Regional Operational Plan No. ROP.SF.1J.2023.01

Investigating Presence/Absence of European Green Crab in the Ketchikan, Alaska Area

by

Tammy Davis

February 2023

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	′
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	″
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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by
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February 2023

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Signature Page

Project Title:	Investigating Presence/Absence of European Green Crab in the Ketchikan, Alaska Area
Project leader(s):	Tammy Davis
Division, Region and Area:	Sport Fish, Region I, Juneau, Alaska
Project Nomenclature:	SWG T10 CWS Aquatic Resource Implementation and Alaska Aquatic Nuisance Species Management Plan
Period Covered:	August 22, 2022 – December 30, 2022
Field Dates:	August – September 2022
Plan Type:	Category I

Approval

Title	Name	Signature	Date
Project Leader	Tammy Davis	DocuSigned by: E8C55903ED024AD...	8/28/2022
Research Coordinator	Jeff Nichols		8/29/2022

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ABSTRACT

The objectives of this study are to detect the presence of invasive European green crab *Carcinus maenas* on target shorelines at Revillagigedo and Gravina Islands in southern Southeast Alaska and if detected, determine magnitude of presence in the Ketchikan area. Methods to achieve these goals are to conduct roadside and remote shoreline molt and trapping surveys. Alaska Department of Fish and Game will use data to understand the extent of the aquatic invasive species in southern Southeast Alaska.

Keywords: presence, absence, European green crab, *Carcinus maenas,* Ketchikan, Southeast Alaska, invasive species

PURPOSE

Live European green crabs (*Carcinus maenas*), listed as banned invasive species in state of Alaska regulation 5 AAC 41.075, were confirmed from Annette Island Reserve, southeast of Ketchikan, by Metlakatla Indian Community Department of Fish and Wildlife staff on July 22, 2022. After carapaces of these invasive crabs were first detected in Tamgas Harbor by NOAA and Metlakatla Indian Community staff during shoreline surveys on July 19, 2022, intensive trapping was initiated to determine if live crabs were present in the area. Since that time, 56 live crabs have been collected at Tamgas Harbor on Annette Island, and 2 dead crab have been found at Smuggler Cove, the adjacent embayment to Tamgas Harbor. With the initial goal of determining the presence or absence of European green crab in the Ketchikan area, the Alaska Department of Fish and Game (ADF&G) Divisions of Sport and Commercial Fisheries will conduct trapping and shoreline molt surveys on roadside and remote beaches on Revillagigedo and Gravina islands.

BACKGROUND

The World Conservation Union considered European green crab as one of the 100 worst invasive species globally (Lowe et al. 2000). European green crabs are voracious predators, targeting native bivalves, mollusks and crustaceans that reside in eelgrass meadows. As they forage for benthic invertebrates, eelgrass roots and blades are dug up and destroyed. Based on the drastic depletion of seagrass habitat after they have become established outside their native range elsewhere in North America, it is anticipated they could cause devastating impacts on nearshore habitats in Alaska and reduce species abundance and diversity. Eelgrass beds provide food and protection for juvenile salmon, Dungeness crab and other culturally and economically important species. The negative impacts European green crab cause are of such high concern that in early 2022, the Governor of Washington state authorized emergency actions and funding to combat them in the Salish Sea.

European green crabs have been established in British Columbia, Canada since 1999. In the past two decades, their distribution has extended north and southward from the point of first detection. In June 2020, European green crab larvae were confirmed from Prince Rupert. In July 2020, adult invasive green crabs were detected near Queen Charlotte, Haida Gwaii, Canada. Until July 2022, no live crabs had been detected in Alaska by early detection monitors. Early detection of new European green crab populations is important for protecting important subsistence, personal use, and commercial aquatic resources. For the past decade, community-based early detection monitoring has occurred in Southeast Alaska (Hamilton *Unpublished*[1]). Early detection of invasive species followed by rapid response actions to reduce population density can reduce the potential for harmful impacts to the area (Drinkwin, et al. 2018)

[1] Hamilton, J. Unpublished. Alaska European green crab community-based Early Detection Monitoring Manual. Located at: Alaska Department of Fish and Game, Juneau.

