Washington Sea Grant Trap Survey Report: Update on the Status of Green Crabs using Trap Survey Data from 2025 and 2026

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Abstract

European green crabs (EGC; *Carcinus maenas*) are a destructive invasive species that has been present in Washington since 1998, preying on native crabs and destroying vital eelgrass habitat. Washington Sea Grant Crab Team has created a survey program using minnow traps to monitor the spread of EGC throughout Washington shorelines. In July 2025, EGCs were observed at False Bay on San Juan Island for the first time since 2019 (WDFW). This paper examines differences in species abundance and richness between a trap survey of Argyle Beach in 2025 (before the last EGCs were observed) and surveys of Argyle and False Bay from 2026, using the WSG protocol. There was a significant increase in overall abundance and a slight decline in species richness in the 2026 Argyle survey compared to 2025. EGCs were not observed in either year, nor were multiple crab species of interest that were observed in visual surveys of Argyle Beach weeks before the 2026 trapping. These holes in the data may indicate flaws in the trap survey methods, whether it be trap type, location, or sample size. The surveys indicate that EGCs have not established a population on San Juan Island yet and can be referenced in the future if EGCs establish a population.

Introduction

The European green crab (EGC; *Carcinus maenas*) invasion in the Pacific has negatively affected native biota, outcompeting native crab species and destroying eelgrass habitat. From shellfish to crabs, EGCs have led to significant declines in native populations over 3-5 years (Grosholz et al., 2000).

EGC presence has been growing in Washington since 1998 (WDFW), and in 2025, there were 8 confirmed EGC found in False Bay, San Juan Island, Washington, by Washington Sea Grant's (WSG) molt and trap surveys (WDFW). However, studies have found that EGCs exhibit varying dynamics with respect to San Juan Island's local crab species in laboratory settings. For instance, in predation success, *Cancer productus* (red rock crab) outcompeted EGCs in every

lab trial (Nicol & Leighton, 2025). Additionally, *Hemigrapsus* spp. (shore crabs) were found to outcompete juvenile EGCs for under-rock habitat (Jensen *et al.* 2002). However, EGCs outcompeted the juvenile *Metacarcinus magister* (dungeness crab) for habitat under laboratory conditions (McDonald *et al.* 2001). Another important component of WSG's crab surveys is understanding how these observed dynamics affect wild crab populations.

Washington Sea Grant's crab molt survey, a community science program, has a broad scope with inconsistent participation and site choice, and relies on volunteers to conduct it (pers comms. Emily Grason). This effort is being used in tandem with trap surveys, which are more sensitive and have been conducted more consistently at targeted sites with more consistency. Previous surveys have indicated that carapace width varies significantly more in wider-opening traps, while smaller traps tend to catch crabs with smaller widths (pers comms. Emily Grason).

This experiment aims to examine differences in species richness and abundance in the trap surveys in 2025 and 2026, and between 1" and 2" openings of minnow traps used to collect crabs for the WSG's EGC surveys. EGCs have been observed on San Juan Island between the 2025 and 2026 surveys, so assessing the extent of the EGC presence at nearby sites and their impact on native crab populations is critical.

Hypotheses

- Traps set in 2026 will catch fewer *Cancer productus* than those set in 2025*,* as there has now been a recorded case of EGCs on San Juan Island, which compete with *C. productus*.
- Traps set in 2026 will catch fewer individuals from the *Hemigrapsus* species than those set in 2025 due to the documented presence on San Juan Island since the 2025 data collection concluded.
- Traps set in 2026 will display lower species richness than those set in 2025 due to the presence of EGCs.
- Traps set in 2026 will yield fewer juvenile *M. magister* compared to those set in 2025 due to the presence of competitively dominant EGCs.
- Future traps will yield fewer *M. magister* long-term because of EGC predation (McDonald *et al.* 2001).

