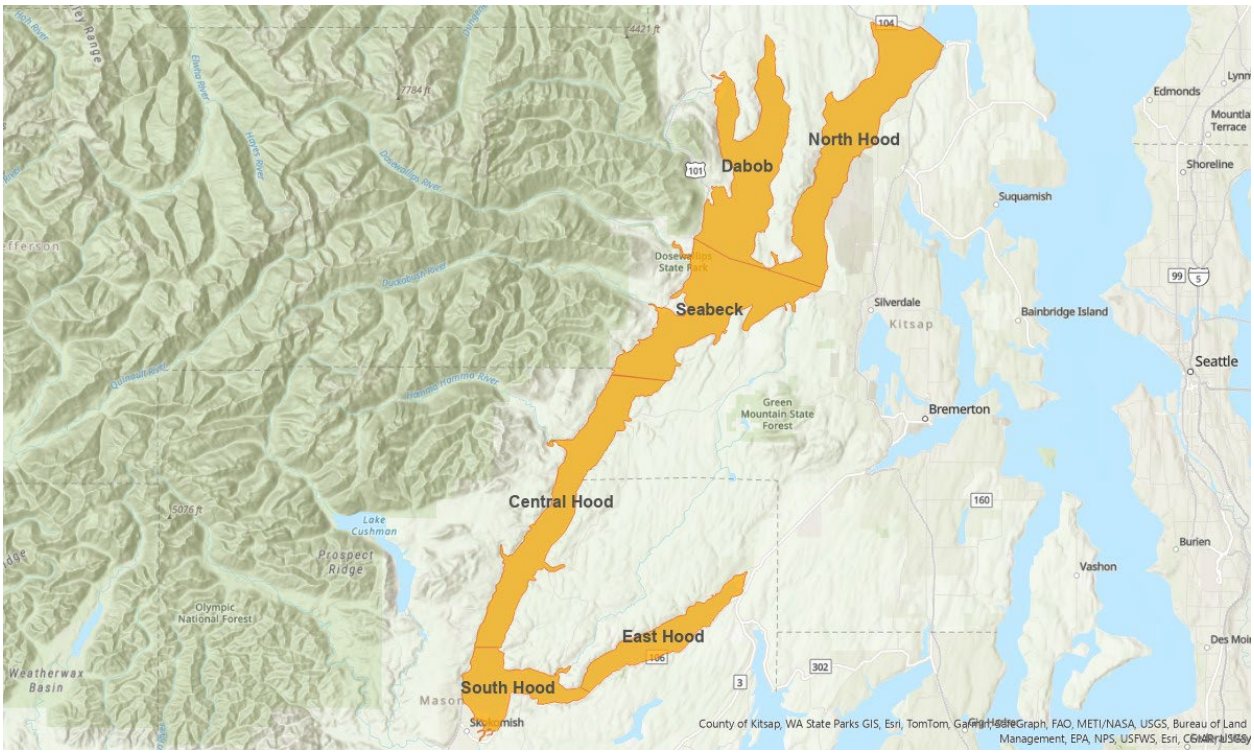
Action SPS.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Action SPS.10.1.2: Squaxin Island Tribe performs outreach efforts focused on local educators, and other local communities and organizations.

Performance Measures:
PM SPS.10.1A: Maintain record of outreach efforts.

Hood Canal

Figure 10 Map of Hood Canal Management Area.



Hood Canal is split into six Coordination Areas (North Hood, Dabob, Seabeck, Central Hood, South Hood, and East Hood).

The Hood Canal Management Area consists of the Washington coastline and waters of the Salish Sea accessible after heading south of the Hood Canal Floating Bridge. Hood Canal Management Area is home to the Skokomish Indian Tribe. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, Hood Canal Management Area tribal usual and accustomed areas (U&As), restoration sites, and other sites of cultural and ecological importance. Commercial, tribal, and recreational shellfish fisheries are also active in the region.

Though monitoring began in 2016 by WSG's Crab Team Monitoring Network, green crab were first detected in the Hood Canal Management Area in 2022. While green crab have only been detected in the Dabob and Seabeck Coordination Areas and at low numbers, green crab have been detected every year since 2022.

Hood Canal Management Area is a high priority for green crab management. It is unique in that while green crab are present in some Coordination Areas, Hood Canal is also at the very edge of the green crab invasion front. Given the relatively low abundance and geographic distribution of green crab in this Management Area, the opportunity remains to act before green crab become well-established. Monitoring efforts are ongoing to detect potential populations and monitor long-term trends in the

region. Monitoring efforts are ongoing to detect potential new populations and monitor long-term trends in the region.

Objective HC.1: Early detection of green crab in new geographic areas.

Strategy HC.1.1: Perform early detection monitoring.

Action HC.1.1.1: DNR performs early detection monitoring at sites within the Dabob, Seabeck, and South Hood Coordination Areas and assists with trapping at Potlatch State Park.

Action HC.1.1.2: Skokomish Indian Tribe performs early detection monitoring.

Action HC.1.1.3: Skokomish Indian Tribe acquires resources to increase capacity to expand monitoring efforts.

Action HC.1.1.4: WDFW will perform early detection monitoring in all Coordination Areas.

Performance Measures:
PM HC.1.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

PM HC.1.1B: Acquisition of necessary resources.

Strategy HC.1.2: Perform haphazard early detection efforts.

Action HC.1.2.1: Hama Hama Oyster Company staff perform haphazard early detection efforts during normal operations.

Performance Measures:
PM HC.1.2A: Collection of molts, photographs, or other evidence for confirmation of green crab detection.

Objective HC.2: Rapid response planning.

Strategy HC.2.1: Develop rapid response plan(s).

Action HC.2.1.1: WDFW develops rapid response plans for new detections.

Performance Measures:
PM HC.2.1A: Acquisition of necessary resources.

PM HC.2.1B: Internal publication of rapid response plan.

Objective HC.3: Support and assist with management activities.

Strategy HC.3.1: Support and assist with management activities.

Action HC.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action HC.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM HC.3.1A: Collection of green crab and bycatch data resulting from trapping data.

Objective HC.4: Assess green crab distribution and abundance.

Strategy HC.4.1: Perform assessment trapping.

Action HC.4.1.1: WDFW performs assessment trapping in Seabeck, Dabob, and North Hood Coordination Areas.

Performance Measures:
PM HC.4.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective HC.5: Long-term monitoring of green crab and other species.

Strategy HC.5.1: Perform long-term monitoring trapping (non-WSG sites).

Action HC.5.1.1: WDFW performs long-term monitoring trapping in Seabeck Coordination Areas.

Performance Measures:
PM HC.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective HC.7: Reduce spread of green crab.

Strategy HC.7.1: Prevent unintentional spread of green crab via aquaculture activities.

Action HC.7.1.1: Hama Hama Oyster Company staff implements best management practices to prevent accidental green crab transport.

Performance Measures:
PM HC.7.1A: Documentation of implementation of best practices.

Objective HC.10: Outreach and education related to green crab.

Strategy HC.10.1: Perform outreach to local communities and organizations.

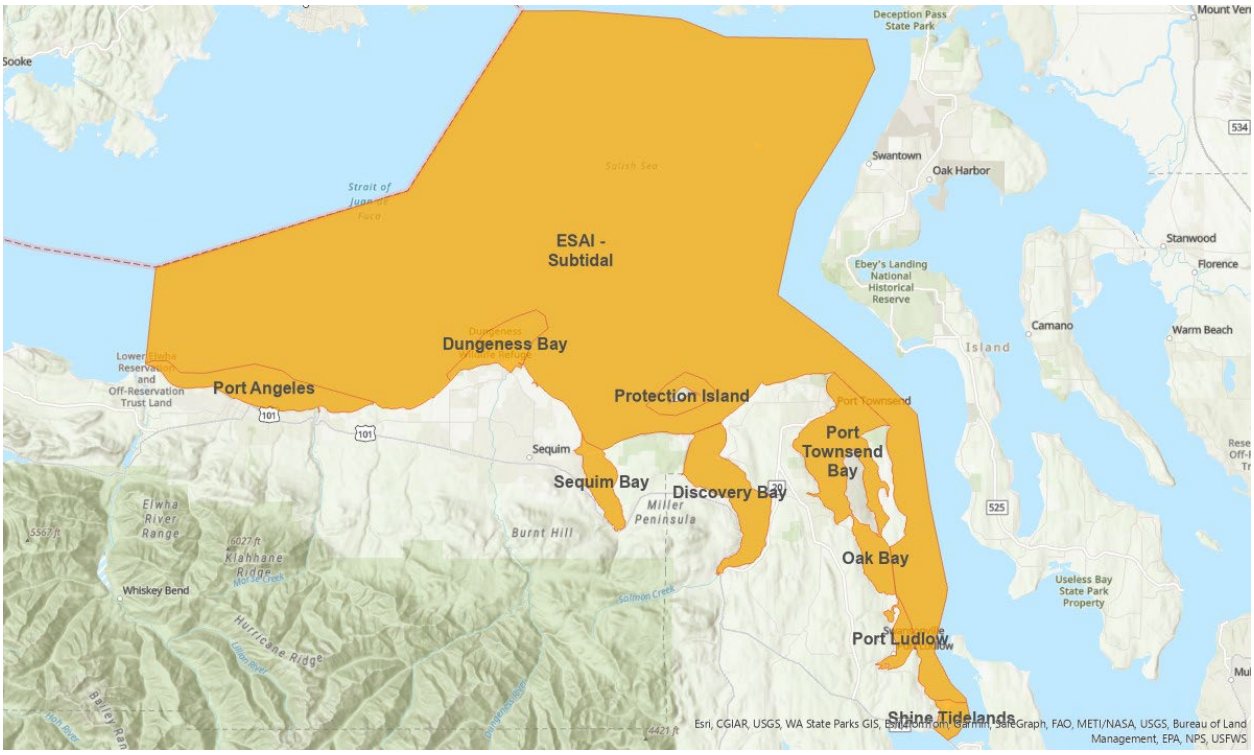
Action HC.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Action HC.10.1.2: Skokomish Tribe performs outreach efforts focused on tribal citizens, fishers, and other local communities and organizations.

Performance Measures:
PM HC.10.1A: Maintain record of outreach efforts.

Eastern Strait & Admiralty Inlet

Figure 11 Map of Eastern Strait & Admiralty Inlet Management Area.



Eastern Strait & Admiralty Inlet is split into nine Coordination Areas (Port Angeles, Dungeness Bay, ESAI – Subtidal, Sequim Bay, Protection Island, Discovery Bay, Port Townsend Bay, Oak Bay, and Port Ludlow).

The Eastern Strait & Admiralty Inlet Management Area consists of the Washington coastline and waters of the Salish Sea from the Hood Canal Floating Bridge north to Point Wilson, then heading west to Angeles Point. Eastern Strait & Admiralty Inlet Management Area is home to the Jamestown S'Klallam Tribe and the Lower Elwha Klallam Tribe and borders Canada in the Strait of Juan de Fuca. Coordination and collaboration between tribal, state, federal, Canadian, and First Nations governments are essential for effective management in the region. In addition, Eastern Strait & Admiralty Inlet Management Area contains marine protected areas, tribal usual and accustomed areas (U&As), aquatic reserves, restoration sites, and other sites of cultural and ecological importance. Tribal and recreational shellfish fisheries are also active in the region.

Green crab were first detected in the Eastern Strait & Admiralty Inlet Management Area in 2017 by the WSG Crab Team. Green crab have been detected in the Discovery Bay, Dungeness Bay, and Sequim Bay Coordination Areas, with ~360 crabs removed from 2022-2024.

The Eastern Strait & Admiralty Inlet Management Area continues to be a high priority for green crab management. Control trapping is ongoing in areas where green crab are most abundant, while

monitoring efforts are ongoing to detect potential new populations and monitor long-term trends in the region.

Objective ES.1: Early detection of green crab in new geographic areas.

Strategy ES.1.1: Perform early detection monitoring.

Action ES.1.1.1: DNR performs early detection monitoring trapping at sites within and near the Protection Island Aquatic Reserve at Travis Spit and assists with trapping at Squim and Discovery Bays.

Action ES.1.1.2: Jamestown S'Klallam Tribe performs early detection monitoring trapping at sites in the Sequim Bay Coordination Area.

Action ES.1.1.3: Jamestown S'Klallam Tribe acquires additional staff and resources for geographic and frequency expansion of monitoring efforts.

Action ES.1.1.4: WDFW will perform early detection monitoring in Port Ludlow, Shine Tidelands, and potentially additional Coordination Areas.

Performance Measures:
PM ES.1.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

PM ES.1.1B: Acquisition of necessary staff and resources.

Objective ES.3: Support and assist with management activities.

Strategy ES.3.1: Support and assist with management activities.

Action ES.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action ES.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM ES.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM ES.3.1B: Documentation of support activities.

Objective ES.4: Assess green crab distribution and abundance.

Strategy ES.4.1: Perform assessment trapping.

Action ES.4.1.1: Lower Elwha Klallam Tribe performs Monitoring trapping at sites in Port Angeles Coordination Area.

Action ES.4.1.2: WDFW performs assessment trapping in Discovery Bay, Port Angeles, Dungeness Bay, and Port Townsend Bay Coordination Areas.

Performance Measures:
PM ES.4.1A: Collection of medium standard or higher green crab and bycatch data resulting from trapping efforts.

Objective ES.5: Long-term monitoring of green crab and other species.

Strategy ES.5.1: Perform long-term monitoring at WSG crab team sites.

Action ES.5.1.1: USFWS performs long-term monitoring using WSG monitoring protocols at monitoring sites.

Action ES.5.1.2: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.

Performance Measures:
PM ES.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Strategy ES.5.2: Perform long-term monitoring trapping (non-WSG sites).

Action ES.5.2.1: WDFW performs long-term monitoring trapping in Discovery Bay Coordination Area.

Performance Measures:
PM ES 5.2A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective ES.6: Reduce local green crab abundance.

Strategy ES.6.2: Perform control trapping.

Action ES.6.2.1: Jamestown S'Klallam Tribe performs control trapping.

Action ES.6.2.2: Jamestown S'Klallam Tribe performs control trapping at highest capacity at new detection locations.

Action ES.6.2.3: WDFW performs control trapping at sites in Discovery Bay Coordination Area.

Action ES.6.2.4: USFWS performs control trapping at sites in Dungeness Bay Coordination Area.

Performance Measures:
PM ES.6.2A: Collection of Minimum Standard or higher green crab and bycatch data resulting from trapping efforts.

Objective ES.10: Outreach and education related to green crab.

Strategy ES.10.1: Perform outreach to local communities and organizations.

Action ES.10.1.1: Jamestown S'Klallam Tribe performs outreach efforts focused on tribal fishers, the Audubon Society, Dungeness River Management Teams, and other local communities and organizations.

Action ES.10.1.2: Jamestown S'Klallam Tribe provides updates to Jefferson and Clallam County Marine Resource Commissions.

Action ES.10.1.3: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Action ES.10.1.4: USFWS performs outreach efforts focused on local communities and organizations.

Performance Measures:
PM ES.10.1A: Maintain record of outreach efforts.

Objective ES.11: Research related to green crab.

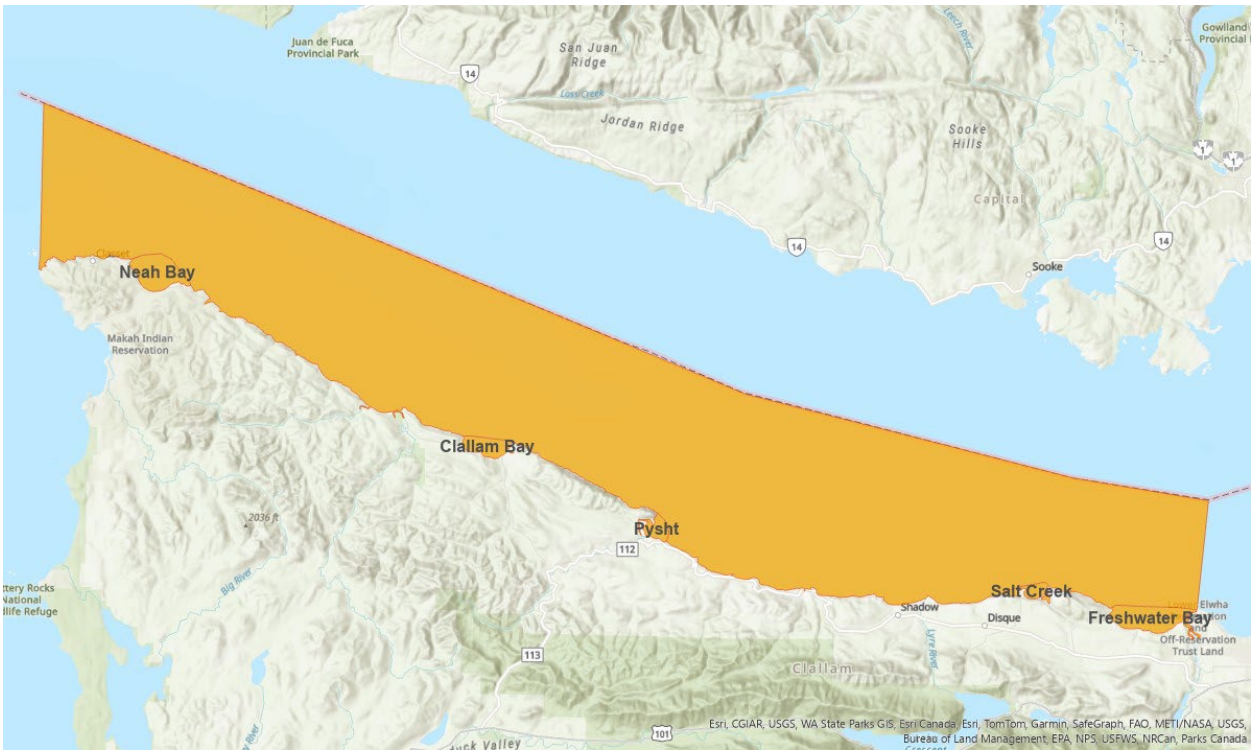
Strategy ES.11.1: Assess local green crab populations.

Action ES.11.1.1: Jamestown S'Klallam Tribe conducts mark-recapture study to assess green crab movement and perform a population estimate in Dungeness National Wildlife Refuge or in Discovery Bay if capacity allows.

Performance Measures:
PM ES.11.1A: Dissemination of study results.

Western Strait

Figure 12 Map of Western Strait Management Area.



Western Strait is split into five Coordination Areas (Neah Bay, Pysht, Salt Creek, and Freshwater Bay).

The Western Strait Management Area consists of the Washington coastline and waters of the Salish Sea from Angeles Point west to Cape Flattery. Western Strait Management Area is home to the Lower Elwha Klallam Tribe and the Makah Tribe and borders Canada in the Strait of Juan de Fuca. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, Western Strait Management Area contains tribal U&As, of the Makah, Lower Elwha Klallam, Jamestown S'Klallam, and Port Townsend S'Klallam Tribes, the eastern extent of the Olympic Coast National Marine Sanctuary, restoration sites, and other sites of cultural and ecological importance. Tribal and recreational shellfish fisheries are also active in the region.

Green crab were first detected in the Western Strait Management Area in 2023 by the Makah Tribe in Neah Bay Coordination Area, with detections by the Lower Elwha Klallam Tribe in Freshwater Bay that same year. Thus far, green crab have only been detected in Neah Bay and Freshwater Bay Coordination Areas.

Western Strait Management Area a high priority for green crab management. Assessments at the locations of recent detections are necessary to determine the status of these populations and what further actions are appropriate. In addition, monitoring efforts are ongoing to detect potential new populations and monitor long-term trends in the region.

Objective WS.1: Early detection of green crab in new geographic areas.

Strategy WS.1.1: Perform early detection trapping.

Action WS.1.1.1: Makah Tribe performs monitoring trapping at sites in Neah Bay Coordination Area and other locations in Western Strait MA as feasible.

Action WS.1.1.2: Makah Tribe collaborates with Northwest Indian Fisheries Commission in the collection and analysis of samples for green crab eDNA testing.

Performance Measures:
PM WS.1.1A: Dissemination of results by Makah Tribe.

Action WS.1.2.1: WDFW performs early detection monitoring trapping in Clallam Bay, Pysht, and Freshwater Bay Coordination Areas.

Performance Measures:
PM WS.1.2A: Collection of highest standard green crab data resulting from trapping efforts.

Objective WS.3: Support and assist with management activities.

Strategy WS.3.1: Support and assist with management activities.

Action WS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action WS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM WS.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM WS.3.1B: Documentation of support activities.

Objective WS.4: Assess green crab distribution and abundance.

Strategy WS.4.1: Perform assessment trapping.

Action WS.4.1.1: Makah Tribe performs assessment trapping at sites in Neah Bay Coordination Area.

Action WS.4.1.2: Lower Elwha Klallam Tribe performs assessment trapping at sites in Freshwater Bay Coordination Area.

Action WS.4.1.3: Lower Elwha Klallam Tribe performs assessment trapping at sites in Pysht Coordination Area.

Action WS.4.1.4: WDFW performs assessment trapping at sites in Salt Creek Coordination Area.

Performance Measures:
PM WS.4.1A: Collection of medium standard or higher green crab data resulting from trapping efforts.

Objective WS.5: Long-term monitoring of green crab and other species.

Strategy WS.5.1: Perform long-term monitoring at WSG crab team sites.

Action WS.5.1.1: Lower Elwha Klallam Tribe performs long-term monitoring using WSG monitoring protocols in the Pysht Coordination Area.

Performance Measures:
PM WS.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective WS.6: Reduce local green crab abundance.

Strategy WS.6.1: Perform control trapping.

Action WS.6.1.1: Makah Tribe performs control trapping at sites in Neah Bay Coordination Area.

Performance Measures:
PM WS.6.1A: Collection of Minimum Standard or higher green crab data resulting from trapping efforts.

Objective WS.10: Outreach and education related to green crab.

Strategy WS.10.1: Perform outreach to local communities and organizations.

Action WS.10.1.1: Makah Tribe performs outreach efforts focused on local communities and organizations.

Action WS.10.1.2: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Performance Measures:
PM WS.10.1A: Maintain record of outreach efforts.

Objective WS.11: Research related to green crab.

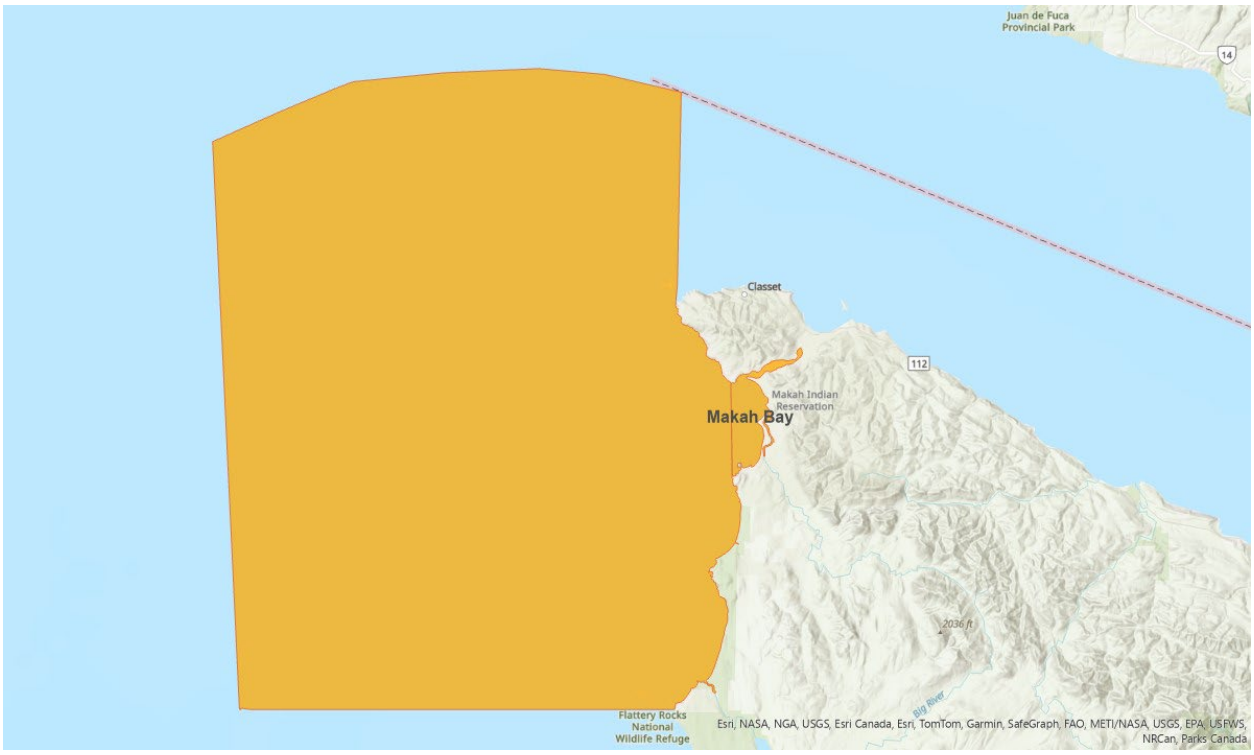
Strategy WS.11.1: Assess green crab eDNA detection tools.

Action WS.11.1.1: Lower Elwha Klallam Tribe assists USGS WFRC in the collection of samples for green crab eDNA testing.

Performance Measures:
PM WS.11.1A: Dissemination of results by USGS WFRC.

North Coast

Figure 13 Map of North Coast Management Area.



North Coast consists of the Makah Bay Coordination Area.

The North Coast Management Area consists of the Washington coastline and subtidal waters from Cape Flattery south to Cape Alava and is bounded by the Canadian border to the north. North Coast Management Area is home to the Makah Tribe and includes the Makah Reservation, northern extent of the Ozette (Makah) Reservation, and the northwestern portion of the Makah Tribe's U&A. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, North Coast Management Area contains waters of the Olympic Coast National Marine Sanctuary, coastal shorelines of the Olympic National Park and Washington Islands National Wildlife Refuges, and other sites of cultural and ecological importance. Makah Tribe shellfish fisheries are also active in the region.

Green crab were first detected in the North Coast Management Area in 2017 by the Makah Tribe in Makah Bay Coordination Area. Green crab management efforts have continued at varying intensities since, and from 2022-2023 ~34,000 green crab were removed.

