

2021 was an abbreviated year not starting until late summer and then with a very reduced number of trips with the small number of cruise ships sailing to Juneau. No crab pot pulls were done in 2020.

A total 75 crab pot pulls were conducted in two fixed locations in Auke Bay during from July 23 to October 11, 2021. Protocol followed permit CF-21-089 issued by the Alaska Department of Fish and Game. Location map with coordinates is included on the last page.

No European green crab was identified in any of the pots.

Location

Location	Pots pulled
Coghlan 1 (FAA beach N)	46
Coghlan 3 (middle beach)	29

2021 Subtidal Life Survey Results

Count by Species			
Species	# of Pulls	%of pulls	Total count
Green Sea Urchin	60	80.0%	1881
Staghorn Sculpin	23	30.7%	63
Widehand Hermit	32	42.7%	222
Mottled Sea Star	27	36.0%	70
Sunflower Sea Star	2	2.7%	3
Lyre Crab	2	2.7%	2
Snails-unid	3	4.0%	3
Fish-unid	4	5.3%	4
Pollock	4	5.3%	4
Crab-unid	1	1.3%	1
Yellow-fin Sole	6	8.0%	6
Dungeness Crab	4	3.1%	22
Helmet Crab	17	5.3%	5
Northern Seastar	1	1.3%	2
Oregon Triton	4	3.1%	10
Jellyfish-unid	1	1.3%	1
Pacific Red Octopus	0	0%	0
Ribbon Prickleback	0	0%	0
Gunnel	0	0%	0
Blue Mussel	0	0%	0
Irish Lord	0	0%	0
Seastar-unid	0	0%	0
Shrimp-unid	1	1.3%	1
Acorn Barnacle	0	0%	0
Sea Squirt-unid	0	0%	0
Chiton-unid	0	0%	0

Procedure

Two pots were deployed off Coghlan Island in 2021. These are commercial shrimp pots where the openings to the pot have been greatly expanded to allow for the largest measured European green crab to enter. The pots are baited with large (8+ inch) frozen herring. The pots are pulled as a part of Gastineau Guiding's "Discover Alaska's Whales" science adventure to monitor Auke Bay for the European green crab and simultaneously do a shallow sub-tidal life survey.

The crab pots are deployed in 30 feet of water off specific locations on Coghlan Island. The line attached is 75 feet long which ensures that the crab pot will remain on the bottom and the two marked buoys remain floating on the surface regardless of the tidal exchange.

Photographs are taken of each pot and all the contents are returned to the ocean, alive, in the spot collected. The only exception to the live release are some unidentified remains that were obviously eaten by other creatures in the pot. Data for each collection is included in a spreadsheet matched to the naturalist on board as well as the photographs taken.

This data is being provided to Gary Freitag, MAP Agent and Associate Professor at UAF as a part of the Alaska Sea Grant Marine Advisory Program for a subtidal life survey.

Identifications should be considered tentative for all.

A careful review of our data by fisheries biologist Dan Michrowski found that most of the sculpin captured are Pacific staghorn sculpin, (*Leptocottus armatus*) and not the great or spiny sculpin (*Myoxocephalus polyacanthocephalus*). That species shows up in the "fish-unid" category twice in 2019.

The exact species of the northern sea star is not determined but is likely *Solaster endeca*.