Trap Survey Methods

12 minnow traps containing bait jars of mackerel pieces were laid out across Argyle Bay and Lagoon (8 traps in Bay, 4 in Lagoon) in deep enough water to fully submerge them. Traps were placed 10 meters apart and alternated between 1” and 2” openings. The contents of each trap were emptied into a bin with scale bars measuring 150 mm and 200 mm, corresponding to the bin's length and width. The contents were photographed with scale bars and a tag clearly visible, noting the size and trap number. Any fish removed from the bin with a dip net were photographed and returned to the collection site. Crabs were identified, sexed, and measured, then returned to the sample site of their respective traps. Species count, crab sex, and crab carapace size were collected on a WSG Crab Team datasheet. Species were identified under a four-letter code using the first two letters of the genus and species based on WSG guidelines (Table 1). The traps at Argyle Beach were set at 9:05 A.M. on May 13, 2026, and retrieved at 7:50 the following morning. The same procedure was carried out at False Bay, with 12 traps set at 9:16 am on May 27, and retrieved at 8:45 am on May 28, 2026.

These methods were used based on data collection from the previous year, taken on April 29-30, 2025, at Argyle Bay and Lagoon. Unlike the 2026 study, six traps were set at each site in 2025, compared with the eight and four split between Argyle Bay and Lagoon in 2026. This study compares the data from the 2025 and 2026 surveys to determine whether species richness and abundance have changed over time.

Table 1: The trap survey dataset is organized using four-letter species codes based on the first two characters of each species’ name and genus, with the exception of groups of species. The scientific names and species codes for species of note are contained in the table below (WSG Crab Team).

Scientific Name	Species Code
Hemigrapsus oregonensis	HEOR
Hemigrapsus nudus	HENU
Metacarcinus gracilis	MEGR
Metacarcinus magister	MEMA

Cancer productus	CAPR
Leptocottus armatus	LEAR
Pagurus hirsutiusculus	PAHI
Telmessus cheiragonus	TECH
Sand shrimp species in family Crangonidae	SAND

