

Fish Analysis OCNMS

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04/15/2024

Exploratory analysis

These are some analyses based on the 2015-19 survey data for fish. I've done a bunch of processing in the Git repo (file “/GitHub/OCNMS/R scripts/Fish, Invert, Kelp Analysis/Swath Fish.R”).

I first plotted a bunch of species together to look at the fish community. Then I plot individual species by site and time.

During the sampling, the sampling they observed a total of 36 species and species groups. A few of these are redundant, though. Here is how the sampling was distributed across sites and depths among years (underscores indicate sampling depth).

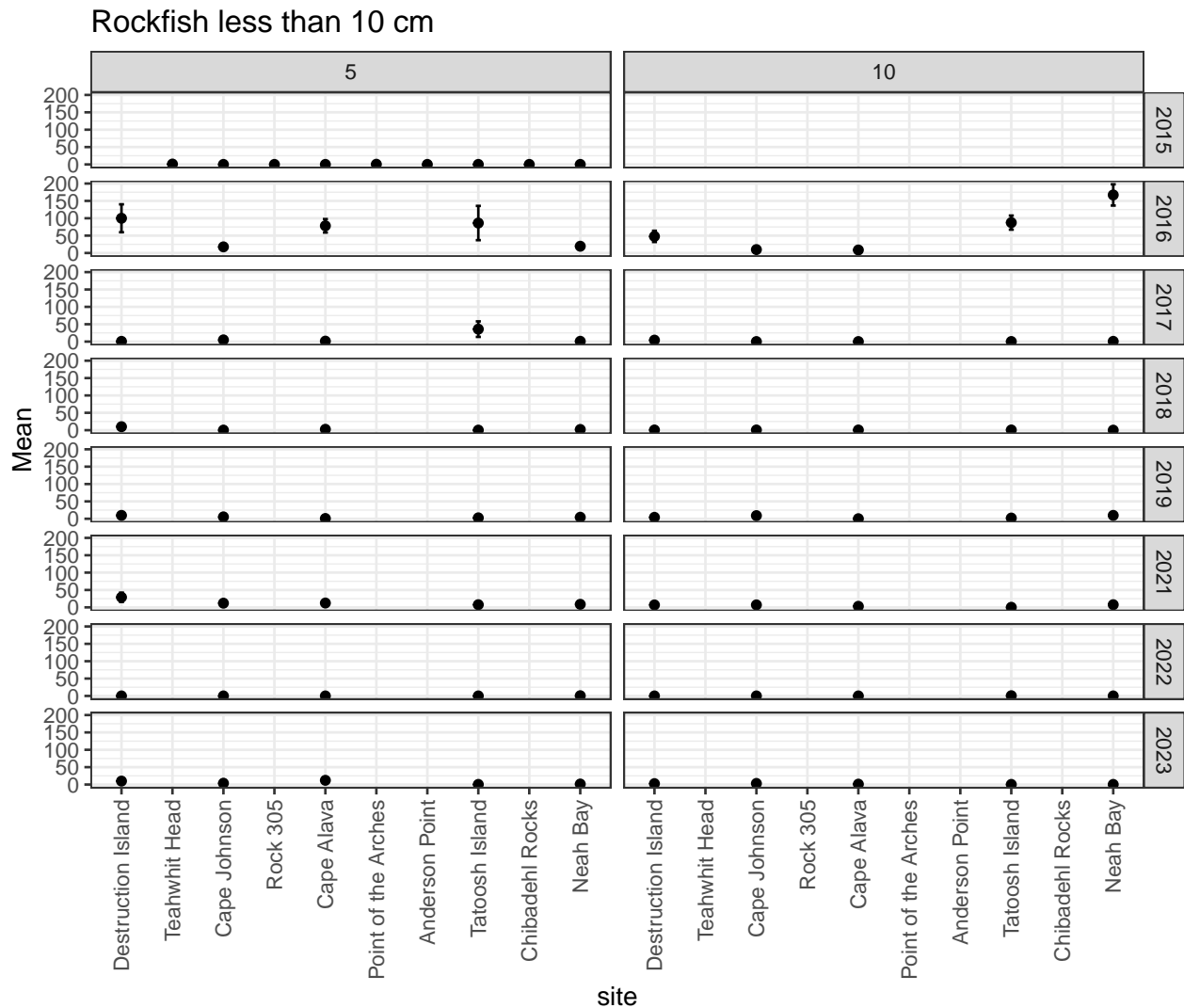
##	site	2015_5	2016_5	2016_10	2017_5	2017_10	2018_5	2018_10
## 1	Destruction Island	0	4	6	8	6	8	7
## 2	Teahwhit Head	4	0	0	0	0	0	0
## 3	Cape Johnson	4	6	6	8	8	8	7
## 4	Rock 305	4	0	0	0	0	0	0
## 5	Cape Alava	4	6	6	8	11	8	8
## 6	Point of the Arches	4	0	0	0	0	0	0
## 7	Anderson Point	4	0	0	0	0	0	0
## 8	Tatoosh Island	4	4	4	6	7	8	7
## 9	Chibadehl Rocks	4	0	0	0	0	0	0
## 10	Neah Bay	4	4	6	8	8	7	8
##	2019_5	2019_10	2021_5	2021_10	2022_5	2022_10	2023_5	2023_10
## 1	8	8	8	6	2	2	8	7
## 2	0	0	0	0	0	0	0	0
## 3	8	7	8	8	2	2	8	9
## 4	0	0	0	0	0	0	0	0
## 5	8	8	7	7	8	7	8	8
## 6	0	0	0	0	0	0	0	0
## 7	0	0	0	0	0	0	0	0
## 8	8	6	8	6	8	6	8	8
## 9	0	0	0	0	0	0	0	0
## 10	7	8	8	8	8	5	10	7

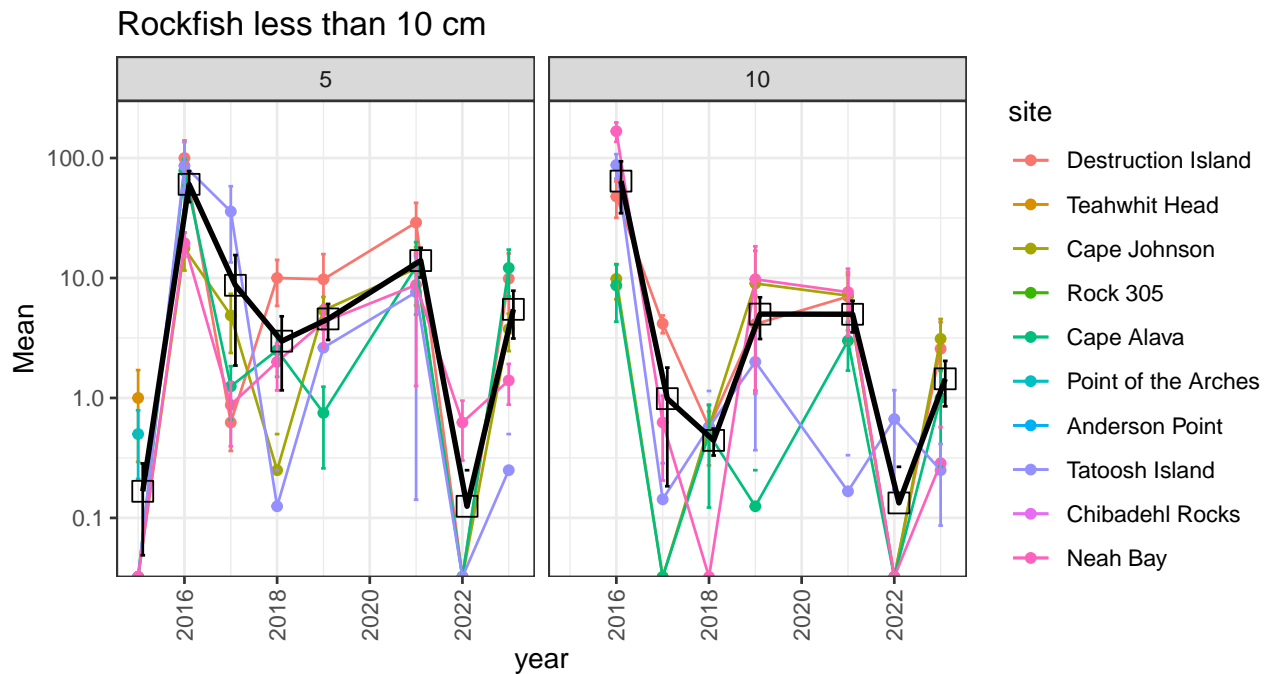
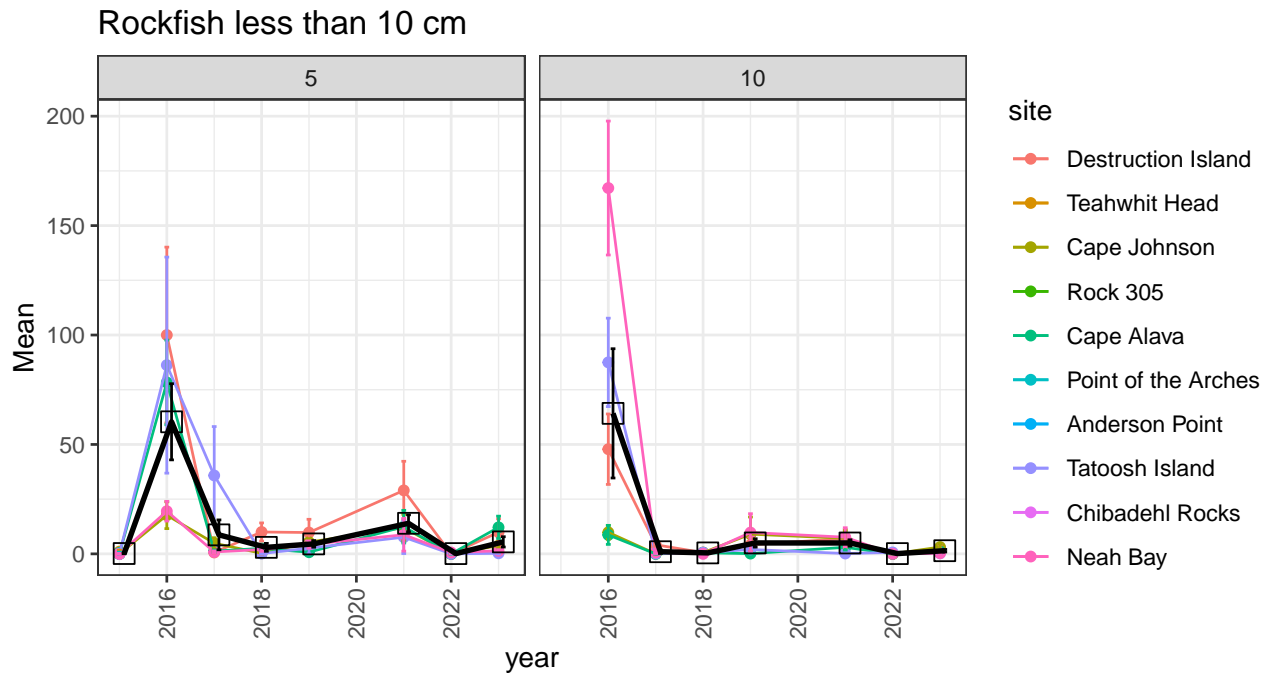
Here is a cheat sheet for species abbreviations and associated common names (ordered by abbreviation):

##	species	common.name
## 1	AMHE	<NA>
## 2	ARHA	Scalyhead sculpin (<i>Artedius harringtoni</i>)
## 3	AUFL	Tubesnout
## 4	BAITBALL	Bait, Sardines/Anchovies
## 5	CHNU	Mosshead warbonnet
## 6	CITH	Sanddabs
## 7	CLUP	Herring
## 8	COTT	Sculpins
## 9	EMBI	Surfperches
## 10	EMLA	Striped Surfperch
## 11	ENBI	Buffalo Sculpin
## 12	HEDE	Kelp Greenling
## 13	HEHE	Red Irish Lord
## 14	HELA	Rock Greenling
## 15	HEST	Whitespotted greenling
## 16	HEXA	unidentified Hexagrammos
## 17	JOZO	Longfin Sculpin
## 18	MYOPOL	<NA>
## 19	NO_DATA	Transect not done, data not available
## 20	NO_ORG	No organisms present in this sample
## 21	OPEL	Lingcod
## 22	OXPI	Painted Greenling
## 23	PHOL	Gunnels
## 24	RHNI	Blackeye Goby
## 25	RHVA	Pile perch
## 26	RIMU	Kelp clingfish
## 27	RYOY	Rockfish young of the year, unidentified sp.
## 28	SCMA	cabezon
## 29	SEBYT	black and yellowtail rockfish YOY complex
## 30	SECA	copper rockfish
## 31	SEFL	Yellowtail rockfish
## 32	SEMA	Quillback rockfish
## 33	SEME	black rockfish
## 34	SEMY	blue rockfish
## 35	SENE	china rockfish
## 36	SEPI	canary rockfish
## 37	SYGI	Manacled sculpin (<i>Synchirus gilli</i>)
## 38	UNID	Unidentified Fish

Small Rockfish (<10cm)

Here are the rockfish plotted in a couple different ways. This is for all small rockfish combined. I have included all transects here, not just those with visibility > 2m. See the end for information about the transects and visibility. In the bottom panel, the black boxes and error bars are simple the among site means and SE using the site means. For all panels, the 5 vs. 10 columns indicate water depth category.

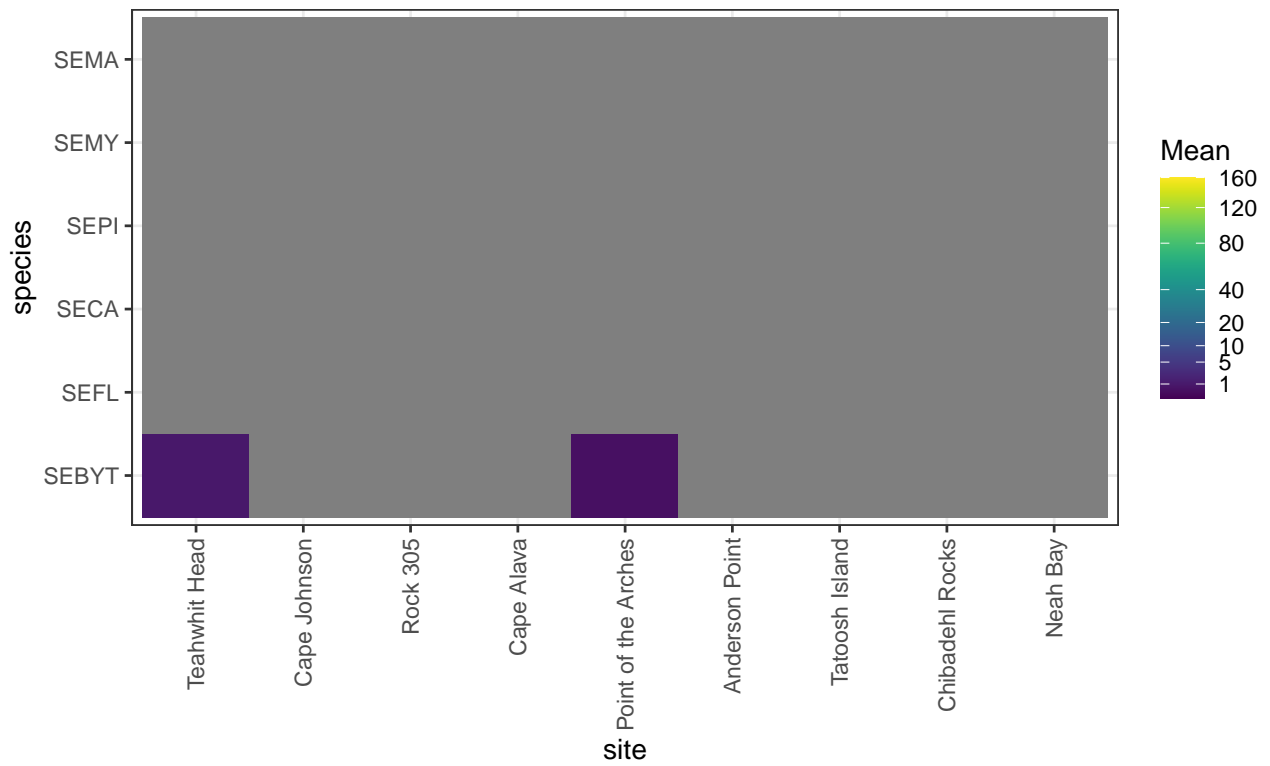




Here is why I didn't make plots of species by sub-types. Different levels of taxonomic specificity are available for different observers and years.