North Coast Management Area is a high priority for green crab management. Control trapping efforts are ongoing alongside long-term monitoring efforts to fully evaluate the impacts of trapping efforts on local green crab populations and early detection efforts focused on finding potential new sites.

Objective NC.1: Green crab early detection monitoring.

Strategy NC.1.1: Perform early detection monitoring.

Action NC.1.1.1: Makah Tribe collaborates with Northwest Indian Fisheries Commission in the collection and analysis of samples for green crab eDNA testing.

Performance Measures:
PM NC.1.1A: Dissemination of results by Makah Tribe.

Action NC.1.2.1: Makah Tribe performs early detection monitoring trapping sites in Makah Bay Coordination Area and other locations in North Coast Management Area as feasible.

Performance Measures:
PM NC.2.1A: Collection of highest standard green crab data resulting from trapping efforts.

Objective NC.3: Support and assist with management activities.

Strategy NC.3.1: Support and assist with management activities.

Action NC.3.1.1: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM NC.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM NC.3.1B: Documentation of support activities.

Objective NC.4: Assess green crab distribution and abundance.

Strategy NC.4.1: Perform assessment trapping.

Action NC.4.1.1: Makah Tribe performs assessment trapping at sites in Makah Bay Coordination Area.

Performance Measures:
PM NC.4.1A: Collection of medium standard or higher green crab data resulting from trapping efforts.

Objective NC.5: Long-term monitoring of green crab and other species.

Strategy NC.5.1: Perform long-term monitoring.

Action NC.5.1.1: Makah Tribe will conduct long-term monitoring in the Makah Bay Coordination Area.

Action NC.5.1.2: Makah Tribe will facilitate long-term monitoring at WSG Sentinel Sites using WSG monitoring protocols in the Makah Bay Coordination Area.

Performance Measures:
PM NC.5.1A: Collection of highest standard green crab data resulting from trapping efforts.

Objective NC.6: Reduce local green crab abundance.

Strategy NC.6.1: Perform control trapping.

Action NC.6.1.1: Makah Tribe performs control trapping at sites in Makah Bay Coordination Area.

Performance Measures:
PM NC.6.1A: Collection of Minimum Standard or higher green crab resulting from trapping efforts.

Objective NC.10: Outreach and education related to green crab.

Strategy NC.10.1: Perform outreach to local communities and organizations.

Action NC.10.1.1: Makah Tribe performs outreach efforts focused on local communities and organizations.

Performance Measures:
PM NC.10.1A: Maintain record of outreach efforts.

Objective NC.11: Research related to green crab.

Strategy NC.11.1: Assess local green crab populations.

Action NC.11.1.1: Makah Tribe conducts mark-recapture study to assess green crab movement and perform population estimates.

Performance Measures:
PM NC.11.1A: Dissemination of study results.

Action NC.11.1.2: Makah Tribe assesses daily water quality metrics (e.g., salinity, temperature) and green crab abundance relationships.

Performance Measures:
PM NC.11.1.2A: Dissemination of study results.

Action NC.11.1.3: Makah Tribe uses benthic collectors and other tools to detect juvenile settlement in Makah Bay Coordination Area.

Performance Measures:
PM NC.11.1.3A: Dissemination of study results.

Strategy NC.11.2: Assess green crab impacts.

Action NC.11.2.1: Makah Tribe assess impacts of green crab on species and habitats of concern.

Performance Measures:
PM NC.11.2A: Dissemination of study results.

Strategy NC.11.3: Assess green crab role in food web.

Action NC.11.3.1: Makah Tribe conducts diet studies of North American river otter to assess predation on green crab.

Action NC.11.3.2: Makah Tribe performs calorimetry study to determine value of green crab as prey in the local ecosystem.

Performance Measures:
PM NC.11.3A: Dissemination of results by Makah Tribe.

Strategy NC.11.4: Trap efficiency trials.

Action NC.11.4.1: Makah Tribe assess trap efficiency using underwater cameras.

Action NC.11.4.2: Makah Tribe tests new bait types/attractants for improving trapping efficiency.

Performance Measures:
PM NC.11.4A: Dissemination of results by Makah Tribe.

North Central Coast

Figure 14 Map of North Central Coast Management Area.

North Central Coast is split into four Coordination Areas (NCC – Subtidal, La Push, Hoh, and Queets).

The North Central Coast MA consists of the Washington coastline and subtidal waters from Cape Alava south to Queets River. The North Central Coast MA is home to the Quileute Tribe, the Hoh Tribe, and the Quinault Indian Nation and includes the southern portion of the Ozette (Makah) Reservation. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, North Central Coast MA contains tribal usual and accustomed areas (U&As) of all four coastal treaty tribes, marine protected areas, restoration sites, a National Marine Sanctuary, a National Park, and other sites of cultural and ecological importance. Tribal and recreational shellfish fisheries are also active in the region.

Green crab were first detected in the North Central Coast MA in 2023 (two molts, one dead, one alive).Trapping by the Makah Tribe in 2024 in the rocky intertidal areas at Cape Alava (Olympic National Park) suggest an established population. Monitoring efforts should continue and expand in the region especially in the pocket estuaries of river mouths and adjacent rocky intertidal habitats.

Objective NCC.1: Early detection of green crab in new geographic areas.

Strategy NCC.1.1: Perform early detection trapping.

Action NCC.1.1.1: WDFW performs early detection monitoring.

Performance Measures:
PM NCC.1.1A: Collection of highest standard green crab data resulting from trapping efforts.

Objective NCC.3: Support and assist with management activities.

Strategy NCC.3.1: Support and assist with management activities.

Action NCC.3.1.1: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM NCC.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM NCC.3.1B: Documentation of support activities.

Objective NCC.4: Assess green crab distribution and abundance.

Strategy NCC.4.1: Perform assessment trapping.

Action NCC.4.1.1: Makah Tribe performs assessment trapping on the Ozette (Makah) Reservation and adjacent rocky intertidal as feasible.

Performance Measures:
PM NCC.4.1A: Collection of medium standard or higher green crab data resulting from trapping efforts.

Objective NCC.5: Long-term monitoring of green crab and other species.

Strategy NCC.5.1: Perform long-term monitoring trapping (non-WSG sites).

Action NCC.5.1.1: Quinault Indian Nation intends to increase the frequency of monitoring of the Queets River mouth and areas north of Beach Trail #3. as personnel time and funding allow.

Performance Measures:
PM NCC.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

South Central Coast

Figure 15 Map of South Central Coast Management Area.

South Central Coast is split into four Coordination Areas (SCC-Subtidal. Moclips, Pacific Beach, and Copalis).

The South Central Coast Management Area consists of the Washington coastline and subtidal waters from Queets River south to the northern end of Long Beach Peninsula. South Central Coast Management Area is home to the Quinault Indian Nation. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, South Central Coast Management Area contains tribal usual and accustomed areas (U&As) and other sites of cultural and ecological importance. Tribal and state recreational and commercial shellfish fisheries are also active in the region.

Green crab were first detected in South Central Coast Management Area by WDFW. Catch numbers have remain very low, with ~40 crabs removed from 2022-2024. However, trapping activity within this region has historically been minimal.

While South Central Coast Management Area been a relatively low priority for green crab management, monitoring should continue and expand in the region.

Objective SCC.1: Early detection of green crab in new geographic areas.

Strategy SCC.1.1: Perform early detection trapping.

Action SSC.1.1.1: Quinault Indian Nation performs early detection monitoring trapping along the South Central Coast MA.

Action SCC.1.1.2: WDFW performs early detection monitoring.

Performance Measures:
PM SCC.1.1A: Collection of highest standard green crab data resulting from trapping efforts.

Objective SCC.3: Support and assist with management activities.

Strategy SCC.3.1: Support and assist with management activities.

Action SCC.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action SCC.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM SCC.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM SCC.3.1B: Documentation of support activities.

Objective SCC.4: Assess green crab distribution and abundance.

Strategy SCC.4.1: Perform assessment trapping.

Action SCC.4.1.1: Quinault Indian Nation performs assessment trapping at sites along the South Central Coast MA.

Action SCC.4.1.2: WDFW performs assessment trapping.

Performance Measures:
PM SCC.4.1A: Collection of medium standard or higher green crab data resulting from trapping efforts.

Objective SCC.5: Long-term monitoring of green crab and other species.

Strategy SCC.5.1: Perform long-term monitoring at WSG crab team sites.

Action SCC.5.1.1: Quinault Indian Nation facilitates long-term monitoring using WSG monitoring protocols at sites along the South Central Coast MA.

Performance Measures:
PM SCC.5.1A: Collection of highest standard green crab data resulting from trapping efforts.

Strategy SCC.5.2: Perform long-term monitoring trapping (non-WSG sites).

Action SCC.5.2.1: Quinault Indian Nation increases frequency of monitoring of the pocket estuaries of the mouths of coastal streams and rivers from the Queets River south to Point Chehalis. as personnel, time, and funding allow.

Action SCC.5.2.2: WDFW performs long-term monitoring trapping at sites in Copalis and potentially additional Coordination Areas.

Performance Measures:
PM SCC.5.2A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective SCC.6: Reduce local green crab abundance.

Strategy SCC.6.1: Perform control trapping.

Action SCC.6.1.1: Quinault Indian Nation performs control trapping at sites along the South Central Coast MA where green crab were encountered during monitoring.

Performance Measures:
PM SCC.6.1A: Collection of Minimum Standard or higher green crab data resulting from trapping efforts.

Objective SCC.10: Outreach and education related to green crab.

Strategy SCC.10.1: Perform outreach to local communities and organizations.

Action SCC.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Action SCC.10.1.2: Quinault Indian Nation performs outreach efforts focused on local communities, schools, and organizations.

Performance Measures:
PM SCC.10.1A: Maintain record of outreach efforts.

Objective SCC.11: Research related to green crab.

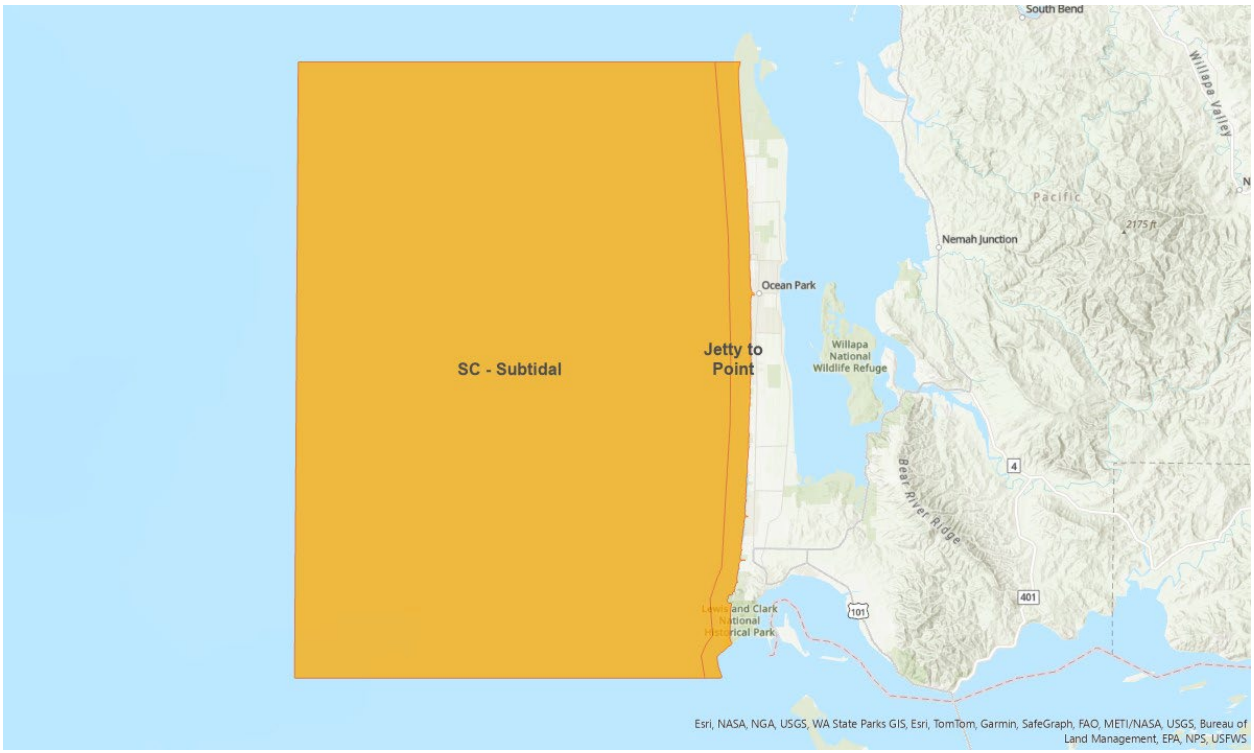
Strategy SCC.11.1: Collect requested data during trapping and monitoring efforts for research groups.

Action SCC.11.1.1: Quinault Indian Nation coordinates with the European Green Crab Research Task Force and other research entities regarding data needs.

Performance Measures:
PM SCC.11.1A: Collection of Highest Standard of green crab data resulting from trapping efforts and other requested data for ongoing and future research.

South Coast

Figure 16 Map of South Coast Management Area.



South Coast is split into two Coordination Areas (SC-Subtidal and Jetty to Point).

The South Coast Management Area begins at the southwestern tip of Cape Disappointment and expands northward to the mouth of Willapa Bay, incorporating the western coastline of Long Beach Peninsula. South Coast is primarily utilized for recreational activities, including razor clam harvest which could be impacted by the presence of green crab.

There are no recorded detections of green crab of any status (alive, dead, or molts) or any life stage (larvae, megalopa, juvenile, or adult) in the South Coast Management Area. Historically South Coast Management Area was dismissed as unnecessary to include in green crab early detection trapping or other management actions due to its lack of quality green crab habitat. The majority of the South Coast Management Area is sandy shoreline, except for the rocky shoreline at the southern end around North Head, which is subject to high wave action. However, recent detections of green crab in outer coast sub-optimal habitats in Oregon suggest further consideration of South Coast as green crab habitat may be warranted.

While South Coast Management Area is currently a low priority regarding green crab management, it cannot be ignored entirely. This Management Area should be assessed for the presence of potential sub-optimal green crab habitat. If potential habitat is discovered, potential assessment trapping should be considered.

Objective SC.8: Determine the extent of potential green crab habitat.

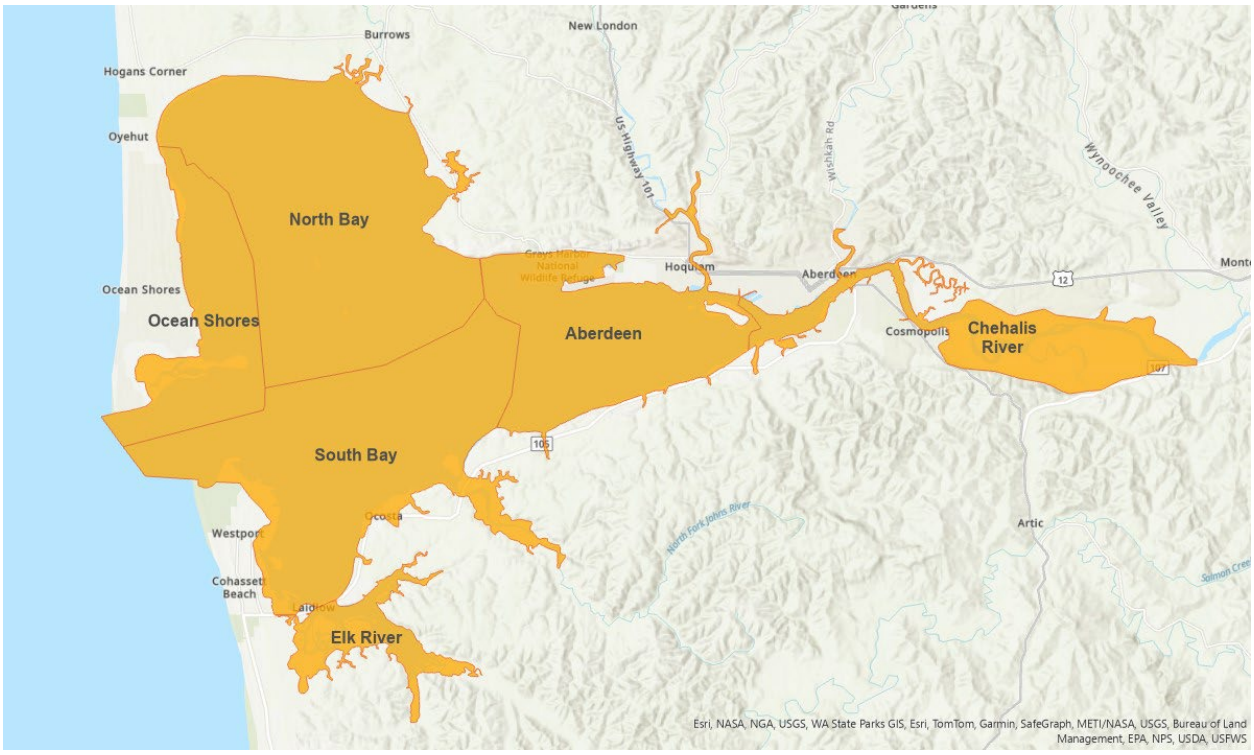
Strategy SC.8.1: Identify potential habitat.

Action SC.8.1.1: WDFW AIS unit staff utilizes satellite imagery and regional expertise to identify the general location of potential green crab habitat.

Performance Measures:
PM SC.8.1A: WDFW report on SC green crab habitat analysis.

Grays Harbor

Figure 17 Map of Grays Harbor Management Area.



Grays Harbor is split into six Coordination Areas (Ocean Shores, North Bay, South Bay, Elk River, Aberdeen, and Chehalis River).

The Grays Harbor Management Area consists of the waters and shoreline of Grays Harbor and up the Chehalis River. Grays Harbor Management Area is home to the Quinault Indian Nation. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, Grays Harbor Management Area contains sites of cultural and ecological importance. Commercial, tribal, and recreational shellfish fisheries are also active in the region.

Specimens of green crab were first discovered in the Grays Harbor Management Area in 1998 (Carlton and Cohen 2003) and, along with Willapa Bay Management Area, contains the longest established green crab populations in Washington. From 2022-2023, ~110,00 green crab have been removed. The effort of the co-managers, tribes, and partners in the Grays Harbor Management Area cannot be understated.

Grays Harbor Management Area remains one of the highest priority locations for green crab management. Control trapping efforts must be maintained and expanded, alongside long-term monitoring efforts to fully evaluate the impacts of trapping efforts on local green crab populations.

Objective GH.3: Support and assist with management activities.

Strategy GH.3.1: Support and assist with management activities.

Action GH.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action GH.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM GH.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM GH.3.1B: Documentation of support activities.

Objective GH.4: Assess green crab distribution and abundance.

Strategy GH.4.1: Perform assessment trapping.

Action GH.4.1.1: DNR performs assessment trapping at sites within DNR Natural Area Preserves, Natural Resource Conservation Areas, and Acidification Nearshore Monitoring Network eelgrass sites.

Action GH.4.1.2: GHCD performs assessment trapping.

Action GH.4.1.3: Quinault Indian Nation performs assessment trapping in and around the Ocean Shores Marina and other harbor locations in coordination with other partners operating in the harbor.

Action GH.4.1.4: WDFW performs assessment trapping in South Bay and Ocean Shores Coordination Area.

Performance Measures:
PM GH.4.1A: Collection of medium standard or higher green crab and bycatch data resulting from trapping efforts.

Strategy GH.4.2: Expand local trapping capacity.

Action GH.4.2.1: GHCD acquires resources to obtain larger boat and seasonal technician to increase in-house capacity.

Action GH.4.2.2: GHCD locates, recruits, trains, and supports new entities, groups, and individuals to become in involved with green crab tapping efforts.

Action GH.4.2.3: Quinault Indian Nation actively seeks funding sources to expand their workforce and trapping efforts within the harbor. In addition, Quinault will make available their research vessel for boat trapping efforts as well as shore operations.

Action GH.4.2.4: Quinault Indian Nation continues training and utilizing Taholah High School Students to assist in trapping efforts and to prepare them for future employment in the workforce.

Performance Measures:
PM GH.4.2A: Collection of medium standard or higher green crab and bycatch data resulting from trapping efforts.

PM GH.4.2B: Acquisition of necessary resources.

Objective GH.5: Long-term monitoring of green crab and other species.

Strategy GH.5.1: Perform long-term monitoring at WSG crab team sites.

Action GH.5.1.1: Local volunteers perform long-term monitoring using WSG monitoring protocols at monitoring sites.

Performance Measures:
PM GH.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Strategy GH.5.2: Perform long-term monitoring trapping (non-WSG sites)

Action GH.5.2.1: DNR performs quarterly monitoring tapping at Grays Harbor National Wildlife Refuge.

Action GH.5.2.2: WDFW performs long-term monitoring trapping in Long Beach North, Long Beach South, South Willapa, and Shoalwater Coordination Areas.

Performance Measures:
PM GH.5.2A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Strategy GH.5.3 Perform long-term research monitoring trapping.

Action GH 5.3.1: Quinault Indian Nation performs long-term monitoring trapping at sites.

Performance Measures:

PM GH.5.3A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective GH.6: Reduce local green crab abundance.

Strategy GH.6.1: Identify green crab hotspots.

Action GH.6.1.1: GHCD identifies hotspots of green crab abundance to target for control trapping.

Performance Measures:
PM NPS.6.1A: Maintain records of green crab hotspots for internal use.

Strategy GH.6.2: Perform control trapping.

Action GH.6.2.1: DNR performs control trapping at sites within DNR Natural Area Preserves, Natural Resource Conservation Areas, and public land and assists local partners with emphasis response efforts.

Action GH.6.2.2: GHCD performs control trapping at identified green crab hotspots as capacity allows.

Action GH.6.2.3: GHCD provides support for other entities conducting control trapping in the Grays Harbor Management Area.

Action GH.6.2.4: Quinault Indian Nation performs control trapping and assist other trapping entities (as capacity allows).

Action GH.6.2.5: WGHOGA members perform control trapping at sites throughout the Grays Harbor Management Area, with prioritization for high-value resource areas (e.g., shellfish beds, seed areas).

Performance Measures:
PM GH.6.2A: Collection of Minimum Standard or higher green crab and bycatch data resulting from trapping efforts.

Strategy GH.6.3: Expand local trapping capacity.

Action GH.6.3.1: Quinault Indian Nation seeks funding and resources to expand monitoring and control efforts in the harbor.

Action GH.6.3.2: Quinault Indian Nation continues with training and utilizing Taholah High School Students to assist in trapping efforts and to prepare them for future employment in the workforce.

Action GH.6.3.3: Quinault Department of Fisheries and the Taholah High School explores working with the Coastal Interpretive Center in Ocean Shores to help educate the general public and to recruit local help in their green crab trapping efforts.

Performance Measures:
PM GH.6.3A: Acquires resources obtained to expand trapping capacity.

PM GH.6.3B: Completion of training for Taholah High School students. Students deploy, manage, and report catch of their own green crab traps at various locations within the harbor.

PM GH.6.3C: Increased trapping effort from locals and public.

Objective GH.10: Outreach and education related to green crab.

Strategy GH.10.1: Conduct outreach and education events.

Action GH.10.1.1: DNR conducts outreach and education events including taking students into the field as capacity allows.

Action GH.10.1.2: GHCD conducts outreach and education events including volunteer trainings and outreach booths.

Action GH.10.1.3: Quinault Indian Nation conducts outreach and education events.

Action GH.10.1.4: USFWS performs outreach efforts focused on local communities and organizations. In addition, Grays Harbor National Wildlife Refuge features exhibitors and agencies at the annual Grays Harbor Shorebird and Nature Festival, dedicated to educating the public about green crab.

Performance Measures:
PM GH.10.1A: Documentation of events and attendance.

Strategy GH.10.2: Perform outreach to local communities and organizations.

Action GH.10.2.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Performance Measures:
PM GH.10.2A: Maintain record of outreach efforts.

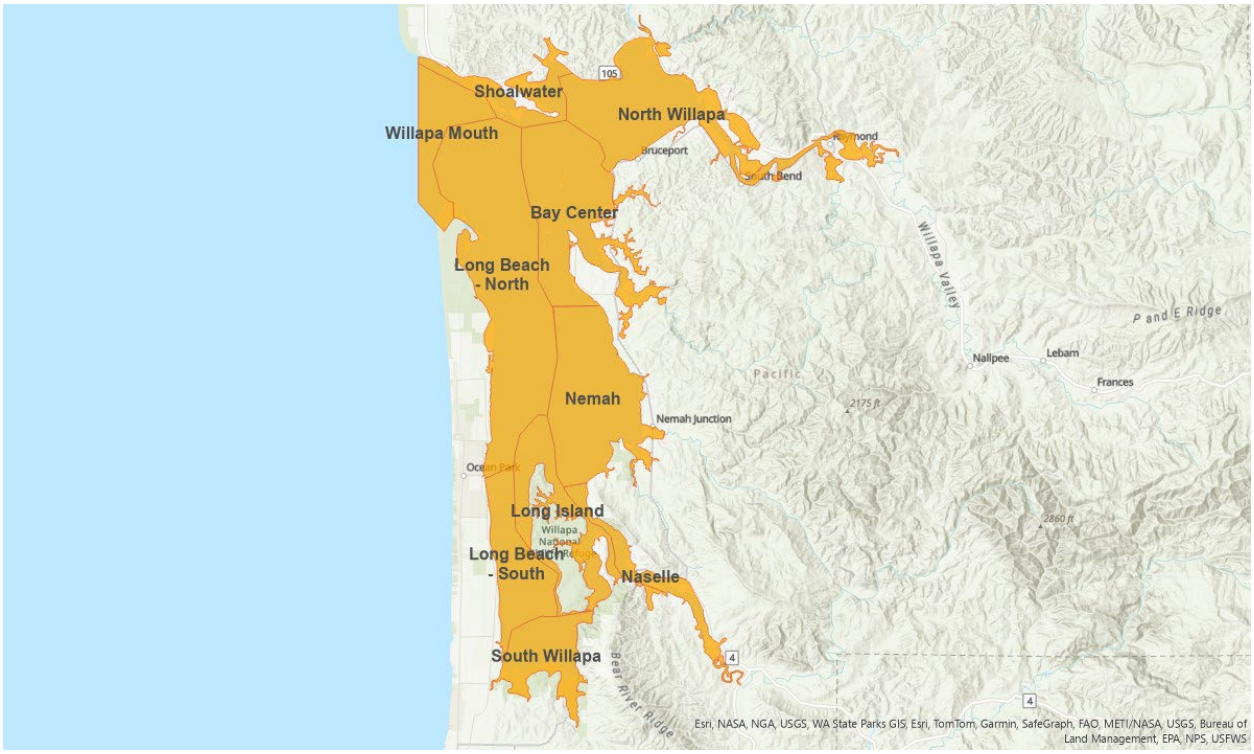
Strategy GH.10.3: Development of outreach materials.