Results

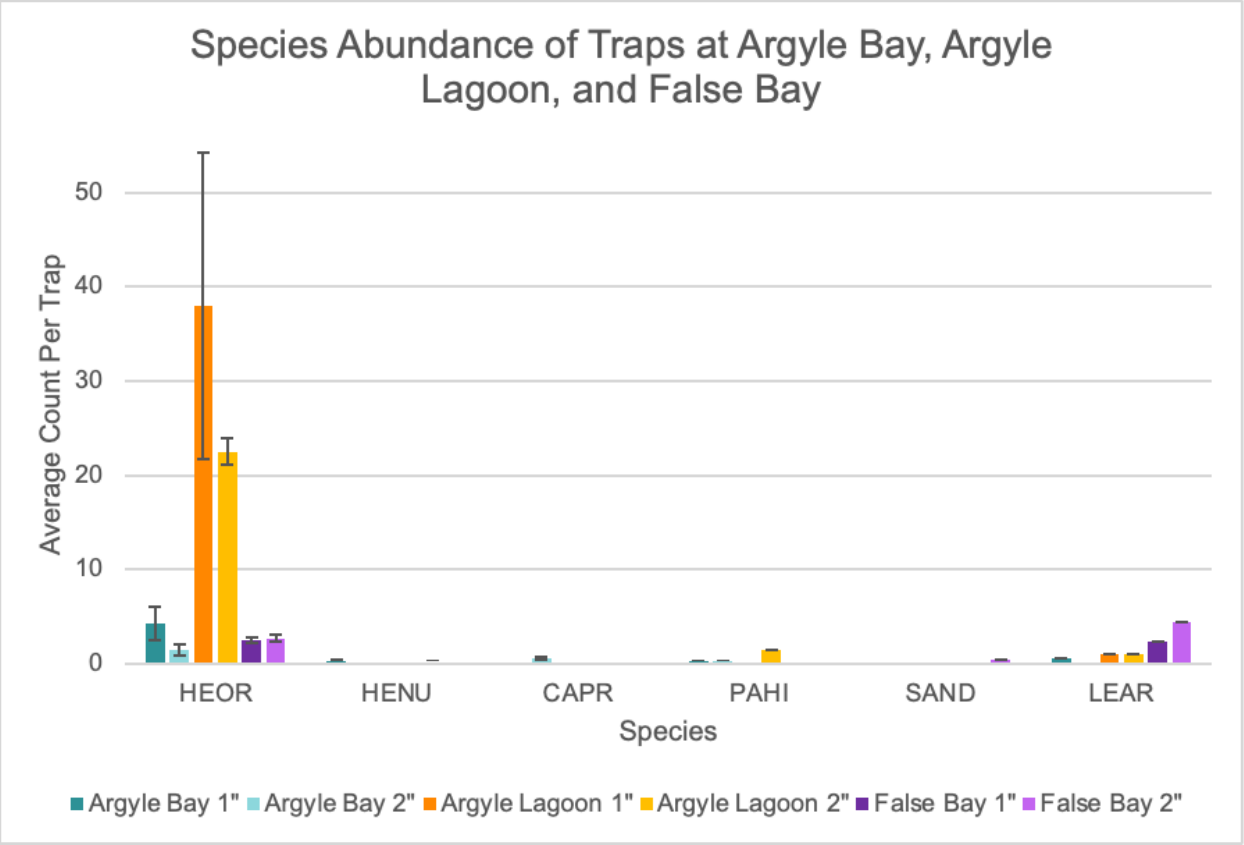

Fig 1. The average number of each species found per trap of different sizes (1” and 2”) at different sites on San Juan Island, WA (Argyle Bay, Argyle Lagoon, and False Bay).

Table 2. Average count for 1” and 2” traps in Argyle Lagoon and Bay between 2025 and 2026.

	Argyle Bay 1" 2026	Argyle Bay 2" 2026	Argyle Lagoon 1" 2026	Argyle Lagoon 2" 2026	Argyle Bay 1" 2025	Argyle Bay 2 " 2025	Argyle Lagoon 1" 2025	Argyle Lagoon 2" 2025
HEOR	4.25	1.50	38.0	22.5	0.667	0.333	8.0	3.0
HENU	0.25	0	0	0	0	0	0	0
CAPR	0	0.50	0	0	1	1	0	0
TECH	0	0	0	0	1	0.333	0	0.667
MEGR	0	0	0	0	1	1	0	0
PAHI	0.25	0.25	0	1.50	0.667	0.333	0.667	0.667
LEAR	0.5	0	1	1	1.333	1	2.333	0