OBJECTIVES

1. To detect the presence of nonnative European green crab on shorelines, beaches and in nearshore habitats on Revillagigedo and Gravina Islands in southern Southeast Alaska.

SECONDARY OBJECTIVES

1. Monitor roadside and remote shorelines by looking for live European green crabs and crab carapaces.
2. Deploy traps in target nearshore habitats accessible by road and to remote areas that are thought to be of highest risk of invasion due to preferred habitat and proximity to known populations.
3. Request residents help by searching shorelines for live suspect crabs and crab carapaces. Photograph suspect crab and crab carapaces and share photos with tammy.davis@alaska.gov Report European green crabs sightings to 1-877-INVASIV or the ADF&G online Invasive Species Reporter: https://www.adfg.alaska.gov/index.cfm?adfg=invasivespeciesreporter.main

METHODS

SHORELINE AND TRAPPING SURVEYS

As time and resources allow shoreline surveys will occur and traps will be deployed at roadside and remote beaches on Revillagigedo and Gravina Islands in southern Southeast Alaska (Table 1, Appendix A 3). Remote surveys will require access to either a department vessel or the ability to charter a local vessel. It is common to identify the presence of European green crab through the discovery of a molt before a live crab is found. Shoreline and trapping procedures are adapted from the Alaska European Green Crab Community-based Early Detection Monitoring Manual (Hamilton *Unpublished).*

Shoreline Surveys:

Manual shoreline visual searches can be conducted weekly to monthly, as time allows. Visually scan the beach above, along and below the wrack line for European green crab molts and carapaces. During low tide events, the crabs can be found scurrying in eelgrass beds and partially submerged in sediment when rocks are flipped over. Collect the shell or crab and document carapace width and location.

Frequency:

The preferred frequency from August through September is at least three times. If staff can survey more frequently, it is encouraged. A minimum number of sampling events is once a month per site. Sampling more often increases the chances of finding invasive green crabs. If a green crab is found, sampling frequency and trapping density will be increased, when capacity allows.

Deploying Traps: At least one array of five folding Fukui traps will be deployed at all sites. Smaller embayments with little to no eelgrass will have one site. Where eelgrass meadows are extensive, up to five arrays of five traps will be deployed.

Location and Distance: When possible, traps will be set in a minimum of -1 ft mean low tide and approximately 10 meters (30 feet) apart. Ideally traps are set in areas where eelgrass is present.

Where possible, as many as five traps per site will be set within eelgrass habitat. In locations with extensive eelgrass, up to five sites will be deployed with 10 meter (30 feet) between sites. Place traps as low as possible in the intertidal, ensuring tide will be low enough to retrieve the following day.

Securing Traps: Secure traps to beach with rebar, tent stakes or wooden stakes, depending on substrate. Traps can be baited using a bait bucket filled with herring, wet cat food or fish offal.

Marking: Mark each trap with permit number, contact name and phone number. For each trap set and retrieved, data will be recorded on a data sheet (Appendix A 2).

Time Period: Deploy traps for a minimum of 24 hours so the soak period covers a full tidal and day/night cycle.

Identification: Adult European green crab are about 3 inches to 4 inches at the widest point of the carapace. Coloration varies from green, yellow to brown, to orange and red. The best way to identify European green crab is the five distinct spines on the outer edge of the carapace on the outside of the eyes. They also have three bumps between the eyes. Native crabs have either fewer or more than five spines on the carapace. European green crabs have differently sized front claws; one is large and the other is smaller (Appendix A 1).

Collection and Recording: All found carapaces will be collected. Four specimens of varying size will be held, and remaining carapaces will be bagged and discarded in waste receptacle. All live crab will be collected. Collect sex and measured carapace width data. Crabs will be held for tissue sampling or killed and then disposed of in a waste receptacle. Record data on sheet provided in Appendix A 2.

Reporting: Completed data sheets should be emailed to Tammy Davis at tammy.davis@alaska.gov.