\$X.2015.5

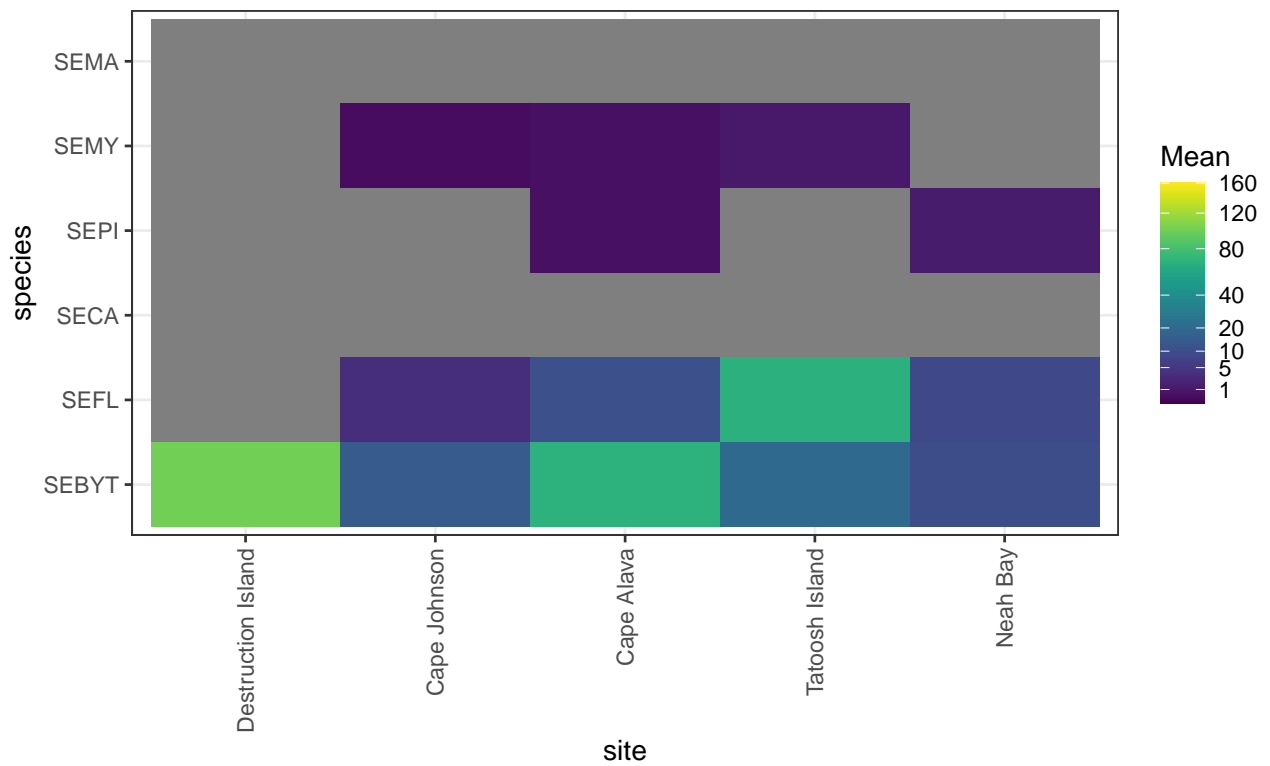
All <10cm, 2015 average count 5m deep (per 30x2x2 m transect)



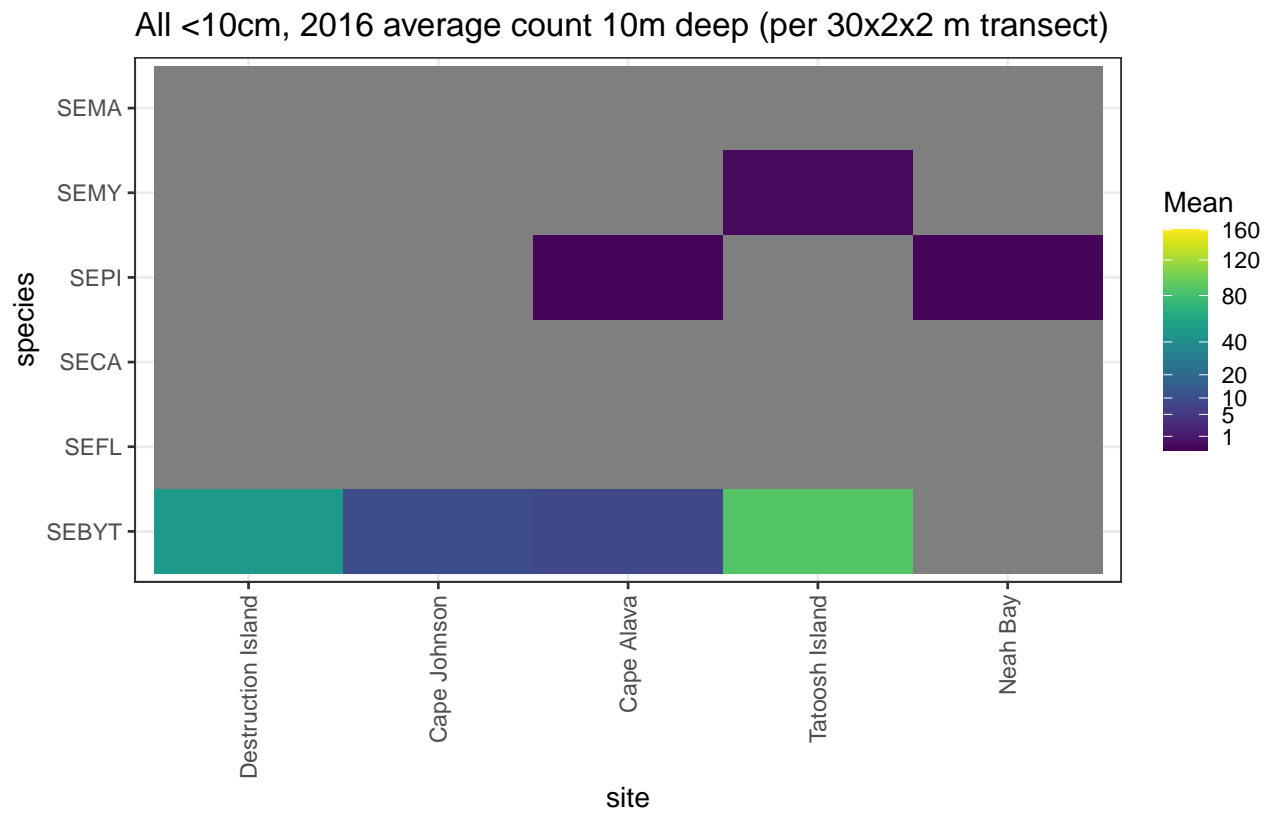
##

\$X.2016.5

All <10cm, 2016 average count 5m deep (per 30x2x2 m transect)

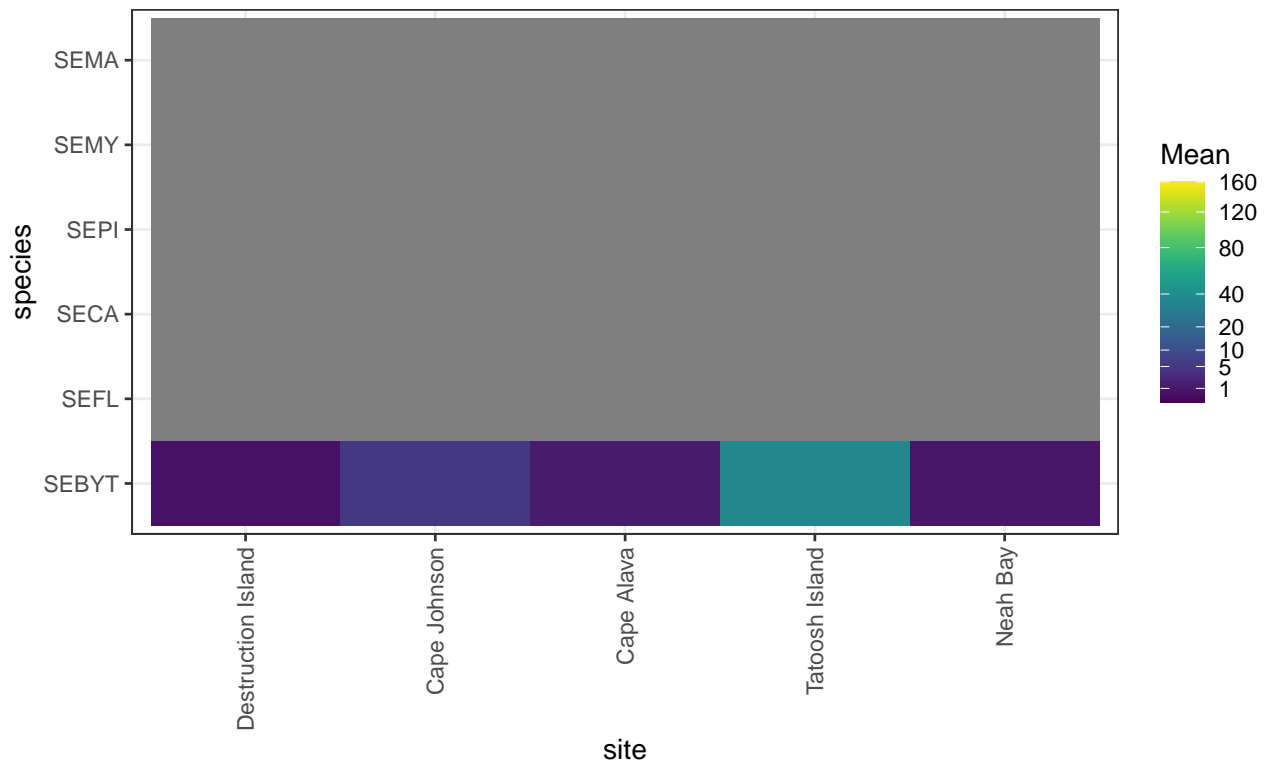


\$X.2016.10



\$X.2017.5

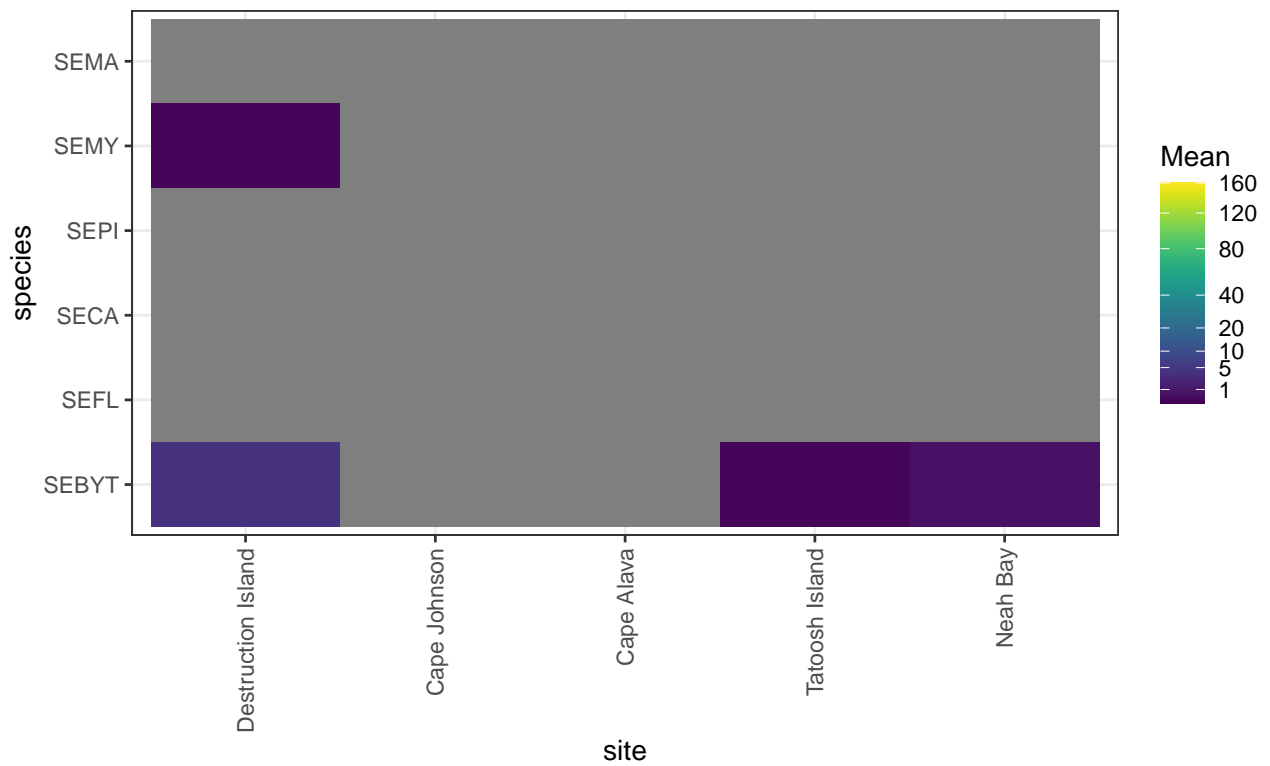
All <10cm, 2017 average count 5m deep (per 30x2x2 m transect)



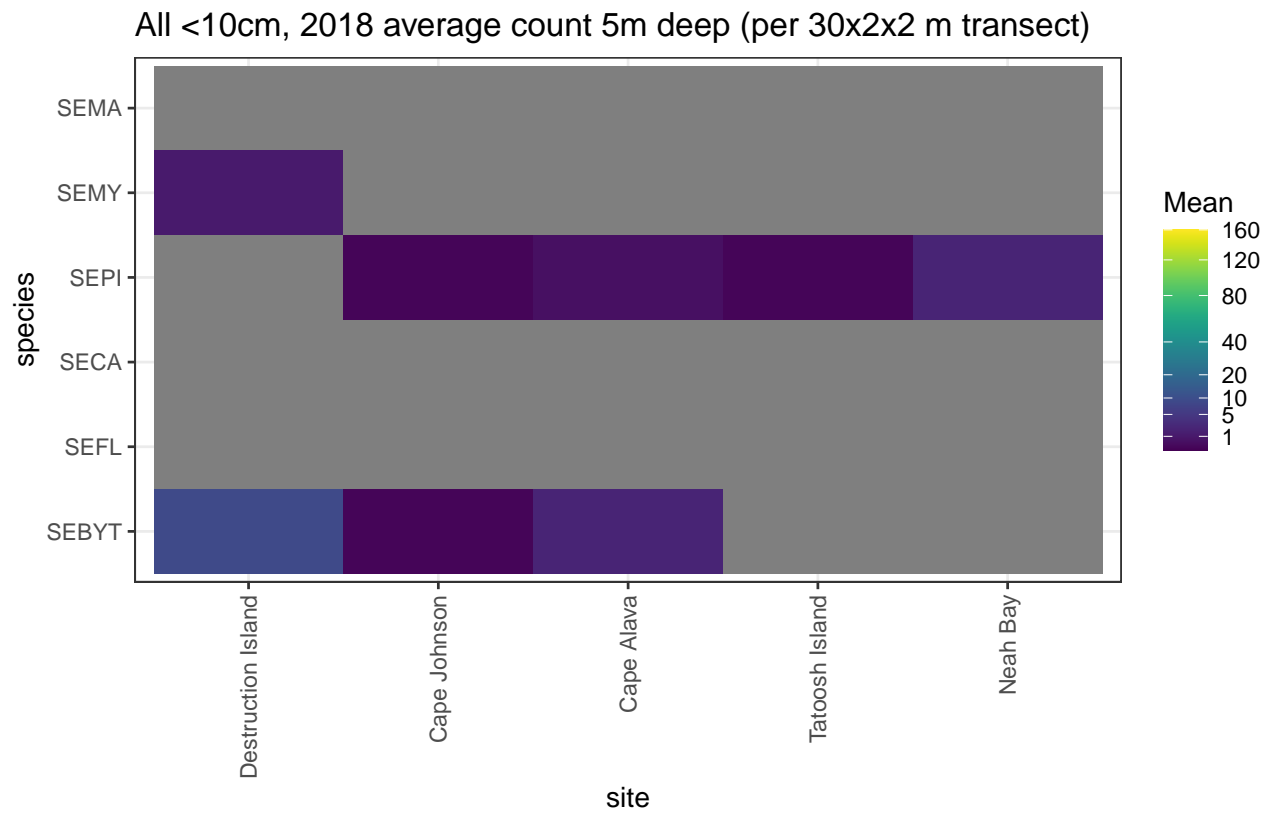
##

\$X.2017.10

All <10cm, 2017 average count 10m deep (per 30x2x2 m transect)

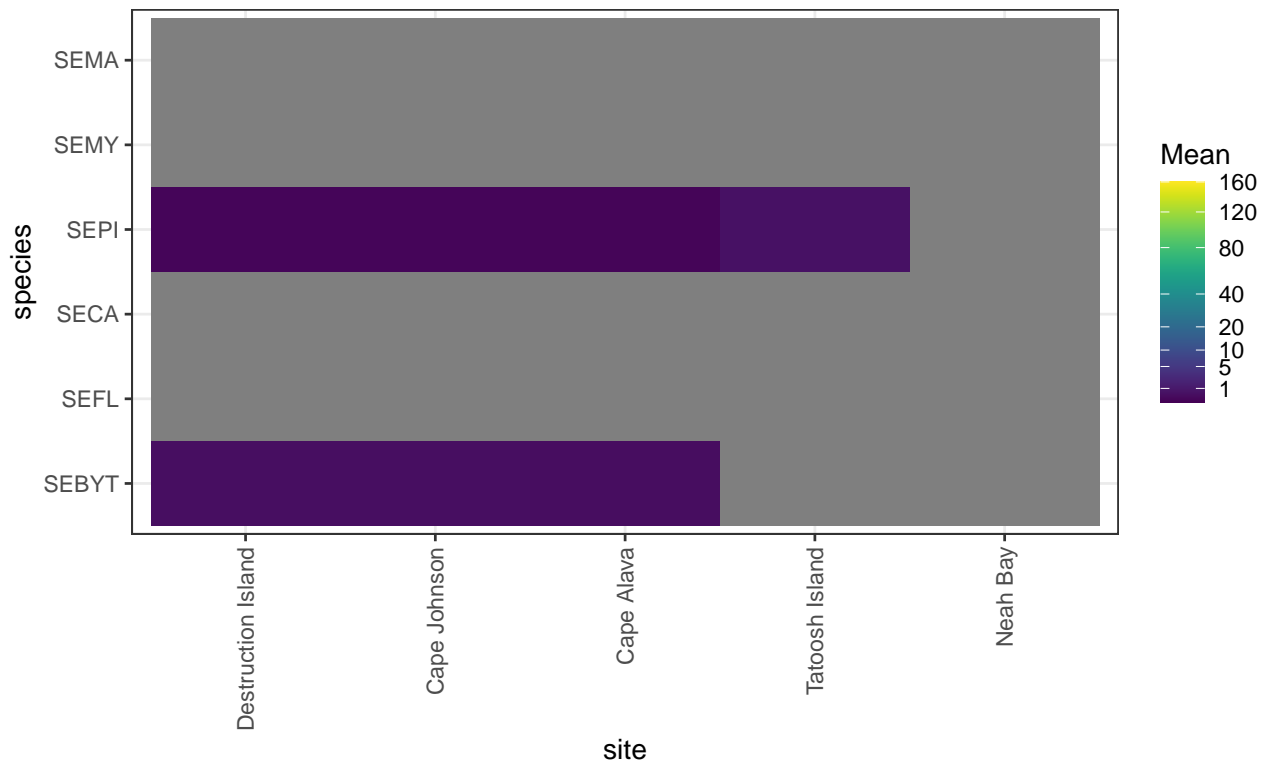


\$X.2018.5



\$X.2018.10

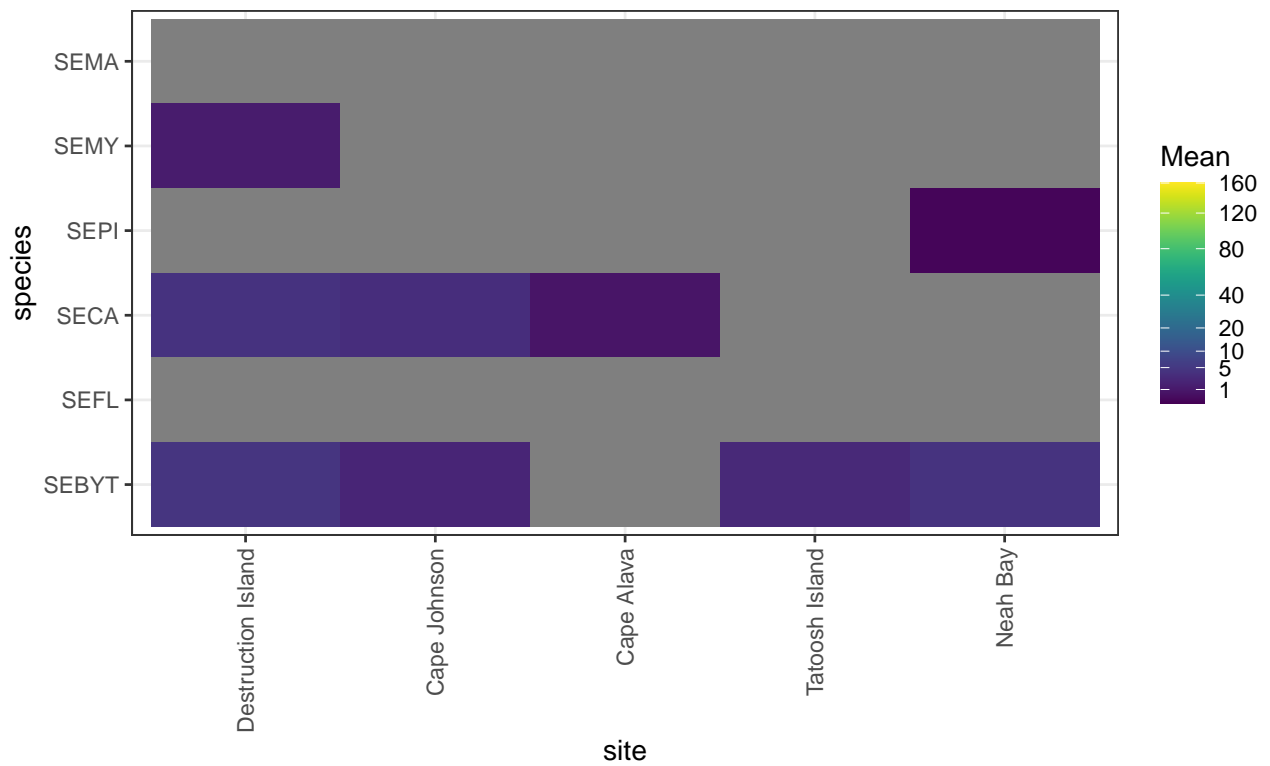
All <10cm, 2018 average count 10m deep (per 30x2x2 m transect)



