summarize output

Total CPUE

The table below summarizes trends and AIC values for 3 models: a null model (only including depth and depth^2, plus year as a factor), a model with a log-linear trend on epsilon, and a model with a trend on epsilon related to mean temperature. There is some support for the temporal trend model for a number of species, but the only case where the temporal model is supported by AIC (» 2) is Aurora rockfish. The temporal coefficients are shown in Fig. 1

species	year_trend	year_se	temp_trend	temp_se	aic_null	aic_trend	aic_trend_temp
Pacific sanddab	-0.02	0.01	-0.01	0.04	2.11	0.00	4.05
Arrowtooth flounder	-0.03	0.01	0.03	0.05	4.54	0.00	6.21
Deepsea sole	0.19	0.14	1.00	0.00	2.75	2.28	0.00
Dover sole	-0.07	0.01	-0.08	0.06	26.09	0.00	26.35
Rex sole	-0.08	0.02	0.14	0.06	22.71	0.00	18.34
English sole	-0.01	0.01	0.06	0.04	1.01	0.00	0.69
Petrale sole	0.04	0.01	0.10	0.04	20.45	0.00	15.87
Curlfin turbot	0.01	0.02	-0.09	0.08	0.00	1.40	0.78
Flathead sole	-0.06	0.03	-0.09	0.13	1.90	0.00	3.34
Lingcod	0.02	0.01	0.04	0.04	7.55	0.00	8.12
Sablefish	-0.01	0.01	0.04	0.03	2.65	0.00	3.14
Longnose skate	-0.02	0.01	0.00	0.06	0.00	0.58	2.00
Dogfish	-0.01	0.01	0.05	0.04	0.00	1.13	0.49
Bocaccio	0.00	0.01	0.04	0.07	0.00	1.93	1.57
Canary rockfish	0.00	0.01	0.06	0.06	0.00	1.96	1.11
Chilipepper rockfish	-0.02	0.01	-0.02	0.05	1.04	0.00	2.84
Rosethorn rockfish	-0.03	0.02	0.05	0.10	0.30	0.00	2.04
Sharpchin rockfish	-0.04	0.02	-0.13	0.08	2.69	0.00	2.30
Shortbelly rockfish	0.00	0.01	0.00	0.05	0.00	1.86	1.99
Yellowtail rockfish	0.01	0.01	0.12	0.07	1.10	2.77	0.00
Greenspotted rockfish	0.02	0.02	0.06	0.09	0.00	0.64	1.52
Greenstriped rockfish	0.00	0.01	0.08	0.05	0.84	2.76	0.00
Stripetail rockfish	0.02	0.01	-0.11	0.05	3.28	1.47	0.00
Aurora rockfish	-0.01	0.02	-0.45	0.22	8.12	9.41	0.00
Melanostomus rockfish	-0.04	0.02	0.15	0.09	0.55	0.06	0.00
Darkblotched rockfish	0.02	0.01	0.04	0.05	2.69	0.00	3.89
Pacific ocean perch	-0.02	0.02	0.06	0.08	0.00	0.67	1.40
Redbanded rockfish	-0.05	0.02	0.00	0.07	10.01	0.00	12.01
Splitnose rockfish	0.05	0.01	0.08	0.05	16.07	0.00	14.67
Longspine thornyhead	-0.54	0.61	0.77	NaN	1.68	0.00	3.68
Shortspine thornyhead	0.04	0.01	0.05	0.06	7.48	0.00	8.77
Pacific grenadiers	0.02	0.02	-0.09	0.07	0.00	1.08	0.44
Redstripe	0.02	0.02	-0.19	0.12	0.88	2.00	0.00