Action GH.10.3.1: GHCD develops outreach materials including pamphlets with basic information, ID cards, Facebook posts, and stickers.

Performance Measures:
PM GH.10.3A: Documentation of distribution of outreach materials (e.g., number of materials distributed).

Willapa Bay

Figure 18 Map of Willapa Bay Management Area.



Willapa Bay is split into 10 Coordination Areas (Willapa Mouth, Shoalwater, North Willapa, Bay Center, Long Beach – North, Long Beach – South, Nemah, Long Island, Naselle, and South Willapa).

The Willapa Bay Management Area consists of the waters and shoreline of Willapa Bay and up the Willapa River. Willapa Bay Management Area is home to the Shoalwater Bay Indian Tribe. Coordination and collaboration between tribal, state, and federal governments are essential for effective management in the region. In addition, Willapa Bay Management Area contains sites of cultural and ecological importance. Commercial, tribal, and recreational shellfish fisheries are also active in the region.

Specimens of green crab were first discovered in the Willapa Bay Management Area in 1998 (Carlton and Cohen 2003) and, along with Grays Harbor Management Area, contains the longest established green crab populations in Washington. From 2022-2023, ~410,00 green crab have been removed. The effort of the co-managers, tribes, and partners in Willapa Bay Management Area cannot be understated.

Willapa Bay Management Area remains one of the highest priority locations for green crab management. Control trapping efforts must be maintained and expanded, alongside long-term monitoring efforts to fully evaluate the impacts of trapping efforts on local green crab populations. Furthermore, monitoring and assessment of under sampled locations within the region should occur.

Objective WB.3: Support and assist with management activities.

Strategy WB.3.1: Support and assist with management activities.

Action WB.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action WB.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM WB.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM WB.3.1B: Documentation of support activities.

Objective WB.4: Assess green crab distribution and abundance.

Strategy WB.4.1: Perform assessment trapping.

Action WB.4.1.1: DNR performs assessment trapping at sites within DNR Natural Area Preserves, Natural Resource Conservation Areas, and Acidification Nearshore Monitoring Network eelgrass sites.

Action WB.4.1.2: Shoalwater Bay Indian Tribe performs assessment trapping in southern properties to assess green crab presence.

Action WB.4.1.3: USFWS performs assessment trapping in South Willapa and Long Island Coordination Areas opportunistically based on capacity.

Action WB.4.1.4: WDFW performs assessment trapping in Long Beach North, Long Beach South, South Willapa, and Shoalwater Coordination Areas as capacity allows.

Performance Measures:
PM WB.4.1.1A: Collection of medium standard or higher green crab and bycatch data resulting from assessment trapping efforts.

Strategy WB.4.2: Expand local trapping capacity.

Action WB.4.2.1: PCISM/PCD facilitates expansion of assessment trapping capabilities for Willapa Bay Management Area, with particular emphasis in South Willapa Coordination Area.

Action WB.4.2.2: USFWS acquires additional resources to expand trapping capacity (e.g., staff, equipment).

Performance Measures:
PM WB.4.2A: Trapping capacity expanded.

Objective WB.5: Long-term monitoring of green crab and other species.

Strategy WB.5.1: Participating co-managers, tribes, and partners to perform long-term monitoring at WSG crab team sites.

Action WB.5.1.1: Local volunteers perform long-term monitoring using WSG monitoring protocols at monitoring sites.

Performance Measures:
PM WB.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Strategy WB.5.2: Perform long-term monitoring trapping (non-WSG sites).

Action WB.5.2.1: WDFW performs long-term monitoring trapping in Long Beach North, Long Beach South, South Willapa, and Shoalwater Coordination Areas.

Performance Measures:
PM WB.5.2A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective WB.6: Reduce local green crab abundance.

Strategy WB.6.1: Perform control trapping.

Action WB.6.1.1: DNR performs control trapping at sites within DNR Natural Area Preserves and Natural Resource Conservation Areas and assists local partners with emphasis response efforts.

Action WB.6.1.2: PCISM performs control trapping at sites within North Willapa Coordination Area(see 6.3.1.).

Action WB.6.1.3: Shoalwater Bay Indian Tribe performs control trapping at sites within Shoalwater (Tokeland) Coordination Area.

Action WB.6.1.4: WGHOGA members perform control trapping at sites throughout the Willapa Bay Management Area, with prioritization for high-value resource areas (e.g., shellfish beds, seed areas).

Action WB.6.1.5: USFWS performs control trapping at Leadbetter Point in Long Beach - North, South Willapa, and Long Island Coordination Area.

Performance Measures:
PM WB.6.1A: Collection of Minimum Standard or higher green crab and bycatch data resulting from trapping efforts.

Strategy WB.6.2: Expand local control trapping.

Action WB.6.2.1: PCISM/PCD secures adequate funding and provides support for control trapping by PCVM in North Willapa Coordination Area.

Action WB.6.2.2: PCISM/PCD facilitates he expansion of control trapping capabilities for Willapa Bay Management Area.

Action WB.6.2.3: Shoalwater Bay Indian Tribe acquires resources (e.g., dedicated staff, fuel storage) to conduct more winter trapping efforts.

Performance Measures:
PM WB.6.2A: Resources acquired.

PM WB.6.2B: Trapping capacity expanded.

PM WB.6.2C: Trapping season expanded into winter months.

Objective WB.9: Sustainable disposal of collected green crab and fish waste.

STRATEGY WB.9.1: Green crab composting.

Action WB.9.1.1: Shoalwater Bay Indian Tribe expands composting program for utilization of collected green crab.

Performance Measures:
PM WB.9.1A: Expanded capacity for use of green crab as fertilizer.

Strategy WB.9.1: Process green crab into fertilizer.

Action WB.9.2.1: WDFW collects green crab and other organic materials approved for this disposal method from participating co-managers, tribes, and partners and delivers to Tidal Grow AgriScience for processing into fertilizer. While processing occurs in the Willapa Bay Management Area, green crab are collected from various Management Areas.

Performance Measures:
PM WB.9.2A: Track deliveries and volume of crabs processed.

Objective WB.10: Outreach and education related to green crab.

Strategy WB.10.1: Perform outreach to local communities and organizations.

Action WB.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Action WB.10.1.2: Shoalwater Bay Indian Tribe performs outreach efforts focused on local communities and organizations, including signage and taking tribal youth out into the field.

Action WB.10.1.3: USFWS performs outreach efforts focused on local communities and organizations, including Facebook posts, molt searches, an information table at the Columbia-Pacific Farmers' Market, brochures, and maintaining green crab information on their website.

Action WB.10.1.4: WSU Extension conducts outreach and education events including molt search events and trainings.

Performance Measures:
PM WB.10.1A: Maintain record of outreach efforts.

Objective WB.11: Research related to green crab.

Strategy WB.11.1: Assess local green crab populations.

Action WB.11.1.1: Shoalwater Bay Indian Tribe conducts mark-recapture study to assess green crab movement.

Action WB.11.1.2: Shoalwater Bay Indian Tribe assesses weekly water quality metrics (e.g., salinity, temperature) and green crab abundance relationships.

Performance Measures:
PM WB.11.1A: Dissemination of study results.

Strategy WB.11.2: Assess trap designs and efficiencies.

Action WB.11.2.1: Shoalwater Bay Indian Tribe examines green crab behavior near and in traps using cameras.

Action WB.11.2.2: WSU Extension assess efficacy of new and traditional trap designs.

Performance Measures:
PM WB.11.2A: Dissemination of trapping results.

Strategy WB.11.3: Development and refinement of early detection methods.

Action WB.11.3.1: WSU Extension refines and expands green crab Molt Search Program.

Performance Measures:
PM WB.11.3A: Dissemination of molt search results.

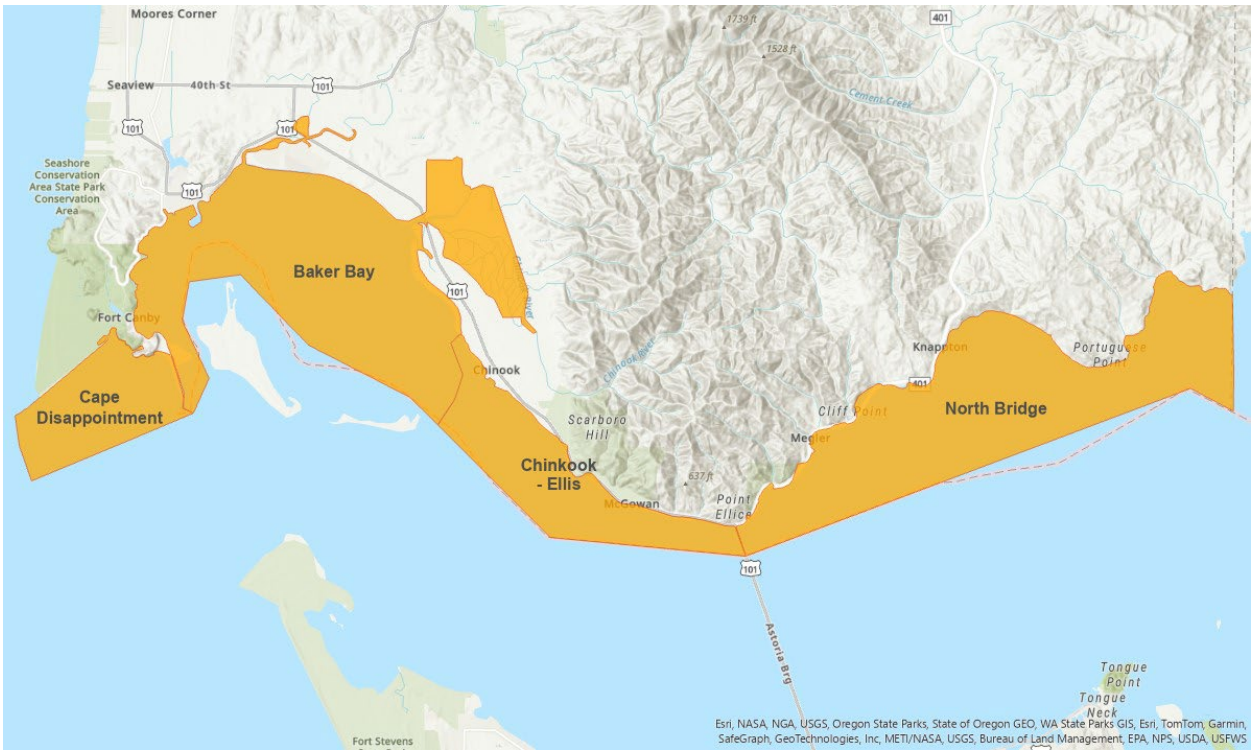
Strategy WB.11.4: Assess green crab impacts.

Action WB.11.4.1: WSU Extension assess impacts of green crab on species and habitats of concern.

Performance Measures:
PM WB.11.4A: Dissemination of study results.

Columbia River

Figure 19 Map of Columbia River Management Area.



Columbia River is split into four Coordination Areas (Cape Disappointment, Baker Bay, Chinook-Ellis, and North Bridge).

The Columbia River Management Area consists of the northern coastline of the Columbia River, starting inland at Rocky Point and expanding westward to the southwestern tip of Cape Disappointment. Due to the high freshwater influx from upriver and tidal influence, the Columbia River experiences highly dynamic salinity conditions, changing from freshwater to marine conditions from east to west and fluctuating daily as the result of the mixed semidiurnal tides of the Pacific Coast. Baker Bay, at the western end of Columbia River, is home to active sport and commercial fishing activities, including Dungeness crab and could be impacted by the presence of green crab.

Green crab were first detected in the Columbia River Management Area in 2022 as part of monitoring efforts by WDFW, which began in 2021. Catch numbers have historically been low, with very few green crab removed as of November 2024. However, trapping efforts have been significantly lower in the Columbia River compared with nearby Management Areas (e.g., Willapa Bay, Grays Harbor).

While the Columbia River Management Area is a relatively low priority regarding green crab management, the presence of green crab in this Management Area is concerning. Currently, monitoring and/or assessment trapping is planned at sites where green crab have previously been detected, with additional early detection monitoring trapping around Baker Bay.

Objective CR.1: Early detection of green crab in new geographic areas.

Strategy CR.1.1: Perform early detection trapping.

Action CR.1.1.1: DNR performs Early Detection Monitoring at sites within the Baker Bay Coordination Area.

Action CR.1.1.2: WDFW performs early detection Monitoring at sites in Baker Bay, Cape Disappointment, and potentially additional Coordination Areas.

PM CR.1.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective CR.3: Support and assist with management activities.

Strategy CR.3.1: Support and assist with management activities.

Action CR.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Action CR.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.

Performance Measures:
PM CR.3.1A: Collection of green crab and bycatch data resulting from trapping data.

PM CR.3.1B: Documentation of support activities.

Objective CR.4: Assess green crab distribution and abundance.

Strategy CR.4.1: Perform assessment trapping.

Action CR.4.1.1: WDFW performs assessment trapping at sites in Baker Bay, Cape Disappointment, and potentially additional Coordination Areas.

Performance Measures:
PM CR.4.1A: Collection of medium standard or higher green crab and bycatch data resulting from trapping efforts.

Objective CR.5: Long-term monitoring of green crab and other species.

Strategy CR.5.1: Perform long-term monitoring trapping (non-WSG sites)

Action CR.5.1.1: WDFW performs long-term monitoring trapping at sites in the Baker Bay and Cape Disappointment Coordination Areas.

Performance Measures:
PM CR.5.1A: Collection of highest standard green crab and bycatch data resulting from trapping efforts.

Objective CR.10: Outreach and education related to green crab.

Strategy CR.10.1: Perform outreach to local communities and organizations.

Action CR.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Performance Measures:
PM CR.10.1A: Maintain record of outreach efforts.

Glossary

Aquatic conveyance means transportable personal property having the potential to move an aquatic invasive species from one aquatic environment to another. Aquatic conveyances include but are not limited to vessels and associated equipment, float planes, construction equipment, fish tanker trucks, hydroelectric and irrigation equipment, personal fishing and hunting gear, and materials used for aquatic habitat mitigation or restoration.

Aquatic Invasive Species means an invasive species of the animal kingdom with a life cycle that is at least partly dependent upon fresh, brackish, or marine waters.

Assessment means periodically checking positive detection green crab areas using trapping methods to assess presence, geographic scope, and numerical scale of a population, at a relatively comprehensive scale. Assessment trapping efforts can occur on the scale of a water body or site, depending on the purpose. The timing and implementation of assessment trapping efforts is generally opportunistic.

Bycatch means species other than green crab collected during trapping and other survey methods.

Catch Per Unit Effort (CPUE) is an indirect metric of the abundance of green crab in relation to a defined geographic area and time scale. It is used to indicate the amount of effort undertaken to collect a given number of green crab. For green crab emergency management data consistency purposes, CPUE must be reported and qualified:

- Per 100 traps as calculated to the nearest 0.10 CPUE;
- By aggregate or individual trap type; and
- By cumulative Trap set days or Trap check days over the operational period or other defined time span of interest.
    - Example 1 - 30 crabs caught in 200 shrimp traps and deployed for 1 overnight period then recovered (200 trap set days): 30 ÷ 200 = 0.15 x 100 = 15.0 CPUE.
    - Example 2 - 30 crabs caught in 200 shrimp traps and deployed for 3 overnight periods then recovered (600 trap set days): 30 ÷ 600 = 0.05 x 100 = 5.0 CPUE.

Control means field activities within a given infested area with the intent of reducing that area's green crab population size.

Decontamination means to the extent technically and measurably possible, the application of a treatment to kill, destroy, remove, or otherwise eliminate all known or suspected invasive species carried on or contained within an aquatic conveyance or structural property by use of physical, chemical, or other methods. Decontamination treatments may include drying an aquatic conveyance for a time sufficient to kill aquatic invasive species through desiccation.

Detection means the new discovery of a live, dead, molt or other remains of a green crab specimen as verified by a green crab expert at a specific geographic location. The life stage or remains of green crab

may trigger different management responses at different geographic scales. This includes finds at locations where green crab have not been found for more than three years.

Early detection means field operations in areas that have no prior green crab detections or detections within the past 5 years and with the intent to detect green crab at their earliest point in the invasion process. This includes such activities as trapping and eDNA.

Education/outreach means providing information on potential pathways of human-mediated risk/spread, green crab identification, and green crab reporting to relevant audiences. Examples might include presentations, creating printed collateral/signage, or informal conversations. This category is different from Training in being broader and less targeted in practical applications.

European Green Crab Management Scale means a hierarchy of geographically defined areas from largest to smallest scale. This system is used for consistency in communications, planning, operations, and other Incident Command Structure functions including:

- Regional – this includes states and provinces of Canada along the Pacific coast.
- Statewide – this includes approximately 3,500 miles of coastal area encompassing marine and estuarine habitats where green crab could become established.
- Branch – Statewide operations are divided into Coastal and Salish Sea branches which corresponds to major differences in green crab management strategies due to significant propagule pressures from green crab larvae arriving in Washington State from coastal sources in California, Oregon, and British Columbia.
- Management Area – Branches are further divided into 14 Management Areas based on WDFW's recreational fishing marine areas with 7 Management Areas within the Salish Sea Branch and 7 within the Coastal Branch.
- Coordination Area – Management Areas are further divided into Coordination Areas based on a place name that best describes a sub-Management Area or it may be based on the jurisdictional lead for that area. Delineation of Coordination Areas continues to evolve based on input from local Management Area co-managers and partners.
- Site – Coordination Areas may be further divided into Sites based on a geographic area of connected, similar habitat suitability, or access limitations and where green crab management actions can be expressed as representing the whole geographic area.
- Sub-Site – Sites can be divided into Sub-Sites in more complex situations based on similar habitat or where different operational actions are required.

Emphasis response means planned management actions including assessment, prospecting, or control effort over a given Site or Coordination Area that brings in a significant increase of resources as would be normal for that situation. It is like a rapid response trapping effort except not expedited as a result of a new detection.

Eradication means removal or destruction of an entire population of invasive species.

Established means a population of a green crab where that population is expected to have a sustained presence based on evidence (i.e., three years of capture of multiple age classes and with increasing or relatively stable abundance irrespective of trapping effort intensity).

Functional Eradication means reducing an aquatic invasive species population below levels that cause unacceptable ecological effects.

Geographic Area Classification means the status of green crab at a geographic area of interest (any scale) based on the monitoring and detection history of green crab. The classification is one of the following:

- Status Unknown – No sampling or monitoring for green crab has occurred.
- Undetected/Negative – Sampling or monitoring for green crab has occurred or is ongoing, but nothing has been detected.
- Suspect – Detection of evidence suggesting green crab are likely present in the area (e.g., molt, positive eDNA, larvae) but not confirmation of the presence of post-settlement green crab.
- Positive – Detection of living green crab post-settlement green crab.
- Infested – Population of green crab that is expected to have a sustained presence based on evidence (i.e., three years of capture of multiple age classes and with increasing or relatively stable abundance irrespective of trapping effort intensity).

Habitat structure means the composition and arrangement of material, be it natural or man-made, within a habitat (e.g., vegetation, docks, rocks, and woody debris). Most commonly, elements of three-dimensional (rising off the bottom) and complex (with crevices in which to hide) structure are favorable to green crab survival.

Habitat suitability means the relative ability of a habitat to support green crab. Characteristics that can be used to assess habitat suitability include physical attributes (e.g., exposure to wave energy, depth, and temperature), chemical attributes (e.g., salinity, pH, oxygen), and biotic attributes (e.g., vegetation, available prey, competitors, and predators).

Haphazard means sampling for evidence of green crab presence in a non-systematic manner. No formal trapping or survey approach is utilized.

Hot Spot means an area with a substantially greater relative abundance of green crab than surrounding areas. Hot spots can be defined at the site level (e.g., a creek mouth within a water body) or at the Coordination Area-level (e.g., Lummi Sea Pond) and can be spatially nested, sites of high density within Coordination Areas of high density.

Incident Action Plan is a concise planning document containing set goals and objectives that guide incident safety, logistics, operations, and other incident actions during a set operational period.

Incident Commander refers to the individual responsible for all green crab emergency measures activities, including the development of strategies and tactics and the ordering and release of resources. The Incident Commander has overall authority and responsibility for conducting green crab emergency measures operations.

Localized detection means green crab detection occurred in a Coordination Area or other location (ex., bay, lagoon, estuary, or tidelands) where green crab have not previously been confirmed but is within a Management Area where green crab have been detected. Localized detections are anticipated during the invasion. WDFW will notify relevant agency staff, co-managers, tribes, partners, tideland owners, and other community members. Depending on need, assessment trapping or rapid response may occur to prevent populations becoming established and reduce risk of spread into new Management Areas.

Management means activities including but not limited to planning (identification and inventory, prioritization, establishing action thresholds), monitoring, prevention, early detection, rapid response, eradication, control, restoration, research, and regulatory approaches used to minimize the threat of aquatic invasive species.

Molt Search means surveys utilizing methods developed by Washington State University Extension to locate and identify molts of green crab and native crab species.

Monitoring means a systematic and designed sampling effort for information-gathering purposes that is implemented consistently and on a routine schedule. Monitoring protocols are well defined and are relatively stable to evaluate changes over space and time. The specific purpose and geographic scope of any individual monitoring effort might vary to suit the project but should remain internally consistent.

Operational Period means the interval of time scheduled for execution of a given set of green crab management actions as specified by an Incident Commander. Typically one month in duration.

Prevention means activities that aim to reduce the arrival of green crab, either as larvae or adults, resulting from the transport/transfer of green crab from one location to another – regardless of whether green crab are present at the receiving location.

Propagule means an organism or part of the organism that can grow into new individuals.

Rapid response means expedited management actions based on new detections or the finding of a significantly increased population for the time-sensitive intent of determining scope of green crab invasion and containing or eradicating green crab before it spreads or becomes further established (RCW 77.135.010(20)). Based on the outcome of rapid response actions, subsequent management action types may be implemented.

Research means field, lab, or other scientific actions implemented to investigate an aspect of the green crab invasion and for with the activities do not fall into standard protocols of any of the above management types. Types of research may include improving efficiency/efficacy of priority management actions, increasing biological knowledge, and predicting/assessing green crab or other impacts.

Site means a defined area of connected, similar habitat suitability, or access limitations.

Site Specific Eradication means removal or destruction of an entire population of invasive species from a specified site.

Sub-Site means a specific area within a site where operational actions are taking place.

Training means providing information or instruction on prevention, early detection, rapid response or other green crab emergency management protocols. This category is distinct from Education/outreach in focusing on specific, practical applications.

Trap set days means when a trap is set intertidally or sub-tidally for the action of capturing green crab for a single overnight period. Overnight trap days are standard trapping protocols based on known green crab feeding activity patterns. If a trap is set and retrieved within a single calendar day, count it as a single trap day, but be aware that it may be later counted as a portion of a trap day for comparability with a standard overnight trap day.

- Total set trap days are counted from the day after a trap is set and includes the day the trap is removed. This metric is mostly a qualitative measure of effort during an operational period or season and may be used to estimate a gross level of potential green crab risk/density to help assess if additional support is needed.
    - Example 1 - 50 traps set on Monday, Aug 8, and retrieved Friday, Aug 12: 50 x 4 = 200 trap days.
    - Example 2 - 50 traps set on Monday, Aug 8, and retrieved Sunday, Aug 21: 50 x 13 = 650 trap days.
    - Example 3 - 50 traps set in a prior OP and to be retrieved in a future OP (example OP is 14 days): 50 x 14 =700 trap days.

Trap check days means the number of days within an operational period that a trap is checked for green crab. This metric is mostly a qualitative measure of effort and may be used to estimate a gross level of potential green crab risk/density to help assess if additional support is needed in a given Coordination Area.

- Total trap check days means the cumulative number of traps checked every day the traps are deployed. If traps are checked every day, total trap check days will be the same as total trap days.
    - Example 1 - 50 traps set on Monday, Aug 8, and retrieved Friday, Aug 12, and checked every day: 50 x 4 = 200 trap check days.
    - Example 2 - 50 traps set Monday, Aug 8, and retrieved Sunday, Aug 21, and checked every day: 50 x 13 = 650 trap check days.
    - Example 3 - 50 traps set in a prior OP and to be retrieved in a future OP and checked every day: 50 x 14 = 700 trap check days.

- Example 4 - 50 traps set Monday, Aug 8, and retrieved Friday, Aug 19, and checked every other day, excluding weekends (i.e., Monday, Wednesday, and Friday): 50 x 5 = 250 trap check days.
- Example 5 - 50 traps set Monday, Aug 8, and retrieved Sunday, Aug 21, and checked on Wednesdays only and the day the traps are retrieved: 50 x 3 = 150 trap check days.

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Appendix I: Level 2 Decontamination Protocols

There is no uniform Level 2 Decontamination Protocol, but rather a range of physical and/or chemical treatments based on best available science. Select an appropriate protocol based on the gear or equipment types and best professional judgment. Please use appropriate PPE and caution with each treatment option.

Level 1 Decontamination clean and drain protocols must be conducted prior to starting Level 2 protocols to ensure the effectiveness of the Level 2 treatments. Gear and equipment undergoing Level 2 Decontamination do not have to follow the Dry step of Level 1 Decontamination before beginning Level 2 protocols.

