Washington Coast European Green Crab Pilot Sentinel Site Summary | 2020

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Overview

In 2020, as a part of the larger effort to assess abundance and distribution of European green crabs (*Carcinus maenas*) along Washington's coast, Washington Sea Grant's (WSG) Crab Team piloted five "sentinel" sites within Makah Bay, Grays Harbor, and Willapa Bay. These survey locations served to compare relative abundance of green crab and native community composition over space and time. This initial effort served as a pilot for sentinel surveys, and despite some challenges getting boots in the mud, site monitors were able to successfully complete systematic sampling at the five designated sites in the months of August and September.

Sentinel sites were one of two, complementary, trapping approaches used as part of a year-long regional assessment effort across Washington's coastal shorelines. Sampling at sentinel sites was implemented via consistent protocols, taking detailed observations on a small number of traps repeatedly across the season. Detailed sentinel trapping protocols can be found at wsg.washington.edu/crabteam. The second trapping approach consisted of larger, more intensive, assessment trapping efforts, collecting less information on a greater number of traps, at sites which might be trapped only once. Together, these techniques provide insight into spatial and temporal patterns of green crab populations, and both are critical to helping managers allocate resources most efficiently for population control.

This brief report summarizes what was learned from pilot sentinel surveys during 2020, in some cases comparing to intensive assessment data. A more detailed recap of the intensive assessment efforts in 2020 can be found in a Crab Team blog post. These results are preliminary findings and the strength of what we learn here will be improved in the coming year, as we look forward to collecting a full season's worth of data (April through September 2021) and hope to double the number of actively surveyed as sentinel sites.

Acknowledgements

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Results

Species Composition

Nine species were captured in traps across the five sites and two months of sampling (Table 1). These fish and crab species are part of the ecological communities likely to be associated with, and impacted by, European green crabs (*Carcinus maenas,* hereafter simply "green crab"). The overall low species richness was dominated by three-spined stickleback (*Gasterosteus aculeatus*), hairy shore crab (*Hemigrapsus oregonensis*), and staghorn sculpin (*Leptocottus armatus*). Green crab was the fourth most numerous species caught across the sites. Stackpole, had the greatest species richness, recording seven species across the two sampling efforts, as well as the greatest total number of green crabs of all the sites (14). However, as a proportion of the total trap catch, green crab dominated Ocean Shores more than any of the other sites; 48% of all animals trapped at the Ocean Shores site were European green crab. Continuing to expand the dataset will enable us to explore community composition in greater depth, including which species might be predictors of, or impacted most by, green crabs.

Table 1. 2020 Sentinel Site Trap Catch. *Total number of each species captured in trapping surveys by taxon and site during the 2020 sampling season.*

		Makah Bay	Grays Harbor	Willapa Bay			
		Makah	Ocean Shores	Tokeland	Stackpole	Nahcotta	**TOTAL**
CRUSTACEANS	*Carcinus maenas*	3	12	2	14	6	**37**
	Hemigrapsus oregonensis	162	11	7	20	-	**200**
	Cancer (Metacarcinus) magister	3	-	-	5	-	**8**
	Crangonidae spp.	-	-	-	3	-	**3**
FISHES	*Gasterosteus aculeatus*	-	-	95	92	87	**274**
	Leptocottus armatus	40	2	5	6	15	**68**
	Cottus asper	-	-	-	4	5	**9**
	Eel-like fishes	-	-	-	-	4	**4**
	Cymatogaster aggregata	-	-	-	-	1	**1**
TOTAL		208	25	109	144	118	**604**
Species Richness		4	3	4	7	6	**9**
Proportion *C. maenas*		0.01	0.48	0.02	0.10	0.05	**0.06**

C. maenas CPUE (#/100 traps)	25	100	17	117	50	**62**

The sentinel site protocols also include a molt survey for dead crustaceans and crustacean molts. These searches yielded evidence of green crab presence at every site except Makah Bay, where no green crab specimens were found during either month of surveys (Table 2). Molt surveys enabled the detection of two additional species of grapsid crab not captured in traps, including purple shore crab (*Hemigrapsus nudus*) and the lined shore crab (*Pachygrapsis crassipes*). While green crab molts were numerically most abundant at Tokeland, they made up the greatest proportion of molts found (40%) at both Nahcotta and Ocean Shores. Consistent with trapping surveys, the most abundant species of crustacean detected in molt searches was the hairy shore crab (*H. oregonensis*), underscoring the importance of this native crab in habitats also inhabited by green crabs.