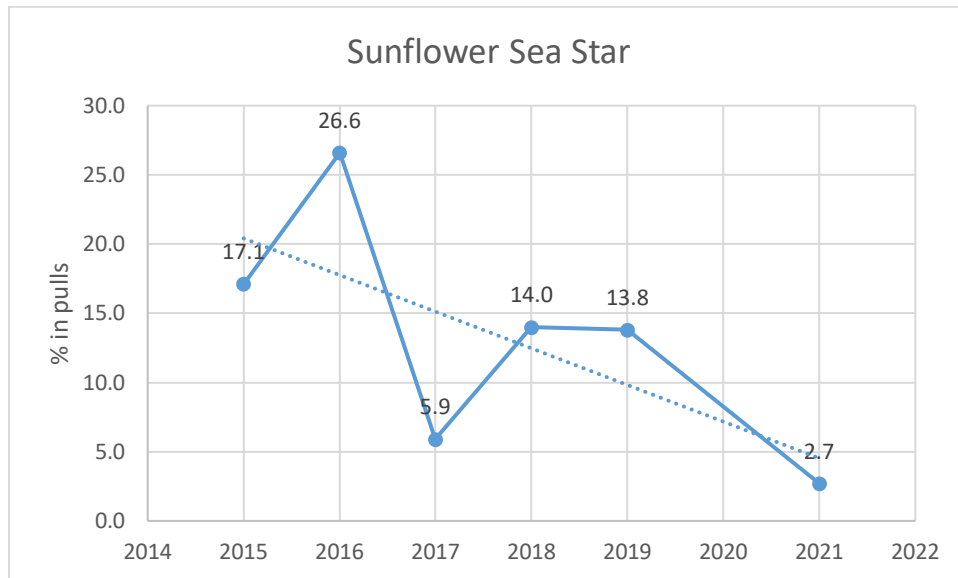
There may be some starry flounder included in the yellowfin sole photographs and this species is very likely common in our sampled waters.

The limited number of pots pulled, and shortened season, may influence the results. Procedures were the same as in every other year so seasonality may be involved but was not investigated.

Notable Observations

Sunflower Sea Star (*Pycnopodia helianthoides*)

The effect of sea star wasting disease (SSWD) that on the sunflower sea star continues to play out and has deteriorated a second time.



The steep rise from 2015 to 2016 is unexplained, but the dramatic collapse of the sunflower sea star in 2017 reflects the extreme mortality from sea star wasting disease reached Southeast Alaska. A small rebound lasted for two years, but 2021 shows the population is still suffering in Auke Bay.

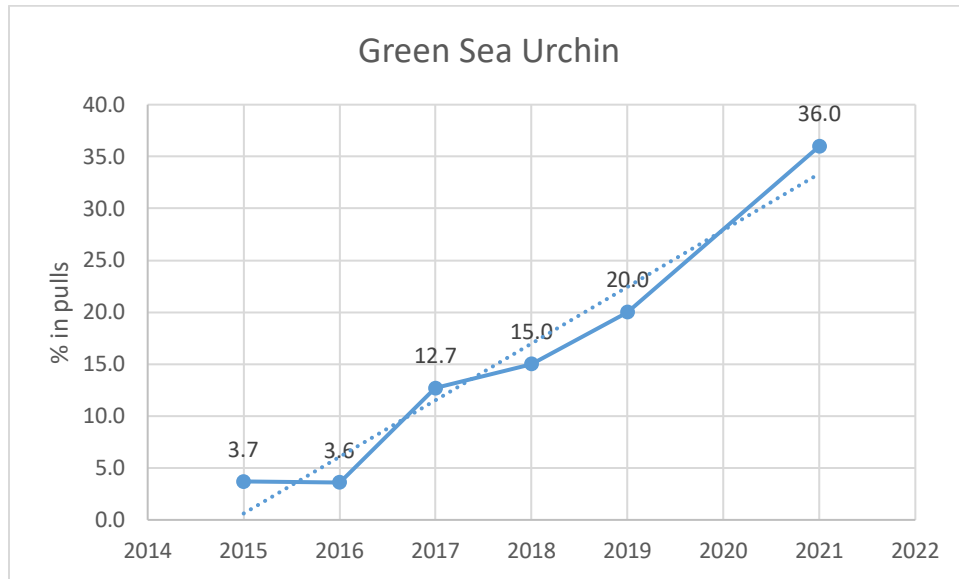
The size of the sea stars has dramatically decreased along with their numbers. In 2015 and 2016 many pulls had a 36+ inch sea star on the top of the crab pot with its stomach everted into the bait trap to eat the herring. As many as six sea stars made it into the trap, some as large as 30 inches. In 2021 all 70 sea stars all were under 10 inches across and were inside the pot.

Divers in the area do report there are still large sunflower sea stars in many places, but our crab pot pulls show that while the Auke Bay population may have enjoyed a small increase in 2018 and 2019, it is still in a state of decline as the dashed trendline illustrates. There is reason for concern for the health of Auke Bay.