Collection Permits: An Aquatic Resource Permit will be issued to department staff assisting in shoreline surveys and trapping. Please carry a copy of the permit with you when conducting surveys. Please make sure all traps are labeled with the permit number, contact name and a phone number.

Local resident shoreline molt surveys

European green crabs are classified as banned invasive species as listed in the Alaska Administrative Code 5AAC 41.075. Possession and transport of banned invasive species is prohibited without a collection permit. If the public is participating in shoreline molt surveys or has come across a European green crab, instead of collecting suspect crabs, pictures from different angles (top and bottom) and including a recognizable object (pencil, credit card, etc.) to show size along with specific location can be reported by calling 1-877-INVASIV or to the ADF&G online Invasive Species Reporter:

https://www.adfg.alaska.gov/index.cfm?adfg=invasivespeciesreporter.main

Table 1.–Roadside and remote locations to conduct European green crab surveys in the Ketchikan area of Southeast Alaska.

Roadside Location Carapace Surveys	Remote Location Trapping Surveys
Tongass Narrows	Bostwick Inlet
Mountain Point Boat Launch	Foggy Bay
Buggy Beach/Rotary Park Beach	Very Inlet
Saxman Beach	
Thomas Basin	
Bar Harbor	
Totem Bight	
Knudson Cove Marina	
Settler's Cove	

SCHEDULE AND DELIVERABLES

The Divisions of Sport Fish and Commercial Fisheries staff in Ketchikan will begin shoreline molt surveys and trapping events as time and funding allows in the summer and fall of 2022.

RESPONSIBILITIES

Personnel	Responsibilities
Tammy Davis	Project leader, primary point of contact, coordinate and conduct surveys, data management and reporting.
Ketchikan DSF and DCF staff	Coordinate and conduct molt surveys and trapping events

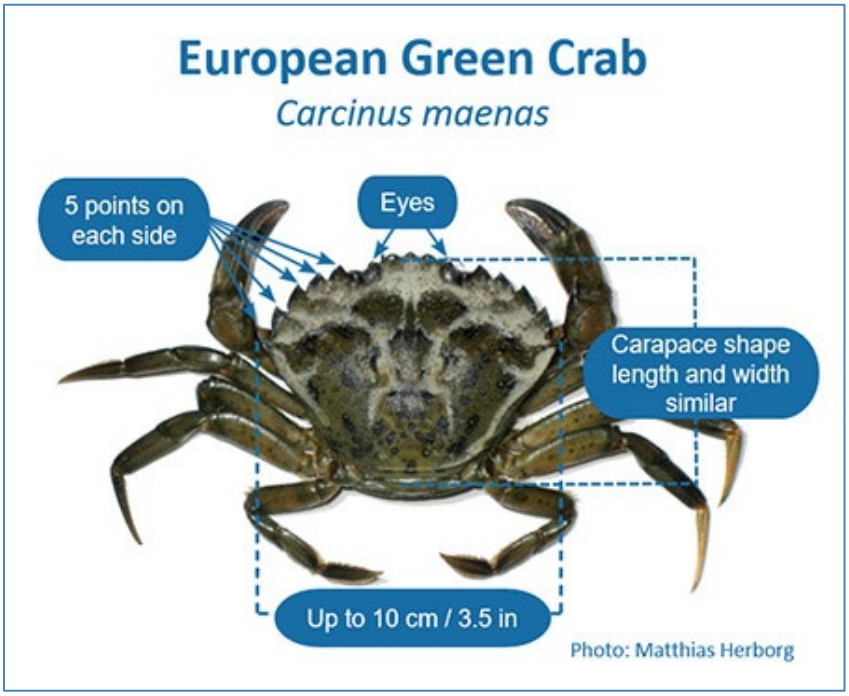
REFERENCES CITED

Drinkwin, J., Pleus, A., Therriault, T., Talbot, R., Grason, E.W., McDonald, P.S., Adams, J., Has, T., and K. Litle. 2018. Salish Sea Transboundary Action Plan for the Invasive European Green Crab. Puget Sound Partnership.