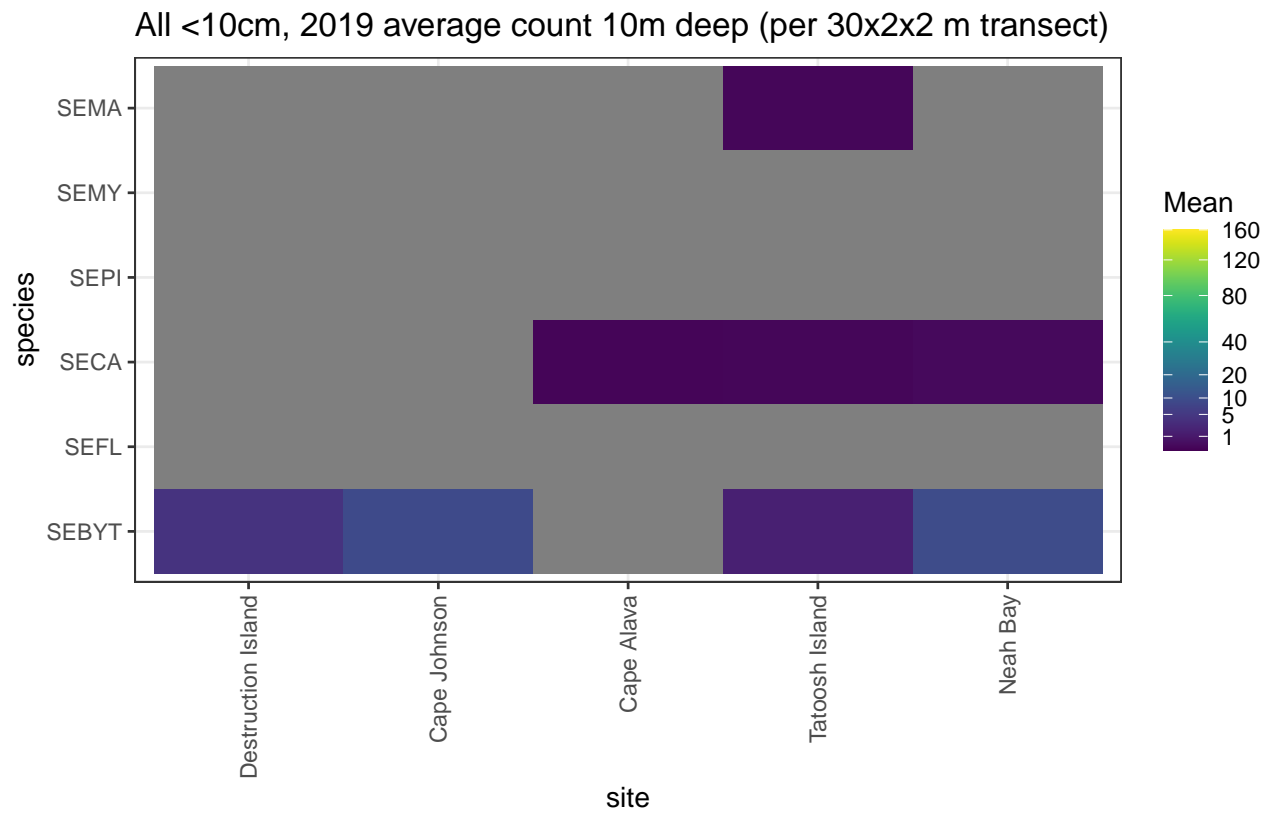
##

\$X.2019.5

All <10cm, 2019 average count 5m deep (per 30x2x2 m transect)

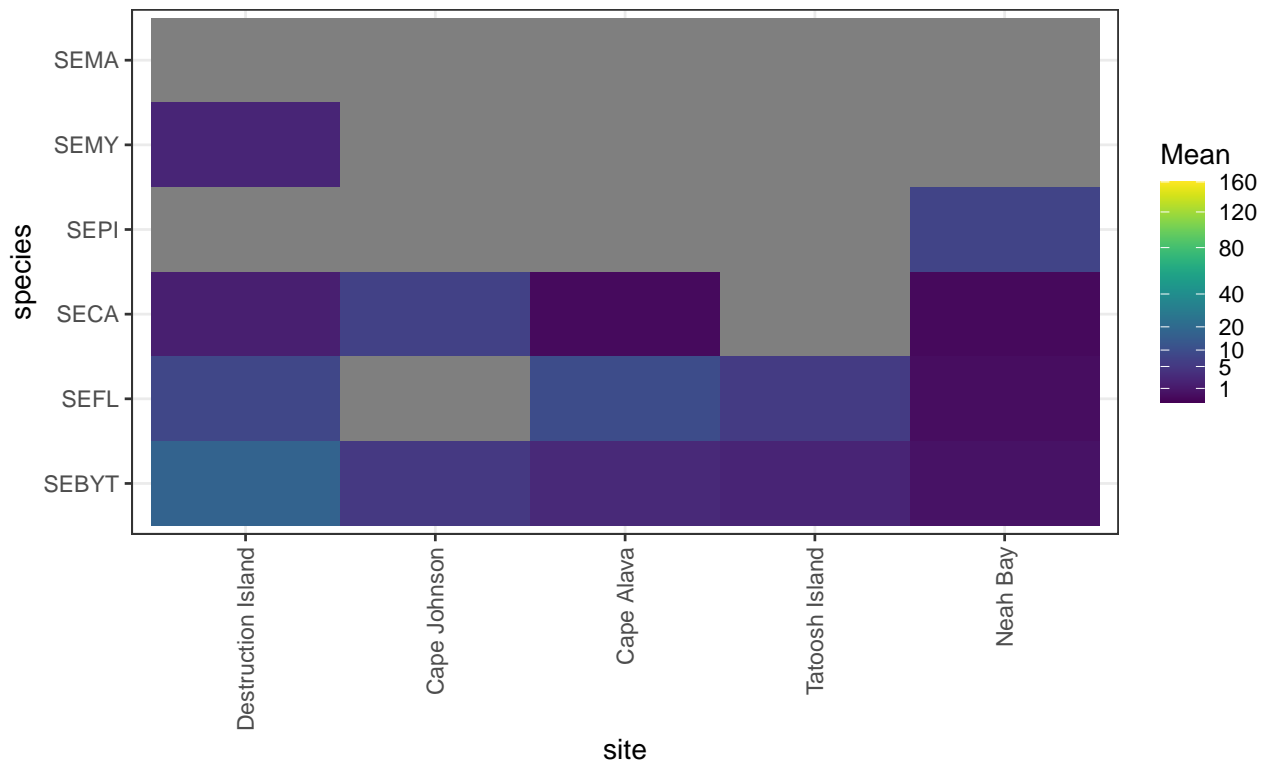


\$X.2019.10



\$X.2021.5

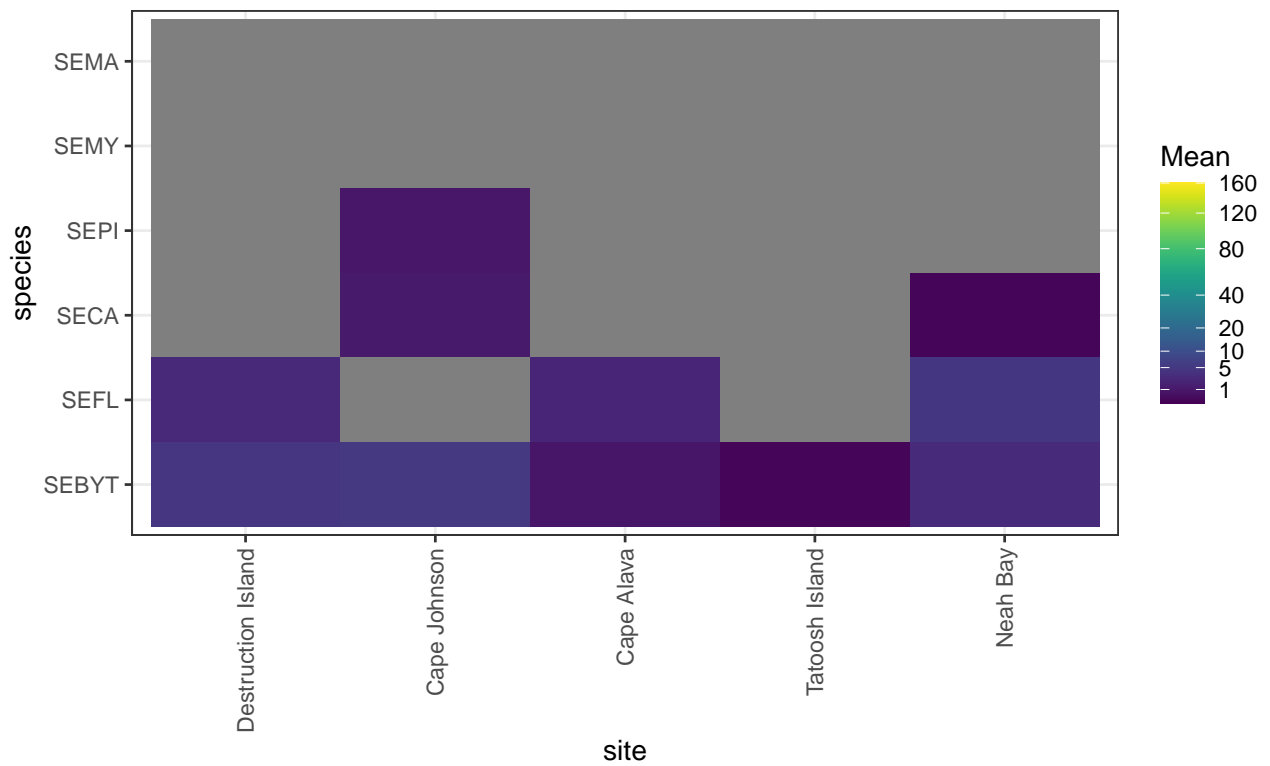
All <10cm, 2021 average count 5m deep (per 30x2x2 m transect)



##

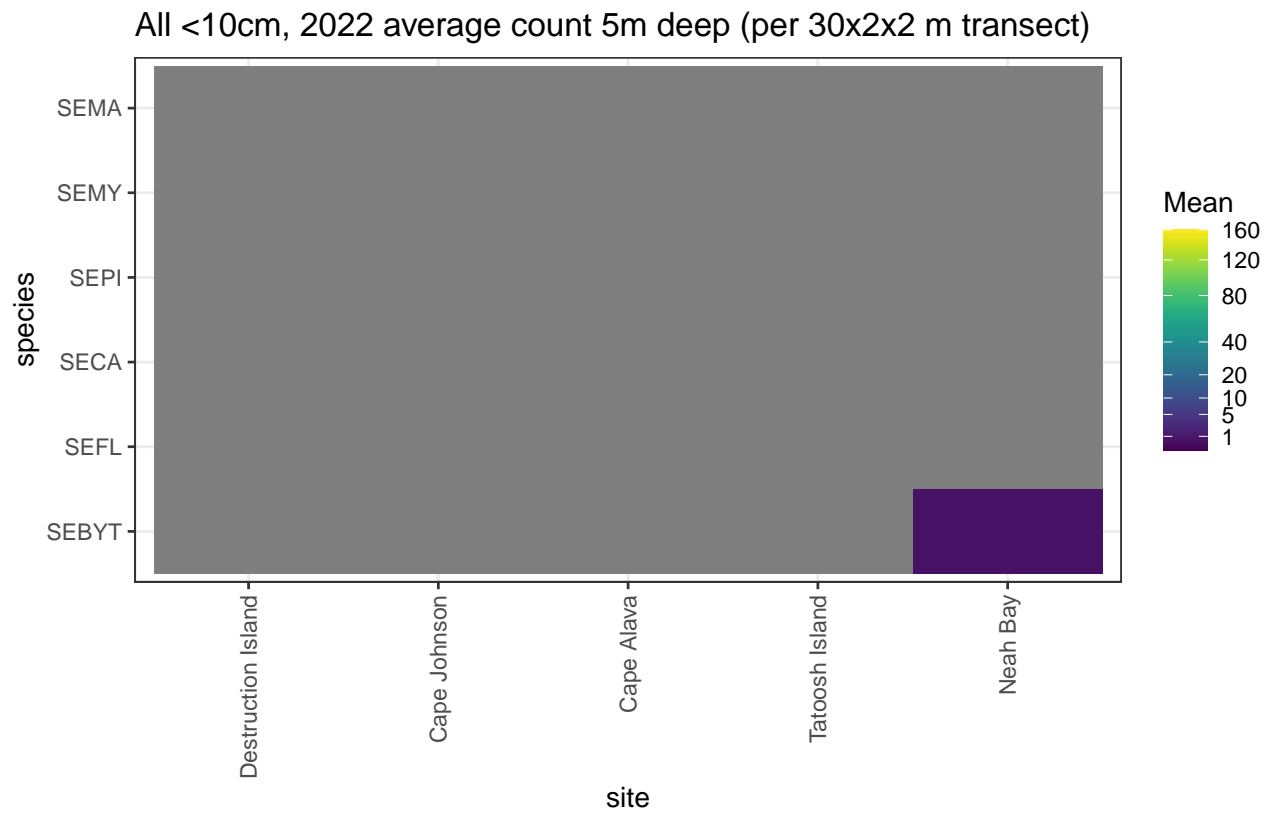
\$X.2021.10

All <10cm, 2021 average count 10m deep (per 30x2x2 m transect)