- **Hot Water Treatment:** *This is the preferred method for most aquatic conveyances and species*. Hot water treatment can be applied by soaking or via a hot water pressure washer.
    - Hard non-porous surfaces require constant exposure for a minimum of 140°F (60°C) at a minimum of fifteen (15) seconds.
    - Porous materials and gear with multiple folds/cavities require constant exposure at a minimum of 140°F (60°C) for a minimum of five minutes or at 120°F (49°C) for a minimum of 30 minutes.
    - *HOT WATER WARNINGS:*
        - Decontamination temperatures can burn exposed skin.
        - 140°F (60°C) and higher temperatures cannot be achieved using most hot water heaters that are installed for domestic uses, which should be kept at 120°F to avoid burns.
        - Do not use this method for Gore-Tex® or other materials that cannot hold up to high temperatures.
- **Freezing Treatment:** Expose materials to 14°F (-10°C) or colder for a minimum of 8 hours or 15°F to 32°F (-9°C to 0°C) for 24 hours. *For gear and equipment used in marine or estuary situations, rinse thoroughly with potable fresh water before freezing.* Do not use for whirling disease or fish virus decontamination.
- **Virkon® Aquatic Solution Treatment:** The powder should be mixed with clean water according to the dilution instructions for a 1% or 2% solution. *Do not apply the powder directly on the surface you are trying to disinfect.* Refer to the Virkon Aquatic instructions and SDS sheets for chemical storage, use, dilution, and disposal.
    - Decontamination for bacteria and viruses (micro-organisms) requires soaking gear thoroughly with 1% solution so that it is completely saturated for a minimum of 10 minutes.
    - Decontamination for larger aquatic organisms such as New Zealand mud snails requires soaking gear thoroughly with 2% solution until it is completely saturated, for a for a minimum of 20 minutes.

    - *VIRKON SAFETY WARNING*: Must be mixed in a well-ventilated area, preferably outdoors. A splash apron, gloves, and safety goggles must be used. Wear protective gear, eye protection, and gloves when using.
- **Formula 409 Solution Treatment:** Must use an anti-bacterial version.
    - Expose materials thoroughly to 100% solution for a minimum of 10 minutes. Rinse thoroughly in a contained area.
    - Rinse water must be disposed of down a sewage drain, *not* a storm drain.

Remember, once you have completed a Level 2 Decontamination on aquatic conveyances, clean, rinse, and dry all decontamination equipment used.

Additional information on decontamination treatments, including more detailed methods, can be found in the Washington Department of Fish And Wildlife Invasive Species Management Protocols at wdfw.wa.gov/sites/default/files/publications/01490/wdfw01490.pdf

Appendix II: Trapping and Trapping Protocols

Trapping is an essential tool for managing green crab populations due to its targeted and efficient approach. Baited traps are the standard for detecting, monitoring, assessing, and reducing green crab numbers, with the ability to be set in potential habitats such as the intertidal zone, which limits bycatch of native species and minimizes ecological impacts (Duncombe and Therriault 2017, Ens et al. 2022). Effective trapping can reduce local green crab populations, collect detailed demographic data, and cause minimal harm to non-target species (Ens et al. 2022). Despite being resource-intensive, trapping allows for the direct removal of invasive crabs and provides critical data on their population dynamics and behavior, aiding broader management strategies and preventing the establishment of new invasions. When done correctly, trapping is integral to effective green crab management efforts (Tummon Flynn et al. 2023).

This section serves as a broad overview for trapping guidelines as it relates to green crab management activities. Current or potential co-managers, tribes, and partners interested in trapping training should contact WDFW's AIS Unit at ais@dfw.wa.gov.

Identifying Sites

The biology of green crab can be utilized to identify sites where green crab are likely to be present. Along the Pacific coast of North America, green crab 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). While green crab have wide tolerances for salinity (1.4-54 ppt) and temperature (0-35 °C), they prefer conditions between the extremes of these ranges (Leignel et al. 2014). The presence of larger predatory crabs such as the red rock crab (*Cancer productus*) in subtidal waters can limit green crab presence to higher tidal elevations which are less favorable to red rock crab (Jensen et al. 2007). However, evidence suggests that green crab shift sites seasonally in response to behavioral changes (active in shallow water in the summer, seek stable conditions in deeper water in the winter. Using what we know of green crab, we recommend the following guidelines to assist in identifying trapping sites:

If trapping in warmer months:

- Tidal Elevation: Intertidal (+1' to +6' MLLW); deeper waters depending on location.
- Near Structure: Pilings, riprap, shell piles, steep muddy embankments, tidal channels, saltmarsh, shoreline vegetation, surf/eelgrass beds, areas of dense algae, woody debris, and logs. They are also often found in creek systems.

If trapping in colder months:

- Tidal Elevation: Shallow subtidal (-1' to +1' MLLW); deeper waters depending on location.
- Near Structure: Pilings, riprap, shell piles, steep muddy embankments, tidal channels, saltmarsh, shoreline vegetation, surf/eelgrass beds, areas of dense algae, woody debris, and logs.

Bycatch (organisms captured in traps other than green crab) can serve as a metric of proper trap deployment. If deployed correctly, typical bycatch species in traps include hairy shore crab (*Hemigrapsus oregonensis),* staghorn sculpins (*Leptocottus armatus*), tidepool sculpins (*Oligocottus maculosus*), small graceful crab (*Metacarcinus gracilis*), small Dungeness crab (*Metacarcinus magister*), hairy helmet crab (*Telmessus cheiragonus*) and hermit crabs (Family *Paguridae*). When bycatch is dominated by red rock crab (*Cancer productus*) or larger Dungeness crab this indicates the traps are placed in deeper, more marine locations and are unlikely to catch European green crab. If bycatch contains terrestrial animals such as raccoons, the traps are exposed for too long, and the location and timing, as it relates to tides, should be adjusted. The presence of freshwater sculpins or the absence of any crab species also suggests improper deployment of traps. If bycatch includes ESA listed species (salmonids, forage fish, or rockfish) trap deployment should be reconsidered to minimize potential impacts.

Selecting Traps

There is no universal “best” trap for the collection of green crab. Each has their own strengths and weaknesses and should be chosen based on site conditions, management goals, deployment capacity, and other relevant factors. Below we discuss the three primary categories of traps utilized in Washington for baited trapping of green crab: Minnow, Fukui, and Shrimp traps.

Fukui Traps

Historically, Fukui traps[3] are the primary trap utilized for green crab management (Duncombe and Therriault 2017, Bergshoeff et al. 2019, Ens et al. 2022). Fukui traps are rectangular with two tunnels at either end, where two netting panels form a horizontal ‘‘V’’ with an expandable entry slit at the narrow end. The traps are lightweight, collapsible, and can easily be transported and deployed on land or via boat.

Fukui traps are best suited for shallow or subtidal habitats. Their relatively small footprint allows for deployment in narrow habitats such as channels and marshes. However, their lightweight and flexible structure makes subtidal deployment and recovery difficult.

While Fukui traps are effective at catching and retaining green crab with > 20 mm carapace width (CW), they are biased against the collection of the smallest green crab. In addition, Fukui traps can potentially capture a wide range of bycatch species, including ESA listed fish species.

Fukui traps are typically modified for use in green crab management activities. The two panels for each opening are zip-tied in the center to reduce the one large opening at either end to two smaller

[3] Please note that Fukui is a specific brand of this style of collapsible box trap. In Washington and this Plan, the term Fukui is used as a catchall for all traps of this type.

openings. These smaller openings increase green crab retention and reduce large bycatch (e.g., large fish, raccoons, otters, etc.).

Fukui traps are highly versatile and can be utilized for any trapping effort (e.g., early detection, monitoring, assessment, and control trapping).

Minnow Traps

Minnow traps, also called crayfish traps, are cylindrical traps with two inverted conical entrances, one at either end of the trap. Each trap consists of two connected halves which, when separated, allow for easy stacking, transport, and storage. Minnow traps are small, light, compact, and cheap but lack the durability of Fukui or Shrimp traps.

Minnow traps can be deployed in shallow habitats, and their small footprint allows for deployment in even the narrowest channels. Given their light weight and lack of durability, these traps are not recommended for subtidal deployment. However, they can be deployed sub-tidally if properly secured via stakes.

The entrances of minnow traps are small (25 mm in diameter), which prevents the entry of larger green crab but can catch and retain smaller crabs. As a result, these traps are ideal to deploy at mouths of estuaries where the most young of the year (YOY) are present. Minnow traps often display lower total mortality and diversity of bycatch compared with Fukui traps, though this is dependent on local community structure.

Minnow traps are typically modified for use in green crab management activities. The tunnel openings are expanded from 1” to ~2-3” in diameter. These larger openings increase green crab capture rates.

Minnow traps are useful for early detection, monitoring, and assessment trapping. However, their limited capacity and size bias limits their usefulness for control trapping efforts. If utilized for control trapping, be sure to also utilize larger Fukui or Shrimp traps to offset the minnow traps limitations.

Shrimp Traps

A variety of shrimp traps and mesh types are currently used for green crab management in Washington. The most common type are box traps, which have four tunnel openings and a built-in bait tunnel in the center. Additional weights or rebar can be added to keep the trap on the bottom for deployment in subtidal areas or areas with high tidal exchange. Collapsible shrimp traps that are circular, weighted, and stackable are also used by some groups. Shrimp traps are heavier, durable, and have a higher CPUE of green crab compared to Fukui and minnow traps when green crab are abundant.

Shrimp traps can be deployed in a range of habitats provided some water remains at low tide, ranging from the intertidal, to salt marsh channels or river sloughs that are of adequate width, to subtidal habitats. However, their relatively large footprint may limit their use in narrow channels.

Shrimp traps are somewhat biased towards larger crabs, though this varies with mesh size. If using the 1-inch mesh, it is recommended a second trap type with a smaller mesh size (e.g., ½ inch shrimp or minnow trap) if the goal is to target a wider range of green crab size classes.

Shrimp traps are typically modified for use in green crab management activities. Additional weights or rebar can be added to keep the trap on the bottom to increase trap stability in subtidal areas or areas with high tidal exchange. Additionally, the tunnel openings are zip-tied to reduce to an ~5" opening (a large fist should fit through) to reduce bycatch of larger native crab species. Some trappers increase the size of the top opening (used for crab removal) for easier removal of green crab and bycatch species, though this modification is not universal.

Shrimp traps are highly versatile and can be utilized for any trapping effort (e.g., early detection, monitoring, assessment, and control trapping).

Table 9 Overview of primary trap types currently used in Washington as part of European green crab management efforts.

Trap Type	Fukui	Minnow		Shrimp	
Brands	Fukui, Promar	Gee, Fraybill	Promar, Willapa marine	Promar	Promar (Collapsible)
Trap Size (inches)	24 x 18 x 8	9 x 17.5	24 x 24 x 9	24 x 24 x 9	32 x 12
Mesh Size (inches)	½	¼	1	½	1
Tunnel Type	2 x mesh	2 x rigid mesh	4 x semi-rigid mesh	4 x semi-rigid mesh	4 x mesh
Modifications	Yes[1]	Yes[2]	Yes[3]	Yes[3]	No
Recommended Tidal Elevation for Deployment	Intertidal to Shallow Subtidal	Intertidal	Lower Intertidal to Subtidal	Lower Intertidal to Subtidal	Lower Intertidal to Subtidal
Approximate Crab Size Range (mm CW)	20-Max	15-65	40-Max	20-Max	40-Max
Approximate Crab Age Range (years)	0-Max	0-2	1-Max	0-Max	1-Max

[1]Zip-tie tunnel openings in center, [2]Expand tunnel openings to ~2-3" diameter, [3]2 pieces of 2' by ½" rebar attached to bottom for added weight and zip-tie openings so they are ~5" wide. Table derived from Akmajian (2024), Buffington (2024), Buzzell (2023), and (Grason 2024).

Additional Traps

While more limited in their use, other trap designs are utilized for green crab trapping. Below are a few traps of note.

- Hand captures: While not a typical “trap,” the opportunistic capture of green crab by hand is very common during management activities. While labor and time intensive, hand captures are effective for smaller crabs (<30 mm) that may not typically enter baited traps. Hand captures are generally not a primary trapping method but a supplement to other activities.
- Pitfall trap: These traps typically consist of 5-gallon buckets buried in the intertidal zone with the top level with the sediment's surface. They are passive traps designed to collect crabs as they walk across the surface. The contents of the bucket are removed and recorded every 24 hours. Failure to maintain and monitor pitfall traps can result in rapid collection of sediment and injury or mortality of benthic epifauna. After the trapping period, lids are placed on the buckets until the next trapping event. Pitfall traps are typically used for annual monitoring events.
- Beach Seine: Beach seine netting can be highly useful in areas with softer, mud bottoms such that as the net is rolled along the bottom it lightly disturbs the mud and spooks the crabs out of the mud. This has been found effective for crabs of all sizes, including crabs <30 mm that might not typically enter baited traps. Beach seining can also be a useful tool for monitoring bycatch in the area as it is trap independent.
- Crab Slab: A trap design under development by the Tulalip Tribes. The premise behind the design of the Crab Slab is that it simulates a flat rock or other similar structure, with some space under it that provides cover and refuge for green crab. Animals can move freely in and out, but green crab and other shore crabs should hunker down when an ebb tide exposes them and await the next flow cycle. During these periods, Crab Slabs are checked, and green crab can be collected. This design has yet to be tested in areas with documented green crab presence (though the Tulalip Tribes are working with the Makah Tribe and Lummi Nation to address this), so its effectiveness is currently speculative, though it has been shown to be effective on hairy shore crab. A Crab Slab deployed in Maine collected five green crabs during a trial deployment, though local green crab densities are unknown. Crab Slabs are not intended to substitute for baited traps but rather an additional tool for early detection and control trapping.

Bait Selection

The broadly recommended bait options green crab management are mackerel, herring, anchovy, or any other oily, smelly fish. These fish are relatively cost efficient, readily available, and effective at attracting green crab. These fish are more effective than less pungent baits (e.g., squid, mussels). The type of fish used will vary depending on cost and availability, but it is recommended that, if possible, the same type of bait is used for all trapping activities undertaken by a given co-manager, tribe, or partner (e.g., WDFW utilizes mackerel for all trapping activities). This allows for a comparison of trap contents, capture rates, and other variables without having bait type as a confounding factor. The type of bait used during a given trapping effort should always be documented for future reference.

While oily fish is the recommended bait for green crab trapping, they are not the only option. Baits such as cat food and chicken have been utilized, though the consensus is they are not as effective. Recently, the researchers from the Makah Tribe examined the use of processed green crab as bait. Early results show no statistical difference in green crab catch between traps baited with green crab and traps baited

with herring and a significant reduction in bycatch caught in the traps baited with green crab, but further work is ongoing to fully explore this potential bait source (Akmajian 2024).

Other attractants (e.g., pheromones, magnets, lights) have been proposed as alternative to traditional bait. Isolated green crab pheromones attracted male green crab in a laboratory setting, though this response was highly sensitive to water temperature and pH (males only responded if temperature < 15 °C and pH ~8) (Yamada 2024). While pheromones have the potential to attract significantly more green crab than un-baited traps, the logistical and manufacturing challenges require pheromones to work at least an order of magnitude greater than conventional bait before they would be a viable alternative (Yamada personal communication) Anecdotal evidence from crabbers in Netarts Bay, OR, suggested green crab were attracted to traps containing cow magnets, though initial investigations found no evidence to support this claim (Yamada personal communication). A study by (Naimullah et al. 2022) found that traps containing green LED's captured more orange mud crab (*Scylla olivacea*) compared with un-baited traps, though research is needed to determine if green crab respond similarly to lighted traps.

Recording Data

There are two readily available options for recording data: physical data sheets and mobile apps. For any questions or assistance on the use of these options please contact WDFW's AIS Unit at ais@dfw.wa.gov. For more information on data submission and management, please see Data Standards, Collection & Reporting.

Co-managers, tribes, and partners can record data on datasheets, then transfer that information into an electronic format for submission. While the exact datasheets used are up to each co-manager, tribe and partner, care must be taken to ensure the necessary data is recorded. WDFW utilizes (and recommends) the use of the following datasheets related to green crab trapping (examples of these datasheets and an explanation of data fields can be found in this appendix).

- Trap Deployment Datasheet
  This datasheet provides details on trap deployment and location.
- Trap Effort Datasheet
  This datasheet provides details on all organisms captured in each trap.
- EGC Biometrics Datasheet
  This datasheet provides details on individual green crab captured in each trap.
- Trap Label – Simple
  This label provides details on the number, sex, and reproductive status of the green crab collected from an individual trap. It is placed in a plastic bag along with the collected crab.
- Trap Label – Detailed
  This label provides detailed information on individual green crab from a particular trap. It is placed in a plastic bag along with the collected green crab.

There are two mobile apps related to green crab trapping. These apps are publicly available for free, but access must be granted to use the content specifically designed for the green crab emergency. WDFW can provide logins for co-managers, tribes, and partners to utilize these apps if they don't have ArcGIS access.

- ArcGIS Quick Capture
  This app is used to record details on trap deployment and individual trap information (i.e., trap type, number, location, bait type, site, personnel).
- ArcGIS Survey 123
  This app is used to record catch information for each individual trap deployed (i.e., green crab counts, bycatch).

Bycatch

In the context of green crab management, bycatch refers to any animal species collected in traps other than green crab. While bycatch is unavoidable, every effort should be made to maximize the bycatch survival rate. Proper trap placement, regular trap checks, and proper bycatch handling can significantly increase the chance of bycatch survival. In addition, simple trap modifications can greatly reduce bycatch rates of larger organisms.

Bycatch data can provide valuable insight into local community structure, be used to assess changes in community structure over time and is a useful tool in evaluating the impacts of green crab. As a result, it is essential to strike a balance between proper documentation of bycatch and ensuring the safe release of these organisms. See Appendix III – WDFW Bycatch Protocol for an example of detailed guidelines on bycatch documentation and handling.

Trapping Protocols

Always check tides and expected weather conditions prior to going into the field. This will affect when you can deploy, check, and retrieve traps. Safety is the number one priority and should be considered during all aspects of field operations.

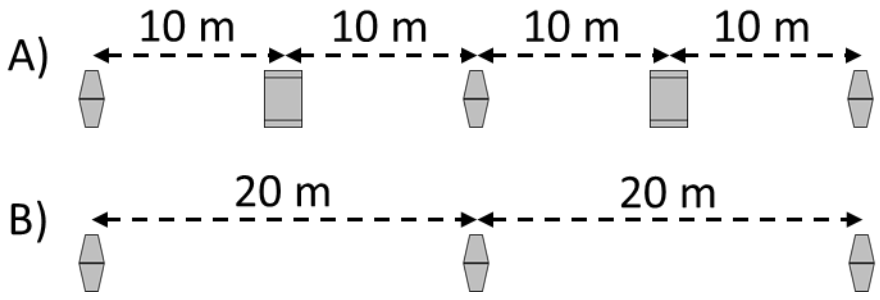
There is a high degree of variability among and within field sites. While the methods below will serve as the basis for trapping efforts, they will not be a perfect fit for every location and situation. As you become familiar with the trapping protocols and field work, you will be able to adjust to improve the effectiveness of your trapping and how to best deploy traps at a new site.

Trap Deployment

- Deploy traps during the lowest low tide of the day. Ensure traps are at least 50% submerged and will remain so for the duration of the trap deployment.
  - Check tides for the duration of the deployment to ensure traps will remain submerged.
- Whenever possible, deployed traps near (<20 m) structure.

    - Structure can be vegetation (e.g., eelgrass, seaweed), shellfish beds, riprap, or other material that could provide cover for green crab.
    - Structure in the high intertidal that is never submerged is **not** effective cover.
- Avoid high flow/scour areas or steep slopes and areas that will be 100% fresh water at low tide.
    - These conditions are more appealing for green crab.
    - Lower flow conditions also reduce the risk of trap loss.
- Place traps ≥10 m apart (when in doubt place further apart), alternating between types (ex. Minnow, Fukui, Minnow, so on) if using multiple trap types. If using only one type of trap, place traps ≥20 m apart (Figure 20).
    - Example: If the site is limited to upper intertidal habitat use minnow traps only. This will target smaller crabs and/or reduce bycatch of native species and mammals.
    - Example: If in complex marsh channels with bends rather than a straight channel, you can place traps closer (but no closer than 10 m) together.
- Traps should be placed with their openings perpendicular to the flow of water whenever possible. This will reduce fish bycatch and is particularly important when salmonids are present.
- Place ~ 3 oz of your chosen bait in each trap. Bait containers (hard plastic containers with holes) are highly recommended, as they prevent the consumption of bait by animals in the trap and prolong the ability of the bait to attract green crab.
    - Bait containers can be purchased or manufactured (e.g., plastic lunchmeat containers with holes poked in them).
    - Be sure to record bait type used.
- Secure trap to substrate using stakes, weights, or both.
    - This will prevent trap loss and increase green crab catch rates (crabs are reluctant to enter unstable traps).
    - Depending on the location, other methods may need to be employed to secure traps in place. Use whatever approach is effective and safe at your site.
- Record all relevant data for each trap on the Trap Deployment Datasheet or ArcGIS Quick Capture.

Figure 20 Placement of traps for European green crab management activities.



When alternating between trap types, place traps ≥ 10 m apart (example A). When using only one trap type, place traps ≥ 20 m apart (example B).

Checking Traps

Please note that the protocols below assume you are collecting green crab Highest Data Standard and Bycatch Highest Data Standard. Please adjust your actions accordingly if using another data standard.

- Return to the site and check traps after at least 1 trap day (see Glossary for more details).
    - A trap day does not have to be exactly 24 h.
    - We recommend checking traps at ~24 hour intervals during a trapping effort. This will reduce bycatch stress and mortality.
- Pick a trap. Depending on tide heights you may want to work from higher elevations to lower elevations or vice versa. Each site may act differently, it is important to do your research and understand how your site reacts to changing tides.
- Record trap details and contents on the Trapping Effort Datasheet or ArcGIS Survey 123.
- Record and release bycatch first. Always, count number of individuals for each species. If pressed for time (tides coming in faster than expected), record what species of bycatch were in a trap.
    - If you cannot identify a species with 100% confidence, take photos (See Appendix III: WDFW Bycatch Protocol) for later ID. Be sure to document the trap tag to help match the observations (including in the photo is an effective technique).
    - If you suspect you have captured a SALMON, ROCKFISH or a FORAGE FISH of **ANY KIND,** please note the capture and record the species, take photos, clearly record on datasheet, and contact your direct supervisor (for WDFW employees) when it is safe to do so. For non-WDFW employees, please contact the WDFW AIS Unit.
- Collect and process any green crab. Select a zip-lock bag that can hold all green crab from a single trap. Fill out a Trap Label as you process the green crab and place it in the bag along with the crabs.
    - Place all green crab from a single trap into the same bag if they can fit. If more than one bag is required, clearly label the number of bags used for that trap.
    - Do not place green crab from multiple traps in one bag.
    - Treat hand captures as if they were a trap, place green crab in a new bag with a new label and record on datasheet.
    - No need to fill out bags for traps that did not capture green crab.
- Count and record the sex of all green crab in the trap and place them in the bag.
- Return the trap to where you collected it. Repeat the process for each trap.
    - Replace bait daily for exposed bait in shrimp traps.
    - Replace bait at least every other day for multi-day trapping efforts.
    - Replace bait if bait is missing.
- Take the crabs back to your base of operations. Assess all crabs for the variables listed on the green crab Biometrics Datasheet and ArcGIS Survey 123. If green crab are from inland shorelines, contact WSG to determine if they would like specimens live or frozen. Euthanize and dispose of green crab following protocols outlined in the Euthanasia and Disposal section.

Trap Retrieval

- Return to the site at the end of your trap deployment. While you want to deploy traps for at least 1 trap day, it is recommended to deploy for 2 trap days, with at least one check before recovery.

- Follow the procedure outlined in the "Checking Traps" stage but recover the traps rather than returning them to the site. Please remove all bait by placing it into a Bait Waste Bag and disposing of it in a municipal landfill or other approved method.

Handling

Green crab collected in the field should be placed in a covered cooler with newspaper or other inert material saturated with local water. The cooler should have a pint-size frozen cold pack (wrapped in newspaper to avoid direct contact with green crab) per cubic foot of cooler space to maintain a low temperature without freezing the crabs. In situations where individual specimens need to be segregated, place a small amount of saturated newspaper, a specimen label, and the crab into a zip-top plastic bag before placing into the cooler. Cold packs should be disinfected and re-frozen between uses.

Euthanasia and Disposal

The following methods are approved for the euthanasia of green crab.

- Place crabs into freezer for a minimum 72 hours or longer to assure fully frozen throughout; or
- Cool in freezer or salt/ice slurry until insensible. The crabs must then either be:
    - Spiked to destroy the ganglia (de Souza Valente 2022) or
    - Placed in boiling water for 15 minutes (Reilly 2001).

All partners requiring an green crab Collection Permit must dispose of dead green crab using one of the following procedures:

- Seal euthanized specimens in a durable bag that is tagged or marked with your permit number and disposed of in a municipal landfill.
- Coordinate with WDFW for the collection of specimens to be processed into organic fertilizer.
- Any alternate disposition of specimens that has been approved by WDFW prior to disposal.

Co-managers and tribes working outside of state jurisdiction (e.g., Federal agencies on federal land, Tribes on sovereign tribal land, off-reservation trust land, and Usual & Accustomed Areas) may dispose of dead green crab in the manner they see fit.

Data Fields

The following is a breakdown and explanation of the data fields on the Data Sheets used by WDFW for green crab management activities.

- Location: Where traps are deployed. Separated into three levels.
    - Site: Name of specific site where the traps were deployed. Sites are generally pre-determined by local management. If unsure, ask your direct supervisor or local expert.
    - Coordination Area: Name of the designated Coordination Area in which a particular site is located. If unsure, ask your direct supervisor (for WDFW employees) or the WDFW AIS Unit.