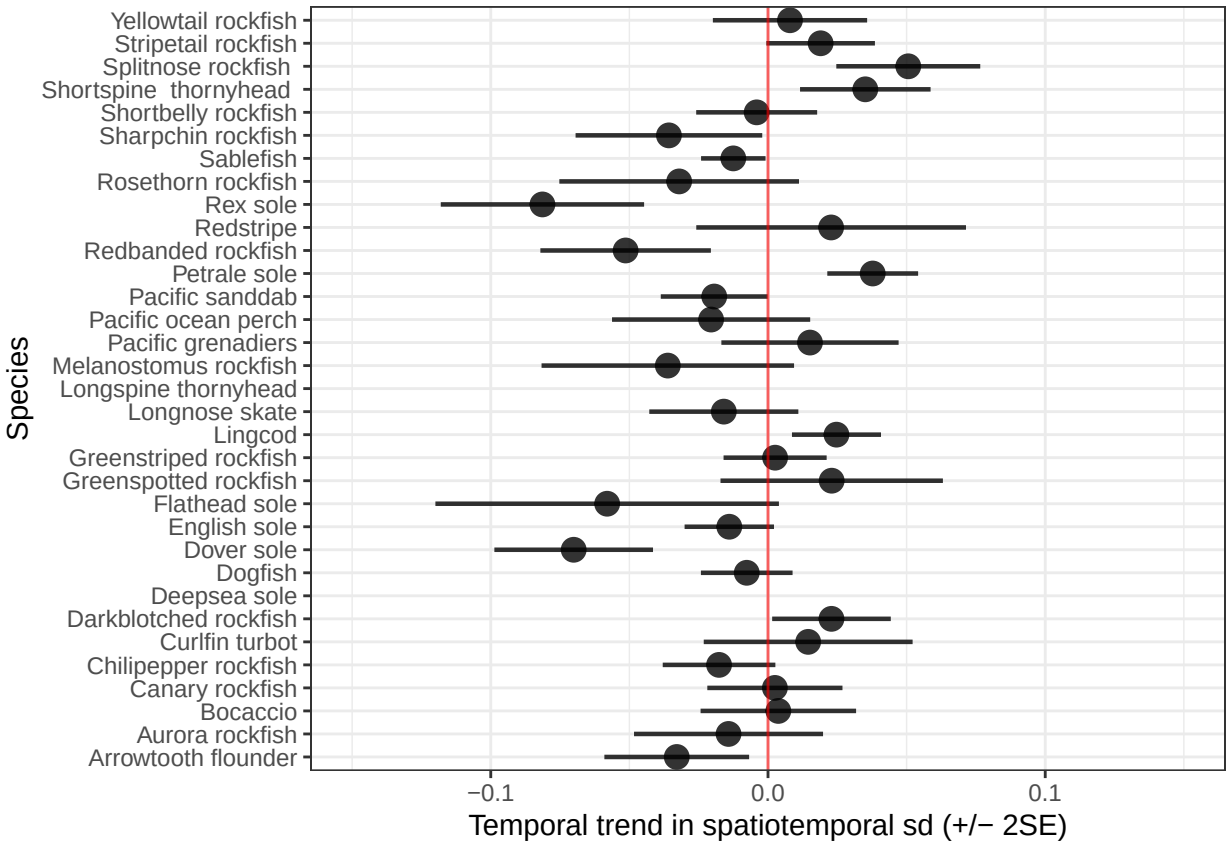


Figure 1: Temporal trend in epsilon, for models with total CPUE as a response

Presence-absence

We ran the same models for presence-absence of each species.

There is some support for the temporal trend model for a few species (Shortbelly rockfish), but overall support across species seems not strong for the model with epsilon ~ time or model with epsilon ~ temperature. The temporal coefficients are shown in Fig. 2

species	year_trend	year_se	temp_trend	temp_se	aic_null	aic_trend	aic_trend_temp
Pacific sanddab	0.00	0.03	-0.03	0.14	0.00	1.99	1.95
Arrowtooth flounder	0.02	0.09	0.14	0.11	0.00	1.97	0.38
Deepsea sole	-0.78	788.24	0.09	1503.66	0.00	2.00	2.00
Dover sole	0.05	0.03	0.10	0.14	0.94	0.00	2.46
Rex sole	-0.03	0.05	0.06	0.24	0.00	1.67	1.93
English sole	0.04	0.03	0.01	0.11	0.00	0.28	1.98
Petrale sole	0.05	0.04	0.05	0.16	0.00	0.24	1.89
Curlfin turbot	-0.02	0.03	-0.08	0.15	0.00	1.54	1.71
Flathead sole	-0.05	0.05	-0.10	0.17	0.00	1.00	1.61
Lingcod	0.03	0.02	-0.10	0.12	0.08	0.00	1.30
Sablefish	0.02	0.02	0.07	0.08	0.08	0.00	1.44
Longnose skate	-0.11	0.08	0.19	0.36	1.74	0.00	3.44
Dogfish	0.02	0.02	0.17	0.10	0.85	2.06	0.00
Bocaccio	0.04	0.03	-0.20	0.17	0.00	0.82	0.66
Canary rockfish	-0.86	471.38	0.52	1.66	0.00	2.00	1.97
Chilipepper rockfish	-1.00	0.00	-1.00	NaN	6.08	0.00	4.16
Rosethorn rockfish	-0.18	0.15	0.53	0.48	0.00	0.12	0.79
Sharpchin rockfish	-1.00	0.01	0.25	677.79	0.00	1.62	2.00
Shortbelly rockfish	0.08	0.03	-0.09	0.15	4.91	0.00	6.55
Yellowtail rockfish	-0.61	NaN	0.93	0.43	7.86	17.61	0.00
Greenspotted rockfish	-1.00	0.00	0.21	0.55	0.00	0.43	1.85
Greenstriped rockfish	-0.10	0.07	-0.81	0.85	1.47	0.00	1.78
Stripetail rockfish	-0.02	0.03	-0.23	0.13	1.17	2.57	0.00
Aurora rockfish	-1.00	0.03	-0.15	2.80	0.00	0.84	2.00
Melanostomus rockfish	-0.62	NaN	1.00	0.00	0.00	2.00	1.35
Darkblotched rockfish	-0.34	0.13	0.52	0.18	7.71	7.96	0.00
Pacific ocean perch	-0.98	83.93	-0.05	NaN	0.00	2.00	2.00
Redbanded rockfish	-0.88	36.70	0.05	2083.75	0.00	2.00	2.00
Splitnose rockfish	-0.03	0.07	-0.12	0.26	0.00	1.83	1.76
Longspine thornyhead	-0.01	24.39	1.00	0.00	0.00	2.00	1.61
Shortspine thornyhead	-0.42	0.27	0.70	0.92	3.72	0.00	5.39
Pacific grenadiers	-0.54	1898.46	0.21	1201.78	0.00	2.00	2.00
Redstripe	-0.26	0.36	0.68	0.88	0.00	0.62	1.42