##

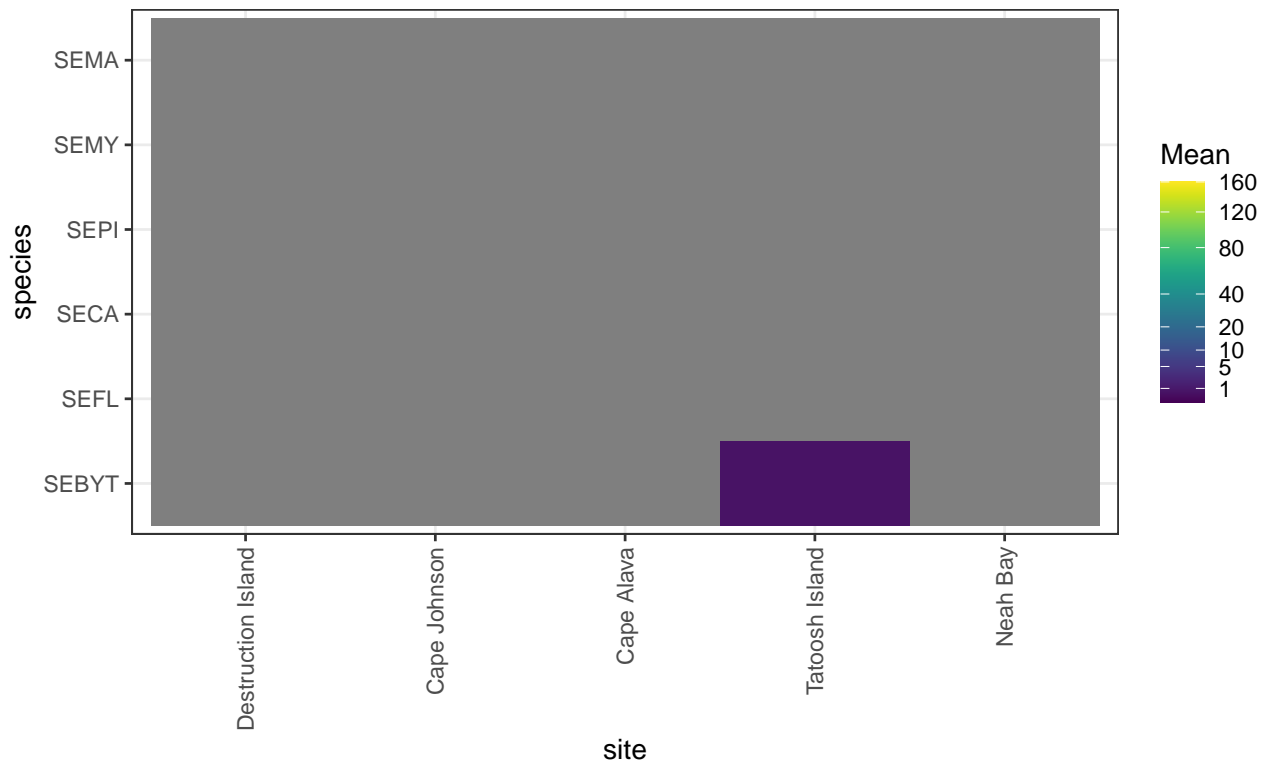
\$X.2022.5



##

\$X.2022.10

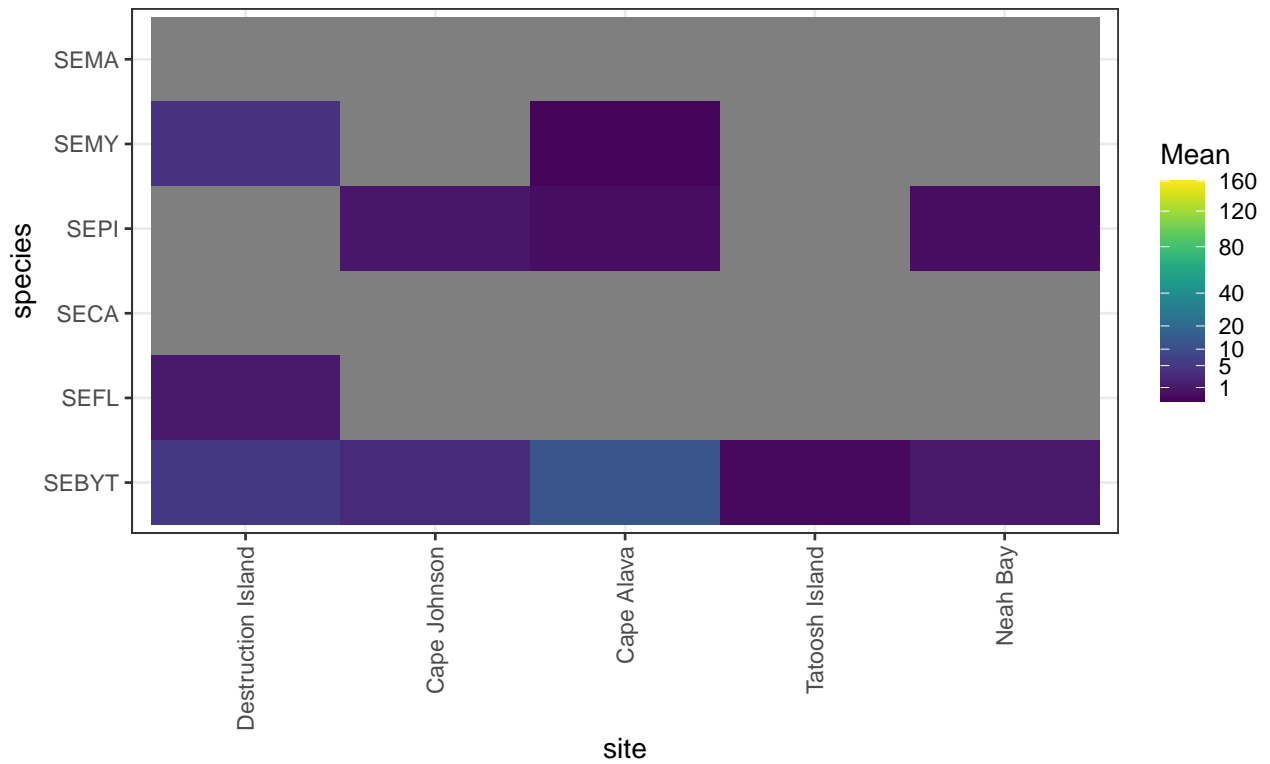
All <10cm, 2022 average count 10m deep (per 30x2x2 m transect)



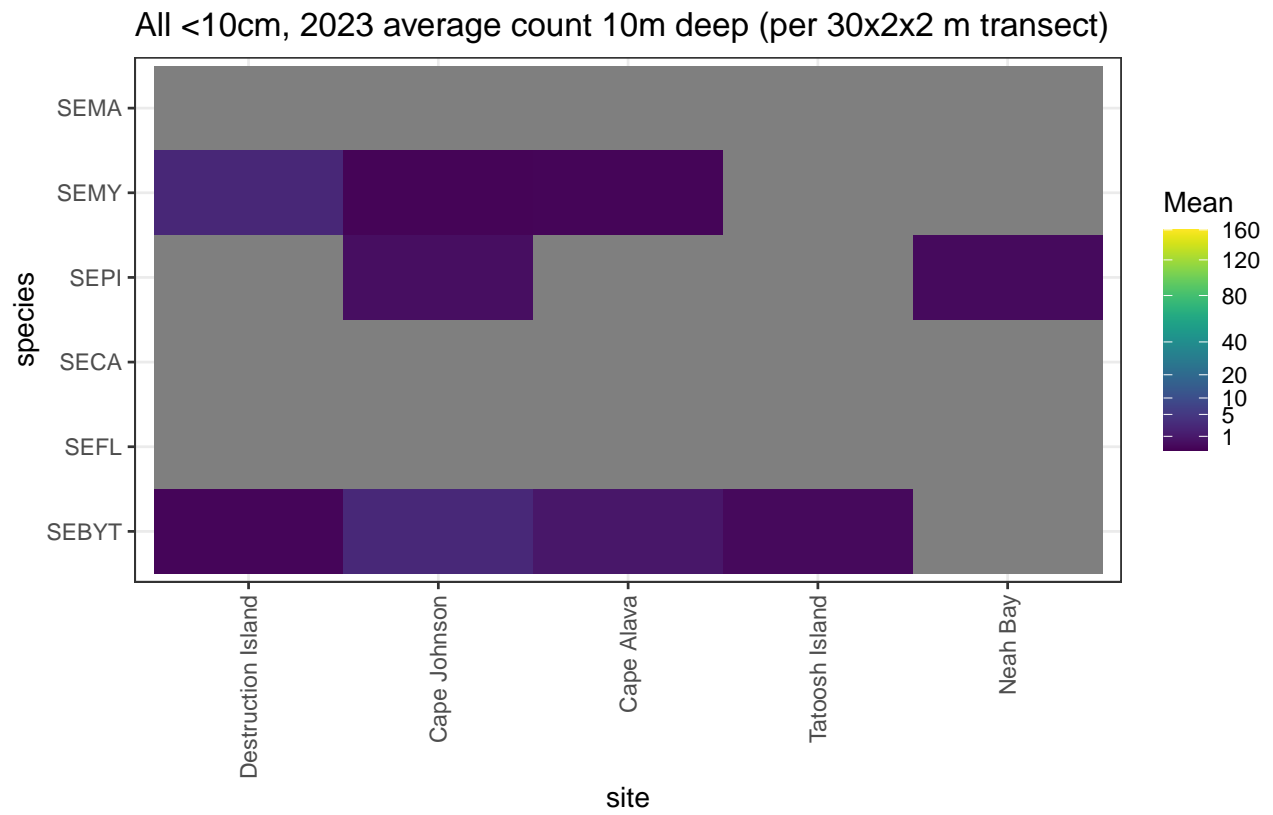
##

\$X.2023.5

All <10cm, 2023 average count 5m deep (per 30x2x2 m transect)



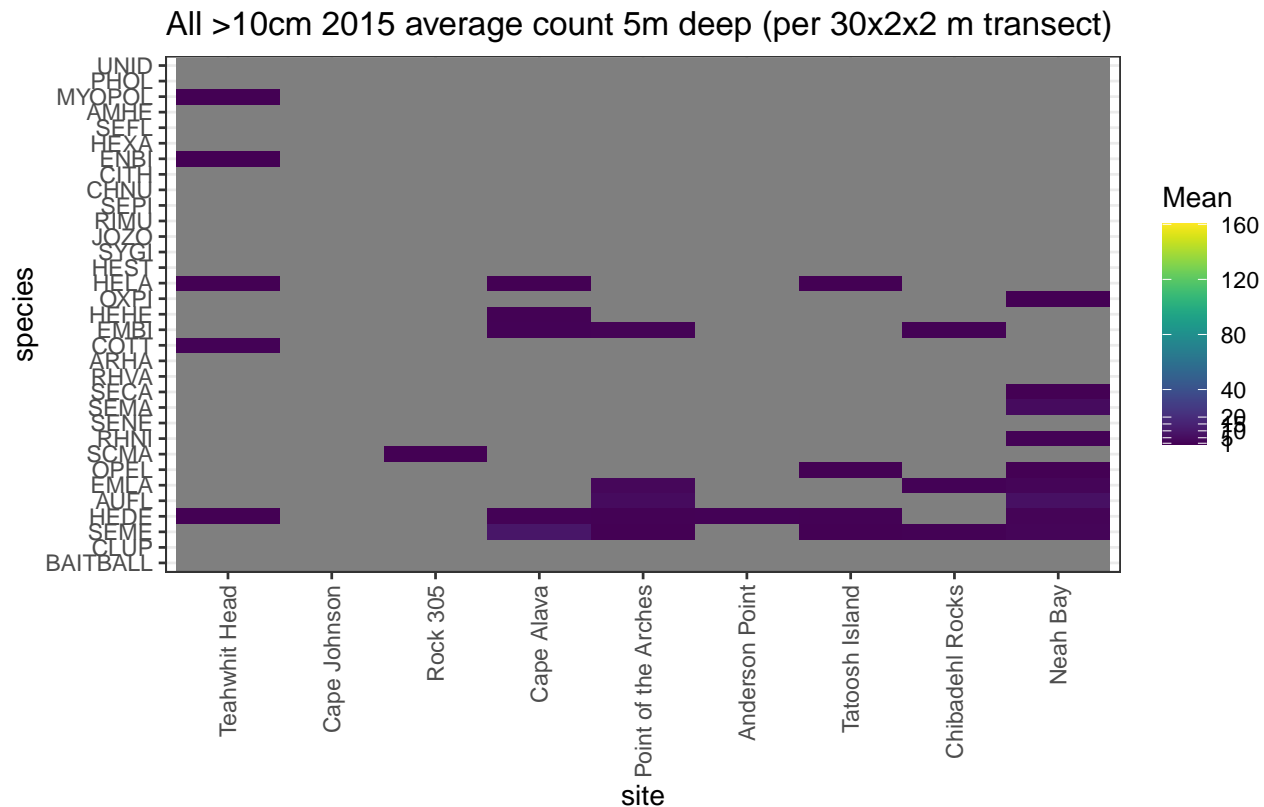
\$X.2023.10



All Other Fish Except small rockfish

Here, here are the fish > 10 cm. In general, you will notice a lot of grey in the figures. This means most species were not observed in any transect at that site-year combination.

\$X.2015.5



##

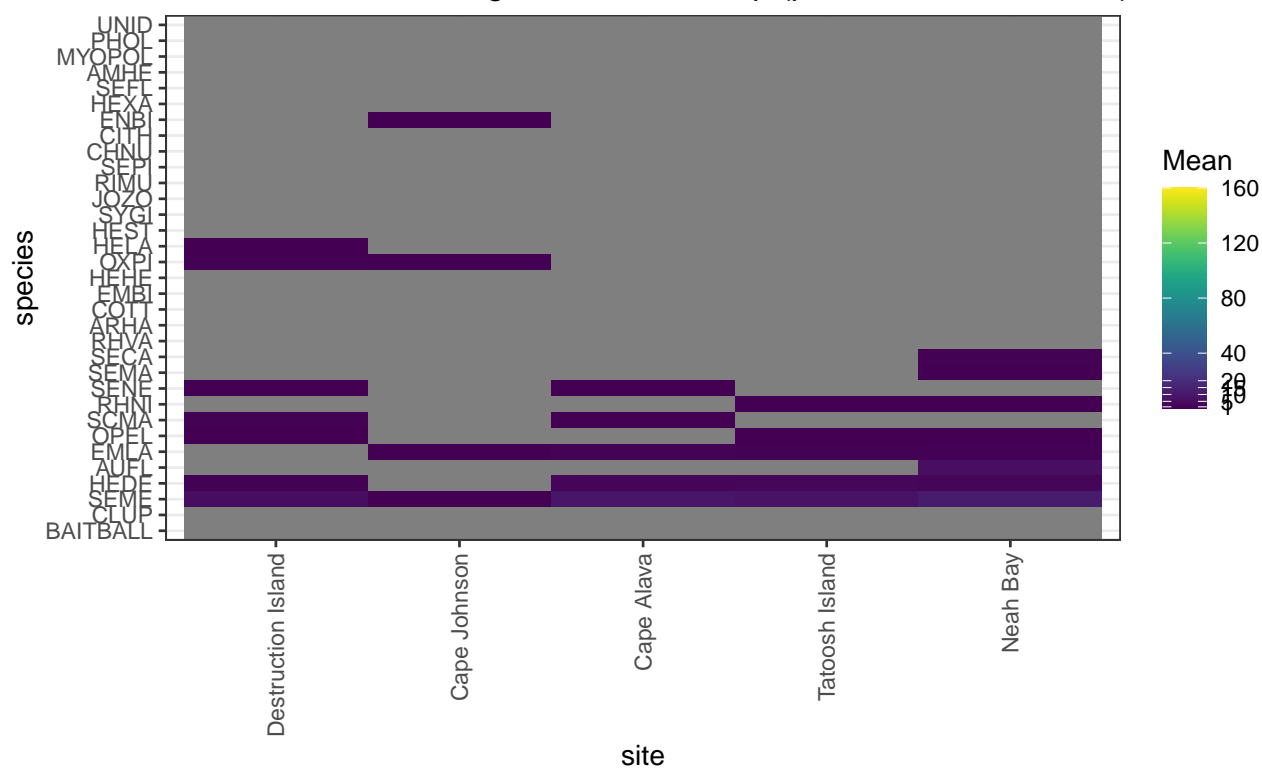
\$X.2016.5

```
## $X.2016.10
```

Heatmap showing the mean number of individuals per species across five sites. The y-axis lists 30 species, and the x-axis lists five sites: Destruction Island, Cape Johnson, Cape Alava, Tatoosh Island, and Neah Bay. A color scale on the right indicates the mean number of individuals, ranging from 0 (dark purple) to 160 (yellow).

species	Destruction Island	Cape Johnson	Cape Alava	Tatoosh Island	Neah Bay
UNID	0	0	0	0	0
PHOL	0	0	0	0	0
MYOP	0	0	0	0	0
AMHE	0	0	0	0	0
SEFT	0	0	0	0	0
HEXA	0	0	0	0	0
ENB	0	0	0	0	0
CHIN	0	0	0	0	0
SEPU	0	0	0	0	0
RIMU	0	0	0	0	0
JOZO	0	0	0	0	0
SYGL	0	0	0	0	0
HEST	10	0	0	0	0
HELA	10	0	0	0	0
OXPA	10	0	0	0	0
HEHE	10	0	0	0	0
EMBL	0	10	0	0	0
COLA	0	0	10	0	0
ARHA	0	0	10	0	0
DRHA	0	0	0	10	0
SECA	0	0	0	0	10
SEMA	0	0	0	0	10
SENE	0	0	0	0	10
RHNA	0	0	0	0	10
SCMA	0	0	0	0	10
OPFA	10	0	10	10	10
EMFA	10	0	10	10	10
AUTFA	10	0	10	10	10
HEFA	10	10	10	10	10
SEMFA	10	10	10	10	10
CLUB	0	0	0	0	0
BAITBALL	0	0	0	0	0

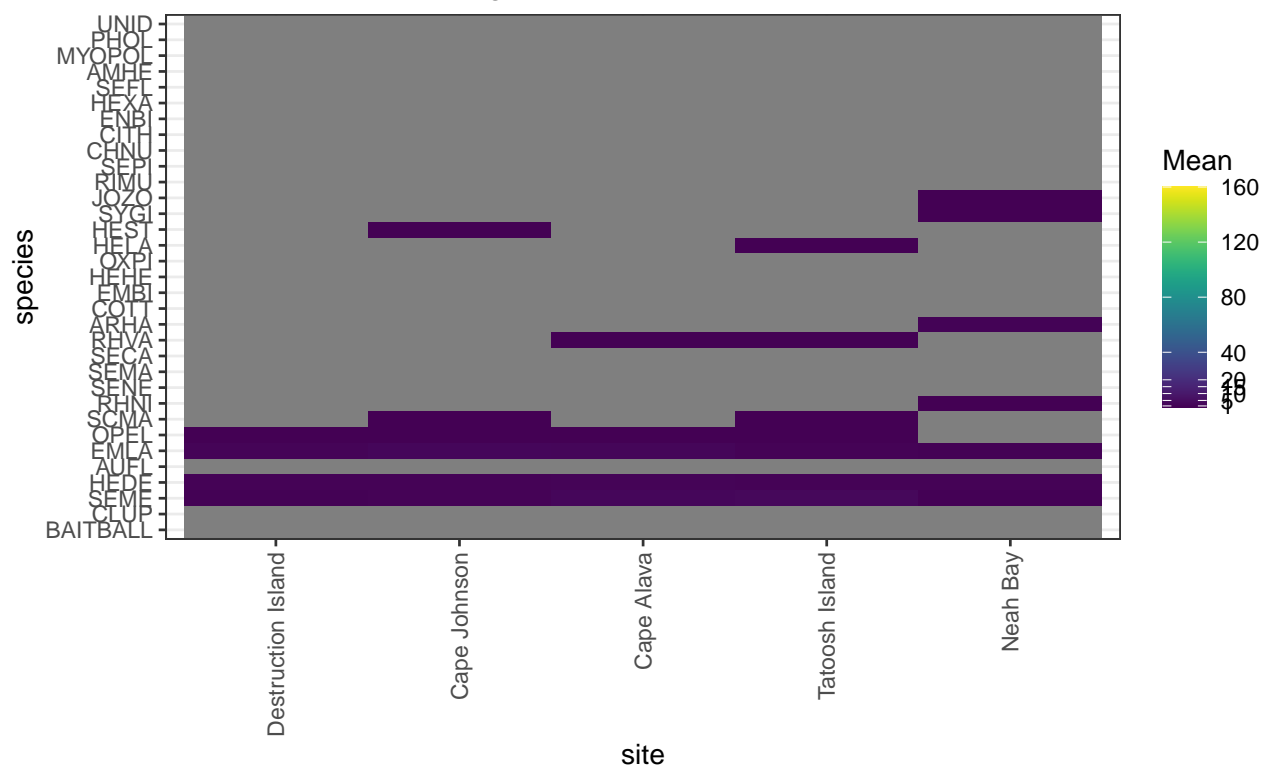
All >10cm 2017 average count 10m deep (per 30x2x2 m transect)



