Krill Lengths Appendix

```
library(tidyverse)
```

```
## -- Attaching packages ---------------------------------------------------------------- tidyverse 1.3.0
```

```
## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.3     v dplyr   1.0.2
## v tidyr   1.1.1     v stringr 1.4.0
## v readr   1.3.1     v forcats 0.5.0
```

```
## -- Conflicts ------------------------------------------------------------------- tidyverse_conflicts()
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(reshape2)
```

```
##
## Attaching package: 'reshape2'
```

```
## The following object is masked from 'package:tidyr':
##
##     smiths
```

##Data Description Table

```
load("../data/allLengths.rda")
tally <- as.data.frame(group_by_at(allLengths, vars(year, region, shore, species, sex)) %>% tally())
tally <- na.omit(tally)
tally <- dcast(tally, year+region+shore+species~sex, mean)
```

```
## Using n as value column: use value.var to override.
```

```
tally$F[is.nan(tally$F)] <- 0
tally$M[is.nan(tally$M)] <- 0
tally <- mutate(tally, total = F+M)
knitr::kable(tally)
```

year	region	shore	species	F	M	total
2011	central	onshore	EP	55	58	113
2011	central	onshore	TS	67	22	89
2011	north	offshore	EP	180	134	314
2011	north	offshore	ND	34	16	50
2011	north	offshore	TS	2	3	5
2011	north	onshore	EP	221	158	379
2011	north	onshore	TS	105	269	374
2011	north_central	offshore	EP	673	357	1030
2011	north_central	offshore	TS	59	132	191
2011	north_central	onshore	EP	86	45	131
2011	north_central	onshore	TS	403	266	669
2012	central	onshore	EP	131	38	169
2012	central	onshore	TS	78	29	107

year	region	shore	species	F	M	total
2012	north	offshore	EP	54	40	94
2012	north	offshore	TS	31	12	43
2012	north	onshore	TS	78	17	95
2012	north_central	offshore	EP	277	189	466
2012	north_central	offshore	ND	38	23	61
2012	north_central	offshore	TS	196	122	318
2012	north_central	onshore	EP	247	241	488
2012	north_central	onshore	TS	294	145	439
2012	south	offshore	EP	69	27	96
2012	south	onshore	EP	425	227	652
2012	south	onshore	ND	130	14	144
2012	south	onshore	TS	198	89	287
2013	north	offshore	EP	178	167	345
2013	north	offshore	TS	23	27	50
2013	north	onshore	EP	47	36	83
2013	north	onshore	TS	71	50	121
2013	north_central	offshore	EP	328	191	519
2013	north_central	offshore	ND	52	13	65
2013	north_central	offshore	TS	43	84	127
2013	north_central	onshore	EP	7	5	12
2013	north_central	onshore	TS	462	240	702
2015	central	offshore	EP	115	30	145
2015	central	offshore	ND	7	0	7
2015	central	offshore	TS	5	1	6
2015	central	onshore	EP	41	0	41
2015	central	onshore	TS	28	28	56
2015	north	offshore	EP	193	117	310
2015	north	offshore	ND	35	16	51
2015	north	onshore	EP	83	51	134
2015	north	onshore	TS	1	0	1
2015	south	offshore	EP	110	63	173
2015	south	offshore	ND	197	27	224
2015	south	offshore	TS	73	85	158
2015	south	onshore	EP	192	105	297
2015	south	onshore	ND	113	24	137
2015	south	onshore	TS	64	17	81
2016	central	offshore	EP	76	9	85
2016	central	offshore	ND	59	25	84
2016	central	offshore	TS	3	0	3
2016	central	onshore	EP	257	145	402
2016	central	onshore	ND	7	0	7
2016	central	onshore	TS	0	1	1
2016	north	offshore	EP	124	68	192
2016	north	offshore	ND	24	15	39
2016	north	offshore	TS	51	36	87
2016	north	onshore	EP	3	1	4
2016	north	onshore	TS	16	27	43
2016	north_central	offshore	EP	269	215	484
2016	north_central	offshore	ND	153	21	174
2016	north_central	offshore	TS	54	49	103
2016	north_central	onshore	EP	147	114	261
2016	north_central	onshore	ND	2	0	2