Positive models

We ran the same models for presence-absence of each species.

There is some support for the temporal trend model for a few species (Shortbelly rockfish), but overall support across species seems not strong for the model with epsilon ~ time or model with epsilon ~ temperature. The temporal coefficients are shown in Fig. 3

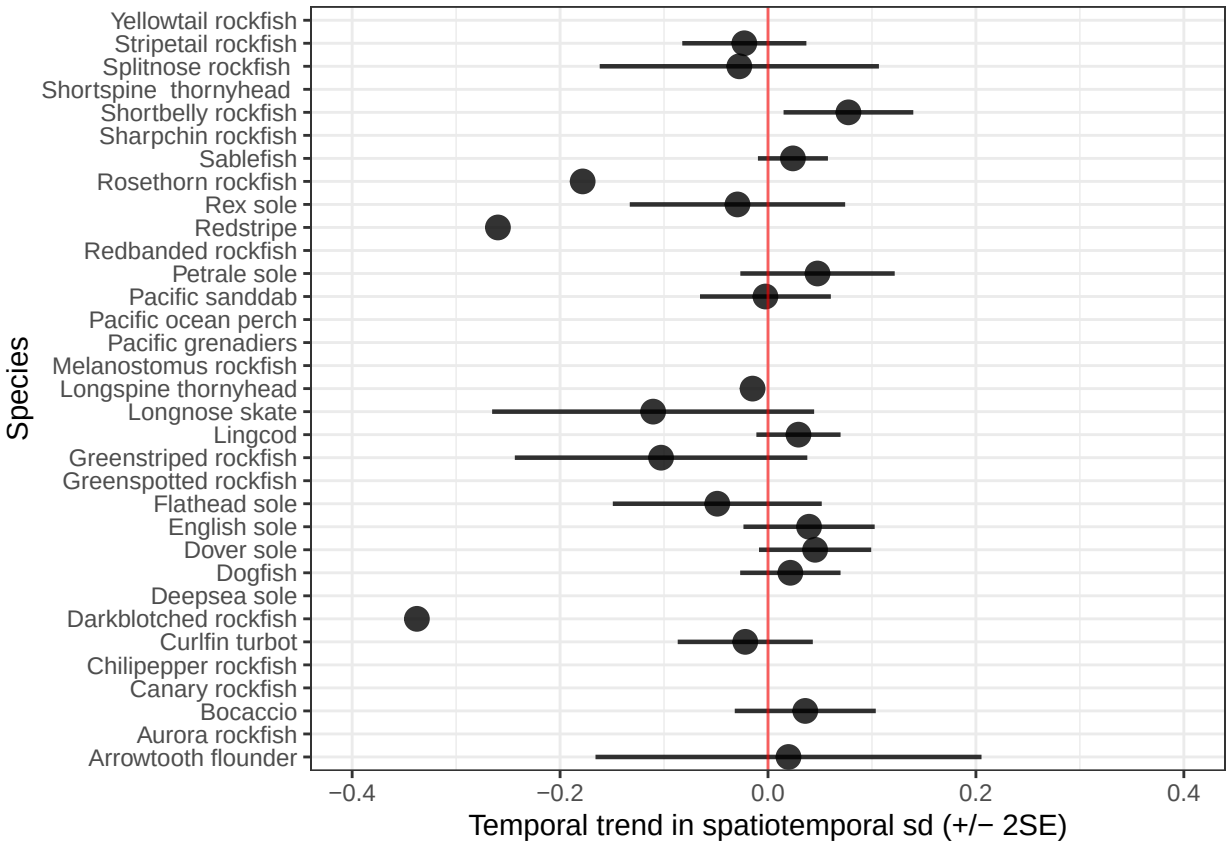


Figure 2: Temporal trend in epsilon, for models with presence absence as a response

species	year_trend	year_se	temp_trend	temp_se	aic_null	aic_trend	aic_trend_temp
Pacific sanddab	0.01	0.02	-0.09	0.10	0.00	1.89	1.20
Arrowtooth flounder	-0.01	0.02	-0.05	0.10	0.00	1.80	1.71
Deepsea sole	0.85	NaN	0.16	260.92	0.00	2.00	2.00
Dover sole	-0.08	0.02	-0.19	0.08	21.76	0.00	16.59
Rex sole	-0.05	0.02	0.02	0.07	3.07	0.00	4.98
English sole	-0.01	0.01	-0.02	0.06	0.00	1.49	1.90
Petrale sole	0.06	0.04	0.14	0.19	0.76	0.00	2.13
Curlfin turbot	-1.00	0.00	0.21	0.19	0.00	3.43	0.84
Flathead sole	-1.00	0.00	-1.00	0.00	1.28	4.86	0.00
Lingcod	0.00	0.03	0.02	0.12	0.00	2.00	1.97
Sablefish	-0.03	0.02	-0.03	0.08	0.00	0.57	1.89
Longnose skate	0.00	0.03	0.30	0.12	4.18	6.18	0.00
Dogfish	-0.02	0.02	-0.18	0.10	1.44	2.38	0.00
Bocaccio	0.07	0.03	-0.05	0.14	2.83	0.00	4.72
Canary rockfish	-0.25	1.52	1.00	0.11	0.00	2.00	1.95
Chilipepper rockfish	-0.16	0.11	-1.00	0.00	7.16	6.81	0.00
Rosethorn rockfish	-0.53	554.48	0.01	585.22	0.00	2.00	2.00
Sharpchin rockfish	0.00	156.88	0.29	861.97	0.00	2.00	2.00