    - Management Area: Name of the Management Area where the Coordination Area is located. The state has been split into fourteen Management Areas: North Puget Sound, North Central Puget Sound, South Central Puget Sound, South Puget Sound, Hood Canal, Eastern Strait & Admiralty Inlet, Western Strait, North Coast, North Central Coast, South Central Coast, South Coast, Grays Harbor, Willapa Bay, Columbia River.
- Personnel: Names of all individuals present and conducting the action.
    - This helps in quality control for post processing of data if there are any questions about the records.
    - Record the affiliation if collaborating with someone outside of your organization.
- Deployment and Retrieval Start/End Times: Time when traps are deployed/retrieved.
    - Record start time when first trap is deployed or retrieved.
    - Record end time when last trap is deployed or retrieved.
    - Use 24-hour clock when recording times. Ex. 1:13 PM should be recorded as 13:13.
- Date Deployed/Checked/Retrieved: Dates traps are deployed/checked/retrieved.
    - Record dates as Month/Day/Year.
- Latitude/Longitude: Latitude and longitude position of a given trap in decimal degrees.
    - Record to five decimal points. Ex. 48.33103, -124.65948
    - PLEASE DO NOT record in DMS or decimal minutes.
- Trap Type: Method used to catch crabs.
    - M = Minnow, F = Fukui traps (shorthand for collapsible fish traps, regardless of brand), S = Shrimp trap, S-1” = Shrimp trap with 1” mesh, S-1/2” = Shrimp trap with ½” mesh, S-C = Shrimp trap that is collapsible, H = Hand capture, D = Dipnets, Ps = small Pitfall, Pl = large Pitfall.
    - If new traps are being used and type is unknown write out the details in the notes section.
- Trap Number: Unique identification number for a given trap.
    - Located on the tag attached to each trap.
    - Do not include the 0's that precede a trap number.
    - Ex. A tag with the number 0013 would be recorded as 13.
- CAMA Total: The total number of European green crabs caught in a trap.
    - CAMA is the database species code for European green crab (*Carcinus maenas*).
    - One common acronym is EGC, but CAMA matches codes used among management entities. These acronyms are used interchangeably on many datasheets.
    - Crabs must be alive or dead but fully intact to count. Partial crabs or molts should not be counted, but please make note of them in the Notes section.
- EGC #: Identification number for an individual CAMA
    - In order processed that day. First crab is 1, second is 2, and so on.
- Size (mm): Carapace width (CW) of a CAMA.
    - Measured at the widest point of the carapace. This is from the tip of one of the terminal teeth (5th tooth moving back from anterior [front] to posterior [back]) to the tip of the other on the other side. Be sure to include the carapace tooth in the measurement.

    - This is different from the recreational fishery measurement of Dungeness crab, where the gauge/calipers are set in front of the widest spine measuring "notch width".
- Sex: The sex of a CAMA.
    - Male = M, Female = F, Unknown = UNK
    - Only use UNK if the body is damaged to the point where sex is impossible to determine or if the crab escapes before sex can be determined.
- Gravid: Denotes presence of eggs on abdomen of female CAMA.
    - Only options are Yes, No, and NA.
    - Choose Yes if any eggs are present, regardless of size of egg mass.
    - Choose NA for Male or UNK CAMA. Do not leave blank.
- Color: Color of the of 3rd maxillipeds of a CAMA.
    - Standardized options include: G = Green, LG = Light-Green, DG = Dark Green, LG/O = Light-Green/Orange, LO = Light-Orange, O = Orange, RO = Red/Orange, R = Red, Y = Yellow
- Limb Status: Denotes damage to or loss of limbs of a CAMA.
    - L = Left side, R = Right side. Crab's left and right side, not yours. Should be looking down on top of crab.
    - 1-5 denotes limb; 1 = claw, 2-5 = legs from anterior to posterior.
    - r = regrowing limb (gooey bump, soft stump, or significantly smaller limb), d = damaged limb (missing part of claw, end of leg, etc.)
    - Ex. L1,2 Rr4,Rd5 = Missing left limbs 1 and 2, Regrowing right 3rd limb and damaged 4th leg.
- Epibionts: Denotes presence of barnacles or other epibionts (e.g., algae) on CAMA carapace.
    - Only options are Yes and No.
    - Choose Yes if any epibionts (organism attached to CAMA body) are present.
- Bycatch Species: The non-CAMA species caught in a trap.
    - Please note that there is no cell or column labelled Bycatch Species on any datasheet.
    - On the Trap Effort datasheet, write in the four-letter code for a given species of bycatch at the top of a blank column. Two columns are already labeled for this purpose:
    - HEOR = *Hemigrapsus oregonensis,* hairy shore crab
    - LEAR = *Leptocottus armatus*, staghorn sculpin
    - See Species Codes for four-letter species codes.
    - If no code for a species, record as OTHER and write species name in notes.
    - If you cannot identify the species, record as other and take detailed photos for later ID
- Bycatch Total: The number of individuals for each non-CAMA species caught in the trap.
    - Please note that there is no cell or column labelled Bycatch Species on any datasheet.
    - Record the Bycatch Total for each Bycatch Species in the appropriate column you created on the Trapping Effort datasheet.
    - Ex. If you catch 15 hairy shore crab, write 15 in the column labeled HEOR.
- Weather conditions: General description of weather conditions

- Standardized options include: Sunny, Partly Cloudy, Mostly Cloudy, Cloudy, Foggy, Overcast, Wind, Rain, Thunderstorms.
- Can be a mixture of the above.

- Additional notes/comments: Any additional notes or comments.
  - If something is out of the ordinary, and it is worth making a note about it (e.g., habitat type, unknown species caught, escaped crabs, damaged or moved equipment, unique trap types, unique weather issues like smoke).

Datasheets

The following are copies of the datasheets utilized by WDFW for green crab management activities. Other co-managers, tribes, and partners are welcome to use these datasheets or to inform the development of new datasheets.

Figure 21 Example of Trap Deployment Datasheet

TRAP DEPLOYMENT DATASHEET	LOCATION (MANGEMENT AREA[1]/COORDINATION AREA[2]/SITE):							PAGE __ of __
	PERSONNEL:							ENTERED IN DATABASE: ☐
DEPLOYMENT START/END TIME:		NOTES:						TOTAL TRAPS_____
RETRIEVAL START/END TIME:								
WEATHER:								
DATE DEPLOYED	**DATE RETRIEVED**	**TRAP TYPE[3]**	**TRAP #**	**LATITUDE**	**LONGITUDE**	**CHECKED DAY 1**	**CHECKED DAY 2**	**NOTES**
MM/DD/YY	MM/DD/YY	M	600	48.34113	-124.57412	X	X	
								15 ENTRIES PER PAGE

[1]Management Area: Columbia River, Grays Harbor, Hood Canal, North Central Coast, North Central Puget Sound, North Coast, North Puget Sound, South Central Puget Sound, South Coast, South Puget Sound, Strait of Juan de Fuca, Willapa Bay

[2]Coordination Area: Each Management Area is made up of several Coordination Areas, check with your direct supervisor if unknown.

[3]Trap Type: M = Minnow, F = Fukui, S - 1/2" = 1/2 mesh Shrimp pot, S - 1" = 1" mesh Shrimp pot, SC = collapsible Shrimp pot, P = Pitfall, H = Handcapture

Used to record details on trap deployment and location.

Figure 22 Example of Trapping Effort Datasheet

TRAP EFFORT DATASHEET	LOCATION (MANGEMENT AREA[1]/COORDINATION AREA[2]/SITE):												PAGE ____ of ____
	PERSONNEL:												ENTERED IN DATABASE ☐
CHECK DATE:	NOTES:												
START/END TIME:													EGC: YES / NO
WEATHER:													
CAMA Total	**TRAP TYPE[3]**	**TRAP #**	**CAMA - M**	**CAMA - F**	**HEOR**	**LEAR**							**Input**
20	F	1146	15	5	X	1(1)			( ) = # of mortalities, from the total				
													15 ENTRIES / PAGE

[1]Management Area: Columbia River, Grays Harbor, Hood Canal, North Central Coast, North Central Puget Sound, North Coast, North Puget Sound, South Central Puget Sound, South Coast, South Puget Sound, Strait of Juan de Fuca, Willapa Bay

[2]Coordination Area: Each Management Area is made up of several Coordination Areas, check with your direct supervisor if unknown.

[3]Trap Type: M = Minnow, F = Fukui, S - 1/2" = 1/2 mesh Shrimp pot, S - 1" = 1" mesh Shrimp pot, SC = collapsible Shrimp pot, P = Pitfall, H = Handcapture

Used to record details on all organisms captured in each trap.

Figure 23 Example of EGC Biometrics Datasheet

EGC BIOMETRICS DATASHEET PAGE _____ of ______

LOCATION/SITE:	*note changes in sites*						DATE:	*note changes in dates*		
EGC #	TRAP TYPE[1]	TRAP #	SEX	SIZE (MM)	COLOR[2]	LIMB STATUS[3]		EPIBIONTS	COMMENTS	INPUT
1	M	613	(M) / F	87.4	LG	L1,2; Lr4	R3; Rd2	(YES) / NO	gravid, dmg carapace	□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO		□
			M / F					YES / NO	*30 per page*	□

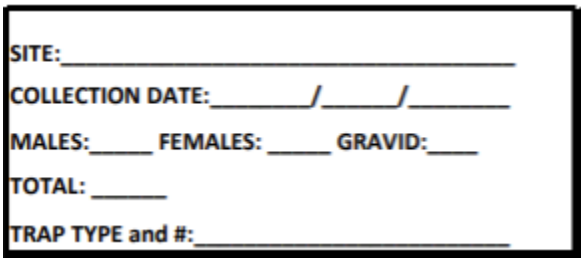
[1]Trap Type: M = Minnow, F = Fukui, S - 1/2" = 1/2 mesh Shrimp pot, S - 1" = 1" mesh Shrimp pot, SC = collapsible Shrimp pot, P = Pitfall, H = Handcapture

[2]Color: LG = Light Green, DG = Dark Green, G= Green, O = Orange, RO = Red Orange, R = Red

[3]Limb Status: L = left, Lr = left rejuvenating, Ld = left damaged; R = right, Rr = right rejuvenating, Rd = right damaged

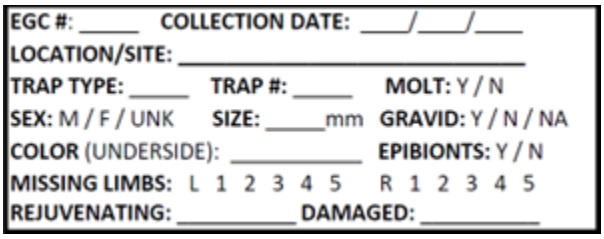
Used to record details on individual European green crab (EGC) captured in each trap.

Figure 24 Example of Trap Label – simple



Used to record details on CAMA collected from a specific trap on a specific day.

Figure 25 Example of Trap Label – detailed



Used to record detailed information on individual CAMA collected from a specific trap on a specific day.

Appendix III: WDFW Bycatch Protocol

While trapping is an important tool for green crab management, there is high potential for trapping bycatch (organisms that are not green crab). It is your responsibility to document bycatch and to minimize any trapping or handling impacts to bycatch to the best of your ability. This document serves as a guide for the safe handling and documentation of bycatch during trapping efforts. Please note that CAMA (*Carcinus maenas*) is the acronym used for green crab in capture data in Washington and will be used in place of European green crab, green crab, and ESG throughout the rest of the document.

Endangered Species Act (ESA) Species

An ESA Section 10(a)(1)(A) research permit or (B) incidental take permit is required to conduct trapping efforts throughout various areas in the state of Washington due to potential ESA listed species "take" or bycatch. WDFW has obtained this permit for Department related operations. All co-managers, tribes, and partners are responsible for obtaining their own permits if required.

ESA listed species encountered must be handled with great care following the appropriate handling procedures described below. ESA listed species must be documented, photographed, and reported.

ESA listed species that may be encountered include salmonids, forage fish, or rockfish. Proper identification is required to maintain accurate records and reporting requirements. When unsure of identification, follow detailed photographing procedures described below.

Bycatch Handling/Release/Disposal

IF BYCATCH IS ALIVE:

1) Prioritize the release of bycatch over processing captured green crab (CAMA). This is to minimize impacts to our native species and reduce bycatch mortality.
    a. Take any required pictures before release.
2) Release bycatch at the site of capture in a manner to increase likelihood of survival.
    a. For aquatic bycatch, release into cool, protected water.
    b. For fish bycatch, do not handle with dry hands.
    c. For terrestrial bycatch, bring the trap onto dry land prior to release. Open the trap away from yourself and others. Back away and maintain a safe distance after opening the trap.
3) Take care to ensure bycatch safety post-release.
    a. Watch your step. Some bycatch (e.g., crabs) may remain where you release them for a time. If released near traps, you may accidentally step on them.
    b. Keep an eye out for gulls and other scavengers. They may prey on released bycatch (e.g., small shore crabs and fish).

IF BYCATCH IS DEAD:

4) Dispose of the bycatch at the site of capture unless such disposal is at a publicly accessible location or where not acceptable to the landowner.
5) Where catch-site disposal is not acceptable, remove bycatch, place it in a sealed opaque (solid color) plastic bag, and dispose of it in a municipal landfill.
    - An alternative is to donate the bycatch for scientific or educational purposes to an entity that has a valid Department Scientific Collection Permit for the take of that species.
    - If you wish to donate the bycatch, place the sealed opaque plastic bag in a freezer and contact WDFW at ais@dfw.wa for assistance.

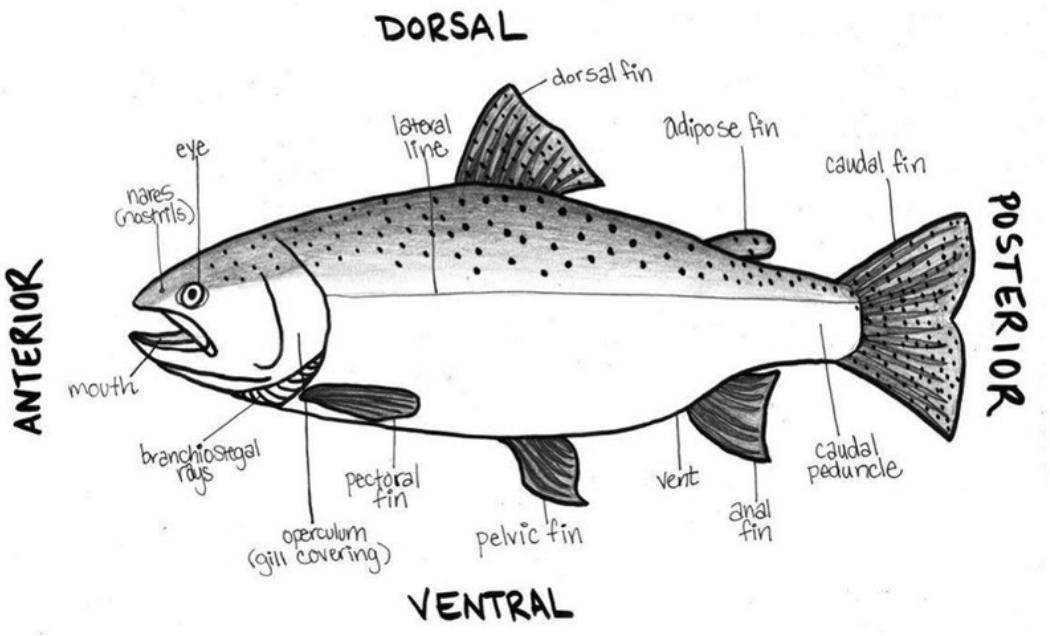
Fish Bycatch

General Procedure

Accurate identification of fish bycatch is critical for documenting and reporting ESA listed species. For any fish caught in traps please complete the following steps:

1) If you can confidently identify the organism and it is not an ESA listed species, record the species code and quantity and then, if alive, safely release it.
    - Common fish encounters may include staghorn sculpins, tidepool sculpins, three-spined sticklebacks, shiner perch, and various gunnels. See species list.
2) If you cannot confidently identify the species or you can but it is an ESA listed species, please take detailed photographs (procedures detailed below) and then, if alive, safely release it.
    - If you catch multiple fish of the same species, take photos of three specimens (alive or dead), and document the number of additional specimens.

Figure 26 External teleost fish anatomy.



Fish is positioned left side up. Image credit: Danielle Clarr.

Procedure for photographing fish bycatch

If fish is alive:

1) Take a plastic bag and fill it with a small amount of seawater (enough to submerge the fish completely). Place the fish inside. Adjust water level if needed.
    - If photographs take more than 10 minutes, replace the water to maintain water quality.
    - If possible, place a neutral-colored surface (white or black is preferable) behind the fish.
2) During the photographs, a second person can control the fish by gently holding it against the side of the bag. Ensure that the fins are in a natural position and that the mouth is not open for breathing (which may indicate undue stress and handling should cease). Careful handling should allow you to identify the fish without causing them harm.
3) Take a picture of the fish next to an object for scale. It does not need to be in the bag but should be close enough to the fish to serve as a good reference.
4) Take a picture of the side of the fish. If not possible, take pictures of whatever side you can. Refer to images below for reference.
5) Take a picture of the ventral side of the fish.
6) Take a picture of the dorsal side of the fish.
7) Take a picture of the adipose fin or adipose area if absent.
8) Take a picture of the jaw or maxillary area of the fish.
9) Check photographs for clarity. Ensure you have at least one clear image for each angle of the specimen (side, dorsal, ventral). If necessary, take more photographs to ensure clear images of fins or other markings.

5) Safely and properly release fish back in the water. If possible, release in cool, protected water to help recovery.
10) Please send pictures to WDFW at ais@dfw.wa.gov for identification and archival.

IF FISH IS DEAD:

1) Pose the fish right side down on a flat, neutral-colored surface (white or black is preferable). If necessary, support the fish under the head or back to ensure it lies parallel to the camera.
2) Place an object next to the fish for scale. A ruler or calipers are ideal, but another object of uniform size (e.g., coin, wallet card) will suffice.
3) Take a picture of the left side of the fish. Do your best to unfold fins so they are clearly visible, particularly the adipose, anal, caudal, and dorsal fins. Please note only some fish have an adipose fin (e.g., wild salmonoids), and some will have more than one dorsal fin.
4) Reposition the fish ventral side down. Take a picture of the dorsal side. If necessary, support the sides of the fish to keep it upright or have someone else hold it in position.
5) Reposition the fish dorsal side down. Take a picture of the ventral side. If necessary, support the sides of the fish to keep it upright or have someone else hold it in position.
6) Check photographs for clarity. Ensure you have at least 1 clear image for each angle of the specimen (side, dorsal, ventral). If necessary, take more photographs to ensure clear images of fins or other markings.
7) Dispose of organism at site or retain the organism and store in a freezer if it is an ESA listed or unknown species. Make sure to label the specimen bag with date, location, and contact.
8) Please send pictures to WDFW at ais@dfw.wa.gov for identification and archival.

Figure 27 Example fish bycatch photos.

Side, dorsal, and ventral photographs (from left to right) of a live staghorn sculpin, Leptocottus armatus, a common fish bycatch species.

Marine Invertebrate Bycatch

General procedure

Marine invertebrates, particularly crabs, are commonly caught as part of green crab trapping efforts. The majority of what you catch will be easy to identify, but you want to be sure to document any

unidentified bycatch. For any marine invertebrate bycatch caught in traps please complete the following steps:

1) If you can confidently identify the organism, record the species code and quantity, then, if alive, safely release it.
    - Common crab encounters may include several native species such as hairy shore crab, graceful crab, and Dungeness crab. Please note the bycatch species list is not a comprehensive list and additional species may be added over time.
2) If you cannot confidently identify the species, please take detailed photographs (procedures detailed below) and then, if alive, safely release it.
    - Please take photographs of one specimen of each species (alive or dead) and document the number of additional specimens present.

Procedure for photographing marine invertebrate bycatch

IF BYCATCH IS ALIVE:

6) For hard-bodied bycatch (e.g., crabs, sea stars, snails), pick up the organism and take a photograph of the dorsal and ventral sides of the organism, respectively. Take close pictures of other details (e.g., claws, shell texture) that may aid identification.
    - For instructions on handling large crabs safely, see this video from WSG Crab Team.
    - For hermit crab, hold it still for a time to allow it to relax. It may emerge.
7) For soft-bodied organisms (e.g., sea slugs, jellies), take a plastic bag and fill it with a small amount of seawater (enough to submerge the organism completely). Take a close picture of either side, dorsal, and ventral side respectively.
8) Check photographs for clarity. Ensure you have at least one clear image for each angle of the specimen. If necessary, take more photographs to ensure clear images of claws or other markings.
9) Safely and properly release organism back in the water. If possible, release in cool, protected water to help recovery.
10) Please send pictures to WDFW at ais@dfw.wa.gov for identification and archival.

IF BYCATCH IS DEAD:

1) Pose the organism dorsal side up on a flat, neutral-colored surface (white or black is preferable). Prop organism in place if necessary.
2) Place an object next to the organism for scale. A ruler or calipers are ideal, but another object of uniform size (e.g., coin, wallet card) will suffice.
3) Take a picture of the dorsal side. Turn the organism over and take a picture of the ventral side.
4) Take close pictures of other details (e.g., claws, shell texture, etc.) that may aid identification.
5) Check photographs for clarity. Ensure you have at least one clear image for each angle of the specimen. If necessary, take more photographs to ensure clear images of claws or other markings.
6) Dispose of organism at site or retain the organism and store in a freezer if it is an unknown species. Make sure to label the specimen bag with date, location, and contact.
7) Please send pictures to WDFW at ais@dfw.wa.gov for identification and archival.

Figure 28 Example crab bycatch photos.

Dorsal and ventral photographs (from left to right) of a live hairy shore crab, *Hemigrapsus oregonensis*, a common crab bycatch species.

Vertebrate, Non-Fish Bycatch Procedures

General procedure:

Although rare, there are instances where aquatic or terrestrial birds, reptiles, and mammals (e.g., bullfrogs, ducks, raccoons, otters) are captured as bycatch. **If this occurs or if your bycatch is a marine mammal, contact the WDFW AIS unit at ais@dfw.wa.gov to discuss further precautionary actions** (e.g., altering trap deployment depth, altering traps, site abandonment). For any vertebrate, non-fish bycatch caught in traps please complete the following steps:

1) Take photographs of all organisms for secondary identification confirmation (alive or dead).
2) If you can confidently identify the organism, record the species code or name and quantity, then if alive, safely release it.
    - Any prohibited species may not be released under RCW 77.135.040.
    - If the organism is a nutria (*Myocastor coypus*), a Prohibited Level 3 species, contact a Wildlife Control Operator about humanely euthanizing an/or disposing of the specimen.
    - If the organism is a bullfrog (*Lithobates catesbeianus,* Prohibited Level 3 species), adult or tadpole, contact the WDFW AIS Unit to confirm organisms identification. Follow protocols for humane euthanasia.
2) If you cannot confidently identify the species, please take detailed photographs (procedures detailed below) and then, if alive, safely release it.
    - Release the organism immediately without photographing if there is any perceived risk to the organism's life.

Procedure for photographing vertebrate, non-fish bycatch

IF BYCATCH IS ALIVE:

1) Take a photograph of the organism.
2) Check photographs for clarity. If necessary, take more photographs.
3) Release bycatch at same location as captured or at nearest location where survival is likely.

4) Please send pictures to WDFW at ais@dfw.wa.gov and CC your supervisor for identification and archival.

Figure 29 Example vertebrate bycatch photo.

Photograph of a live northwestern garter snake, *Thamnophis ordinoides*, being released from a minnow trap.

IF BYCATCH IS DEAD:

1) Pose the organism dorsal side up on a flat, neutral-colored surface (white or black is preferable).
2) Take photographs from the front, back and side, respectively.
3) Check photographs for clarity. Ensure you have at least 1 clear image for each angle of the specimen. If necessary, take more photographs.
4) Dispose of organism at site or retain the organism and store in a freezer if it is an unknown species. Make sure to label the specimen bag with date, location, and contact.
5) Please send pictures to WDFW at ais@dfw.wa.gov and CC your supervisor for identification and archival.

Bycatch Species List

Table 10 Bycatch Species List

Please note this list not comprehensive and additional species may be added over time.