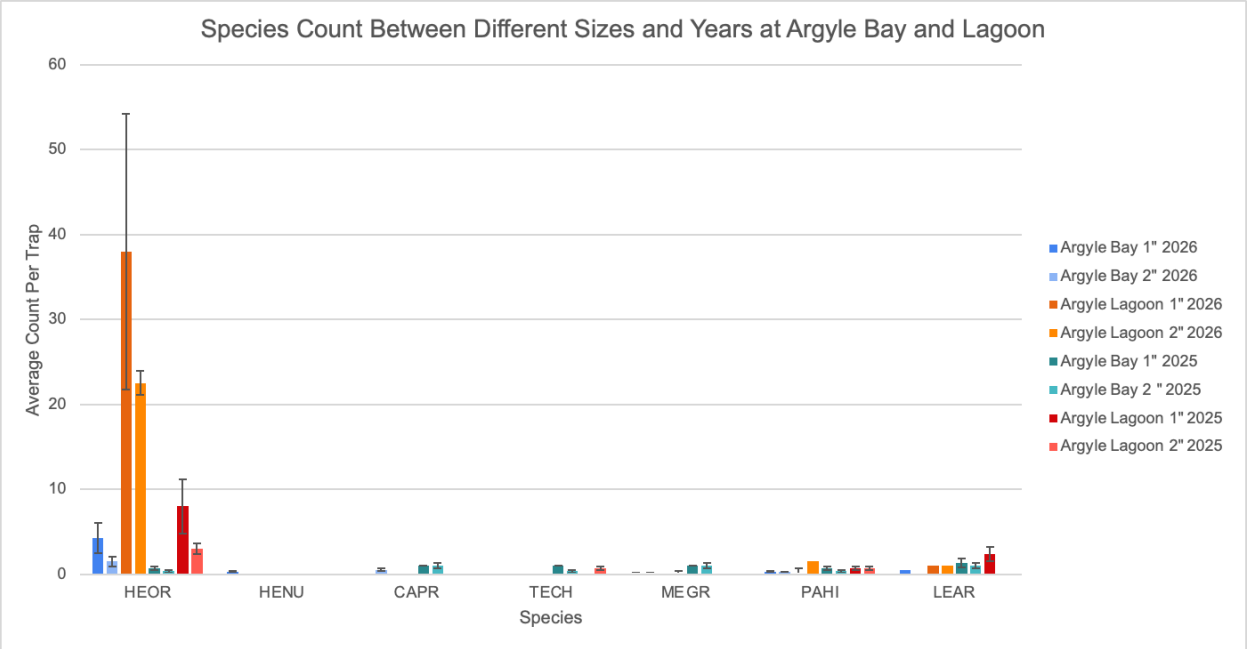

Fig 2. The average number of each species found per trap of different sizes (1” and 2”) between 2025 and 2026 at different sites on San Juan Island, WA (Argyle Bay and Argyle Lagoon). The species uses the codes from Table 1.

The study conducted in May of 2026 showed a 3.47-fold greater abundance of crabs and fish than the April 2025 study at Argyle Bay and Lagoon. In both years, the one-inch trap had a higher overall yield than the two-inch trap. Based on average count per trap, the two-inch

trap in 2025 caught twice as many *C. productus* as the two-inch trap in 2026, with an average of 0.5 in 2026 compared to 1 in 2025 (Table 2). In 2026, *Hemigrapsus nudus* (purple shore crab) were only caught on the one-inch trap (Fig. 2). Both the one- and two-inch traps caught *H. oregonensis* (hairy shore crab) in both 2025 and 2026; in both years, the one-inch trap caught more than the two-inch, 1.4 times more in 2025 and 1.83 times more in 2026. Overall, approximately four times the amount was caught in 2026. In 2025, no *L. armatus* (Pacific staghorn sculpin) were caught, while they were in the one-inch trap in 2026. In 2026, no *Metacarcinus gracilis* (graceful crab) were caught, but some were caught in the one-inch trap in 2025 (Fig. 2). In 2026, *Pagurus hirsutiusculus* (hairy hermit crab) were caught in both the one and two-inch traps. *Telmessus cheiragonus* (hairy helmet crab) was caught only in the two-inch traps in 2025 (Table 2). *M. magister* were left off of charts and tables as none were caught in any traps in 2025 or 2026.

Regarding differences between study sites, the lagoon traps in 2025 had, on average, 11 times as many *H. oregonensis* as the bay traps. In 2026, the lagoon traps had an average of 6 times the number of *H. oregonensis* than the bay traps (Table 2). Additionally, in 2025, species richness was 2 times greater in the bay traps than in the lagoon. In 2026, the species richness between the bay and the lagoon was equal (Table 2). *Hemigrapsus* spp. abundance per trap doubled in the 2026 survey compared to the 2025 survey (Table 2). The overwhelming majority of trapped *Hemigrapsus spp.* individuals were *H. oregonensis* found in Argyle Lagoon. There were 6 times as many total individuals per trap in Argyle Lagoon as in Argyle Bay (Table 2).

Discussion

No EGCs were found in trap surveys at either of the Argyle sites in either year, nor were they found at the 2026 False Bay trap survey. There is not sufficient evidence to accept the hypotheses pertaining to EGCs' effects on local crab populations. At Argyle Beach, EGCs are unlikely to be present, as there have been no recorded cases in the area. EGCs are extremely fecund, and one gravid female can carry up to 200,000 eggs at a time (Griffen, 2016). False Bay may have an established EGC population, but more surveys are needed to know whether this is the case. EGCs can burrow into the mudflats exposed at low tide, taking advantage of a vast swath of habitat that local *Hemigrapsus* species cannot access (Jensen *et al.* 2002). It is also possible that the local *H. oregonensis* that make up a large portion of False Bay's intertidal crab population (pers. obs.) prevented EGCs from establishing themselves by outcompeting the initial EGC invasion for food (Jensen *et al.* 2002).