Sea star wasting disease has been well documented from the nearshore waters from southern British Columbia to California, with only a small number of stations reporting from Southeast Alaska. This project is providing valuable information in a region not included in any of the recent reports. A copy of this report is being provided to C. D. Harvell, lead author of the 2019 article "Disease epidemic and a marine heat wave are associated with the continental-scale collapse of a pivotal predator (*Pycnopodia helianthoides*)" with the offer of providing the raw data underlying it and two others who have requested it.

Green Sea Urchin (*Strongylocentrotus droebachiensis*)

The inverse relation of sea star wasting disease on the sunflower sea star continues to play out in the urchin population.



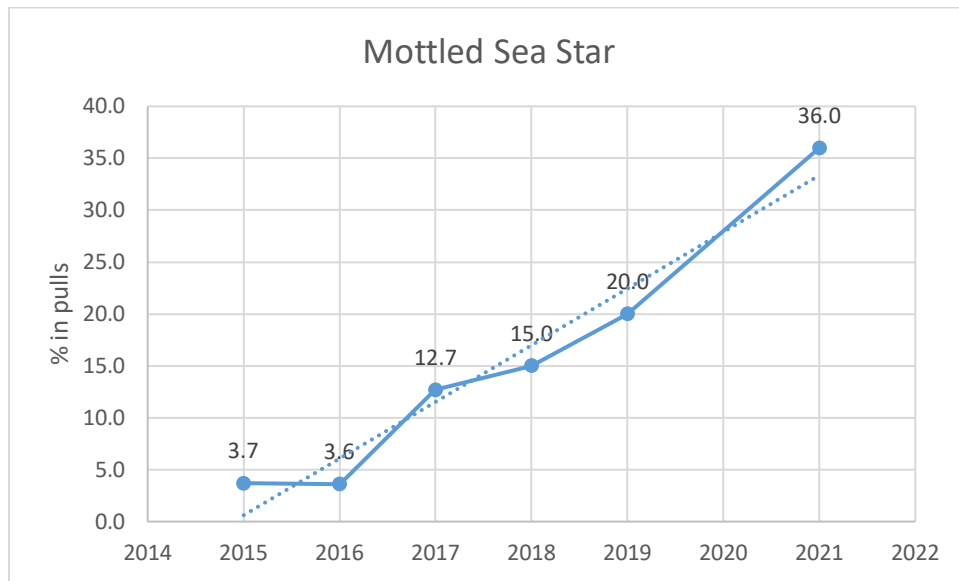
With the decline of a major predator, the sunflower sea star, the green sea urchin is free to expand its range and number with abandon as the graph clearly illustrates. With a healthy sunflower population in 2015 and 2016, the population was small and steady. As soon as the sunflower sea star declines, the green sea urchin population explodes in an incredibly linear pattern as the graph of our numbers is nearly identical to the trend line.

In 2017 through 2019 we did not count the number of urchins in the two northernmost pots off Portland Island as they were often completely full of urchins, probably 200+ individuals. Several pulls in 2021 had well over 100 urchins, but none filled the pot.

Since sea urchins are major consumers of kelp, particularly bull kelp (*Nereocystis luetkeana*), the very limited amount of it in the Juneau area is at risk. Sea otter (*Enhydra lutris*) were exterminated from Southeast Alaska by the Russians by 1867 and their recovery from the transplants to Sitka Sound depends upon healthy kelp forests. With urchins eating the kelp with abandon, it seems that our waters are in an ecological “catch-22” as otters are major predators of urchins. We are faced with too many urchins but not enough kelp to support the otter.

Mottled Sea Star (*Evasterias troschelii*)

The effect of sea star wasting disease (SSWD) on the mottled sea star is muted in Auke Bay.