Type	Common Name	Species	Code
CRABS	Black-clawed crab	*Lophopanopeus bellus*	LOBE
	Dungeness crab	*Cancer (Metacarcinus) magister*	MEMA
	European green crab	*Carcinus maenas*	CAMA
	Graceful crab	*Cancer (Metacarcinus) gracillis*	MEGR
	Grainy-handed hermit crab	*Pagurus granosimanus*	PAGR*
	Hairy helmet crab	*Telmessus cheiragonus*	TECH
	Hairy hermit crab	*Pagurus hirsutiusculus*	PAHI*

Type	Common Name	Species	Code
	Hairy shore crab	*Hemigrapsus oregonensis*	HEOR
	Hermit crab (various)	Multiple in *Paguridae*	HERM*
	Lined shore crab	*Pachygrapsus crassipes*	PACR
	Pacific rock crab	*Romaleon antennarium*	ROAN
	Pea crabs	Multiple in *Pinnotheridae*	PEAS
	Porcelain crabs	Multiple in *Porcellanidae*	PORC
	Purple shore crab	*Hemigrapsus nudus*	HENU
	Pygmy rock crab	*Glebocarcinus oregonensis*	GLOR
	Red rock crab	*Cancer productus*	CAPR
	Spider crabs	Multiple in *Majidae*	SPID**
	Northern kelp crab	*Pugettia producta*	PUPR
FISHES	Banded killifish	*Fundulus diaphanus*	FUDI***
	Bay pipefish	*Syngnathus leptorhynchus*	SYLE
	Buffalo sculpin	*Enophrys bison*	ENBI
	Cabazon	*Scorpaenichthys marmoratus*	SCMA
	Coho Salmon	*Oncorhynchus kisutch*	ONKI
	Cutthroat	*Oncorhynchus clarkii*	ONCL
	Eel-like fishes/gunnels	Various prickelbacks and gunnels	ELFS**
	Flatfishes (except starry flounder)	Various flatfishes	FLAT**
	Gobies	Multiple from *Gobiidae*	GOBY
	High cockscomb	*Anoplarchus purpurescens*	ANPU
	Kelp Greenling	*Hexagrammos decagrammus*	HEDE
Type	**Common Name**	**Species**	**Code**
FISHES	Lingcod	*Ophiodon elongatus*	OPEL
	Monkeyface prickleback	*Cebidichthys violaceus*	CEVI
	Northern pikeminnow	*Ptychocheilus oregonensis*	PTOR
	Pacific lamprey	*Entosphenus tridentatus*	ENTR
	Pacific tomcod	*Microgadus proximus*	MIPR
	Padded Sculpin	*Artedius fenestralis*	ARFE
	Painted Greenling	*Oxylebius pictus*	OXPI
	Peamouth Chub	*Mylocheilus caurinus*	MYCA
	Plainfin midshipmen	*Porichthys natatu*	PONO
	Prickly sculpin	*Cottus asper*	COAS
	Rock greenling	*Hexagrammos lagocephalus*	HELA
	Shiner Perch	*Cymatogaster aggregata*	CYAG
	Silverspotted sculpin	*Blepsias cirrhosus*	BLCI
	Staghorn sculpin	*Leptocottus armatus*	LEAR
	Starry flounder	*Platichthys stellatus*	PLST
	Steelhead	*Oncorhynchus mykiss*	ONMY
	Three-Spined Stickleback	*Gasterosteus aculeatus*	GAAC
	Tidepool sculpin	*Oligocottus maculosus*	OLMA
	Whitespotted Greenling	*Hexagrammos stelleri*	HEST
SNAILS & GASTROPODS	Batillaria (Asian mud snail)	*Batillaria attramentaria*	BAAT
	Bubble shell	*Haminoea spp*	BUBB
	Carinate dove snail	*Alia carinata*	ALCA

Type	Common Name	Species	Code
	Checkered periwinkle	*Littorina scutulata*	LISC
	Chitons	Multiple in Class *Polyplachophora*	CHIT
	Eastern (Atlantic) oyster drill	*Urosalpinx cinerea*	URCI***
	Eastern mudsnail	*Ilyanassa obsoleta*	ILOB
	Frilled dogwinkle	*Nucella lamellosa*	NULA
	Hooded nudibranch	*Melibe leonina*	MELE
	Japanese oyster drill	*Ocinebrellus inornatus*	OCIN***
	Lewis' moonsnail	*Neverita lewisii*	NELE
	Nassariid snails	*N. fraterculus & N. mendica*	NASS**
	Opalescent nudibranch	*Hermissenda crassicornia*	HECR
	Oyster drills	Various species	DRILL***
	Pleated juga	*Juga plicifera*	JUPL
	Pygmy fossaria	*Galba parva*	GAPA
	Sea lemon nudibranch	*Doris montereyensis*	DOMO
	Sitka periwinkle	*Littorina sitkana*	LISI
	Snails (various)	Various	SNAIL**
	Taylor's sea hare	*Phyllaplysia taylori*	PHTA
	Wrinkled amphissa	*Amphissa columbiana*	AMCO
SHRIMP & OTHER CRUSTACEANS	Amphipod	Various	AMPH
	Asian shrimp	*Palaemon macrodactylus*	PAMA***
	Brokenback shrimps	*Pandalidae* and *Hippolytidae*	BROK
	Burrowing shrimps	*Thalassinidae*	BURR
	Sand shrimps	*Crangonidae spp*	SAND
Type	**Common Name**	**Species**	**Code**
SHRIMP & OTHER CRUSTACEANS	Signal crayfish	*Pacifasticus leniusculus*	PALE
	Skeleton shrimps	*Caprellidae spp*	SKEL
	Snapping shrimp	Multiple in Order *Alpheidae*	SNAP
	Isopod	Various	ISOP
ECHINODERMS	6 rayed star	*Leptasterias hexactis*	LEHE
	Green sea urchin	*Strongylocentrotus drcoebachiensis*	STDR
	Purple sea star	*Pisaster ochraceus*	PIOC
	Sand dollar	*Denraster excentricus*	DEEX
MISC.	Giant water bug	*Lethocerus americanus*	LEAM
	Jellyfish/Cnidarians	Various Jellyfish	JELL
	North Pacific Spiny Dogfish Shark	*Squalus suckleyi*	SQSU
	Sea gooseberry	*Pleurobrachia bachei*	PLBA
MAMMALS	Rodents	Various	Rodent
	Nutria	*Myocastor coypus*	Nutria***
	Muskrat	*Ondatra zibethicus*	Muskrat
REPTILES	Snake	Various	Snake
	American bullfrog	*Lithobates catesbeianus*	Bullfrog***
	Frogs	Various	Frog

When in doubt, chose other for bycatch and take multiple photos for ID (see bycatch protocols)

Type	Common Name	Species	Code
*	*WSG uses HERM for molts only. WDFW, use HERM if unknown and take photos to ID later if possible.*		
**	*WDFW, take photos to ID later if possible, these codes are well enough for our efforts. Leave a comment in the notes if you think you know what it might be.*		
***	*Banded Killifish, Oyster Drills, Non-native Asian shrimp, other AIS. Remove all specimens.*		

Appendix IV: eDNA Sampling Protocols

Currently, there is no standardized protocol for eDNA sampling as it relates to green crab. The procedure outlined in detail below is derived from (Keller et al. 2022) and WDFW zebra and quagga mussel eDNA monitoring protocols. This can serve as a starting point for any planned eDNA sampling efforts.

Before samples are collected, co-managers, tribes, and partners should check with the lab contracted for the analysis to ensure compliance with their specific protocols for sample handling and preservation.

Basic Protocols:

- Before sampling begins at a site, all equipment must be either wiped down with or submerged in a 10% bleach solution and subsequently rinsed with deionized (DI) water.
- At each site, collect a minimum of five 500 mL surface water samples ~1-5 meters apart.
    - Recent research on green crab eDNA sampling suggests that ≥ 6 water samples will provide the highest mean probability of eDNA detection at low green crab density (Ostberg personal communication).
- Place water samples on ice and vacuum-filtered onto a cellulose acetate filter (47 mm diameter, 0.45 µm pore size) within four hours of collection.
- Filters should be preserved in 900 µL of Longmire buffer (Longmire et al. 1997, Renshaw et al. 2015) and stored at -20°C to -80°C before DNA extraction.

Protocols using a Smith-Root ANDe™ water sampling backpack:

- Before sampling begins at a site, all equipment (water sampling backpack, filter holding wand, water bottles, etc.) must be either wiped down with or submerged in a 50% bleach solution (Kemp and Smith 2005, Champlot et al. 2010) and subsequently rinsed with DI water.
- At each site, first filter sterile water for an equipment control, paired with each sample, to monitor potential contamination from the filtering equipment. Equipment controls will be analyzed if the paired sample has a positive detection, to ensure the result is not due to contamination (Jerde et al. 2013).
- Collect two liters of water, which will be filtered through a 1.0 µm pore size filter.
- Filters (stored in 100% ethanol in 2 ml tubes) will be stored at -20°C to -80°C until DNA extraction.
- Perform a freshwater rinse of the eDNA Sampler after use in salt water.

Once collected, samples should be analyzed by labs that have green crab primers (WDFW will work on compiling and providing a list of labs that can perform these analyses). The number of polymerase chain reactions (PCRs) performed as part of this analysis can affect the probability of detecting green crab DNA if it is present in the sample. Recent research suggests that ≥10 PCR samples per water sample provide the highest mean probability of eDNA detection at low green crab density (Ostberg personal

communication). Seasonality and tidal phase at time of collection do not appear to significantly impact eDNA detection probability (Ostberg personal communication).

Appendix V: Green Crab Forms

European Green Crab Emergency Measures Status Summary Report (SSR)

<table>
<tr><td colspan="2">Completed Operational Period (OP)</td><td>Dates:
(From/To)</td><td colspan="2">___ to ___, 2024</td></tr>
<tr><td>Emergency Measures Co-Manager/Partner</td><td>Affiliation:</td><td colspan="2">Prepared by:</td><td>Contact info:</td></tr>
<tr><td>Management Area
(Check one)
(See map below if unsure)</td><td><u>Salish Sea Branch</u>
☐ North Puget Sound
☐ North Central Puget Sound
☐ South Central Puget Sound
☐ South Puget Sound
☐ Eastern Strait & Admiralty Inlet
☐ Western Strait
☐ Hood Canal</td><td colspan="2"><u>Coastal Branch</u>
☐ North Coast
☐ North Central Coast
☐ South Central Coast
☐ South Coast
☐ Grays Harbor
☐ Willapa Bay
☐ Columbia River</td><td><u>Coordination Area:</u></td></tr>
<tr><td>Significant Operational Actions Performed
(Check all that apply)</td><td colspan="2">☐ Training
☐ Early detection
☐ Assessment
☐ Sentinel site</td><td colspan="2">☐ Rapid response
☐ Emphasis response
☐ Control
☐ Research</td><td>☐ Other (identify type):</td></tr>
<tr><td>EGC Captures by Coordination Area*</td><td>Total Prior (2024 as of last OP):</td><td colspan="2">Current OP:</td><td>Total to Date (2024):</td></tr>
<tr><td>Trapping Data</td><td>Trap Types Used (Check all that apply):
☐ Shrimp ☐ Fukui ☐ Minnow
☐ Hand ☐ Other _____</td><td colspan="2">Total Trap Set Days:
(Reminder: total # of overnight soaks regardless of # of checks – 5 traps set for 3 overnight soaks = 15 trap set days.)</td><td>Total Trap Check Days:
(Reminder: total # of trap checks regardless of overnight soaks – 5 traps set for 3 overnight soaks only checked on the last day = 5 trap check days; checked every day would be 15 trap checks)</td></tr>
<tr><td colspan="5">Significant Events/Accomplishments (brief)
•</td></tr>
</table>

☐ Photos attached (please note photo credit and photo description)	**Other Notes (brief)** •

*Best estimates and any corrections to total prior values

Next Operational Period (OP)		Dates: (From/To)	**___ to ___, 2024**
Coordination Area(s)	Area name(s):		
Priority Operational Actions (Check all that apply)	☐ Training ☐ Early detection ☐ Assessment ☐ Sentinel site	☐ Rapid response ☐ Emphasis Response ☐ Control ☐ Research	☐ Other (Identify type)
Priority Safety Concerns			
Priority EGC Coordination Area Sites			
Field Plans*	Total Trap Set Days		Total Trap Check Days
Priority Other Events/Actions (brief) •			
Critical Resource Needs •			

Other Notes

-

*Best estimates

European Green Crab Detection Report

<table>
<tr><td colspan="2">EGC Detection Report</td><td>Submission Date</td><td></td><td>Detection Date</td><td></td></tr>
<tr><td>Reporting Party</td><td>Reported by:</td><td colspan="2">Affiliation:</td><td colspan="2">Contact info:</td></tr>
<tr><td>Management Area
(Check one)</td><td colspan="2"><u>Salish Sea Branch</u>
☐ North Puget Sound
☐ Western Strait
☐ Eastern Strait & Admiralty Inlet
☐ Hood Canal
☐ North Central Puget Sound
☐ South Central Puget Sound
☐ South Puget Sound</td><td colspan="2"><u>Coastal Branch</u>
☐ North Coast
☐ North Central Coast
☐ South Central Coast
☒ South Coast
☐ Grays Harbor
☐ Willapa Bay
☐ Columbia River</td><td><u>Coordination Area:</u></td></tr>
<tr><td>Site Name</td><td colspan="5"></td></tr>
<tr><td>Site Latitude and Longitude[1]</td><td colspan="5"></td></tr>
<tr><td>Local EGC Presence
(Check and fill all that apply)</td><td colspan="5">☐ In MA ☐ In CA Distance to next nearest EGC Detection[2]: ____ miles</td></tr>
<tr><td>Sample Information
(Check and fill all that apply)</td><td colspan="2"><u>Specimens</u>
☐ EGC Molt #_____
☐ Dead EGC #_____
☐ Live EGC #_____</td><td colspan="3"><u>Reproductive Status</u>
☐ Male EGC #_____
☐ Female EGC #_____
☐ Gravid Female EGC #_____
☐ Cannot Determine[3] #_____</td></tr>
<tr><td>Detection Effort Information</td><td colspan="2"><u>Detection method</u>
☐ Molt Search
☐ Hand Capture
☐ Trapping Effort
☐ Other</td><td colspan="3"><u>Catch Per Unit Effort (CPUE)</u>[4]
(# EGC Caught___ /
Traps Deployed___) *100 = _____</td></tr>
</table>

[1] Please report latitude and longitude in decimal degrees with at least 5 decimal places.
[2] Distance measured as strait line (as the crow flies) from next nearest confirmed detection of EGC.
[3] This Reproductive Status should only be selected if determination is impossible (e.g., only the carapace is found).
[4] CPUE recorded as number of EGC caught per 100 traps. If detection did not utilize traps (e.g., molt search, hand capture) do not calculate CPUE.

EGC Detection Decision Tree

A gravid female EGC found:

1. Is this the first detection within the MA within the last 5 years?
    - Yes: Response Type I
    - No: Response Type II

Live EGC found:

	1	2	3	Score Value
Number live EGC	**1-10**	**10-50**	**> 50**	
CPUE	**<50**	**50-200**	**>200**	
Calculate the Total Score by adding the Score Value for the Number of Live EGC and CPUE that fit the detection. For example, a detection with 6 live EGC (Score Value of 1) and CPUE of 60 (Score Value 2) would have a Total Score of 3.			**Total Score**	

1. Is this the first detection within the MA within the last 5 years?
    - Yes
        - Total Score 2-3: Response Type II
        - Total Score 4-6: Response Type I
    - No: Go to 2
2. Is this the first detection within the CA within the last 5 years?
    - Yes
        - Total Score 2-3: Response Type III
        - Total Score 4-6: Response Type II
    - No
        - Total Score 2-3: Response Type V
        - Total Score 4-6: Response Type IV

Only molts found:

1. Is this the first detection within the MA within the last 5 years?
    - Yes: Response Type II response
    - No: Go to 2
2. Is this the first detection within the CA within the last 5 years?
    - Yes: Response Type VI
    - No: Response Type IF

Response Type	Baseline Response Time	Baseline Scope
IF	If feasible	Site
VI	2 months	Site
V	1 month	Site
IV	2 weeks	Site
III	2 months	CA
II	1 months	CA
I	2 weeks	CA

Appendix VI: WDFW Field Safety Communication Protocols

THE FOLLOWING RULES APPLY TO ALL FIELD ACTIVITIES:

- No EGC staff will be in the field alone under ***any*** circumstances.
- ***Any*** staff can cancel field operations for ***any*** reason if they feel working conditions are unsafe.
- For any emergency, call 911 or use Garmin InReach if in a remote location.

CALL IN SYSTEM PROTOCOLS

PROTOCOLS FOR EMPLOYEES IN THE FIELD

1. EGC Staff will have work schedules on their Outlook Calendar for the upcoming week, which communicate, for each date:
    a. Locations
    b. Work sites
    c. Approximate times
2. Employee will have designated point-of-contact (POC) for that week and set "over-due" call-in times with the POC.
3. Employee must call in/text the POC before entering the field.
4. Employee must call in/text the POC after leaving the field.
    a. **Set alarm on phone for end time reminder.**
    b. If conditions in the field require adjustments to the call-in timing, contact your POC before the scheduled leaving-the-field call-in.
5. Repeat the call in/text procedure for every site if visiting multiple sites per day.
6. Employee is to call in/text after arriving at their duty station at the end of the day.

PROTOCOLS FOR POINT-OF-CONTACT (POC) NOT IN FIELD

1. Review field schedule and confirm with field employee.
2. Confirm time(s) with field employee when they will be considered overdue.
3. If employee does not check in by the scheduled time, follow this procedure:
    a. **At each stage, be sure to document all actions taken to assist any form of investigation into the incident (e.g., date, time, action taken and results).**

    Overdue deadline 1 (15-30 minutes overdue)

    b. Contact the employee by cell phone (all field employees will have cell numbers on file with all contact persons and supervisors). Note call time(s).
    c. Call the employee's home to see if they returned directly to their residence. Note call time(s).
    d. Identify call-out persons who may have personal knowledge of the working area where the missing employee was last. This may include co-workers, non-WDFW EGC field staff, private industry contacts and family members. Note contacts and call time(s).

Overdue deadline 2 (45-60 minutes overdue)

e. Inform the employee's supervisor that they are missing/missed call-in (or the next person in command if the supervisor is unavailable). Note the time called and the contact person.
f. The employee's supervisor will determine the next course of action—whether to send staff members to the last known location or whether to contact appropriate search and rescue teams.

Appendix VII: WDFW Environmental Hazards Protocols

Heat Safety Rules

Temperatures ≥ 89 °F

When the temperature is at or above **89 °F**, employers are required to:

- Provide water that is cool enough to drink safely**.**
    - Each employee must have sufficient "drinking water" readily accessible throughout each day's activities:
        - "Drinking water" is defined as water, electrolyte-replenishing beverages that do not contain caffeine, or a combination of both
    - The water quantity will be enough to allow each employee to consume at least one quart or more each hour.
- Allow and encourage employees to take additional paid preventative cool-down rests to protect from overheating.
- Be prepared by having a written outdoor heat exposure safety program and providing training to employees.
- Respond appropriately to any employee with symptoms of heat-related illness.

Temperatures ≥ 100 °F

When the temperature is at or above **100 °F**, employers are required to meet the standards for **≥** 89 °F and the following additional steps:

- Contact employees to confirm they have all necessary resources to respond to high temperature conditions.
- Provide shade or another sufficient means for employees to cool down.
- Ensure employees have a paid cool-down rest period of **at least 10 minutes every 2 hours.**

Figure 30 Heat Stress Index (Temperature + Humidity)

Relative Humidity %	Environmental Temperature (°F)									
	70	75	80	85	90	95	100	105	110	115
0%	64	69	73	78	83	87	91	95	99	103
10%	65	70	75	80	85	90	95	100	105	111
20%	66	72	77	82	87	93	99	105	112	120
30%	67	73	78	84	90	96	104	113	123	135
40%	68	74	79	86	93	101	110	123	137	151
50%	69	75	81	88	96	107	120	135	150	
60%	70	76	82	90	100	114	132	149		
70%	70	77	85	93	106	124	144			
80%	71	78	86	97	113	136	Extreme Danger			
90%	71	79	88	102	122					
100%	72	80	91	108						

Extreme Caution
Danger
Extreme Danger

Wildfire Safety & Evacuation Information

Contact your supervisor to discuss any wildfire(s) that may be in the general area of your work or travel. Visit the following links for up-to-date information on wildfires affecting our region:

- DNR Wildfire Intel Dashboard: Information on Wildfires | WA - DNR
- NWCC Northwest Large Fire Interactive Map: gacc.nifc.gov/nwcc/information/fire_info.aspx

Most counties in Washington follow the Ready, Set, Go! wildfire evacuation procedures. Stay informed on evacuations levels in the work or travel area. *If an area is designated as **Evacuation Level 2 (Set)** steer clear and perform work in an alternate location.* A guide to evacuation levels is provided below.

READY– Level 1

A Level 1 Evacuation advises residents that danger exists in their area. You should monitor local media outlets for information. Assemble emergency supplies and belongings in a safe place. Plan escape routes and make sure all those residing within the home know the plan of action.
Residents with special needs (such as a susceptibility to breathing problems in wildfires or those with animals/pets) should take note and begin making preparations to evacuate. For wildfires, smoke can often cause the most problems for residents, especially those sensitive to smoke and animals.
Evacuations currently are voluntary.

SET– Level 2

A Level 2 Evacuation indicates there is significant danger to your area. Pack your emergency items. Stay aware of the latest news and information on the fire from local media, your local fire department, and public safety.
Residents should either voluntarily relocate to a shelter or with family/friends outside of the affected area, or if choosing to remain, to be ready at a moment's notice.

GO! – Level 3

A LEVEL 3 EVACUATION MEANS "GO!" EVACUATE NOW, LEAVE IMMEDIATELY!
The threat to the area is current or imminent, and immediate evacuation is required. If ignored residents must understand that emergency services may not be available to assist you further.

Residents should NOT delay leaving to gather any belongings or make efforts to protect property. **THIS IS THE LAST NOTICE THAT WILL BE GIVEN**. Entry to evacuated areas may be denied until conditions are safe. Area radio and TV stations will have been asked to broadcast periodic updates.

For more information on the RSG Program, visit: Home (wildlandfirersg.org)

Air Quality Safety

All WDFW employees whose job hazard assessment (JHA) identifies wildfire smoke as a potential exposure are required to be knowledgeable of and adhere to the elements of the WDFW Wildfire Smoke Protection Program and the Air-Quality Index (AQI). N95 masks will also be provided to all field staff for voluntary use.

Supervisors must:

- Be familiar with the requirements of this program and the procedures captured above in the AQI Decision Matrix.
- Ensure employees comply with the requirements of this program and related procedures.
- Complete WDFW Wildfire Smoke Protection Awareness training annually and ensure their employees also complete it as assigned in their safety training matrix.
- Maintain a two-way communication system between supervisor and staff.
- Monitor air quality levels before and periodically during an employee's shift. For action levels, refer to the AQI Decision Matrix.
- Notify employees of workplace activity modifications based on the action level.
- Contact emergency services (911) when employees report adverse symptoms of wildfire smoke exposure.
- Assist employees with incident reporting in the Safety and Security Incident Report (SSIR) as needed.

Employees must:

- Adhere to the requirements of this program and AQI Decision Matrix.
- Annually complete WDFW Wildfire Smoke Protection Awareness training as assigned in their Safety and Health training matrix.
- Contact their supervisor of any adverse changes in air quality levels in their work area.
- Immediately report adverse symptoms of wildfire smoke exposure to their supervisor.
- Report any occupational illness resulting from wildfire smoke exposure using the Safety and Security Incident Reports (SSIR).

Visit the following link to access up-to-date and site-specific air quality information: AirNow.gov and download the: AirNow app to your work smartphone.

Table 11 Wildfire Smoke Protection Program – Air Quality Index (AQI) Decision Matrix

AQI Action Level[1]	Respiratory Protection[2]	Exposure Controls	Exposure Time
<69	None	None	NA
69 - 100	Encouraged[3]	Recommended[5]	Exempt from respiratory protection and exposure controls if working outside for less than 1-hour in a 24-hour period
101 - 300	Encouraged and provided[4]	Required[6]	Exempt from respiratory protection and exposure controls if working outside for less than 1-hour in a 24-hour period

301 - 500	Encouraged and provided[4]	Required[6]	Exempt from respiratory protection and exposure controls if working outside for less than 15 minutes in a 24-hour period
>501	Outdoor work highly discouraged. Respiratory protection required[7]	Outdoor work highly discouraged. Respiratory protection required[7]	Any outdoor exposure

Table Notes

1. Visit the AirNow website or "EPA AirNow" mobile app (available for download on WDFW issued cellular phones) and compare the value at your location with the AQI action level.
2. Respiratory protection includes N95 filtering facepiece respirators.
3. Respiratory protection is not required, however it is encouraged.
4. Respiratory protection is not required, however it is encouraged. Employer will provide approved respiratory protection, and it will be carried by employees.
5. Supervisors are encouraged to implement exposure control methods whenever feasible. Exposure control examples include:
   - Locating work in enclosed structures or vehicles where the air is filtered
   - Changing procedures such as moving workers to a place below the action level
   - Reducing work time in areas with unfiltered air
   - Increasing rest time and frequency, and providing a rest area with filtered air
   - Reducing the physical intensity of the work, lower breathing and heart rates
6. Supervisors are required to implement exposure control methods whenever feasible.
7. Tight fitting (half-mask, full-face mask, or powered-air purifier) respiratory protection is required at this AQI. **N95 mask is not an approved option for AQI levels >501.**

Lightning Safety

If there is lightning in the area you plan on working, consensus is "When thunder roars, go indoors!". Contact your supervisor to discuss any lightning and thunderstorms that may be in the general area of work or travel and follow the OSHA and NOAA guidelines below.

OSHA Guidelines:

- If signs of approaching thunderstorms occur, workers should not begin any task they cannot quickly stop.
- **When thunder roars, go indoors!** If you hear thunder, even a distant rumble, get to a safe place immediately. Thunderstorms always include lightning. Any thunder you hear is caused by lightning! NOAA advises that nowhere outside is safe when thunderstorms are in your area.
- Avoid water, and immediately get out of and away from bodies of water (e.g., pools, lakes).
- Water does not attract lightning, but it is an excellent conductor of electricity.

NOAA Guidelines:

- Since you see lightning immediately and the sound of thunder takes about 5 seconds to travel a mile, you can calculate the distance between you and the lightning. If you count the number of

seconds between the flash of lightning and the sound of thunder and then divide by 5, you'll get the distance in miles to the lightning: 5 seconds = 1 mile, 15 seconds = 3 miles, 0 seconds = very close.
- Remember, if you can hear thunder, chances are that you're within striking distance of the storm. You don't want to get struck by the next flash of lightning.

To learn more about NOAA and OSHA guidelines visit the following links:
- NOAA lighting safety: Lightning Safety Tips and Resources (weather.gov)
- OSHA lightning safety: Lightning Safety When Working Outdoors (osha.gov)

Cold Weather Safety

During cold weather conditions, please see the National Weather Service at weather.gov for forecasts and alerts.weather.gov/cap/wa.php?x=1 for active Watches, Warnings or Advisories for Washington. For safety tips during cold conditions, including distinctions between Watches, Warnings and Advisories, see weather.gov/safety/cold.

Fieldwork should not be undertaken in extreme cold conditions. If you must go into the field during cold weather, be sure to review the OSHA Cold Stress Guide (osha.gov/emergency-preparedness/guides/cold-stress) for best practices and signs of cold stress. Always dress accordingly, wearing at least 3 layers of loose clothing and ensuring you bring a spare set of warm dry clothes.

Check mountain pass conditions prior to travel from the Washington Department of Transportation at wsdot.com/travel/real-time/mountainpasses/ and live road conditions via cameras at wsdot.com/Travel/Real-time/Map/?featuretype=camera.