##

\$X.2018.5

All >10cm 2018 average count 5m deep (per 30x2x2 m transect)

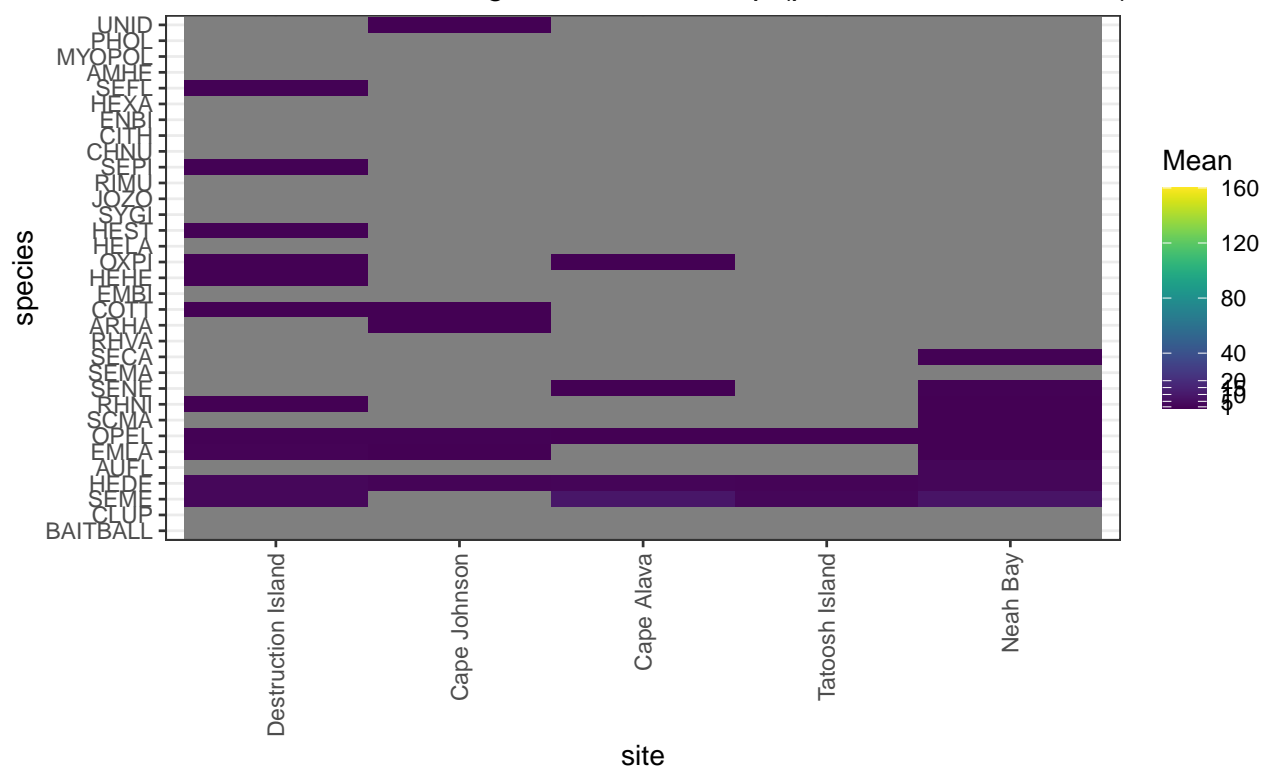


Heatmap showing the mean number of eggs per female (Mean) for various species across five sites. The color scale ranges from 0 (dark purple) to 160 (yellow). The species listed on the y-axis are: BAITBALL, CLU, SEM, LUT, AUT, FEM, PET, OMA, SOM, RHINE, SEN, ECA, SCA, ARHA, COL, EMBL, HEFL, OXP, HEFL, SYGL, JOZO, RIMU, SEP, CINL, ENB, HEXA, SEFT, AMHE, UNID, MYOP, and PHOL. The sites on the x-axis are: Destruction Island, Cape Johnson, Cape Alava, Tatoosh Island, and Neah Bay.

\$X.2019.10

[illegible]

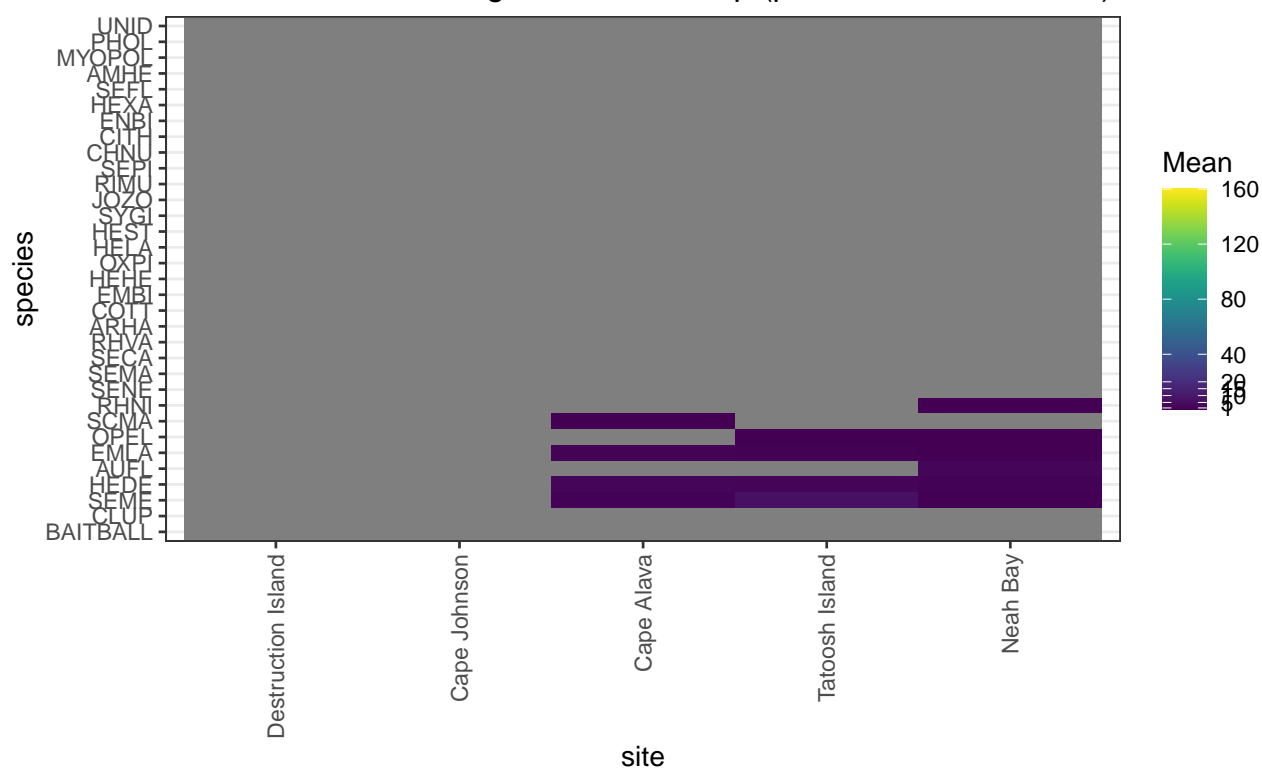
All >10cm 2021 average count 10m deep (per 30x2x2 m transect)



##

\$X.2022.5

All >10cm 2022 average count 5m deep (per 30x2x2 m transect)



Heatmap showing the mean number of individuals per species across five sites. The y-axis lists 30 species, and the x-axis lists five sites: Destruction Island, Cape Johnson, Cape Alava, Tatoosh Island, and Neah Bay. A color scale on the right indicates the mean count, ranging from 0 (dark purple) to 160 (yellow).

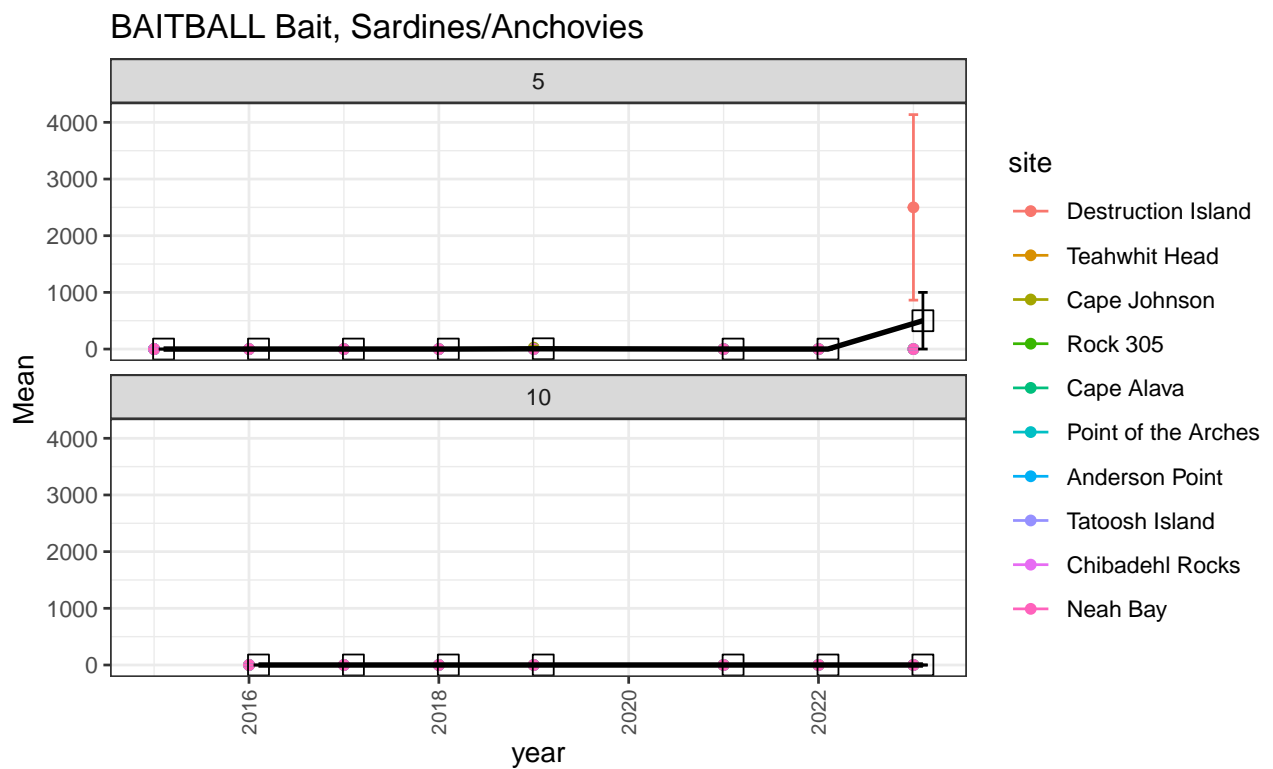
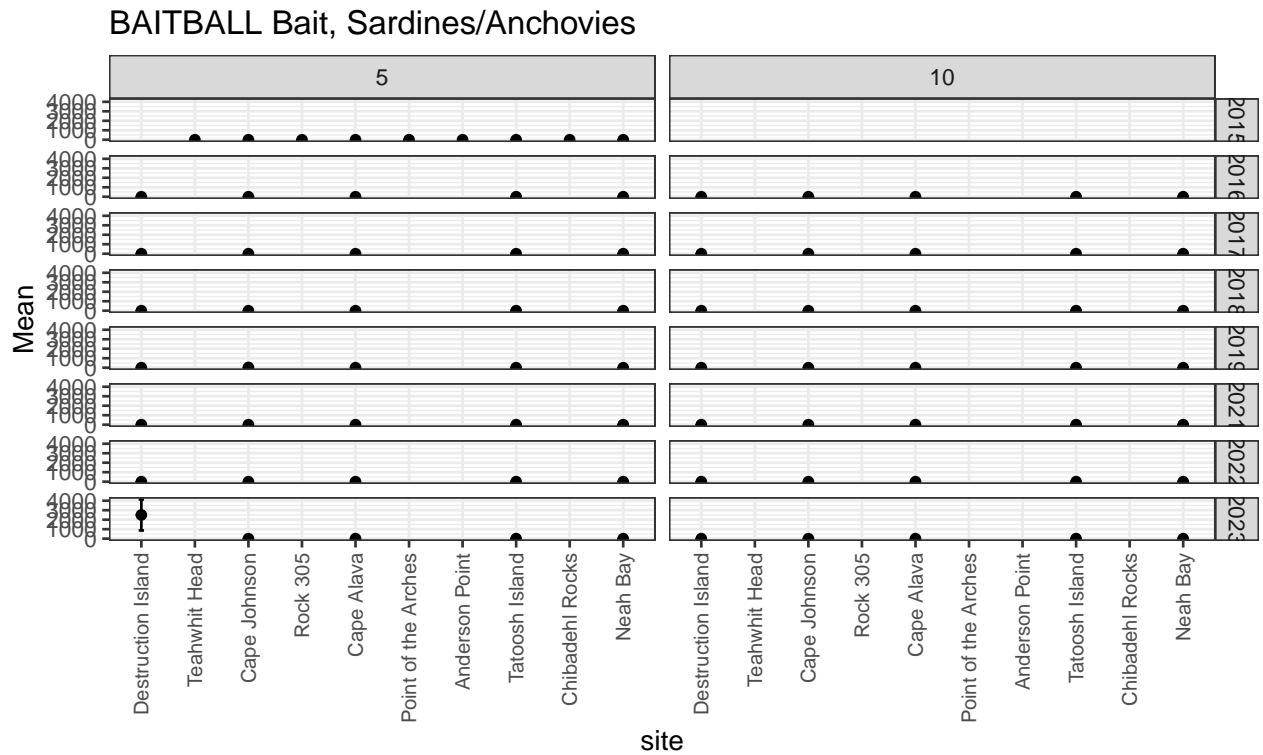
species	Destruction Island	Cape Johnson	Cape Alava	Tatoosh Island	Neah Bay
UNID	0	0	0	0	0
PHOL	0	0	0	0	0
MY	0	0	0	0	0
AMHE	0	0	0	0	0
SEFT	0	0	0	0	0
HEXA	0	0	0	0	0
ENB	0	0	0	0	0
CHNL	0	0	0	0	0
SEU	0	0	0	0	0
RIMU	0	0	0	0	0
JOZO	0	0	0	0	0
SYGL	0	0	0	0	0
HEST	0	0	0	0	0
HELA	0	0	0	0	0
OXPL	0	0	0	0	0
HEHE	0	0	0	0	0
EMBL	0	0	0	0	0
COLL	0	0	0	0	0
ARHA	0	0	0	0	0
DRHA	0	0	0	0	0
SECA	0	0	0	0	0
SEMA	0	0	0	0	0
RHNE	0	0	0	0	0
SOMA	0	0	0	0	0
OFMA	0	0	0	0	0
EMTA	0	0	0	0	0
AUTL	0	0	0	0	0
TEDE	0	0	0	0	0
SEMU	0	0	0	0	0
CLUB	0	0	0	0	0
BAITBALL	0	0	0	0	0

```
## $X.2023.10
```

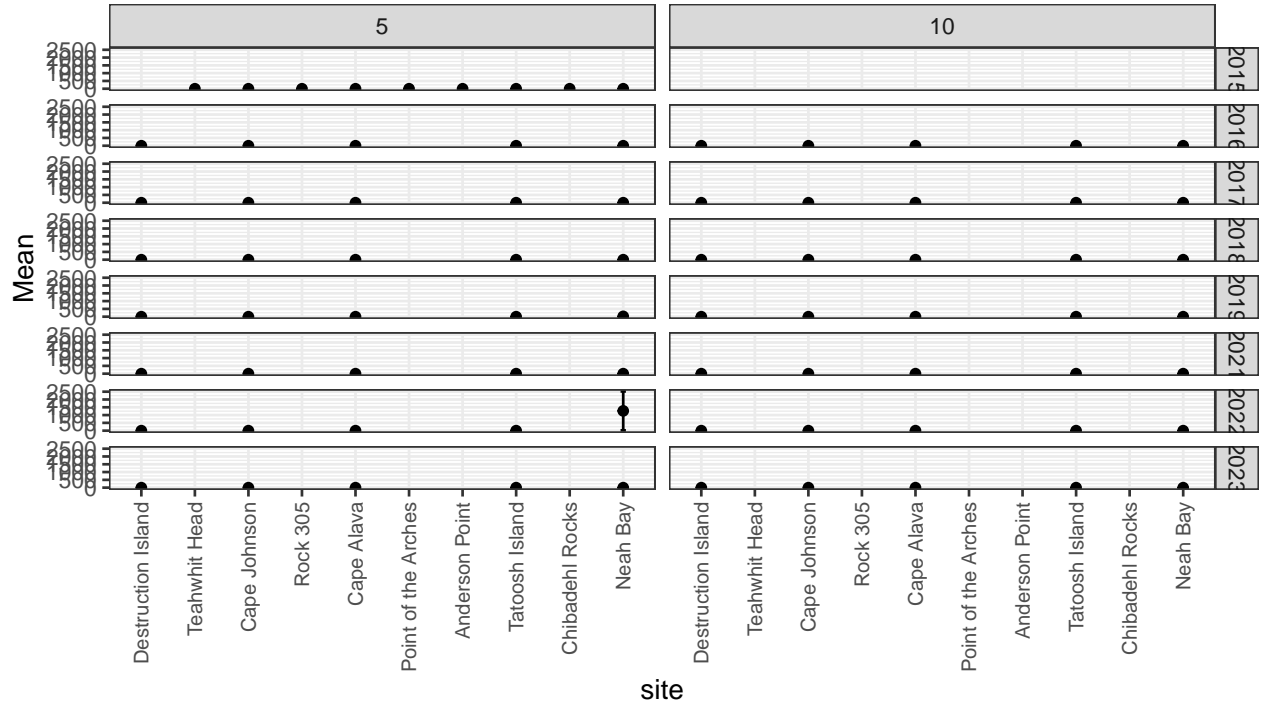
Heatmap showing the mean number of individuals per species across five sites. The y-axis lists 39 species, and the x-axis lists five sites: Destruction Island, Cape Johnson, Cape Alava, Tatoosh Island, and Neah Bay. A color scale on the right indicates the mean count, ranging from 0 (dark purple) to 160 (yellow).