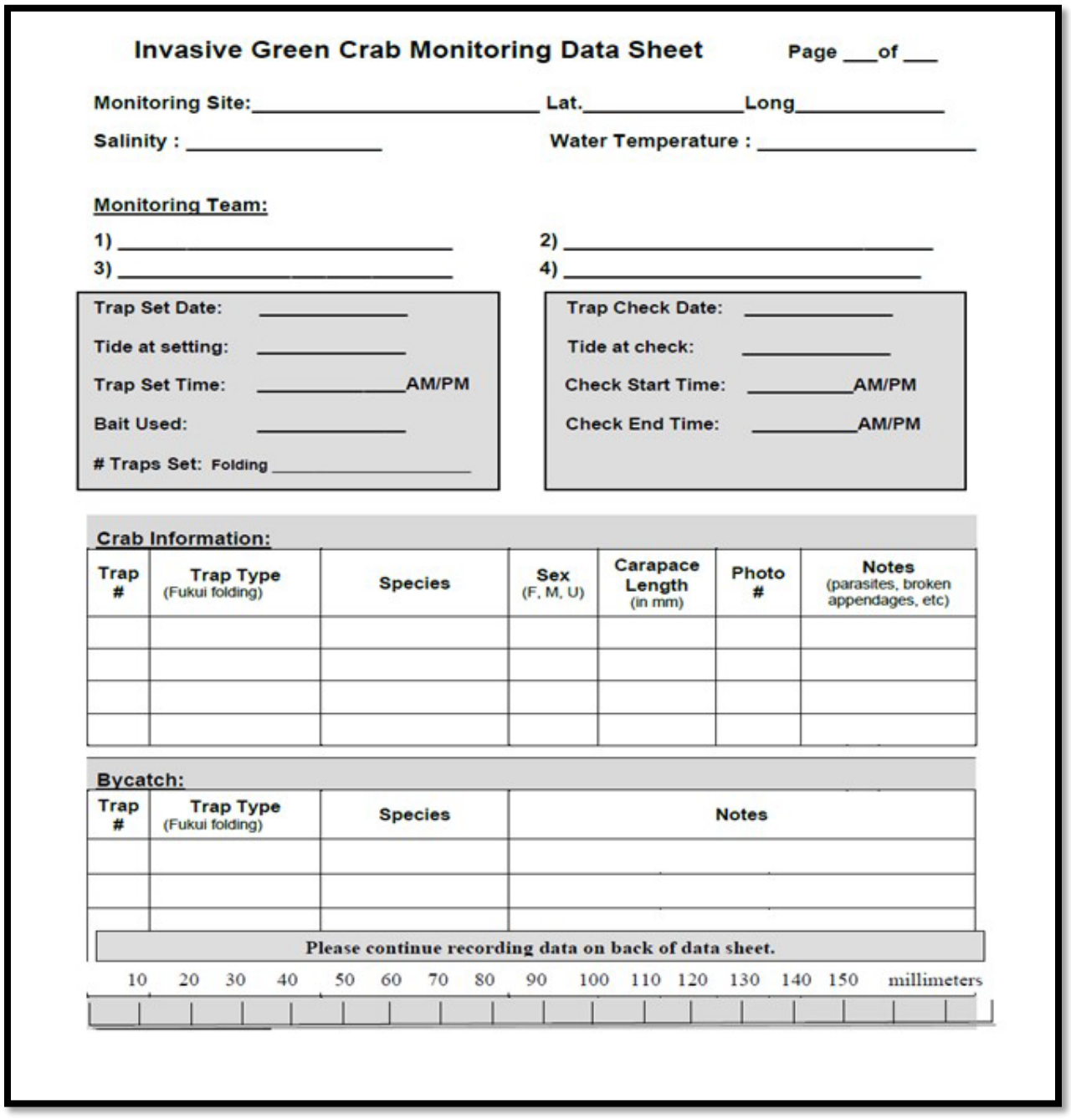
Lowe, S., Brown, M., Boudjelas, S., and M. De Poorter. 2000. 100 of the World's Worst Invasive Alien Species: A selection from the Global Invasive Species Database. The Invasive Species Specialists Group: http://www.issg.org/booklet.pdf

APPENDIX A: DATA COLLECTION REFERENCES

Appendix A1.–Photos of European green crab for correct identification.