Under certain circumstances, winter conditions will result in closures of WDFW facilities. You can access current WDFW inclement weather facility conditions and guidance by calling the applicable WDFW Emergency Hotline below:

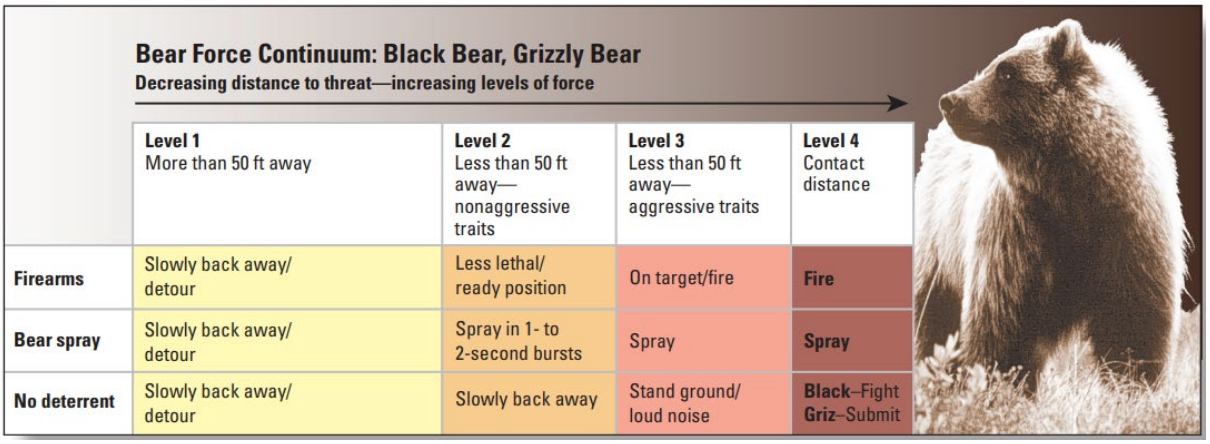
Table 12 WDFW Emergency Hotline Numbers

WDFW and NRB Emergency Hotline	(360) 902-2345
Region 1	(509) 892-7855
Region 2	(509) 754-4624 Extension 211
Region 3	(509) 457-9300
Region 4	(425) 775-1311 Extension 160
Region 5	(360) 906-6700 *2108
Region 6	(360) 249-4628 Extension 265

Bear Encounters

Awareness and proper bear avoidance safety techniques are the best option. When you are safe, contact your supervisor immediately post encounter. Follow the Bear Force Continuum for "No Deterrent" or "Bear Spray" based on what you have available. **Firearms are not an option for our unit**.

Figure 31 Bear Force Continuum Chart



A chart of advised actions in response to the presence of bears. Actions are broken down by distance from the bear, what defensive equipment you have on hand, and bear species.

<u>No Deterrent Procedures</u>

- **Identify yourself** by talking calmly so the bear knows you are a human and not a prey animal. Remain still; stand your ground but slowly wave your arms. Help the bear recognize you as a human. It may come closer or stand on its hind legs to get a better look or smell. A standing bear is usually curious, not threatening.
- **Stay calm** and remember that most bears do not want to attack you; they usually just want to be left alone. Bears may bluff their way out of an encounter by charging and then turning away at the last second. Bears may also react defensively by woofing, yawning, salivating, growling, snapping their jaws, and laying their ears back. Continue to talk to the bear in low tones; this will help you stay calmer, and it won't be threatening to the bear. A scream or sudden movement may trigger an attack. Never imitate bear sounds or make a high-pitched squeal.
- **Make yourselves look as large as possible** (for example, move to higher ground).
- If the bear is stationary, **move away slowly and sideways**; this allows you to keep an eye on the bear and avoid tripping. Moving sideways is also non-threatening to bears.
- **DO NOT RUN**, but if the bear follows, stop and hold your ground. Bears can run as fast as a racehorse both uphill and down. Like dogs, they will chase fleeing animals.
- **DO NOT CLIMB A TREE**. Both grizzlies and black bears can climb trees.
- **Leave** the area or take a detour. If this is impossible, wait until the bear moves away. Always leave an escape route for the bear.

- **Be especially cautious if you see a female with cubs**; never place yourself between a mother and her cub, and never attempt to approach them. The chances of an attack escalate greatly if she perceives you as a danger to her cubs.

No Deterrent Response to Bear Attacks

Bear attacks are rare; most bears are only interested in protecting food, cubs, or their space. However, being mentally prepared can help you have the most effective reaction. Every situation is different, but below are guidelines on how brown bear attacks can differ from black bear attacks. See nps.gov/articles/bearattacks.htm for more information.

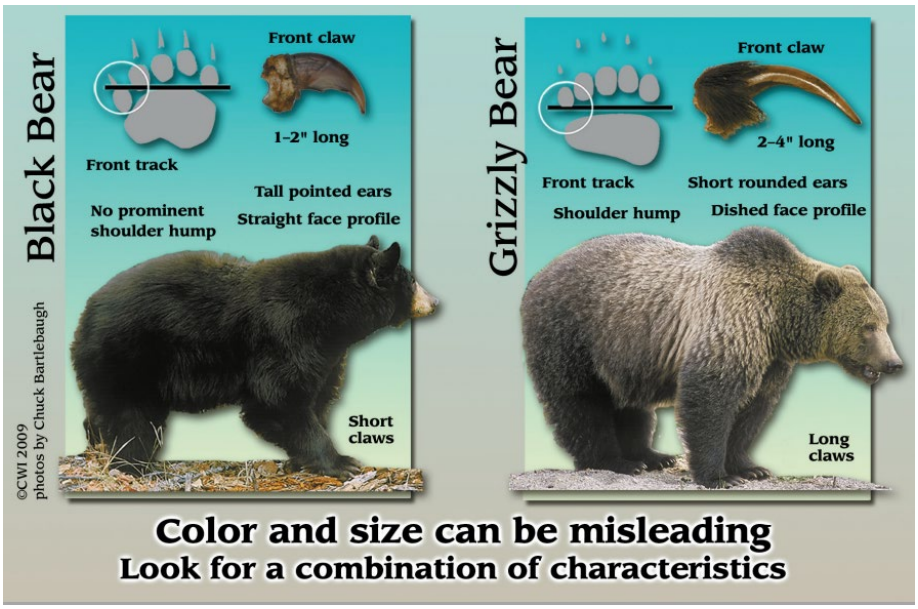
Brown/Grizzly Bears:

- If you are attacked by a brown/grizzly bear, leave your pack on (if you are wearing one) and **PLAY DEAD**.
- Lay flat on your stomach with your hands clasped behind your neck. Spread your legs to make it harder for the bear to turn you over. Remain still until the bear leaves the area. Fighting back usually increases the intensity of such attacks.
- **If the attack persists, fight back vigorously.** Use whatever is at hand to hit the bear in the face.

Black Bears:

- If you are attacked by a black bear, **DO NOT PLAY DEAD**. Try to escape to a secure place such as a car or building.
- **If escape is not possible, try to fight back using any object available**. Concentrate your kicks and blows on the bear's face and muzzle.

Figure 32 Bear Identification: Black vs. Grizzly Bear



Characteristics helpful for determining if a bear is a black or grizzly bear. Proper identification of a bear is crucial in determining the appropriate response to bear attacks.

Bear Spray

Bear spray can be used defensively to stop an aggressive, charging, or attacking bear. Bear spray is not a standard issue for WDFW staff but can be provided if requested and safety training is completed. Speak to your supervisor for more information.

- Although it's used in the same manner you would use mace on an attacking person, bear spray and human pepper spray are not the same.
- Select an EPA-approved product that is specifically designed to stop aggressive bears.
- Be aware that a can of bear spray will only spray for 6-8 seconds.
- Spray in a side-to-side motion to create a wall of spray between you and the bear.
- A useful demonstration for how to use bear spray can be found here: yellowstone.org/videos/bear-spray-demonstration-and-safety/

Cougar Encounters

Awareness and proper cougar avoidance safety techniques are the best option. When you are safe, contact your supervisor immediately post encounter. One of the best protections is numbers, so **do not go out in the field alone**. Additional basic safety information is below. See Mountain Lion Safety (nps.gov/articles/bearattacks.htm) for more information.

If you encounter a lion, remember the goals are to convince it that you are not prey and that you may be dangerous. **Do not play dead.** Follow these safety tips:

- Do not approach a lion. Most mountain lions will try to avoid a confrontation. Give them a way to escape.
- Do not run from a lion. Instead, stand and face the animal. Make eye contact.
- Do not crouch down or bend over.
    - A human standing up is just not the right shape for a lion's prey. Conversely, a person squatting or bending over resembles a four-legged prey animal. In mountain lion country, avoid squatting, crouching or bending over.
- Do all you can to appear larger. Raise your arms. Open your jacket if you are wearing one. Throw stones, branches, or whatever you can reach without crouching or turning your back. Wave your arms slowly and speak firmly in a loud voice.
    - The idea is to convince the mountain lion that you are not prey and that you may be a danger to it.
- Fight back if attacked. Use any items at hand (e.g., rocks, sticks, caps, jackets, garden tools, bare hands). Since a mountain lion usually tries to bite the head or neck, try to remain standing and face the attacking animal.

Appendix VIII: Management Area Actions by Entity

Co-managers, Tribes, and Partners	
Baywater Shellfish Company	Quinault Indian Nation
Chuckanut Shellfish	Quileute Tribe
Drayton Harbor Oysters	Samish Indian Nation
Grays Harbor Conservation District	Shoalwater Bay Indian Tribe
Hama Hama Oyster Company	Skokomish Indian Tribe
Hoh Tribe	Squaxin Island Tribe
Jamestown S'Klallam Tribe	Stillaguamish Tribe of Indians
Lower Elwha Klallam Tribe	Suquamish Tribe
Lummi Nation	Swinomish Indian Tribal Community
Makah Tribe	Taylor Shellfish
Marine Life Center	Tulalip Tribes
Muckleshoot Indian Tribe	United States Fish and Wildlife Service
Nisqually Indian Tribe	United States Geological Survey Western Fisheries Research Center
Nooksack Tribe	United States Navy
Northwest Straits Commission	Upper Skagit Tribe
Pacific Conservation District	Washington Sea Grant
Pacific County Invasive Species Management	Washington State Department of Natural Resources
Pacific Seafoods	Washington State Parks and Recreation Commission
Padilla Bay National Estuarine Research Reserve	Washington State Recreation and Conservation Office
Penn Cove Shellfish	Washington State University Extension
Port Gamble S'Klallam Tribe	Washington State Department of Fish and Wildlife
Puget Sound Partnership	Willapa-Grays Harbor Oyster Growers' Association
Puyallup Tribe	

Table 13 Grays Harbor Conservation District (GHCD)

Management Area	Action
GH	Action GH.4.1.2: GHCD performs assessment trapping.
GH	Action GH.4.2.1: GHCD acquires resources to obtain larger boat and seasonal technician to increase in-house capacity.
GH	Action GH.4.2.2: GHCD locates, recruits, trains, and supports new entities, groups, and individuals to become in involved with green crab tapping efforts.
GH	Action GH.6.1.1: GHCD identifies hotspots of green crab abundance to target for control trapping.
GH	Action GH.6.2.2: GHCD performs control trapping at identified green crab hotspots as capacity allows.
GH	Action GH.6.2.3: GHCD provides support for other entities conducting control trapping in the Grays Harbor Management Area.
GH	Action GH.10.1.2: GHCD conducts outreach and education events including volunteer trainings and outreach booths.
GH	Action GH.10.3.1: GHCD develops outreach materials including pamphlets with basic information, ID cards, Facebook posts, and stickers.

Table 14 Hama Hama Oyster Company

Management Area	Action
HC	Action HC.1.2.1: Hama Hama Oyster Company staff perform haphazard early detection efforts during normal operations.
HC	Action HC.7.1.1: Hama Hama Oyster Company staff implements best management practices to prevent accidental green crab transport.

Table 15 Jamestown S'Klallam Tribe

Management Area	Action
ES	Action ES.1.1.2: Jamestown S’Klallam Tribe performs early detection monitoring trapping at sites in the Sequim Bay Coordination Area.
ES	Action ES.1.1.3: Jamestown S’Klallam Tribe acquires additional staff and resources for geographic and frequency expansion of monitoring efforts.
ES	Action ES.6.2.1: Jamestown S’Klallam Tribe performs control trapping.
ES	Action ES.6.2.2: Jamestown S’Klallam Tribe performs control trapping at highest capacity at new detection locations.
ES	Action ES.10.1.1: Jamestown S’Klallam Tribe performs outreach efforts focused on tribal fishers, the Audubon Society, Dungeness River Management Teams, and other local communities and organizations.

Management Area	Action
ES	Action ES.10.1.2: Jamestown S'Klallam Tribe provides updates to Jefferson and Clallam County Marine Resource Commissions.
ES	Action ES.11.1.1: Jamestown S'Klallam Tribe conducts mark-recapture study to assess green crab movement and perform a population estimate in Dungeness National Wildlife Refuge or in Discovery Bay if capacity allows.

Table 16 Local Volunteers

Management Area	Action
NPS	Action NPS.5.1.4: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.
NCPS	Action NCPS.5.1.3: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.
SCPS	Action SCPS.5.1.2: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.
SPS	Action SPS.5.1.2: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.
ES	Action ES.5.1.2: Local volunteers perform long-term monitoring using WSG monitoring protocols at additional monitoring sites.
GH	Action GH.5.1.1: Local volunteers perform long-term monitoring using WSG monitoring protocols at monitoring sites.
WB	Action WB.5.1.1: Local volunteers perform long-term monitoring using WSG monitoring protocols at monitoring sites.

Table 17 Lower Elwha Klallam Tribe

Management Area	Action
ES	Action ES.4.1.1: Lower Elwha Klallam Tribe performs Monitoring trapping at sites in Port Angeles Coordination Area.
WS	Action WS.4.1.2: Lower Elwha Klallam Tribe performs assessment trapping at sites in Freshwater Bay Coordination Area.
WS	Action WS.4.1.3: Lower Elwha Klallam Tribe performs assessment trapping at sites in Pysht Coordination Area.
WS	Action WS.5.1.1: Lower Elwha Klallam Tribe performs long-term monitoring using WSG monitoring protocols in the Pysht Coordination Area.
WS	Action WS.11.1.1: Lower Elwha Klallam Tribe assists USGS WFRC in the collection of samples for green crab eDNA testing.

Table 18 Lummi Natural Resource AIS Team (LNR)

Management Area	Action
NPS	Action NPS.1.1.2: LNR AIS team performs early detection monitoring in the Sandy Point, Portage Bay, and on the Nooksack River Delta.
NPS	Action NPS.4.1.1: LNR AIS team performs assessment trapping in Lummi Bay and inside the Lummi Sea Pond.
NPS	Action NPS.6.1.1: LNR AIS team identifies hotspots of green crab abundance.
NPS	Action NPS.6.2.2: LNR AIS team performs control trapping at green crab hotspots and other locations within the in the Lummi River, Lummi Bay, and the Lummi Sea Pond.
NPS	Action NPS.6.2.3: LNR cultivates a dynamic core of AIS staff with the experience and knowledge to operate throughout the entirety of the Lummi Nation's waters and the modularity and flexibility to reallocate resources and effort as necessary.
NPS	Action NPS.7.2.1: LNR AIS team determines and implements the most appropriate solution to the issue of the damaged Lummi Sea Pond tide gate.
NPS	Action NPS.10.1.2: LNR AIS hosts interns from Northwest Indian College and local Lummi youth during the summer youth work program as part of outreach efforts.
NPS	Action NPS.10.2.1: LNR AIS team performs outreach efforts focused on local communities and organizations.
NPS	Action NPS.11.1.1: Lummi collaborates with Woods Hole Oceanographic Institution and WSG, collecting samples for RNA analysis.
NPS	Action NPS.11.2.1: Lummi collaborates with Tulalip in a proof-of-concept study using none baited habitat traps to remove green crab.
NPS	Action NPS.11.3.1: LNR conducts larval recruitment and larval timing monitoring using light traps inside and outside the Lummi Sea Pond.
NPS	Action NPS.11.3.2: Lummi collaborates with USGS in the collection and analysis of samples from light traps for DNA and eDNA testing.
NPS	Action NPS.11.4.1: Lummi assesses the impacts of green crab on reservation eelgrass beds by completing the mapping of all current eelgrass beds within reservation boundaries.

Table 19 Makah Tribe

Management Area	Action
WS	Action WS.1.1.1: Makah Tribe performs monitoring trapping at sites in Neah Bay Coordination Area and other locations in Western Strait MA as feasible.
WS	Action WS.1.1.2: Makah Tribe collaborates with Northwest Indian Fisheries Commission in the collection and analysis of samples for green crab eDNA testing.
WS	Action WS.4.1.1: Makah Tribe performs assessment trapping at sites in Neah Bay Coordination Area.

Management Area	Action
WS	Action WS.6.1.1: Makah Tribe performs control trapping at sites in Neah Bay Coordination Area.
WS	Action WS.10.1.1: Makah Tribe performs outreach efforts focused on local communities and organizations.
NC	Action NC.1.1.1: Makah Tribe collaborates with Northwest Indian Fisheries Commission in the collection and analysis of samples for green crab eDNA testing.
NC	Action NC.1.2.1: Makah Tribe performs early detection monitoring trapping sites in Makah Bay Coordination Area and other locations in North Coast Management Area as feasible.
NC	Action NC.4.1.1: Makah Tribe performs assessment trapping at sites in Makah Bay Coordination Area.
NC	Action NC.5.1.1: Makah Tribe will conduct long-term monitoring in the Makah Bay Coordination Area.
NC	Action NC.5.1.2: Makah Tribe will facilitate long-term monitoring at WSG Sentinel Sites using WSG monitoring protocols in the Makah Bay Coordination Area.
NC	Action NC.6.1.1: Makah Tribe performs control trapping at sites in Makah Bay Coordination Area.
NC	Action NC.10.1.1: Makah Tribe performs outreach efforts focused on local communities and organizations.
NC	Action NC.11.1.1: Makah Tribe conducts mark-recapture study to assess green crab movement and perform population estimates.
NC	Action NC.11.1.2: Makah Tribe assesses daily water quality metrics (e.g., salinity, temperature) and green crab abundance relationships.
NC	Action NC.11.1.3: Makah Tribe uses benthic collectors and other tools to detect juvenile settlement in Makah Bay Coordination Area.
NC	Action NC.11.2.1: Makah Tribe assess impacts of green crab on species and habitats of concern.
NC	Action NC.11.3.1: Makah Tribe conducts diet studies of North American river otter to assess predation on green crab.
NC	Action NC.11.3.2: Makah Tribe performs calorimetry study to determine value of green crab as prey in the local ecosystem.
NC	Action NC.11.4.1: Makah Tribe assess trap efficiency using underwater cameras.
NC	Action NC.11.4.2: Makah Tribe tests new bait types/attractants for improving trapping efficiency.
NCC	Action NCC.4.1.1: Makah Tribe performs assessment trapping on the Ozette (Makah) Reservation and adjacent rocky intertidal as feasible.

Table 20 Marine Life Center

Management Area	Action
NPS	Action NPS.1.1.3: Marine Life Center performs early detection monitoring trapping at a site in the Bellingham Bay Coordination Area.
NPS	Action NPS.10.1.3: Marine Life Center conducts outreach and education events including in-house discussions, classroom tours, and special events.

Table 21 Muckleshoot Indian Tribe

Management Area	Action
SCPS	Action SCPS.1.1.2: Muckleshoot Indian Tribe acquires necessary resources to perform early detection monitoring efforts.
SCPS	Action SCPS.2.1.1: Muckleshoot Indian Tribe acquires resources to develop and implement a rapid response plan.

Table 22 Northwest Straits Commission (NWSC)

Management Area	Action
NPS	Action NPS.4.1.2: NWSC coordinates standardized assessment trapping at sites in Drayton Harbor and Samish Bay Coordination Areas.
NPS	Action NPS.4.1.3: NWSC coordinates assists with assessment trapping at Coordination Areas in the North Puget Sound Management Area other than Drayton Harbor and Samish Bay as capacity allows.
NPS	Action NPS.4.2.3: NWSC coordinates monitoring efforts through trapping in Drayton Harbor and Samish Bay Coordination Areas.
NPS	Action NPS.4.4.1: NWSC recruits and trains new entities, groups, and individuals to become involved with green crab trapping efforts.
NPS	Action NPS.4.4.2: NWSC increases local access via increased collaboration with local landowners.
NPS	Action NPS.6.2.4: NWSC performs control trapping at sites in Samish Bay and Drayton Harbor Coordination Areas.
NPS	Action NPS.10.1.4: NWSC conducts outreach and education events to increase public awareness and knowledge of green crab through presentations, molt search training events, social media engagement, and outreach booths.
NPS	Action NPS.10.2.2: NWSC performs outreach efforts focused on shoreline landowners and other local communities through engagement with local county Marine Resources Committees.
NPS	Action NPS.10.2.3: NWSC generates general interest for sustained green crab management through interviews with local media as opportunities allow.

Table 23 Pacific County Invasive Species Management/Pacific Conservation District (PCISM/PCD)

Management Area	Action
WB	Action WB.4.2.1: PCISM/PCD facilitates expansion of assessment trapping capabilities for Willapa Bay Management Area, with particular emphasis in South Willapa Coordination Area.
WB	Action WB.6.1.2: PCISM performs control trapping at sites within North Willapa Coordination Area(see 6.3.1.).
WB	Action WB.6.2.1: PCISM/PCD secures adequate funding and provides support for control trapping by PCVM in North Willapa Coordination Area.
WB	Action WB.6.2.2: PCISM/PCD facilitates he expansion of control trapping capabilities for Willapa Bay Management Area.

Table 24 Padilla Bay National Estuarine Research Reserve (PBNERR)

Management Area	Action
NPS	Action NPS.1.1.4: PBNERR performs early detection monitoring trapping.
NPS	Action NPS.4.1.4: PBNERR performs assessment trapping at sites.
NPS	Action NPS.4.4.3: PBNERR recruits and trains new entities, groups, and individuals to become involved with green crab trapping efforts.
NPS	Action NPS.4.4.4: PBNERR increases local access via increased collaboration with local landowners.
NPS	Action NPS.4.4.5: PBNERR restores boat to usable condition to increase in-house capacity.
NPS	Action NPS.5.1.2: PBNERR will perform long-term monitoring using WSG monitoring protocols at established monitoring sites.
NPS	Action NPS.6.2.5: PBNERR performs control trapping.
NPS	Action NPS.10.1.5: PBNERR provides green crab education and outreach materials for visiting college classes, tours, and for the public through the Padilla Bay Interpretive Center programs.
NPS	Action NPS.11.3.3: PBNERR conducts research and monitoring on the behavior, dispersal, and habitat use of larval and early settler life stages of green crab and environmental factors influencing spread.
NPS	Action NPS.11.3.4: PBNERR convenes annual larval workshop to discuss current larval research and provide larval identification training.

Table 25 Penn Cove Shellfish

Management Area	Action
NPS	Action NPS.1.2.1: Penn Cove Shellfish performs haphazard early detection efforts during normal operations.

Table 26 Port Gamble S'Klallam Tribe

Management Area	Action
SCPS	Action SCPS.1.1.3: Port Gamble S'Klallam Tribe acquires resources to perform early detection monitoring at sites in Port Gamble Bay.
SCPS	Action SCPS.2.1.2: Port Gamble S'Klallam Tribe acquires resources to develop and implement a rapid response plan.
SCPS	Action SCPS.5.1.1: Port Gamble S'Klallam Tribe will perform long-term monitoring using WSG monitoring protocols at monitoring sites.

Table 27 Puyallup Tribe

Management Area	Action
SCPS	Action SCPS.1.1.4: Puyallup Tribe acquires necessary resources to perform early detection monitoring efforts.
SCPS	Action SCPS.2.1.3: Puyallup Tribe acquires resources to develop and implement a rapid response plan.

Table 28 Quinault Indian Nation

Management Area	Action
NCC	Action NCC.5.1.1: Quinault Indian Nation intends to increase the frequency of monitoring of the Queets River mouth and areas north of Beach Trail #3. as personnel time and funding allow.
SCC	Action SSC.1.1.1: Quinault Indian Nation performs early detection monitoring trapping along the South Central Coast MA.
SCC	Action SCC.4.1.1: Quinault Indian Nation performs assessment trapping at sites along the South Central Coast MA.
SCC	Action SCC.5.1.1: Quinault Indian Nation facilitates long-term monitoring using WSG monitoring protocols at sites along the South Central Coast MA.
SCC	Action SCC.5.2.1: Quinault Indian Nation increases frequency of monitoring of the pocket estuaries of the mouths of coastal streams and rivers from the Queets River south to Point Chehalis. as personnel, time, and funding allow.

Management Area	Action
SCC	Action SCC.6.1.1: Quinault Indian Nation performs control trapping at sites along the South Central Coast MA where green crab were encountered during monitoring.
SCC	Action SCC.10.1.2: Quinault Indian Nation performs outreach efforts focused on local communities, schools, and organizations.
SCC	Action SCC.11.1.1: Quinault Indian Nation coordinates with the European Green Crab Research Task Force and other research entities regarding data needs.
GH	Action GH.4.1.3: Quinault Indian Nation performs assessment trapping in and around the Ocean Shores Marina and other harbor locations in coordination with other partners operating in the harbor.
GH	Action GH.4.2.3: Quinault Indian Nation actively seeks funding sources to expand their workforce and trapping efforts within the harbor. In addition, Quinault will make available their research vessel for boat trapping efforts as well as shore operations.
GH	Action GH.4.2.4: Quinault Indian Nation continues training and utilizing Taholah High School Students to assist in trapping efforts and to prepare them for future employment in the workforce.
GH	Action GH 5.3.1: Quinault Indian Nation performs long-term monitoring trapping at sites.
GH	Action GH.6.2.4: Quinault Indian Nation performs control trapping and assist other trapping entities (as capacity allows).
GH	Action GH.6.3.1: Quinault Indian Nation seeks funding and resources to expand monitoring and control efforts in the harbor.
GH	Action GH.6.3.2: Quinault Indian Nation continues with training and utilizing Taholah High School Students to assist in trapping efforts and to prepare them for future employment in the workforce.
GH	Action GH.6.3.3: Quinault Department of Fisheries and the Taholah High School explores working with the Coastal Interpretive Center in Ocean Shores to help educate the general public and to recruit local help in their green crab trapping efforts.
GH	Action GH.10.1.3: Quinault Indian Nation conducts outreach and education events.

Table 29 Samish Indian Nation

Management Area	Action
NPS	Action NPS.4.2.1: Samish Indian Nation acquires necessary resources to perform monitoring trapping.
NPS	Action NPS.4.2.2: Samish Indian Nation performs monitoring trapping.
NPS	Action NPS.4.3.1: Samish Indian Nation performs systematic and haphazard Molt Search events.
NPS	Action NPS.5.1.3: Samish Indian Nation performs long-term monitoring using WSG monitoring protocols at established monitoring sites.
NPS	Action NPS.10.1.6: Samish Indian Nation performs outreach efforts focused on Samish tribal members and other local communities and organizations.