species	Destruction Island	Cape Johnson	Cape Alava	Tatoosh Island	Neah Bay
UNID	0	0	0	0	0
PHOL	0	0	0	0	0
MYOP	0	0	0	0	0
AMHE	0	0	0	0	0
SEFT	0	0	0	0	0
HEXA	0	0	0	0	0
ENBI	0	0	0	0	0
CHIN	0	0	0	0	0
SEPU	0	0	0	0	0
RIMU	0	0	0	0	0
JOZO	0	0	0	0	0
SYGI	0	0	0	0	0
HEST	0	0	0	0	0
HELA	0	0	0	0	0
OXPA	0	0	0	0	0
HEHE	0	0	0	0	0
EMBL	0	0	0	0	0
COLI	0	0	0	0	0
ARHA	0	0	0	0	0
DRHA	0	0	0	0	0
SECA	0	0	0	0	0
SEMA	0	0	0	0	0
RHNE	0	0	0	0	0
SOMA	0	0	0	0	0
OPET	0	0	0	0	0
EMIT	0	0	0	0	0
AUTU	0	0	0	0	0
HEDE	0	0	0	0	0
SEMU	0	0	0	0	0
CLUB	0	0	0	0	0
BAITBALL	0	0	0	0	0

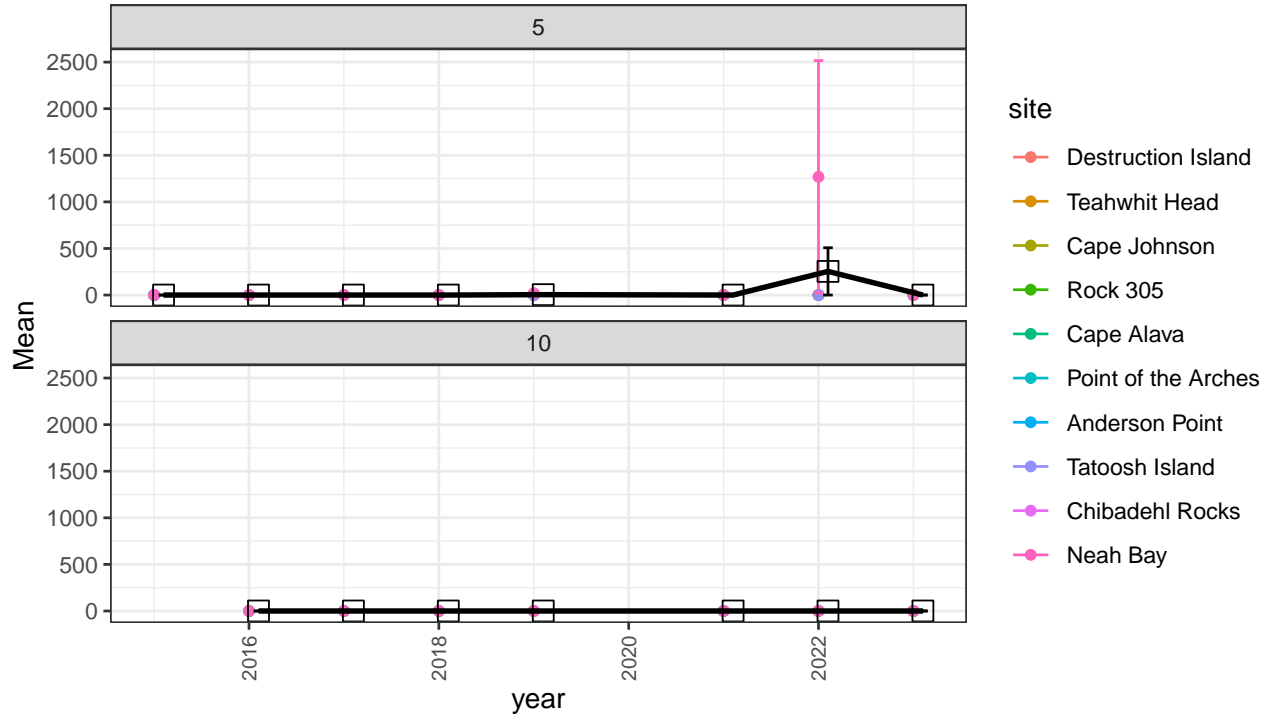
Example time series and spatial variation for the top 8 most common species.

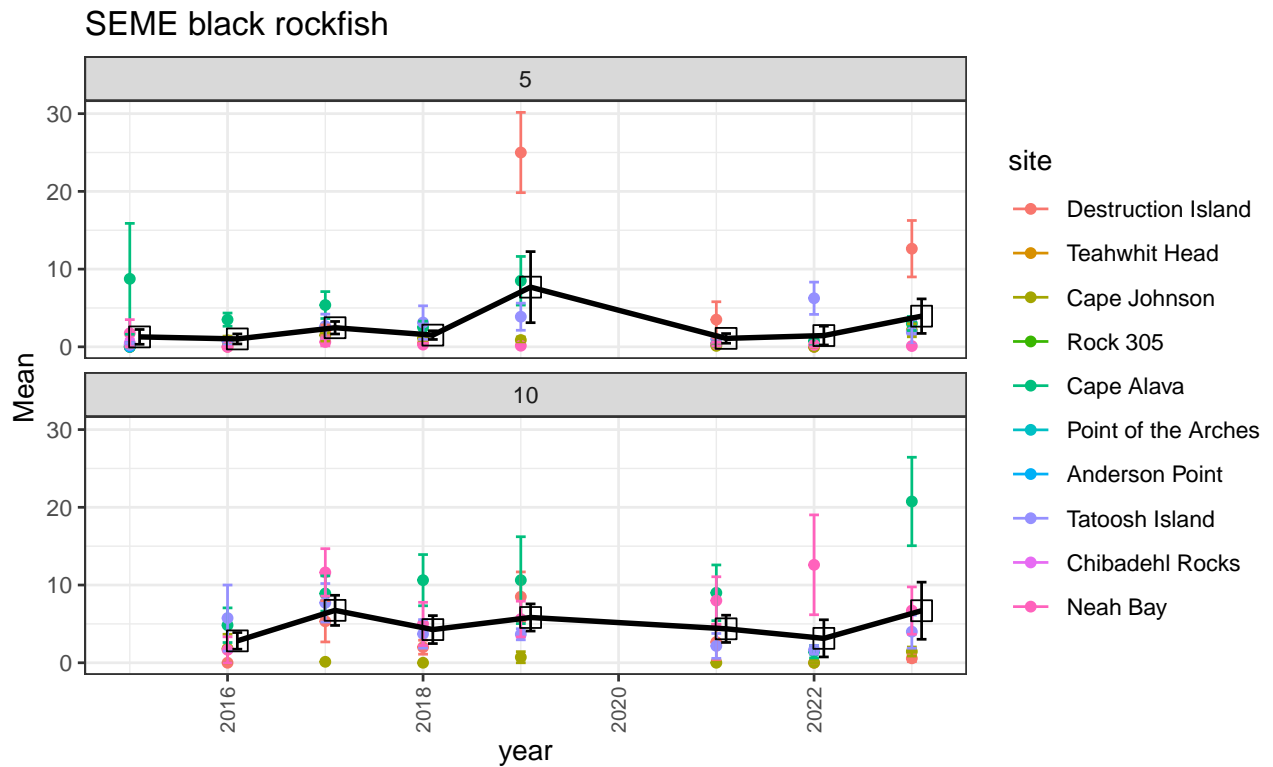
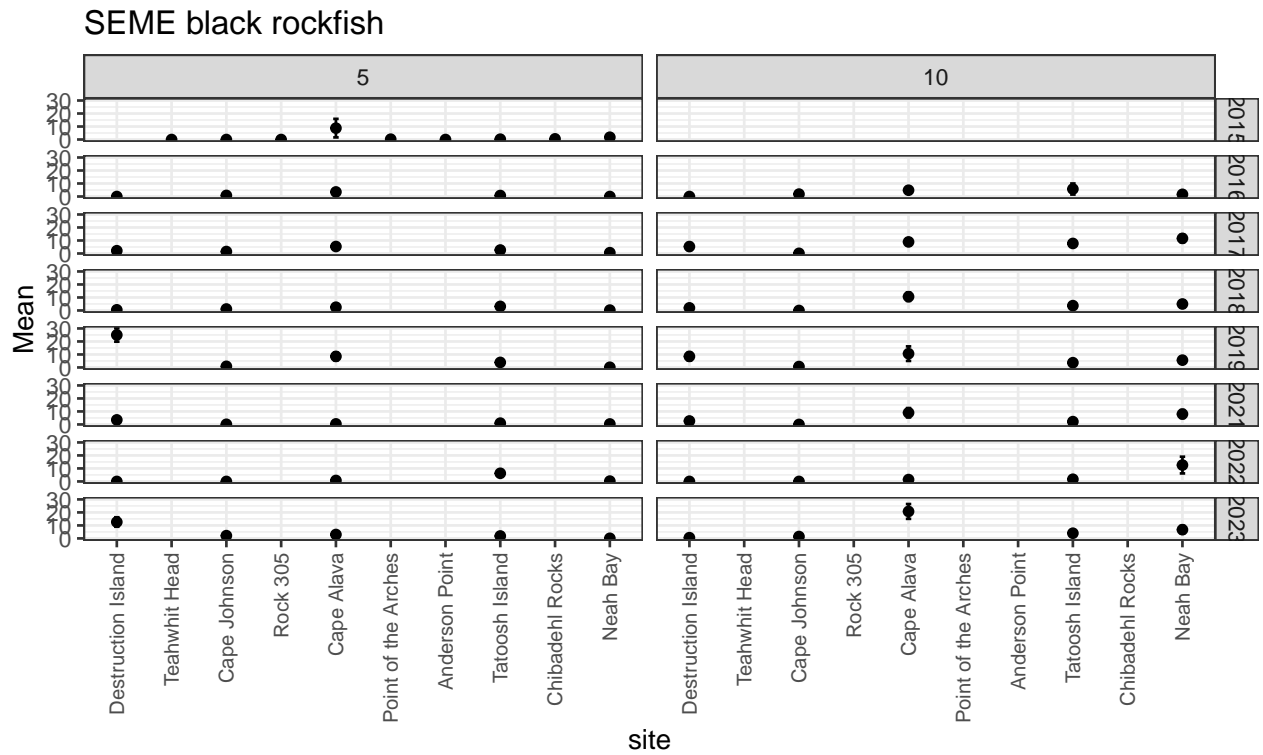


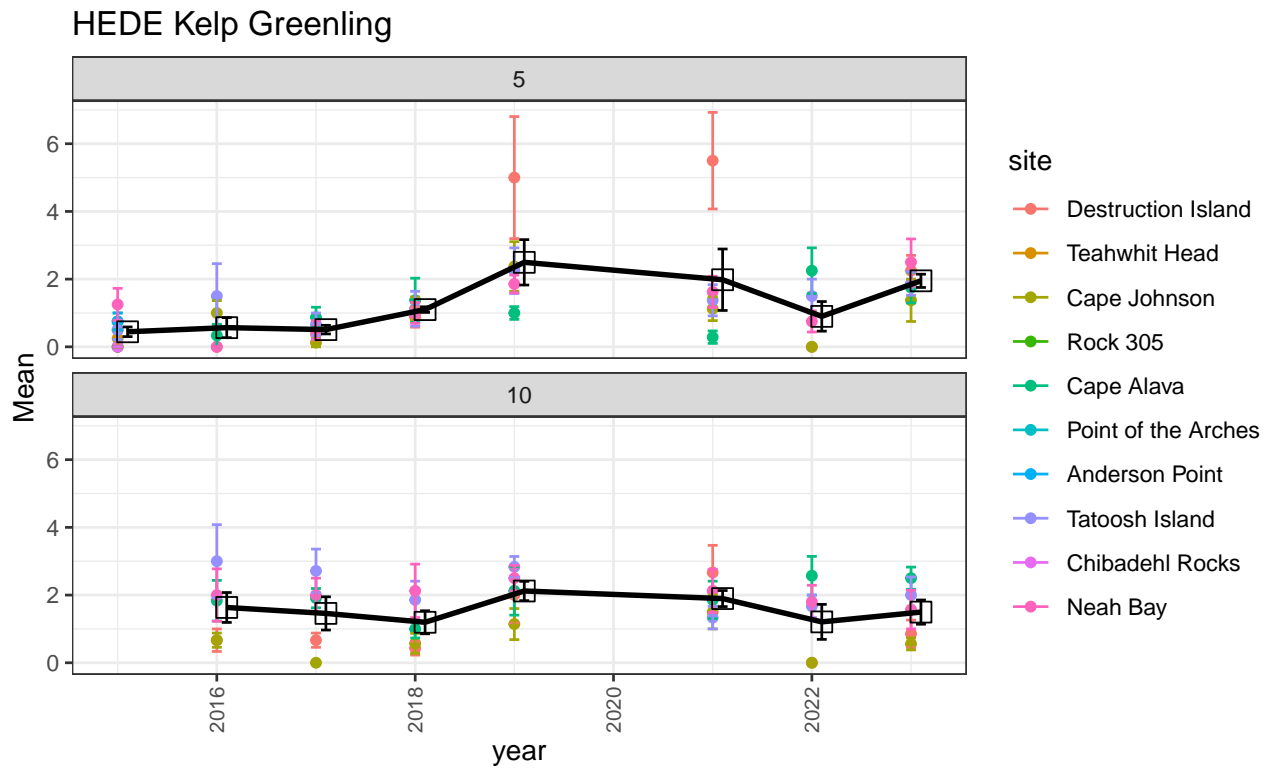
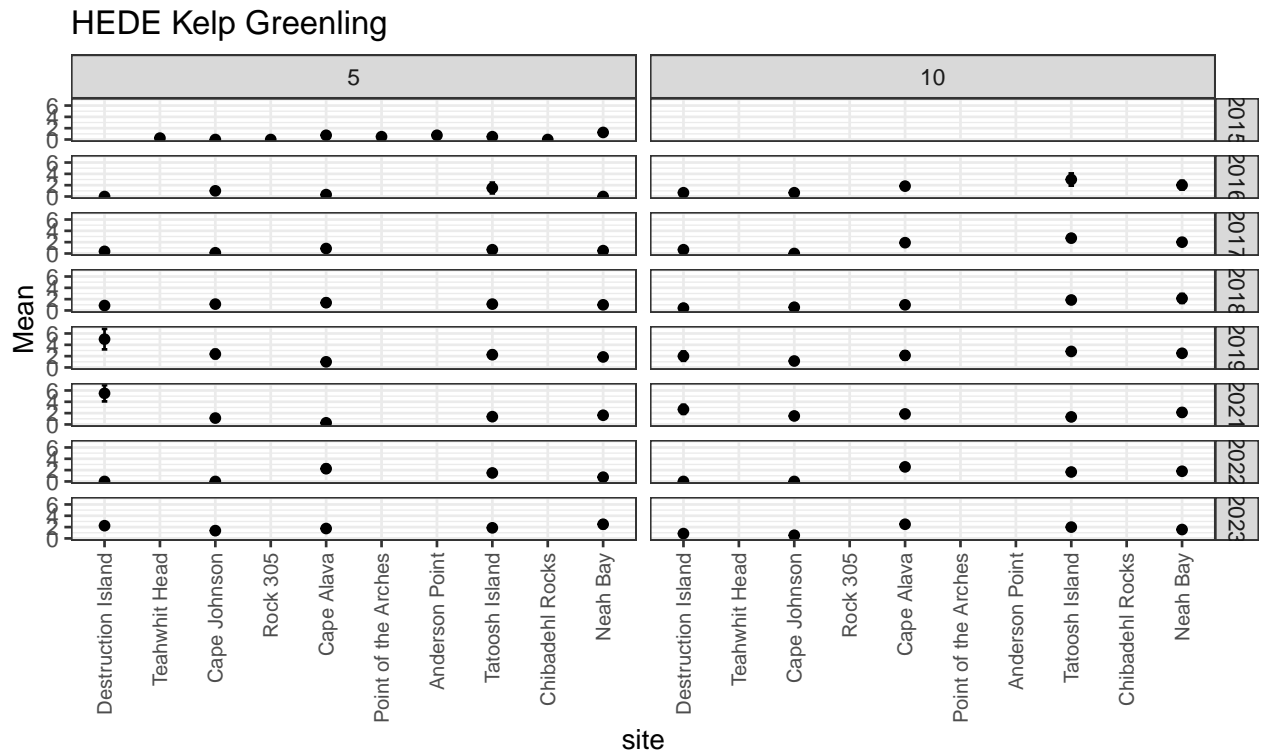
CLUP Herring