Table 2. 2020 Sentinel Site Molt Hunt. *Total number of each species detected in molt searches by taxon and site during the 2020 sampling season.*

	Makah Bay	Grays Harbor	Willapa Bay			
	Makah	Ocean Shores	Tokeland	Stackpole	Nahcotta	**TOTAL**
Carcinus maenas	-	10	14	4	2	**30**
Hemigrapsus oregonensis	64	16	70	73	-	**223**
Cancer (Metacarcinus) magister	2	1	-	3	3	**9**
Hemigrapsus nudus	4	-	1	2	-	**7**
Pachygrapsus crassipes	-	-	-	1	-	**1**
TOTAL	70	27	85	83	5	**270**
Species Richness	3	3	3	5	2	**5**
Proportion *C. maenas*	0	0.4	0.2	0.05	0.4	**0.1**

European green crab abundance and distribution

Relative abundance of green crab, standardized as catch-per-unit-effort (CPUE), varied across an order of magnitude across sentinel sites, ranging from an average of 17 (Tokeland) to 117 (Stackpole) crabs per 100 trap sets (Table 1, Figure 1). At most sites, green crab abundance also varied between the two months (Figure 2). Totaled across all sites, fewer green crabs were captured in September (CPUE = 30) than in August (CPUE = 93). This finding echoes seasonal patterns of green crab trap catches recorded along inland shorelines, which typically begin to decline as temperatures drop. Nevertheless, sites varied in their temporal trend; at Nahcotta, CPUE was consistent between months, and Makah Bay saw an increased CPUE in September relative to August. In 2021, we expect to collect a full season of data which will allow us to

better assess seasonal patterns in trapping rates and potentially identify months in which crabs are most "catchable," enabling more efficient allocation of limited resources.

Figure 1. 2020 Sentinel Site CPUE Summary. *The catch-per-unit-effort of European green crab at each sentinel site averaged over the 2020 field season. Note: This graph only includes sentinel data from efforts for trapping maximum comparability.*