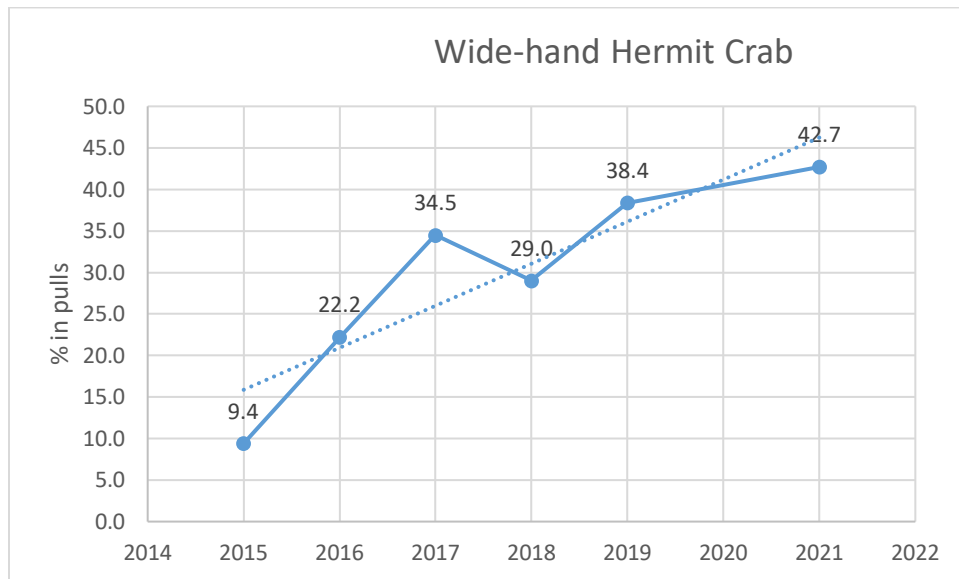
Our first two years of observations show a low and steady number of mottled sea star, but a significant rise that nearly parallels the trend line since then.

It may well be this species suffered from sea star wasting disease before we began our study and had already collapsed. No mottled sea star showed any sign of SSWD in any year.

Perhaps the tough-skinned mottled sea star is more resistant than the very soft-skinned sunflower sea star.

Wide-hand Hermit Crab (*Elassochirus tenuimanus*)

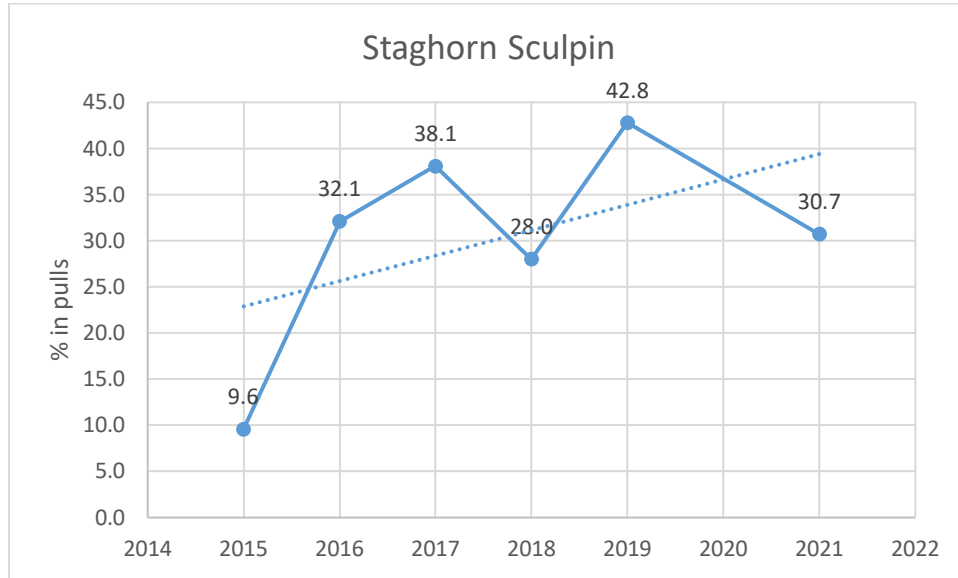
The catch rate of this species continues a steady increase after a small dip in 2018.



The connection with the collapse of the sunflower sea star on them is undetermined, but the graph suggests a connection.

Staghorn Sculpin (*Leptocottus armatus*)

While the trend line shows a steady increase, 20-18 and 2021 show significant declines in the population of the sculpin. This is a very common fish in the intertidal zone and our sampling may simply be the result of normal population fluctuations.