Table 30 Shoalwater Bay Indian Tribe

Management Area	Action
WB	Action WB.4.1.2: Shoalwater Bay Indian Tribe performs assessment trapping in southern properties to assess green crab presence.
WB	Action WB.6.1.3: Shoalwater Bay Indian Tribe performs control trapping at sites within Shoalwater (Tokeland) Coordination Area.
WB	Action WB.6.2.3: Shoalwater Bay Indian Tribe acquires resources (e.g., dedicated staff, fuel storage) to conduct more winter trapping efforts.
WB	Action WB.9.1.1: Shoalwater Bay Indian Tribe expands composting program for utilization of collected green crab.
WB	Action WB.10.1.2: Shoalwater Bay Indian Tribe performs outreach efforts focused on local communities and organizations, including signage and taking tribal youth out into the field.
WB	Action WB.11.1.1: Shoalwater Bay Indian Tribe conducts mark-recapture study to assess green crab movement.
WB	Action WB.11.1.2: Shoalwater Bay Indian Tribe assesses weekly water quality metrics (e.g., salinity, temperature) and green crab abundance relationships.
WB	Action WB.11.2.1: Shoalwater Bay Indian Tribe examines green crab behavior near and in traps using cameras.

Table 31 Skokomish Indian Tribe

Management Area	Action
HC	Action HC.1.1.2: Skokomish Indian Tribe performs early detection monitoring.
HC	Action HC.1.1.3: Skokomish Indian Tribe acquires resources to increase capacity to expand monitoring efforts.
HC	Action HC.10.1.2: Skokomish Tribe performs outreach efforts focused on tribal citizens, fishers, and other local communities and organizations.

Table 32 Squaxin Island Tribe

Management Area	Action
SPS	Action SPS.1.1.2: Squaxin Island Tribe performs early detection monitoring.
SPS	Action SPS.1.1.3: Squaxin Island Tribe acquires resources to ensure long-term capacity for early detection monitoring.
SPS	Action SPS.10.1.2: Squaxin Island Tribe performs outreach efforts focused on local educators, and other local communities and organizations.

Table 33 Stillaguamish Tribe of Indians

Management Area	Action
NCPS	Action NCPS.1.1.4: Stillaguamish Tribe of Indians performs early detection monitoring trapping.
NCPS	Action NCPS.1.1.5: Stillaguamish Tribe of Indians performs Molt Search Surveys on tribal tidelands.
NCPS	Action NCPS.1.2.2: Stillaguamish Tribe of Indians acquires resources to expand trapping capacity.
NCPS	Action NCPS.2.1.1: Stillaguamish Tribe of Indians develops a rapid response plan.
NCPS	Action NCPS.5.1.1: Stillaguamish Tribe of Indians performs long-term monitoring using WSG monitoring protocols at established monitoring sites.
NCPS	Action NCPS.10.1.2: Stillaguamish Tribe of Indians performs outreach efforts focused on local classrooms and other local communities and organizations.

Table 34 Swinomish Indian Tribal Community

Management Area	Action
NPS	Action NPS.1.1.5: Swinomish Indian Tribal Community incorporates green crab monitoring into existing larval and juvenile Dungeness crab survey work.
NPS	Action NPS.1.1.6: Swinomish Indian Tribal Community coordinates with other local co-managers, tribes, and partners to expand monitoring within already established programs.
NPS	Action NPS.10.1.7: Swinomish Indian Tribal Community conducts outreach and education events including molt search events as capacity allows.
NCPS	Action NCPS.1.1.6: Swinomish Indian Tribal Community incorporates green crab monitoring into existing larval and juvenile Dungeness crab survey work.
NCPS	Action NCPS.1.1.7: Swinomish Indian Tribal Community coordinates with other local co-managers, tribes, and partners to expand monitoring within already established programs.
NCPS	Action NCPS.1.1.8: Swinomish Indian Tribal Community performs early detection monitoring trapping at sites in the Swinomish Channel.
NCPS	Action NCPS.1.2.3: Swinomish Indian Tribal Community acquires resources to expand trapping capacity.
NCPS	Action NCPS.2.1.2: Swinomish Indian Tribal Community develops a rapid response plan.
NCPS	Action NCPS.5.1.2: Swinomish Indian Tribal Community performs long-term monitoring using WSG monitoring protocols at established monitoring sites.
NCPS	Action NCPS.10.1.3: Swinomish Indian Tribal Community conducts outreach and education events including molt search events as capacity allows.
NCPS	Action NCPS.11.2.1: Swinomish Indian Tribal Community monitors for larval presence in light traps.

Table 35 Taylor Shellfish

Management Area	Action
NPS	Action NPS.4.1.5: Taylor Shellfish performs assessment trapping.
NPS	Action NPS.6.2.6: Taylor Shellfish participates in control trapping in support of larger efforts.
NPS	Action NPS.7.1.1: Taylor Shellfish staff implement best management practices to prevent accidental green crab transport.

Table 36 Tulalip Tribes

Management Area	Action
NCPS	Action NCPS.1.1.2: Tulalip Tribes perform early detection monitoring trapping.
NCPS	Action NCPS.1.1.3: Tulalip Tribes performs Molt Search surveys.
NCPS	Action NCPS.1.2.1: Tulalip Tribes acquires resources to expand capacity (e.g., boat, staff) to increase in-house trapping capacity.
NCPS	Action NCPS.2.1.3: Tulalip Tribes develops a rapid response plan.
NCPS	Action NCPS.10.1.4: Tulalip Tribes conducts outreach and education events including molt search events as capacity allows.
NCPS	Action NCPS.11.1.1: Tulalip Tribes assess efficacy of new (i.e., crab slab) and traditional trap designs.

Table 37 United States Fish and Wildlife Service (USFWS)

Management Area	Action
ES	Action ES.5.1.1: USFWS performs long-term monitoring using WSG monitoring protocols at monitoring sites.
ES	Action ES.6.2.4: USFWS performs control trapping at sites in Dungeness Bay Coordination Area.
ES	Action ES.10.1.4: USFWS performs outreach efforts focused on local communities and organizations.
GH	Action GH.10.1.4: USFWS performs outreach efforts focused on local communities and organizations. In addition, Grays Harbor National Wildlife Refuge features exhibitors and agencies at the annual Grays Harbor Shorebird and Nature Festival, dedicated to educating the public about green crab.
WB	Action WB.4.1.3: USFWS performs assessment trapping in South Willapa and Long Island Coordination Areas opportunistically based on capacity.
WB	Action WB.4.2.2: USFWS acquires additional resources to expand trapping capacity (e.g., staff, equipment).
WB	Action WB.6.1.5: USFWS performs control trapping at Leadbetter Point in Long Beach - North, South Willapa, and Long Island Coordination Area.
WB	Action WB.10.1.3: USFWS performs outreach efforts focused on local communities and organizations, including Facebook posts, molt searches, an information table at the Columbia-Pacific Farmers' Market, brochures, and maintaining green crab information on their website.

Table 38 Washington State Department of Fish and Wildlife (WDFW)

Management Area	Action
NPS	Action NPS.1.1.7: WDFW performs early detection monitoring trapping in the San Juan Islands Coordination Area.
NPS	Action NPS.3.1.2: WDFW assists NWSC with assessment trapping in Drayton Harbor and Samish Bay Coordination Areas.
NPS	Action NPS.3.1.3: WDFW assists LNR and NWSC with control trapping in Drayton Harbor, Samish Bay, and Lummi Bay Coordination Areas.
NPS	Action NPS.3.1.4: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
NPS	Action NPS.4.1.6: WDFW performs assessment trapping in Bellingham Bay, Birch Bay, and San Juan Islands Coordination Areas.
NPS	Action NPS.5.2.1: WDFW performs assessment trapping in Bellingham Bay, Birch Bay, and San Juan Islands Coordination Areas.
NCPS	Action NCPS.1.1.9: WDFW performs early detection monitoring trapping in all Coordination Areas.
NCPS	Action NCPS.2.1.4: WDFW develops rapid response plans for new detections.
NCPS	Action NCPS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions
SCPS	Action SCPS.1.1.5: WDFW performs early detection monitoring trapping in all Coordination Areas.
SCPS	Action SCPS.2.1.4: WDFW develops rapid response plans for new detections.
SCPS	Action SCPS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
SPS	Action SPS.1.1.4: WDFW performs early detection monitoring trapping in all Coordination Areas.
SPS	Action SPS.2.1.1: WDFW develops rapid response plans for new detections.
SPS	Action SPS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
HC	Action HC.1.1.4: WDFW will perform early detection monitoring in all Coordination Areas.
HC	Action HC.2.1.1: WDFW develops rapid response plans for new detections.
HC	Action HC.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
HC	Action HC.4.1.1: WDFW performs assessment trapping in Seabeck, Dabob, and North Hood Coordination Areas.
HC	Action HC.5.1.1: WDFW performs long-term monitoring trapping in Seabeck Coordination Areas.
ES	Action ES.1.1.4: WDFW will perform early detection monitoring in Port Ludlow, Shine Tidelands, and potentially additional Coordination Areas.

Management Area	Action
ES	Action ES.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
ES	Action ES.4.1.2: WDFW performs assessment trapping in Discovery Bay, Port Angeles, Dungeness Bay, and Port Townsend Bay Coordination Areas.
ES	Action ES.5.2.1: WDFW performs long-term monitoring trapping in Discovery Bay Coordination Area.
ES	Action ES.6.2.3: WDFW performs control trapping at sites in Discovery Bay Coordination Area.
WS	Action WS.1.2.1: WDFW performs early detection monitoring trapping in Clallam Bay, Pysht, and Freshwater Bay Coordination Areas.
WS	Action WS.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
WS	Action WS.4.1.4: WDFW performs assessment trapping at sites in Salt Creek Coordination Area.
NC	Action NC.3.1.1: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
NCC	Action NCC.1.1.1: WDFW performs early detection monitoring.
NCC	Action NCC.3.1.1: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
SCC	Action SCC.1.1.2: WDFW performs early detection monitoring.
SCC	Action SCC.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
SCC	Action SCC.4.1.2: WDFW performs assessment trapping.
SCC	Action SCC.5.2.2: WDFW performs long-term monitoring trapping at sites in Copalis and potentially additional Coordination Areas.
SC	Action SC.8.1.1: WDFW AIS unit staff utilizes satellite imagery and regional expertise to identify the general location of potential green crab habitat.
GH	Action GH.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
GH	Action GH.4.1.4: WDFW performs assessment trapping in South Bay and Ocean Shores Coordination Area.
GH	Action GH.5.2.2: WDFW performs long-term monitoring trapping in Long Beach North, Long Beach South, South Willapa, and Shoalwater Coordination Areas.
WB	Action WB.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
WB	Action WB.4.1.4: WDFW performs assessment trapping in Long Beach North, Long Beach South, South Willapa, and Shoalwater Coordination Areas as capacity allows.
WB	Action WB.5.2.1: WDFW performs long-term monitoring trapping in Long Beach North, Long Beach South, South Willapa, and Shoalwater Coordination Areas.

Management Area	Action
WB	Action WB.9.2.1: WDFW collects green crab and other organic materials approved for this disposal method from participating co-managers, tribes, and partners and delivers to Tidal Grow AgriScience for processing into fertilizer. While processing occurs in the Willapa Bay Management Area, green crab are collected from various Management Areas.
CR	Action CR.1.1.2: WDFW performs early detection Monitoring at sites in Baker Bay, Cape Disappointment, and potentially additional Coordination Areas.
CR	Action CR.3.1.2: WDFW supports and assists co-managers, tribes, and partners with additional management actions.
CR	Action CR.4.1.1: WDFW performs assessment trapping at sites in Baker Bay, Cape Disappointment, and potentially additional Coordination Areas.
CR	Action CR.5.1.1: WDFW performs long-term monitoring trapping at sites in the Baker Bay and Cape Disappointment Coordination Areas.

Table 39 Washington State Department of Natural Resources (DNR)

Management Area	Action
NPS	Action NPS.1.1.1: DNR performs early detection monitoring trapping at sites in Fidalgo Bay and Cherry Point Aquatic Reserve.
NPS	Action NPS.5.1.1: DNR will perform long-term monitoring using WSG monitoring protocols in the Cypress Island Aquatic Reserve.
NPS	Action NPS.6.2.1: DNR assists with control trapping efforts at Birch Bay, Henry Island, and Roche Harbor as capacity allows.
NPS	Action NPS.10.1.1: DNR conducts outreach and education events with coordination from Aquatic Reserve Citizen Stewardship Committees (CSCs) and local green crab co-managers, tribes, and partners, highlighting AIS and the stewardship of Aquatic Reserves.
NCPS	Action NCPS.1.1.1: DNR performs early detection monitoring trapping at sites within and near the Whidbey Island Aquatic Reserve and assists partners trapping within Skagit Bay.
SCPS	Action SCPS.1.1.1: DNR performs early detection monitoring at the Maury Island Aquatic Reserve and assists partners trapping within Port Gamble.
SPS	Action SPS.1.1.1: DNR performs early detection monitoring trapping at sites within the Nisqually Reach and Woodard Bay Natural Resource Coordination Areas.
SPS	Action SPS.5.1.1: DNR will perform long-term monitoring using WSG monitoring protocols in the Nisqually Reach Aquatic Reserve.
HC	Action HC.1.1.1: DNR performs early detection monitoring at sites within the Dabob, Seabeck, and South Hood Coordination Areas and assists with trapping at Potlatch State Park.

Management Area	Action
ES	Action ES.1.1.1: DNR performs early detection monitoring trapping at sites within and near the Protection Island Aquatic Reserve at Travis Spit and assists with trapping at Sequim and Discovery Bays.
GH	Action GH.4.1.1: DNR performs assessment trapping at sites within DNR Natural Area Preserves, Natural Resource Conservation Areas, and Acidification Nearshore Monitoring Network eelgrass sites.
GH	Action GH.5.2.1: DNR performs quarterly monitoring tapping at Grays Harbor National Wildlife Refuge.
GH	Action GH.6.2.1: DNR performs control trapping at sites within DNR Natural Area Preserves, Natural Resource Conservation Areas, and public land and assists local partners with emphasis response efforts.
GH	Action GH.10.1.1: DNR conducts outreach and education events including taking students into the field as capacity allows.
WB	Action WB.4.1.1: DNR performs assessment trapping at sites within DNR Natural Area Preserves, Natural Resource Conservation Areas, and Acidification Nearshore Monitoring Network eelgrass sites.
WB	Action WB.6.1.1: DNR performs control trapping at sites within DNR Natural Area Preserves and Natural Resource Conservation Areas and assists local partners with emphasis response efforts.
CR	Action CR.1.1.1: DNR performs Early Detection Monitoring at sites within the Baker Bay Coordination Area.

Table 40 Washington State Parks and Recreation Commission (Parks)

Management Area	Action
NPS	Action NPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
NPS	Action NPS.10.2.4: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
NCPS	Action NCPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
NCPS	Action NCPS.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
SCPS	Action SCPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.

Management Area	Action
SCPS	Action SCPS.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
SPS	Action SPS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
SPS	Action SPS.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
HC	Action HC.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
HC	Action HC.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
ES	Action ES.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
ES	Action ES.10.1.3: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
WS	Action WS.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
WS	Action WS.10.1.2: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
SCC	Action SCC.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
SCC	Action SCC.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
GH	Action GH.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
GH	Action GH.10.2.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.
WB	Action WB.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
WB	Action WB.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Management Area	Action
CR	Action CR.3.1.1: Parks facilitates trapping access to co-managers, tribes, and partners.
CR	Action CR.10.1.1: Parks performs outreach efforts focused on local communities and organizations, including signage and educational programming for park visitors.

Table 41 Washington State University Extension (WSU Extension)

Management Area	Action
WB	Action WB.10.1.4: WSU Extension conducts outreach and education events including molt search events and trainings.
WB	Action WB.11.2.2: WSU Extension assess efficacy of new and traditional trap designs.
WB	Action WB.11.3.1: WSU Extension refines and expands green crab Molt Search Program.
WB	Action WB.11.4.1: WSU Extension assess impacts of green crab on species and habitats of concern.

Table 42 Willapa Grays Harbor Oyster Growers Association (WGHOGA)

Management Area	Action
GH	Action GH.6.2.5: WGHOGA members perform control trapping at sites throughout the Grays Harbor Management Area, with prioritization for high-value resource areas (e.g., shellfish beds, seed areas).
WB	Action WB.6.1.4: WGHOGA members perform control trapping at sites throughout the Willapa Bay Management Area, with prioritization for high-value resource areas (e.g., shellfish beds, seed areas).

Appendix IX: 2025-2027 Recommendations to the Washington State Legislature

1. Washington Department of Fish and Wildlife recommends that the Department's current ongoing state funding continue to be appropriated, $6,082,000 of the general fund—state appropriation for fiscal year 2026 and $6,082,000 of the general fund—state appropriation for fiscal year 2027, solely for the department to implement eradication and control measures on European green crabs through coordination and grants with partner organizations as outlined in the long-term management plan.

2. Washington Department of Fish and Wildlife recommends a report to the State Legislature on additional recommendations and funding for new and unanticipated European green crab populations that are identified outside of the scope of the current plan by October 1, 2026.

3. Washington Department of Fish and Wildlife recommends that the Department facilitated European Green Crab Research Task Force develop a prioritized and actionable list of research necessary to inform achievement of long-term control and eradication by October 1, 2026, to inform future state and federal funding requests.

4. Engrossed Senate Bill 5950 - 2023-24 - Making 2023-2025 fiscal biennium supplemental operating appropriations, provided the University of Washington $174,000 of the general fund—state appropriation for fiscal year 2025 for genome sequencing and other research to improve control and eradication of the European green crab. Washington Department of Fish and Wildlife recommends that the WDFW and supporting partners, develop and seek funding to continue European green crab genetic research for the purpose of long-term achievement of control and potential eradication of the European green crab using genetic interventions.

5. Washington Department of Fish and Wildlife recommends support for a Washington Department of Natural Resources (DNR) 2025-2027 budget decision package titled *Managing Invasive European Green Crab on State-Owned Aquatic Lands*. DNR is requesting $1,347,500 in Fiscal Year 2026, and $1,195,900 per fiscal year ongoing to manage European green crab populations on state-owned lands to prevent significant negative impacts to biota and critical habitats. The State Legislature provided one-time funding in fiscal year 2025 due to DNR needs exceeding WDFW funding. DNR's proposed actions and budget needs have been incorporated into the long-term management plan. DNR has removed more than 26,000 European green crab to date and are a critical partner in the state's effort to successfully address this issue long-term.

6. The Washington Department of Fish and Wildlife recommends support for Washington State Department of Ecology's 2025-2027 budget proposal titled *European Green Crab Research and Control.* Ecology is requesting $270,000 per fiscal year to support research into European green crab behavior to inform long-term, strategic management, and monitoring. This critical research cannot be done within existing WDFW funding levels and will help managers understand

environmental factors affecting the invasive species' dispersal and predict impacts to coastal resources. This proposed research was identified as a high priority during a workshop including statewide European green crab managers and researchers and has been incorporated into the long-term management plan. This funding will also support ongoing trapping and monitoring efforts in Padilla Bay and adjacent waters.

Appendix X: Federal Funding and Action Needs

1. In Federal Fiscal Year 2024, Congress directed the U.S. Department of Commerce, National Oceanographic and Atmospheric (NOAA) Fisheries, Administration, Office of Habitat Conservation, Restoration Center to invest $1.5 million for management, intervention, and mitigation of invasive European green crab. In Federal Fiscal Year 2025, the Congressional Senate has proposed an additional $1.5 million for management, intervention, and mitigation of invasive European green crab. The Washington Department of Fish and Wildlife recommends that Congress continue appropriations to NOAA Fisheries to support State of Washington efforts.

2. Historically, U.S. Department of Commerce, National Oceanographic and Atmospheric (NOAA) Fisheries provided national marine invasive species coordination and response through a national Aquatic Invasive Species Program (AISP) that supported informed actions to protect NOAA steward resources from aquatic invasive species. The mission of the NOAA Aquatic Invasive Species Program (AISP) was to protect resources under NOAA's stewardship responsibilities from invasive species threats, and it also emphasized the use of research and outreach to confront these threats. Despite the critical role it played, the NOAA AISP was terminated over 10-years ago because it was mainly funded by earmarks that were discontinued. Much AISP program funding was directed to states as grants for AIS prevention work that included mitten crab, European green crab, Atlantic salmon and Dreissenid mussel activities. Without this important program, gaps in addressing marine aquatic invasive species have persisted because a federal lead no longer exists. The Washington Department of Fish and Wildlife views reestablishment of the NOAA AISP as a critical component to long-term European green crab control and eradication success and recommends that Congress reestablish the AISP office. Reestablishment of the office is also supported by the 2023 Aquatic Invasive Species Commission Report and Recommendations: Improving the Prevention, Eradication, Control and Mitigation of Aquatic Invasive Species (AIS).

3. The Frank LoBiondo Coast Guard Authorization Act of 2018, Vessel Incidental Discharge Act 16 U.S. Code § 4729 authorized the Coastal Aquatic Invasive Species Mitigation Grant Program and Mitigation Fund for the purpose of improving the understanding, prevention, and mitigation of, and response to, aquatic invasive species in the Coastal Zone and Exclusive Economic Activity Zone. However, Congress has not appropriated funding to this grant program. The Washington Department of Fish and Wildlife recommends that Congress appropriate $5 million annually for the Coastal Aquatic Invasive Species Mitigation Grant Program and Mitigation Fund, which will support European green crab control and eradication, in addition to restoring habitat impacted

by the aquatic invasive species.

4. The Lummi Nation's Lummi Sea Pond, an artificial 750-acre impoundment constructed in 1969 just west of Bellingham and initially built for marine aquaculture purposes, urgently needs significant infrastructure investments. These investments are crucial to prevent the European green crab from spreading into unaffected areas of the Salish Sea. In addition, the Lummi Sea Pond dike wall road is part of the evacuation route that provides safe egress for the Lummi Nation community and public during an emergency such as a tsunami. In State Fiscal Year 2023, the Washington Department of Fish and Wildlife funded a Lummi Nation alternative analysis for infrastructure improvements to the Lummi Sea Pond. The Washington Department of Fish and Wildlife recommends that Congress direct the Federal Emergency Management Agency and other relevant federal agencies to support the Lummi Nation in determining actions and costs to address and improve the Lummi Sea Pond.

5. Washington Department of Fish and Wildlife recognizes that tribal nations exert a critical level of effort in the management of European green crab, and that in many cases this capacity has been built and expanded through funding from a U.S. Department of the Interior Bureau of Indian Affairs annual grant program. Washington Department of Fish and Wildlife recommends that federal appropriations requests include $8 million to the U.S. Department of the Interior Bureau of Indian Affairs Invasive Species Program for Northwestern Region invasive species management priorities, including European green crab. Washington Department of Fish and Wildlife surveyed tribal nations in developing the long-term management plan, identifying a specific need of $1.84 million annually specifically for European green crab control and eradication. Recognizing many invasive species priorities of tribal nations, the Department recommends a total of $8 million be appropriated by Congress to the Bureau of Indian Affairs Invasive Species Program.

6. On May 9, 2024, the national Aquatic Nuisance Species Task Force (ANSTF) provided final approval of the National European Green Crab Management Plan developed by a multi-agency European Green Crab Working Group for implementation through the ANSTF. The approved national management plan and working group recommended that the accomplish the goals of this plan, that the ANSTF establish a European Green Crab Implementation Team consisting of members of local, state, and federal agencies, Tribal communities, universities, non-governmental organizations, and other relevant stakeholders. The European Green Crab Implementation would evaluate progress towards achieving the goals of the National European Green Crab Management Plan using the best available science and the best use of resources. Washington Department of Fish and Wildlife recommends that Congress request that the ANSTF create and support this implementation team to ensure successful national implementation.

7. The U.S. Fish and Wildlife Service is provided funding from Congress annually to fund projects that implement priorities identified in the Quagga and Zebra Mussel Action Plan (QZAP 2.0) for the Western United States. Eligible applicants can submit proposals to address priorities such as containment through watercraft inspection and decontamination, prevention programs, compliance with regulations, public outreach, detection and response capabilities, and related

research. The grant program falls under the Fish and Wildlife Management Assistance authority, which supports state and interstate aquatic nuisance species management plans. The Washington Department of Fish and Wildlife recommends that Congress appropriate $3 million to the U.S. Fish and Wildlife Service annually for a grant program to implement the National European Green Crab Management Plan, using the successful model of Quagga and Zebra Mussel Action Plan grants for the Western United States.

8. Since 2021, the Washington Department of Fish and Wildlife has facilitated a European Green Crab Research Task Force to determine key European research questions and needs to achieve adequate and sustainable European green crab control, and eradication where feasible. Federal scientific expertise and funding is required. The Washington Department of Fish and Wildlife recommends that Congress annually appropriate $800,000 to the U.S. Geological Survey Biological Threats and Invasive Species Research Program for its Western Fisheries Research Center and Alaska Science Center.

9. Federal agency action on federally managed lands is critical to the long-term successful control and eradication of European green crab, including management activities performed on U.S. Fish and Wildlife Service Refuges. To support ongoing state actions, the Washington Department of Fish and Wildlife recommends that Congress appropriate $300,000 annually to Willapa National Wildlife Refuge and Dungeness National Wildlife Refuge/Maritime National Wildlife Refuge Complex for implementation of actions in the European Green Crab Long-Term Management Plan.

10. Washington is the nation's leading producer of farmed shellfish with an estimated annual harvest of cultivated shellfish worth more than $100 million and commercial shellfisheries in the hundreds of millions of dollars annually. Shellfish are also a substantial recreational resource for the public and culturally important for tribes. Washington's shellfish growers are on the front lines of potential European green crab impacts and have been contributing substantial effort since 2021 to controlling and eradicating European green crab with support from the Washington Department of Fish and Wildlife. However, federal assistance is required to providing additional and long-term support for shellfish growers who have been impacted by the spread of European green crab. The Washington Department of Fish and Wildlife recommends that Congress direct the U.S. Department of Agriculture Animal and Plant Health Inspection Service to provide additional support to shellfish growers who have been impacted.