year	region	shore	species	F	M	total
2016	north_central	onshore	TS	73	67	140
2016	south	offshore	EP	78	47	125
2016	south	offshore	ND	116	15	131
2016	south	offshore	TS	4	2	6
2016	south	onshore	EP	24	5	29
2016	south	onshore	ND	33	11	44
2016	south	onshore	TS	6	0	6
2017	central	offshore	EP	145	102	247
2017	central	offshore	ND	45	14	59
2017	central	offshore	TS	14	47	61
2017	central	onshore	EP	178	130	308
2017	central	onshore	TS	60	55	115
2017	north	offshore	EP	76	31	107
2017	north	onshore	EP	125	121	246
2017	north	onshore	TS	69	79	148
2017	north_central	offshore	EP	228	94	322
2017	north_central	offshore	ND	101	52	153
2017	north_central	offshore	TS	16	29	45
2017	north_central	onshore	EP	98	29	127
2017	north_central	onshore	TS	235	44	279
2017	south	offshore	EP	65	31	96
2017	south	offshore	ND	68	20	88
2017	south	offshore	TS	6	22	28
2017	south	onshore	EP	144	65	209
2017	south	onshore	ND	134	25	159
2017	south	onshore	TS	87	0	87
2018	central	offshore	EP	124	47	171
2018	central	offshore	TS	51	0	51
2018	central	onshore	EP	39	20	59
2018	central	onshore	TS	22	21	43
2018	north	offshore	EP	138	77	215
2018	north	offshore	TS	2	3	5
2018	north	onshore	EP	147	77	224
2018	north	onshore	TS	53	49	102
2018	north_central	offshore	EP	321	153	474
2018	north_central	offshore	ND	16	3	19
2018	north_central	offshore	TS	51	52	103
2018	north_central	onshore	EP	135	72	207
2018	north_central	onshore	TS	363	226	589
2018	south	offshore	EP	188	95	283
2018	south	offshore	ND	48	4	52
2018	south	offshore	TS	43	63	106
2018	south	onshore	EP	115	80	195
2018	south	onshore	ND	232	20	252
2018	south	onshore	TS	5	3	8

##Regional Description Table

```
regions <- read.csv("../data/regions.csv")
knitr::kable(regions)
```

station	sites	region	latitude	shore
183	FortRoss	north	38.46670	onshore
453	FortRoss	north	38.46670	onshore
454	FortRoss	north	38.46670	offshore
166	PointReyes	north	38.16670	onshore
167	PointReyes	north	38.16670	onshore
170	PointReyes	north	38.16670	offshore
171	PointReyes	north	38.16670	offshore
138	GulfFarallons	north_central	37.70613	onshore
139	GulfFarallons	north_central	37.70613	onshore
152	GulfFarallons	north_central	37.70613	offshore
156	GulfFarallons	north_central	37.70613	offshore
131	SanMateo	north_central	37.51370	onshore
132	SanMateo	north_central	37.51370	onshore
134	SanMateo	north_central	37.51370	offshore
124	Davenport	north_central	36.98330	onshore
127	Davenport	north_central	36.98330	offshore
114	MontereyBay	north_central	36.65131	onshore
112	MontereyBay	north_central	36.65131	onshore
110	MontereyBay	north_central	36.65131	offshore
117	MontereyBay	north_central	36.65131	offshore
442	PiedrasBlancas	central	35.70330	onshore
445	PiedrasBlancas	central	35.70330	offshore
493	MorroBay	central	35.00000	onshore
495	MorroBay	central	35.00000	offshore
422	SantaBarbara	south	34.15000	onshore
425	SantaBarbara	south	34.15000	offshore
411	MidChannelIslands	south	33.54717	onshore
412	MidChannelIslands	south	33.54717	onshore
413	MidChannelIslands	south	33.54717	offshore
414	MidChannelIslands	south	33.54717	offshore
481	SouthernCA	south	32.87108	onshore
482	SouthernCA	south	32.87108	onshore
402	SouthernCA	south	32.87108	offshore
165	PointReyes	north	38.16670	onshore
492	MorroBay	central	35.00000	onshore
116	MontereyBay	north_central	36.74000	offshore
483	SouthernCA	south	32.81670	onshore

##Model Summary Output Heatwave model outputs > Euphausia pacifica

```
load("Me1.rda")
sjPlot::tab_model(Me1,
                  show.re.var= TRUE,
                  dv.labels= "Spatial and temporal effects on E. pacifica length")
```

Spatial and temporal effects on E. pacifica length

Predictors

Estimates

CI

p

(Intercept)

19.50

19.08 – 19.91

<0.001

year [2012]

0.94

0.70 – 1.19

<0.001

year [2015]

1.19

0.91 – 1.48

<0.001

year [2016]

2.31

2.07 – 2.55

<0.001

year [2017]

2.05

1.79 – 2.32

<0.001

year [2018]

1.83

1.61 – 2.05

<0.001

sex [M]

-0.93

-1.14 – -0.72

<0.001

shore [onshore]

1.33

0.74 – 1.92

<0.001

year [2012] * sex [M]