Red Rock Crab Trends

Contrary to our hypothesis, the observed abundance of *C. productus* remained unchanged despite documented EGC presence on San Juan Island in 2025 (WDFW). Given that EGCs have not been observed at Argyle Beach, it is possible that there is no effect on the *C. productus* population. *C. productus* prefers habitat with an abundance of rocky substrate (WDFW), something that is rare in the deeper regions of Argyle Bay (pers. obs.). It's possible that there is little optimal habitat for adult *C. productus*. This may limit the *C. productus* population and make it difficult to reliably trap.

Shore Crab Trends

H. oregonensis had a significantly higher catch yield compared to all other crab species, and was predominantly found in the Argyle lagoon traps in both years. However, year to year, there was significant variation. This could simply be attributed to stochastic or sampling fluctuations; however, it is more likely that such large changes are due to particularly favorable environmental conditions, such as temperature or prey availability, or a large recruitment event.

Species Richness Trends

The trap species richness results support the hypothesis of declining richness, but the data collection methods may be flawed. *Metacarcinus gracilis*, or the graceful crab, is a useful case study outlining some of the issues with this trap survey. *M. gracilis* was only trapped in 2025 but was observed in Argyle Bay on a snorkel survey within one month of the trap survey (pers. obs.). The observed crabs were both too large to fit into either the 1" or 2" traps and were far enough from shore to avoid the traps altogether. The lack of trap data for target crab species suggests that more comprehensive methods are needed to accurately assess species richness in Argyle Bay and Lagoon.

Dungeness Crab Trends

Despite not being trapped in either year, Argyle Beach had a notable presence of *M. magister* during snorkel surveys (pers. obs.). *M. magister* grows far larger than the 2" minnow trap opening, limiting their catch to juveniles small enough to fit or adults who cut through the traps (pers comms. Blake Zimmerman). Additionally, placing traps in deeper water or near the eelgrass beds in Argyle Lagoon could increase the likelihood of capturing larger crab species,

such as *M. magister.* However, trapping near eelgrass may be too disruptive to the already vulnerable system, making a visual survey a more optimal choice.

Long-Term Dungeness Trends

Given the lack of trap data on *C. maenas* and *M. magister* in either year, it is unclear whether EGCs will establish themselves on San Juan Island in the future. If the interactions observed in McDonald *et al.* 2001 are applicable to wild crabs, it can be assumed that *M. magister* trap yield will decrease in the presence of EGCs. Analyzing trap survey data from areas of Mainland Washington with recent EGC invasions may provide insight into the competitive dynamics between the two species in the wild.

Room for Improvement

It is important to note that there was no difference in catch-effort between the 2025 and 2026 surveys, but the trap-setting procedure differed slightly. There was a larger Lagoon trap sample in 2025, making direct comparisons of data difficult due to differences in CPUE between the Bay and Lagoon for the two years.

Using different trap shapes and larger sample sizes in future surveys may increase species richness in trap yields and yield a more representative sample. Minnow traps, which were used for all samples discussed in this report, are not the most effective method of trapping EGCs. Minnow traps are most effective for smaller crabs like the *Hemigrapsus* shore crabs that were caught in massive numbers in Argyle Lagoon (pers. comms. Blake Zimmerman).

The crabs of note for WSG's dataset get large enough that shrimp or fukui traps become far more effective. These two traps have much larger openings than minnow traps, allowing crabs at later life stages to enter and be observed as part of these trap surveys (pers. comms. Blake Zimmerman). Argyle, in particular, has multiple crab species that get large enough to outgrow the minnow traps used for this survey.

Given the severity of EGC invasion in other regions, more comprehensive surveys must be conducted to get a representative sample of both Argyle Beach and False Bay. Surveys must occur more frequently so that an increase in EGC abundance can be noted before growth becomes uncontrollable.

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