**Unidentified things**

We are working on our ability to correctly identify snails and other species. This data makes it difficult to make year-to-year comparisons. Fortunately, all these numbers remain low.

Conclusion

Aside from the scientific value this sampling of shallow waters might have, the educational value to the guests of Gastineau Guiding is immense. This activity ranked with most as high as whale identification.

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APPENDIX 1: Year-to-Year Comparison 2014-2021

Number of crab pot pulls with each species and the percentage of pulls with that species, by 2019 numbers.

CONTENT	2014	2015		2016		2017		2018		2019		2021	
Total Pots	185	375	%pulled	418	%pulled	441	%pulled	541	%pulled	562	%pulled	75	%pulled
Empty pots	25	92	24.6%	91	21.8%	27	6.1%	29	5%	34	6%	2	3%
Urchin, green sea	X	35	9.4%	54	12.9%	313	71.0%	234	43%	267	47.4%	60	80.0%
Double Ugly (staghorn sculpin)	X	36	9.6%	134	32.1%	168	38.1%	154	28%	233	42.8%	23	30.7%
Hermit crab, wide-hand	X	35	9.4%	93	22.2%	152	34.5%	159	29%	209	38.4%	32	42.7%
Sea star, mottled	X	14	3.7%	15	3.6%	56	12.7%	84	15%	111	20.4%	27	36.0%
Sea star, sunflower	X	64	17.1%	153	36.6%	26	5.9%	74	14%	75	13.8%	2	2.7%
Crab, Pacific lyre	0	7	1.9%	54	12.9%	31	7.0%	27	5%	50	9.2%	2	2.7%
Snail (unidentified to species)	X	15	4.0%	27	6.5%	51	11.6%	30	6%	38	7.0%	3	4.0%
Fish-unidentified	0	1	0.3%	**		7	1.6%	0	0%	26	4.8%	4	5.3%
Pollock	X	12	3.2%	9	2.2%	24	5.4%	5	1%	26	4.8%	4	5.3%
Crab (unidentified to species)	0									19	3.5%	1	1.3%
Crab, Dungeness	X	2	0.5%	7	1.7%	13	2.9%	24	3%	17	3.5%	4	5.3%
Sole, yellowfin	0	4	1.1%	21	5.0%	15	3.4%	9	2%	19	3.5%	6	8.0%
Crab, helmet	0	1	0.3%	5	1.2%	13	2.9%	0	0%	17	3.1%	2	2.7%
Sea star, northern	X	8	2.1%	12	2.9%	8	1.8%	13	2%	10	1.8%	1	1.3%
Jellyfish (unidentified to species)	0									6	1.1%	1	1.3%
Octopus, Pacific	0	1	0.3%	1	0.2%	1	0.2%	1	0%	6	1.1%	0	0%
Triton, Oregon	0									6	1.1%	4	5.3%
Gunnel (unidentified to species)	0	2	0.5%	2	0.5%	1	0.2%	14	3%	3	0.6%	0	0%
Mussel, blue	0	0	0.0%	0	0.0%	6	1.4%	0	0%	3	0.6%	0	0%
Prickleback (unidentified to species)	X	2	0.5%	4	1.0%	0	0.0%	2	0%	3	0.6%	0	0%
Shrimp (unidentified to species)	X	2	0.5%	20	4.8%	5	1.1%	3	1%	2	0.4%	1	1.3%
Barnacle, acorn	X	0	0.0%	0	0.0%	0	0.0%	0	0%	1	0.2%	0	0%
Cucumber, sea (unidentified to species)	0	2	0.5%	0	0.0%	0	0.0%	0	0%	1	0.2%	0	0%
Cod (unidentified to species)	0	2	0.5%	0	0.0%	1	0.2%	0	0%	0	0%	0	0%
Crab, decorator	X	3	0.8%	*		6	1.4%	0	0%	0	0%	0	0%
Hermit crab, red	X	1	0.3%	0	0.0%	0	0.0%	0	0%	0	0%	0	0%

APPENDIX 1: Crab Pot Locations 2021

Coghlan 1
58°21.514' N
134° 41.715' W
Coghlan 3
58° 21.180' N
134° 41.545' W