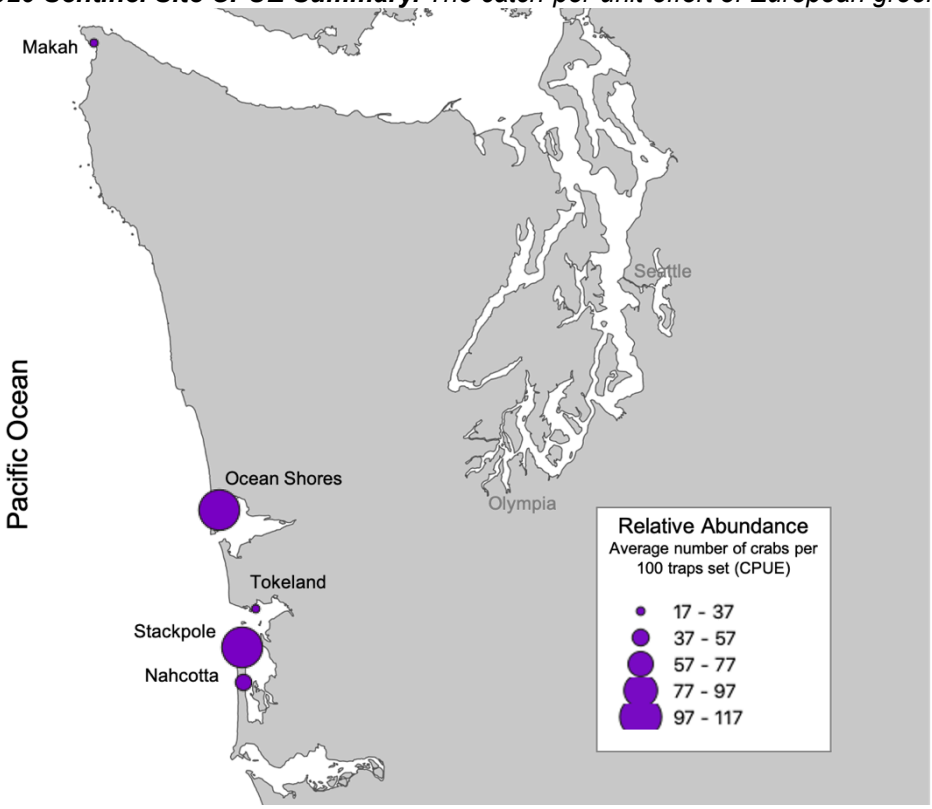
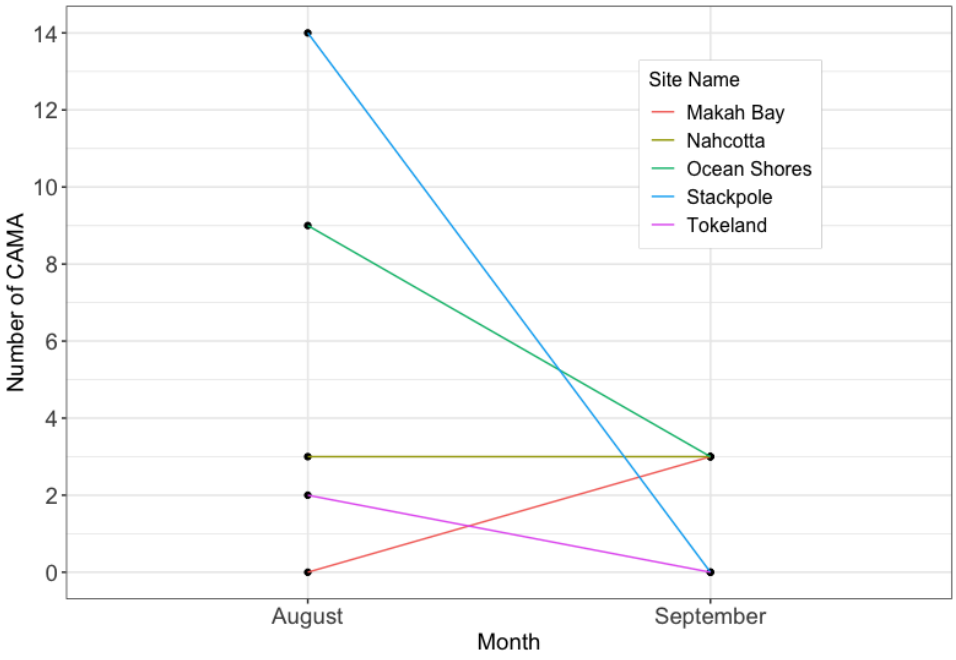


Figure 2. 2020 Sentinel Site CPUE by month. *The total number of European green crabs (CAMA) trapped at each sentinel site in August and September. As a part of each survey six traps (three minnows and three Fukuis) were set.*