Appendix A2.–Data sheet for recording European green crab survey information.



Invasive Green Crab Monitoring Data Sheet

Page ___of ___

Monitoring Site:_____ Lat._____Long_____

Salinity : _____ Water Temperature : _____

Monitoring Team:

1) _____ 2) _____

3) _____ 4) _____

Trap Set Date: _____	Trap Check Date: _____
Tide at setting: _____	Tide at check: _____
Trap Set Time: _____AM/PM	Check Start Time: _____AM/PM
Bait Used: _____	Check End Time: _____AM/PM
# Traps Set: Folding _____	

Crab Information:

Trap #	Trap Type (Fukui folding)	Species	Sex (F, M, U)	Carapace Length (in mm)	Photo #	Notes (parasites, broken appendages, etc)

Bycatch:

Trap #	Trap Type (Fukui folding)	Species	Notes

Please continue recording data on back of data sheet.

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 millimeters

--continued--

Appendix A2.–Page 2 of 2.

Crab Information:

Trap #	Trap Type (folding, minnow, pit)	Species	Sex (F, M, U)	Carapace Length (in mm)	Photo #	Notes

Bycatch:

Trap #	Trap Type (folding, minnow, pit)	Species	Notes

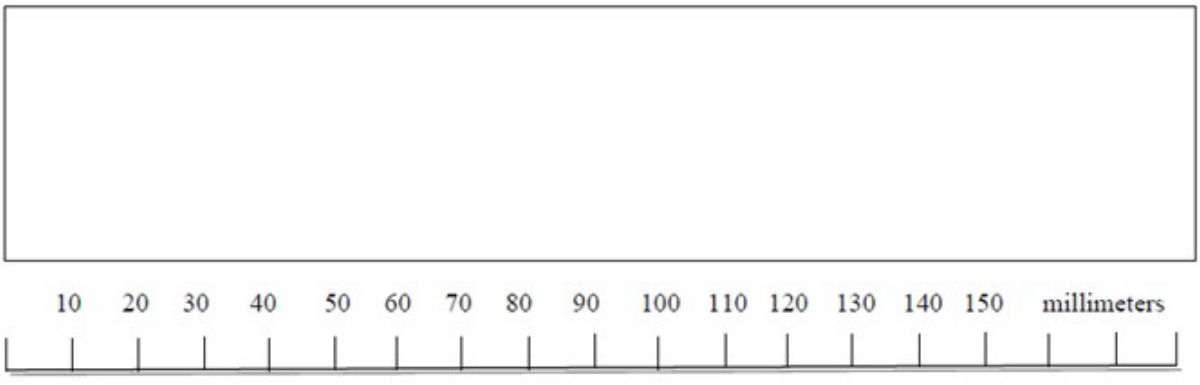
Habitat:

Check all boxes that apply: ☐ **Roadside** ☐ **Remote**

☐ **Sandy Beach** ☐ **Cord or eelgrass** ☐ **River/Stream Mouth**

☐ **Rocky/Cobble Beach** ☐ **Algae** ☐ **other:** _____

Draw a sketch of trap layout with any key characteristics or markings:



Appendix A3.–Supplies needed to conduct molt and trapping surveys for European green crab.

Quantity	Description
5-10 per site	Traps
1 per trap	Bait and bait jars
2-3 per trap	Stakes, Heavy duty tent stakes or rebar
1	Hammer/Mallet
1	bucket
1	Clipboard/pencil
1	Calipers
1	Thermometer
1	Tape Measure
several	Data sheets printed on waterproof paper
25	Ziplock's
1	Tide book
as needed	Crab and invertebrate identification books
1	Camera
1	GPS
as needed	Gloves