-0.23

-0.53 – 0.06

0.120

year [2015] * sex [M]

0.33

-0.02 – 0.68

0.062

year [2016] * sex [M]

-0.40

-0.70 – -0.09

0.011

year [2017] * sex [M]

-0.27

-0.57 – 0.04

0.085

year [2018] * sex [M]

-0.25

-0.54 – 0.05

0.104

year [2012] * shore[onshore]

-0.97

-1.31 – -0.63

<0.001

year [2015] * shore[onshore]

-0.73

-1.13 – -0.33

<0.001

year [2016] * shore[onshore]

-0.13

-0.48 – 0.22

0.458

year [2017] * shore[onshore]

-0.74

-1.09 – -0.39

<0.001

year [2018] * shore[onshore]

-0.69

-1.01 – -0.36

<0.001

sex [M] * shore [onshore]

0.33

0.15 – 0.52

<0.001

Random Effects

2

4.93

00 station

0.57

ICC

0.10

N station

33

Observations

10104

Marginal R2 / Conditional R2

0.161 / 0.248

Thysanoessa spinifera

```
load("Mt1.rda")
sjPlot::tab_model(Mt1,
                  show.re.var= TRUE,
                  dv.labels= "Spatial and Temporal Effects on Krill Length")
```

Spatial and Temporal Effects on Krill Length

Predictors

Estimates

CI

p

(Intercept)

22.75

21.45 – 24.05

<0.001

year [2012]

4.19

3.42 – 4.97

<0.001

year [2015]

-2.35

-3.33 – -1.38

<0.001

year [2016]

2.47

1.51 – 3.42

<0.001

year [2017]

1.41

0.53 – 2.30

0.002

year [2018]

2.23

1.51 – 2.95

<0.001

sex [M]

-0.95

-1.43 – -0.48

<0.001

shore [onshore]

0.22

-1.39 – 1.83

0.788

year [2012] * sex [M]

-2.01

-2.49 – -1.53

<0.001

year [2015] * sex [M]

2.52

1.75 – 3.29

<0.001

year [2016] * sex [M]

-0.91

-1.58 – -0.23

0.009

year [2017] * sex [M]

-1.30

-1.87 – -0.73

<0.001

year [2018] * sex [M]

-0.11

-0.60 – 0.38

0.661

year [2012] * shore[onshore]

-0.15

-0.94 – 0.64

0.713

year [2015] * shore[onshore]

1.94

0.88 – 3.01

<0.001

year [2016] * shore[onshore]

1.55

0.52 – 2.57

0.003

year [2017] * shore[onshore]

1.72

0.83 – 2.60

<0.001

year [2018] * shore[onshore]

1.25

0.53 – 1.97

0.001

sex [M] * shore [onshore]

-1.10

-1.50 – -0.69

<0.001

Random Effects

2

7.98

00 station

4.65

ICC

0.37

N station

35

Observations

5078

Marginal R2 / Conditional R2

0.261 / 0.533

Nematocelis difficilis

```
load("Mn2.rda")
sjPlot::tab_model(Mn2,
                  show.re.var= TRUE,
                  dv.labels= "Spatial and Temporal Effects on Krill Length")
```

Spatial and Temporal Effects on Krill Length

Predictors

Estimates

CI

p

(Intercept)

22.73

21.47 – 24.00

<0.001

year [2012]

-2.45

-3.80 – -1.11

<0.001

year [2015]

1.64

0.60 – 2.69

0.002

year [2016]

-1.10

-2.16 – -0.04

0.043

year [2017]

-1.58

-2.71 – -0.45

0.006

year [2018]

1.29

0.08 – 2.49

0.036

sex [M]

-2.83

-4.36 – -1.30

<0.001

year [2012] * sex [M]

0.28

-1.54 – 2.10

0.762

year [2015] * sex [M]

2.39

0.71 – 4.06

0.005

year [2016] * sex [M]

2.76

1.12 – 4.41

0.001

year [2017] * sex [M]

2.09

0.46 – 3.72

0.012

year [2018] * sex [M]

1.61

-0.24 – 3.45

0.088

year [2012] :shoreonshore

2.53

1.02 – 4.03

0.001

year [2015] :shoreonshore

0.23

-1.13 – 1.59

0.739

year [2016] :shoreonshore

2.03

0.63 – 3.43

0.004

year [2017] :shoreonshore

1.85

0.49 – 3.21

0.008

year [2018] :shoreonshore

-0.48

-1.89 – 0.92

0.502

Random Effects

2

6.61

00 station

1.42

ICC

0.18

N station

20

Observations

1937

Marginal R2 / Conditional R2

0.204 / 0.345

Temperature effects model

Year effects model