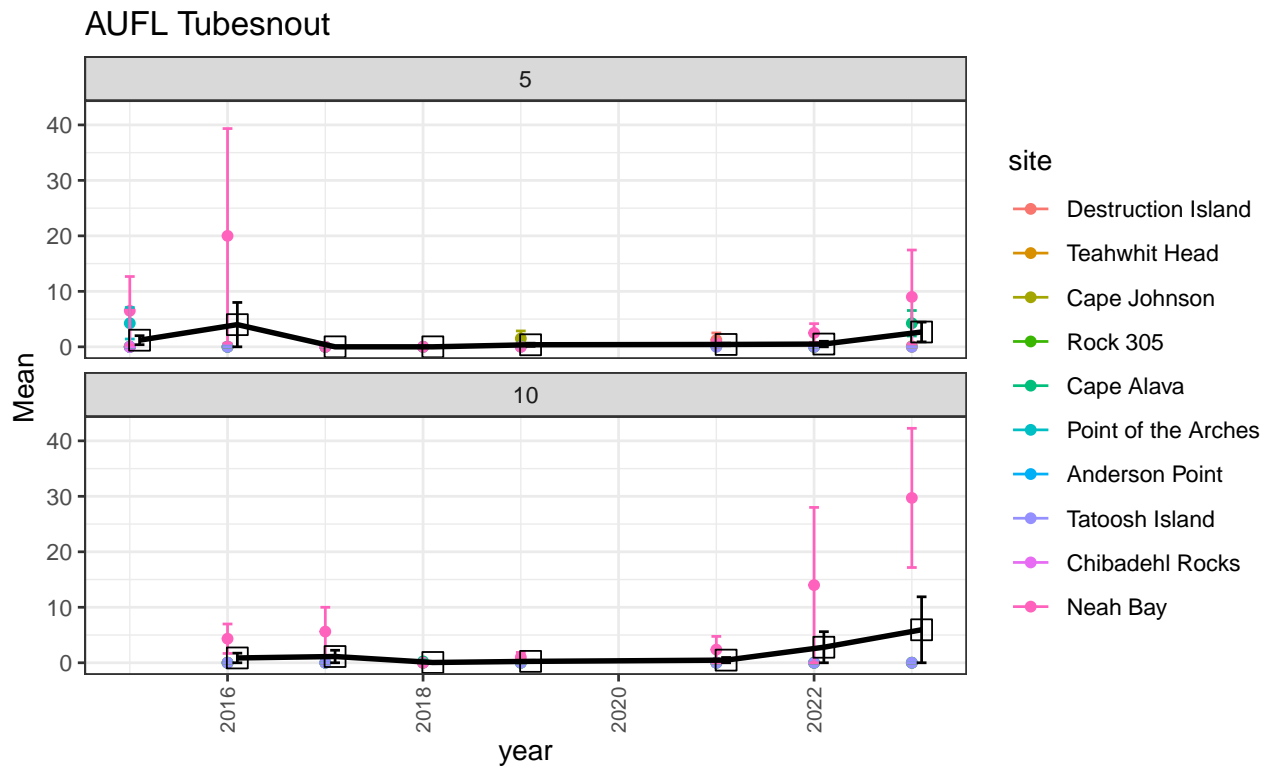
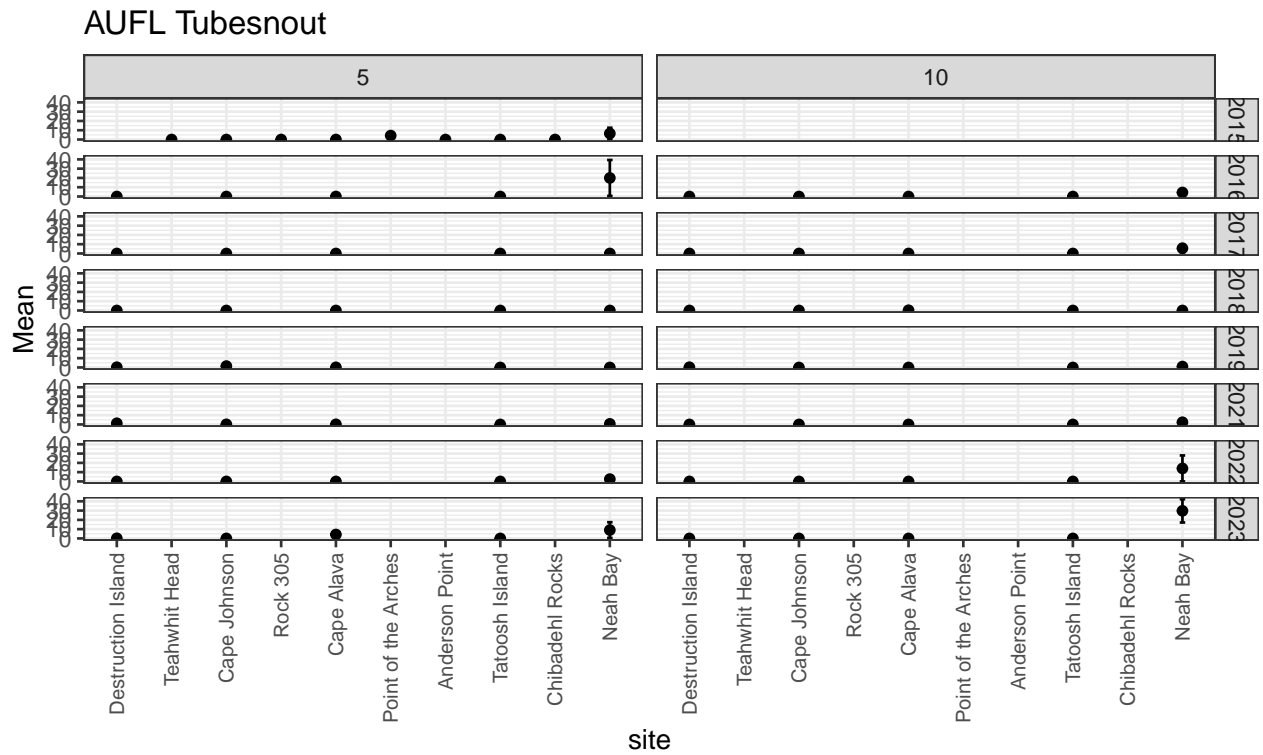


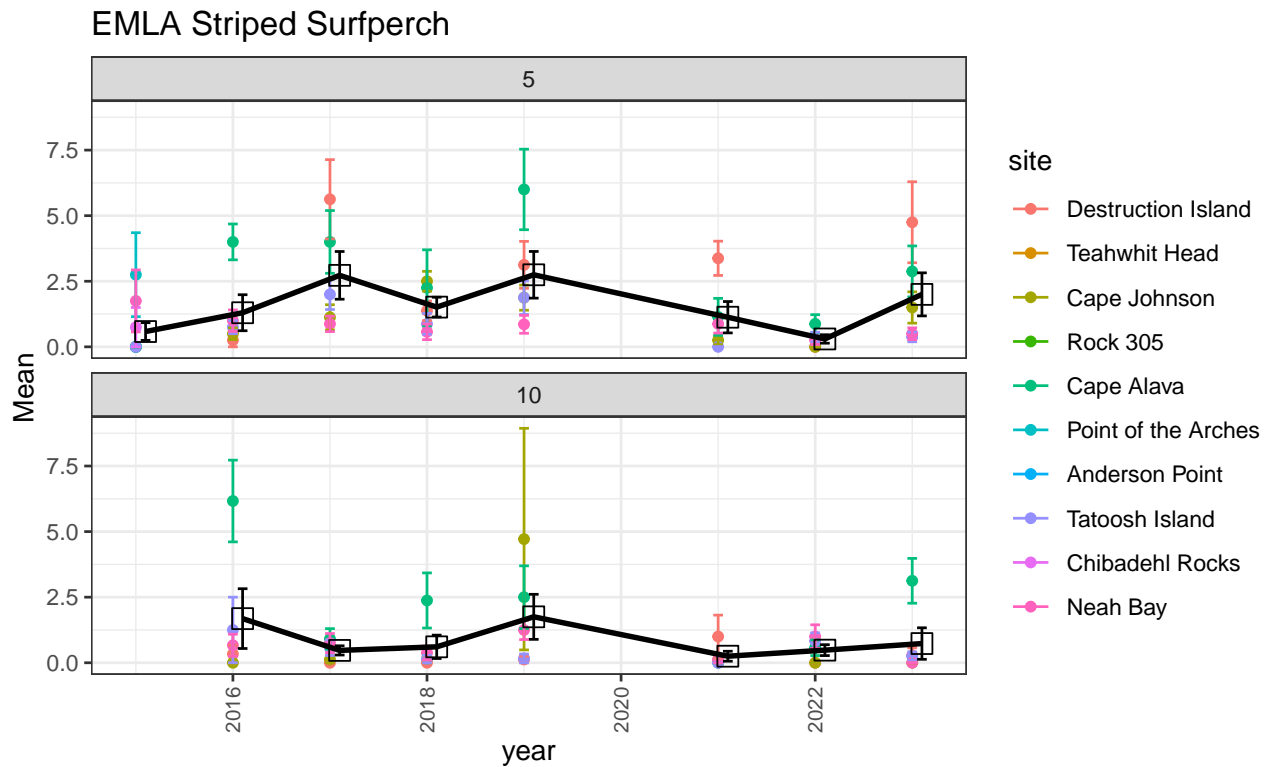
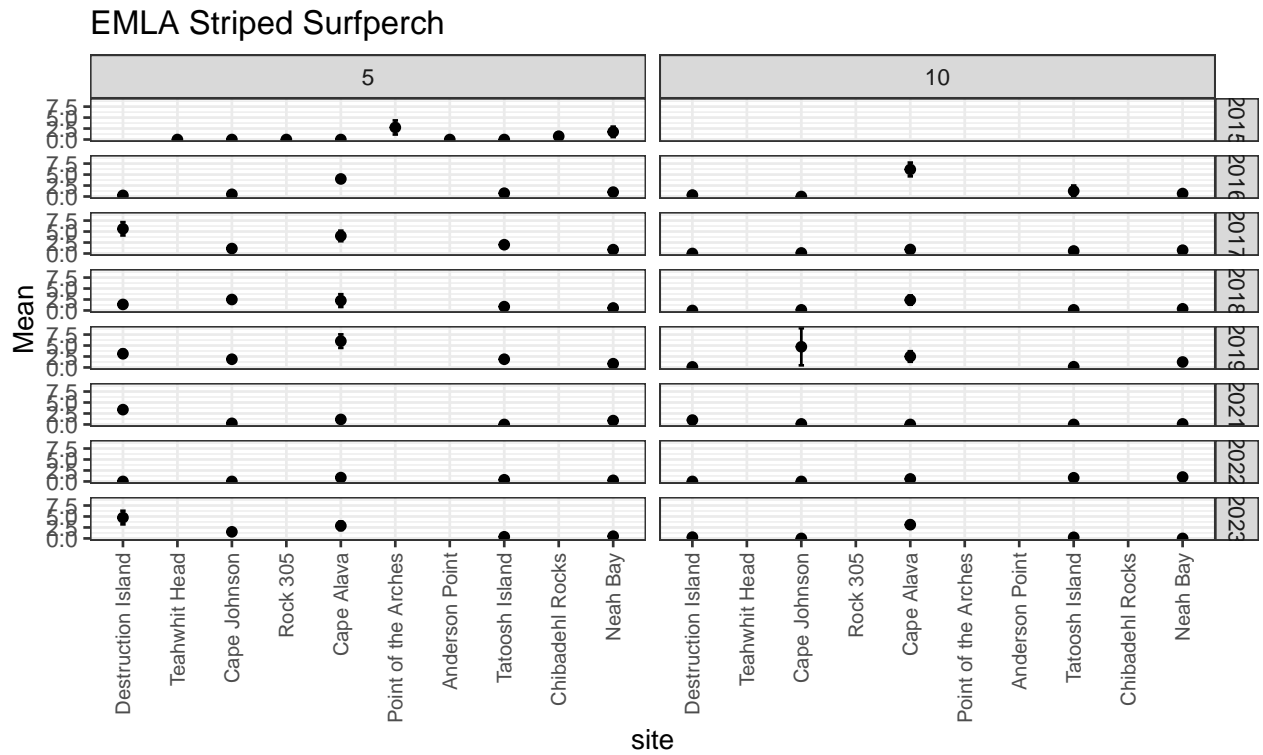
CLUP Herring

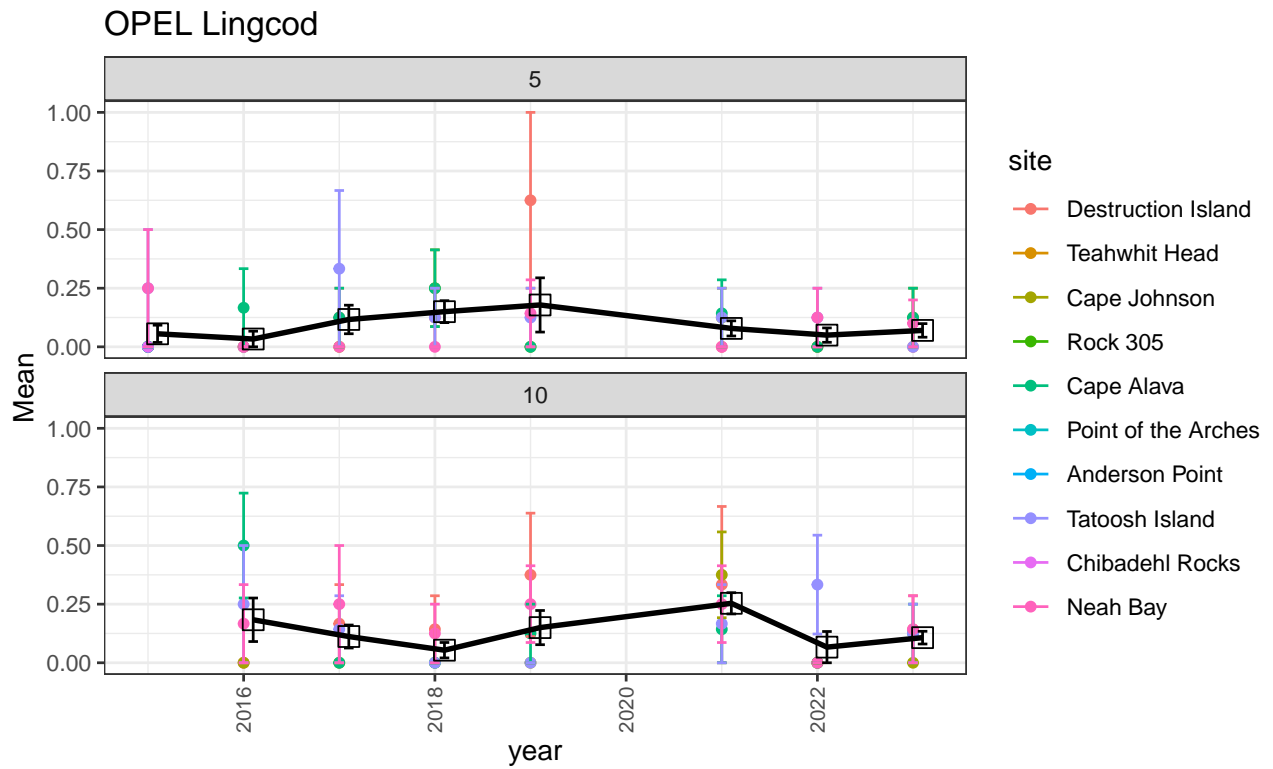
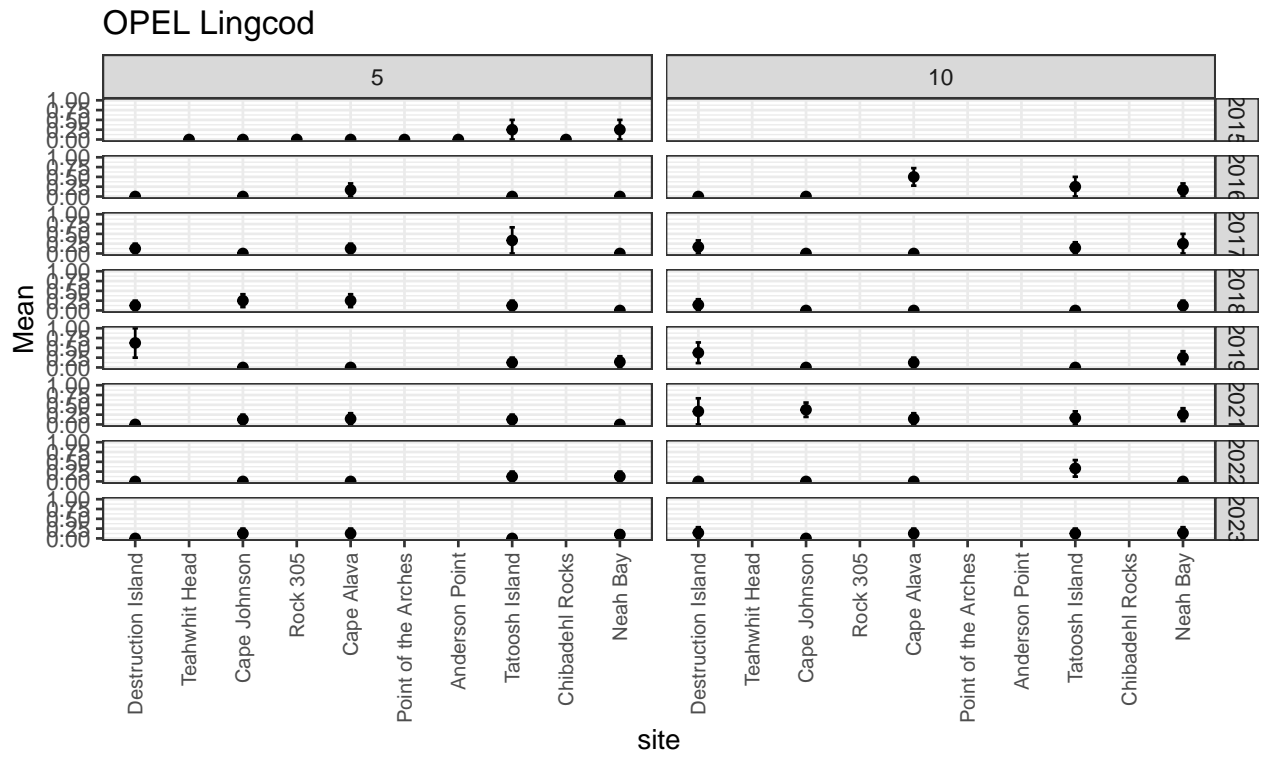