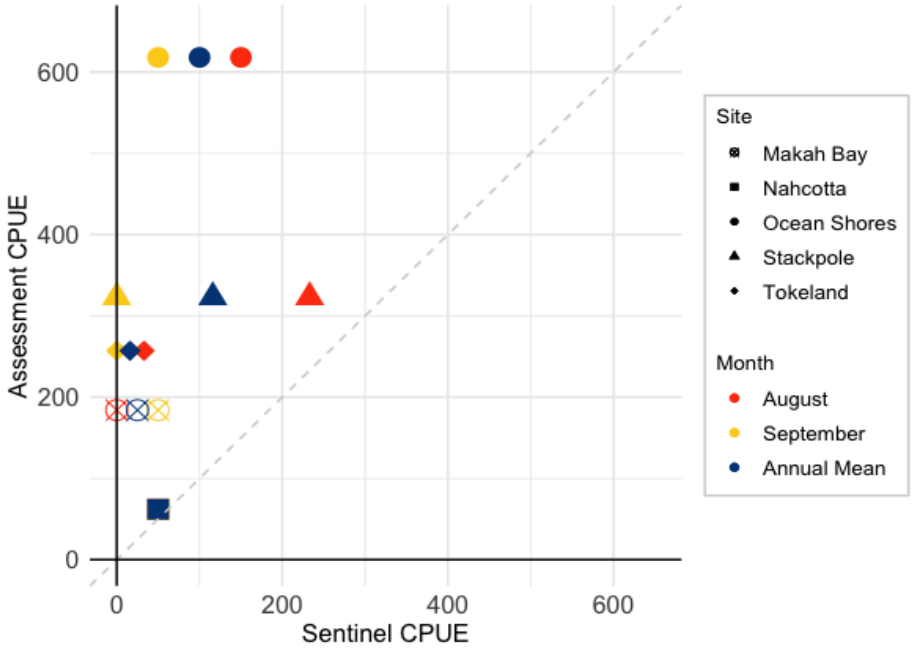


Survey comparisons

Comparing observations of green crab across various surveying methods within a site sheds some light on how detection rates might vary depending on method. Relative intensive assessment-style trapping efforts were also conducted at all five of the sentinel sites in 2020[1], permitting a rough comparison of how repeated small scale trapping efforts (sentinel trapping protocols) might compare to a single large scale trapping effort (assessments) in estimating relative abundance of green crabs for a given site (Figure 3). In nearly all cases, large scale trapping estimated a substantially greater relative abundance of green crabs than sentinel trapping, by as much as a factor of 10. But there was no clear correlation between the two methods. This may be explained in part by discrepancies in timing, trap placement (and in some cases trap type), and other factors. Nahcotta was the only site where sentinel CPUE was almost equal to assessment CPUE.

It is important to note that neither one of these trapping methods is necessarily more correct or accurate than the other as a measure of absolute abundance; this exploration is primarily a way to evaluate how one might integrate both pieces of information since the two methods are complementary to one another. These are starting points for future questions.

Figure 3. 2020 Comparison of CPUE estimation by different trapping efforts. *The sentinel site CPUE of European green crabs, in number of crab per 100 trap sets, for August (orange), September (yellow), and averaged across the two months (blue) relative to the assessment[1] CPUE for those same locations. The dashed line at y=x highlights the expected trend if both techniques yielded the same estimates of CPUE. Note that for Nahcotta, both months of sentinel trapping yielded the same CPUE estimate, and all points overlie each other.*



[1] At all sites except Makah Bay, WDFW and WSG conducted assessment efforts. Data from Makah Bay are provided by Makah Fisheries Management based on their summer removal trapping efforts.

We also examined whether sentinel site trapping rates were correlated with green crab molt count at each site. While finding a dead green crab or a molt might indicate that green crab are present at or near the site, we know that it might not necessarily reflect true green crab abundance since molts can be deposited or removed from the site by scavengers, tides, etc. So, we might generally expect a site with a greater CPUE for crabs trapped to also have more molts, i.e., a positive correlation. The magnitude and shape of an expected relationship, however, would be difficult to predict off the bat, in part because the unit of effort differs for the two survey types.

Nevertheless, at sentinel sites in 2020, we did not observe a correlation between molt CPUE, defined as total number of molts per 20 person-minute survey, and trapping CPUE, defined as above (Figure 4). The lack of a correlation suggests that molts may be best considered an indicator of green crab presence, but not necessarily of abundance. Further, molts may only serve this purpose if green crab populations are locally large enough. That is, there may be a point at which green crab are present at a site, but populations are too small for molts to be detectable at all. Such a scenario might be considered a false negative because we would not know green crabs were present at the site if we hadn't also set traps. Observations like this would help managers determine whether or when alternative detection strategies that may be less resource intensive, like molt surveys, may be useful. The observations in the 2020 sentinel site data for this are mixed, however; Makah Bay had the second-lowest trapping CPUE of all sites but failed to detect any molts. The site with the lowest trapping CPUE, however, was Tokeland, the site which had the highest Molt CPUE. We will continue to investigate this question throughout the 2021 sentinel site season.

Figure 4. 2020 Sentinel Site CPUE vs. Molt CPUE. The sentinel site CPUE compared to the molt CPUE, each shown for August, September, and averaged across the two months.