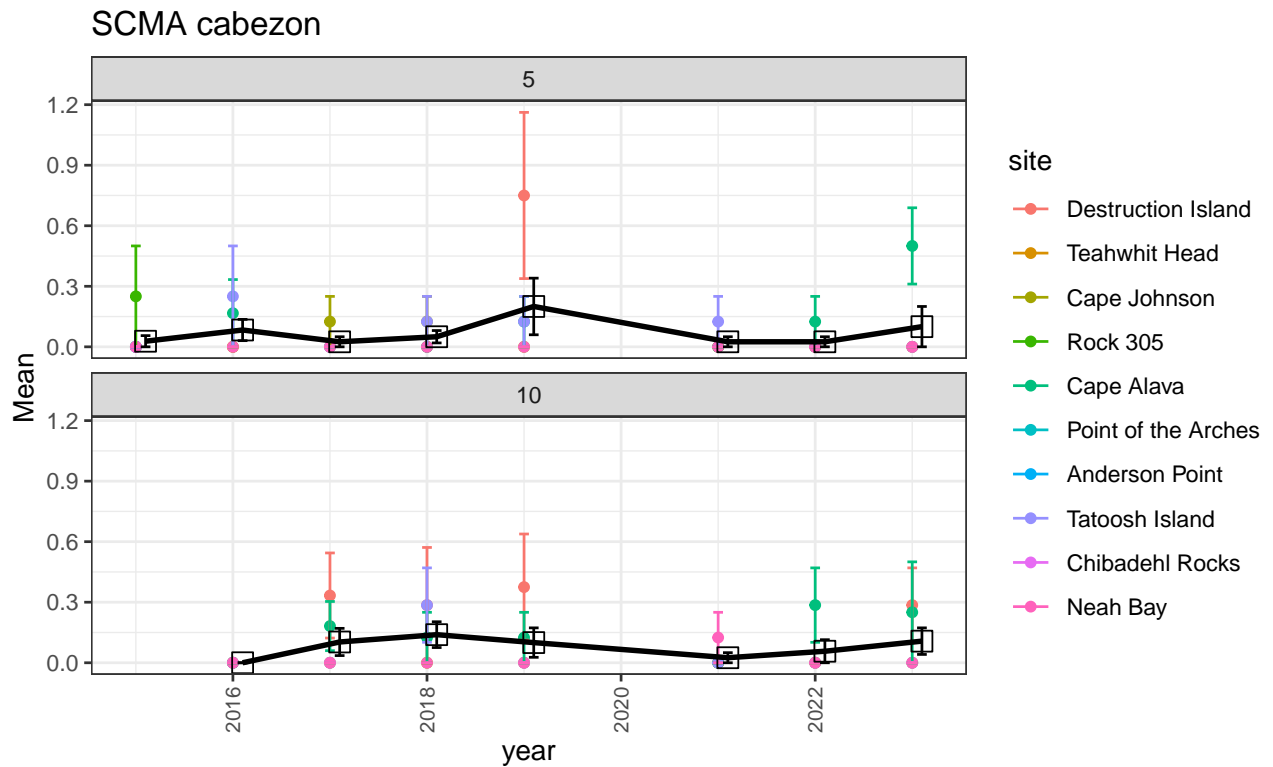
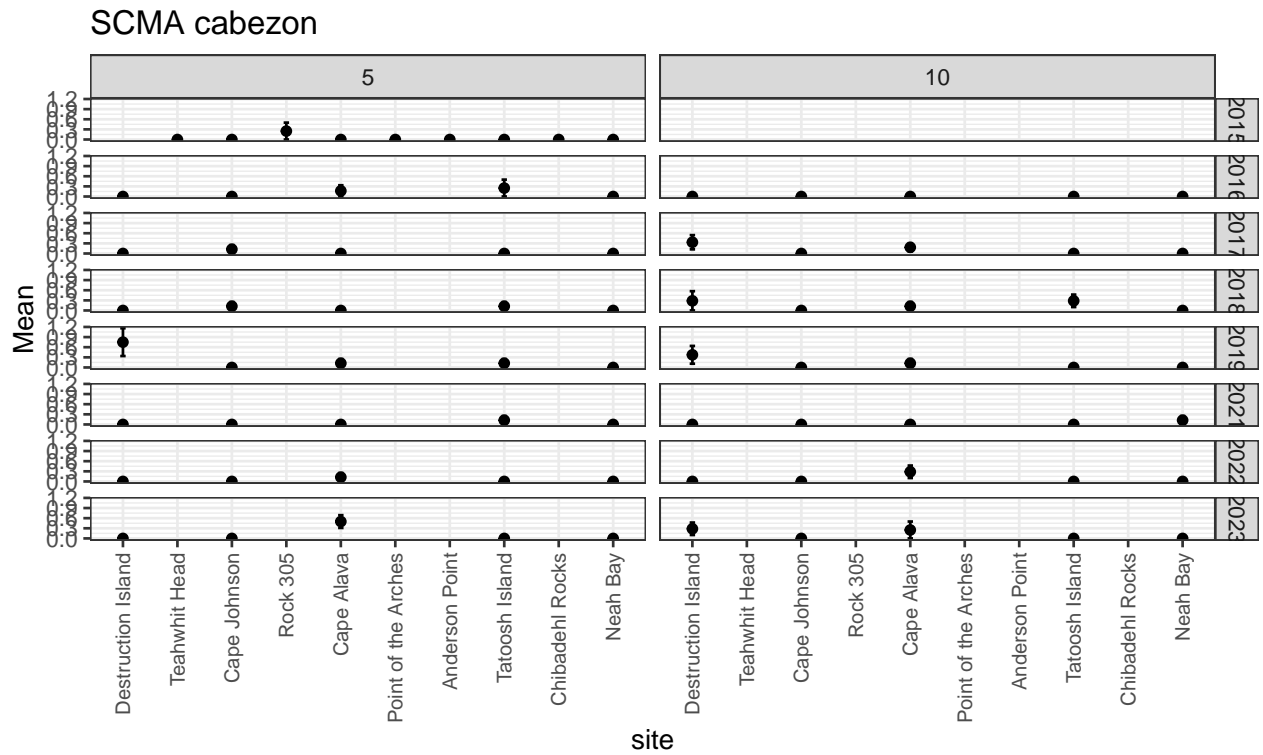




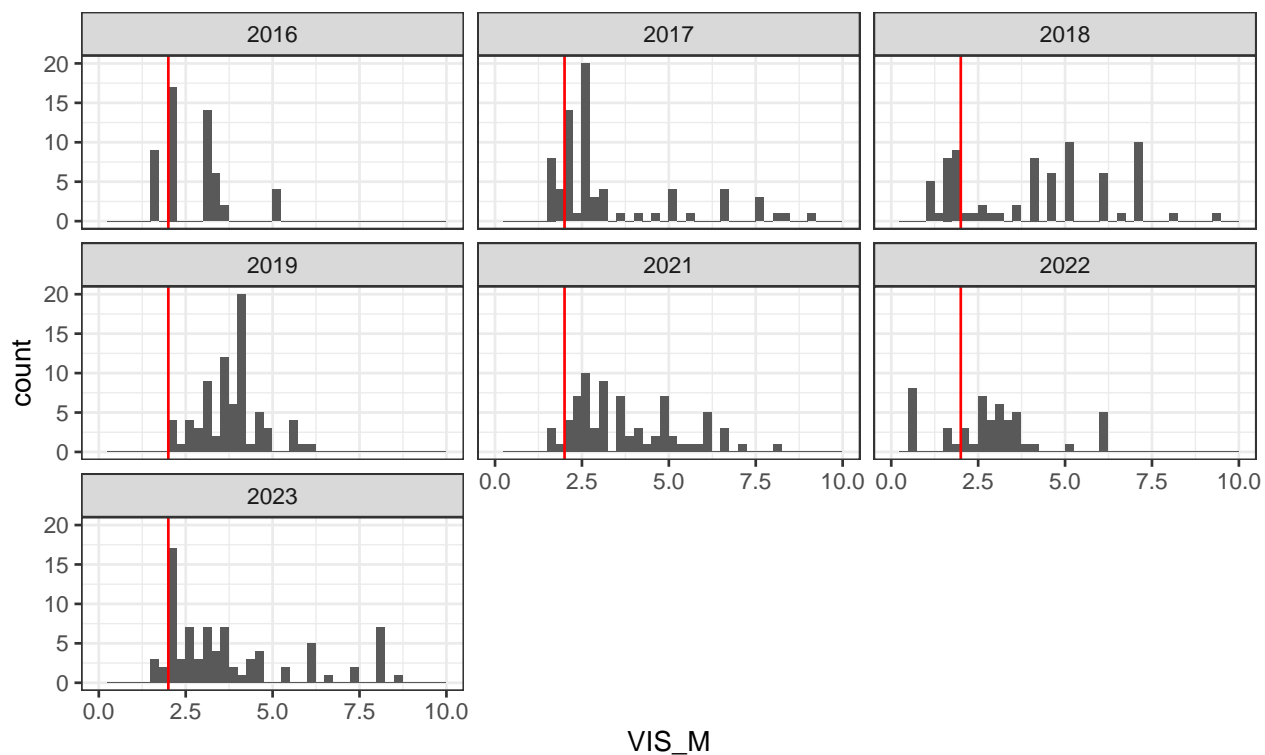
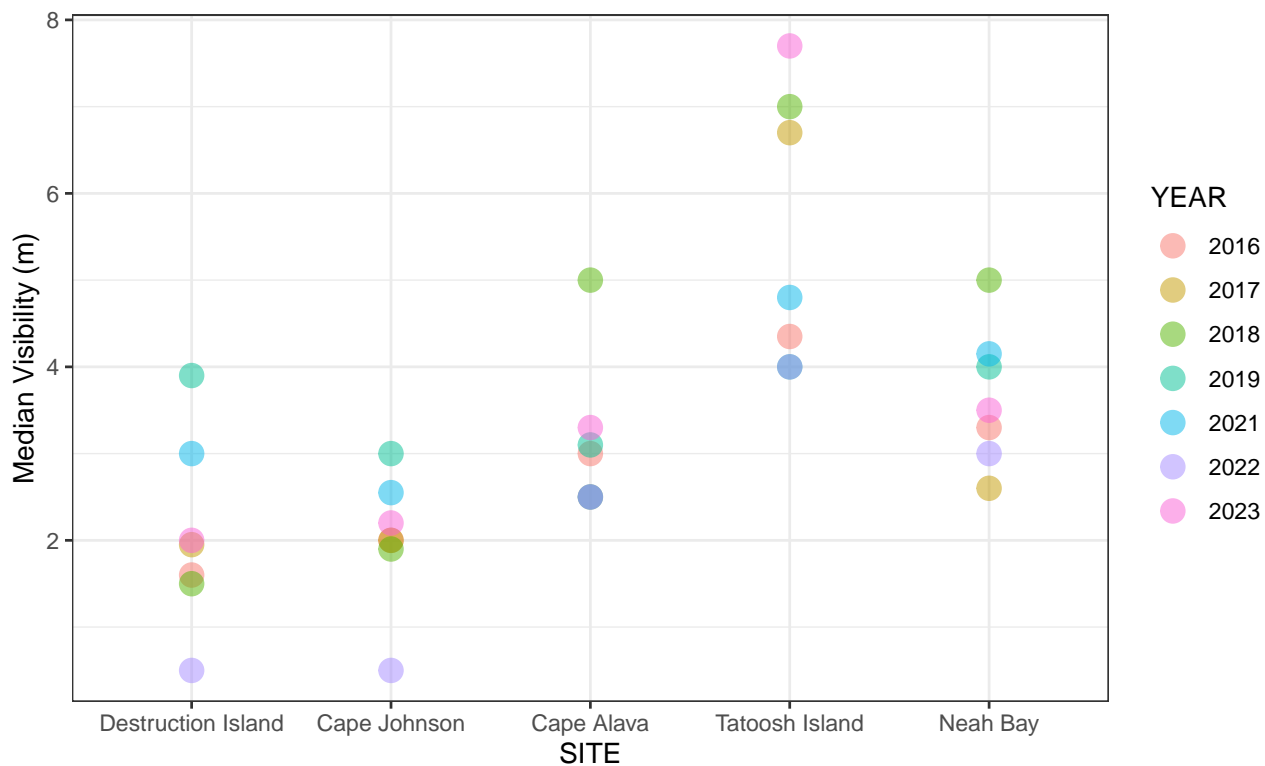








Some plots on visibility by site and depth zone These suggest to me that the 2m cut off that PISCO uses is going to be problematic... there are a lot of surveys that are right on the cusp of 2m visibility.

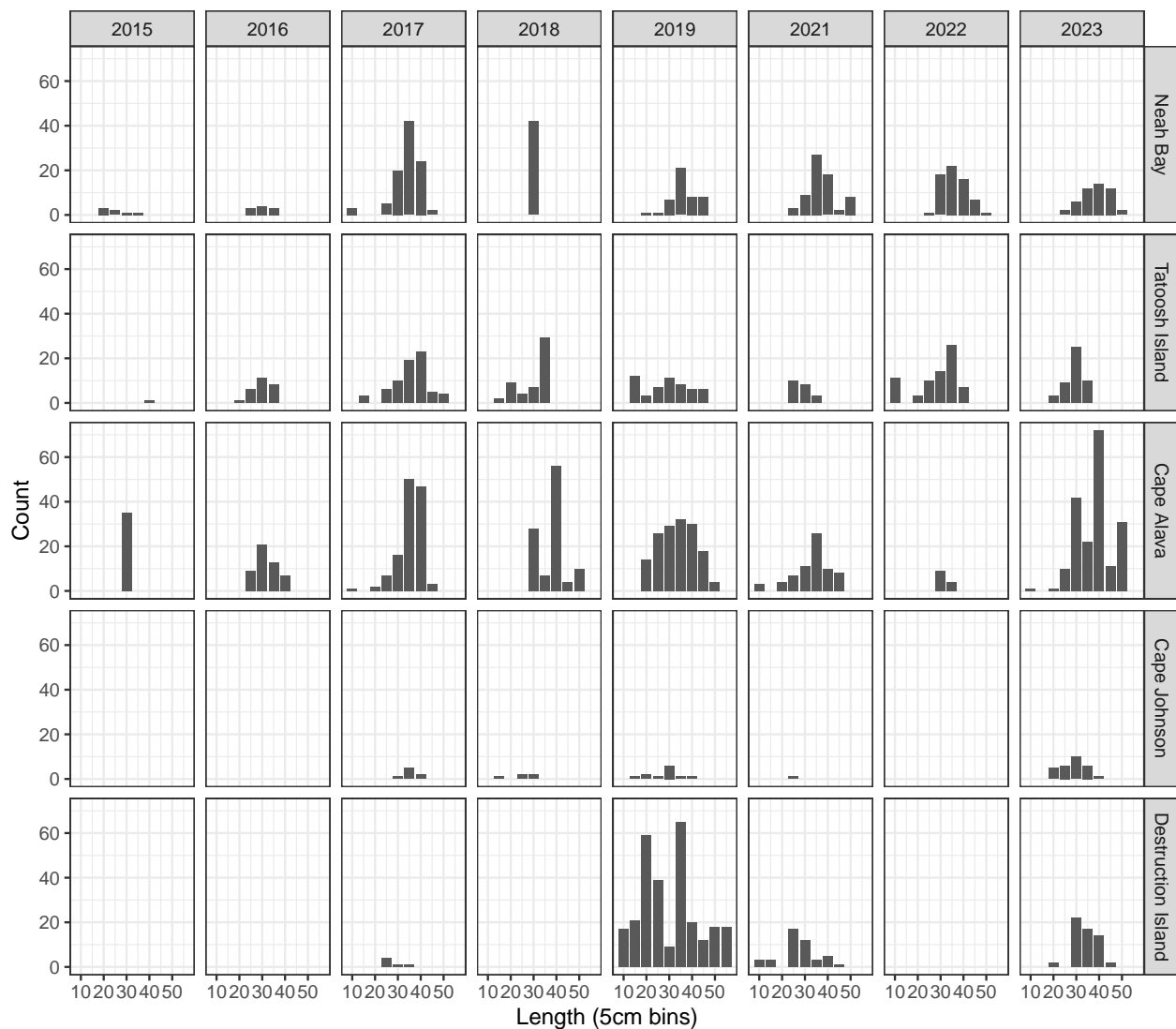


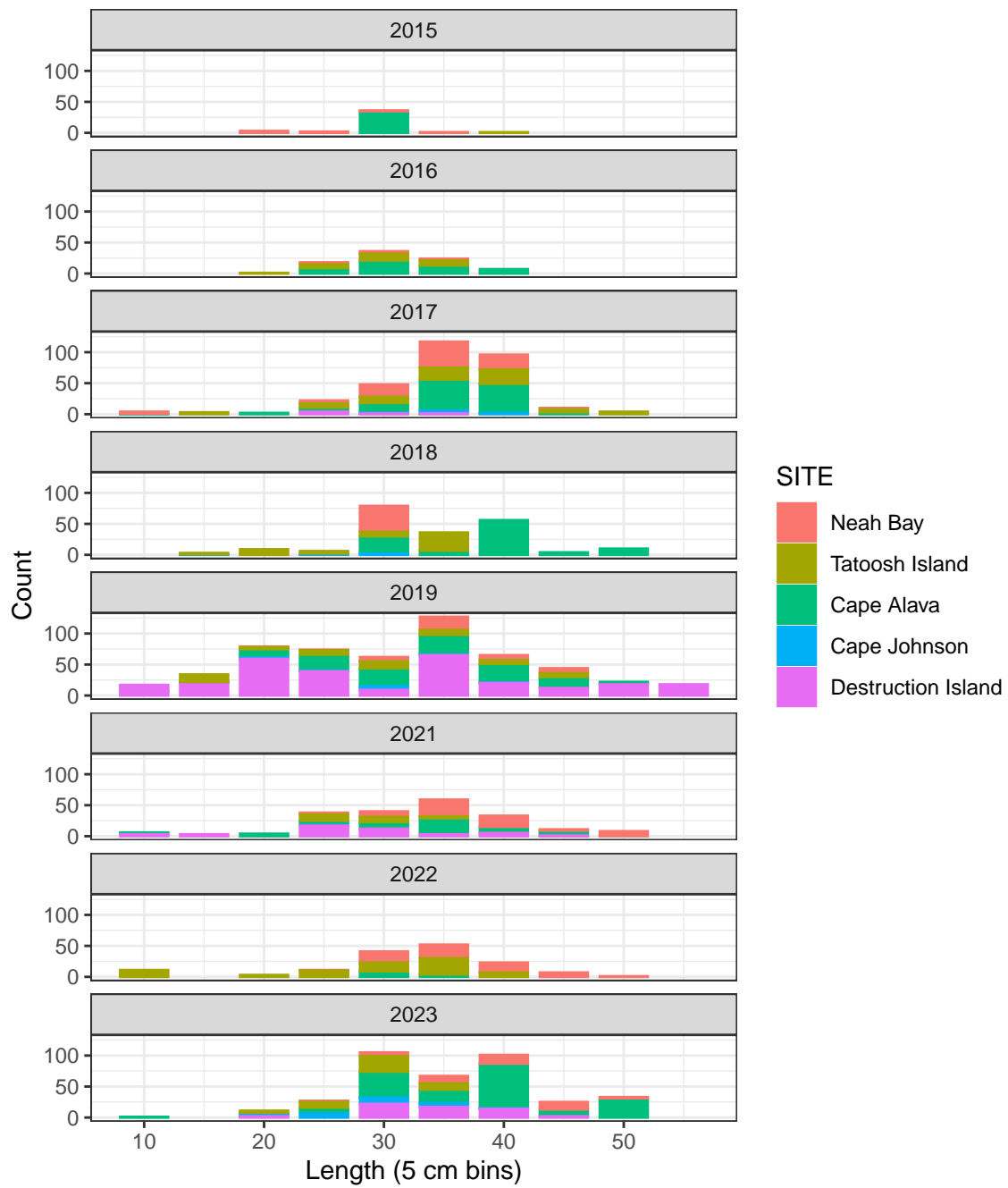
```
source("../R scripts/2022-23 Black Rockfish Assessment/Process Length Structure.R")
```

Information on size data for black rockfish 2015-2022

```
## `summarise()` has grouped output by 'YEAR', 'SITE', 'SPECIES'. You can override
## using the `.groups` argument.
## `summarise()` has grouped output by 'YEAR', 'SITE', 'SPECIES'. You can override
## using the `.groups` argument.
## `summarise()` has grouped output by 'YEAR', 'SITE', 'SPECIES'. You can override
## using the `.groups` argument.
## `summarise()` has grouped output by 'YEAR', 'SITE', 'SPECIES'. You can override
## using the `.groups` argument.
```

Plots of size distribution grouped into 5 cm bins.





Plots of size distribution... but without 5cm bins