Shortbelly rockfish	-0.03	0.04	0.01	0.20	0.00	1.51	2.00
Yellowtail rockfish	-0.68	88.17	-0.23	73.22	0.00	2.00	2.00
Greenspotted rockfish	0.09	0.11	-0.39	0.48	0.00	0.89	1.09
Greenstriped rockfish	0.06	0.04	-0.18	0.15	1.38	0.00	1.82
Stripetail rockfish	0.01	0.03	-0.09	0.12	0.00	1.86	1.33
Aurora rockfish	-0.76	0.59	0.18	1.87	0.85	0.00	2.83
Melanostomus rockfish	0.08	135.57	-0.23	970.56	0.00	2.00	2.00
Darkblotched rockfish	-0.49	NaN	-0.10	449.92	0.00	2.00	2.00
Pacific ocean perch	-0.12	218.17	0.45	783.33	0.00	2.00	2.00
Redbanded rockfish	-1.00	0.00	0.41	1906.92	0.09	0.00	2.09
Splitnose rockfish	0.26	0.19	0.20	0.18	6.81	0.00	7.25
Longspine thornyhead	0.02	0.05	-0.25	0.18	0.01	1.81	0.00
Shortspine thornyhead	0.02	0.02	0.04	0.09	0.00	1.28	1.83
Pacific grenadiers	-1.00	0.01	-1.00	0.06	0.00	0.73	1.23
Redstripe	0.09	0.17	-1.00	0.03	0.00	1.82	1.24

Bottom temperature

We can run the same 3 models used above on the temperature data, with a slight modification in also including a quadratic function of the day of the year (to account for the 2 passes, and duration of the surveys). In this case, there seems to be pretty strong support for modeling epsilon ~ mean temperature.

model	AIC
null	85.40
log-linear	85.89
mean temp	0.00

Digging into the model a bit more, the coefficient is positive (interpretation: years with warmer bottom temperature are also more variable).

```
## [1] "b_epsilon= 0.15  SE =  0.02"
```

Fig. **??** shows the deviations by year

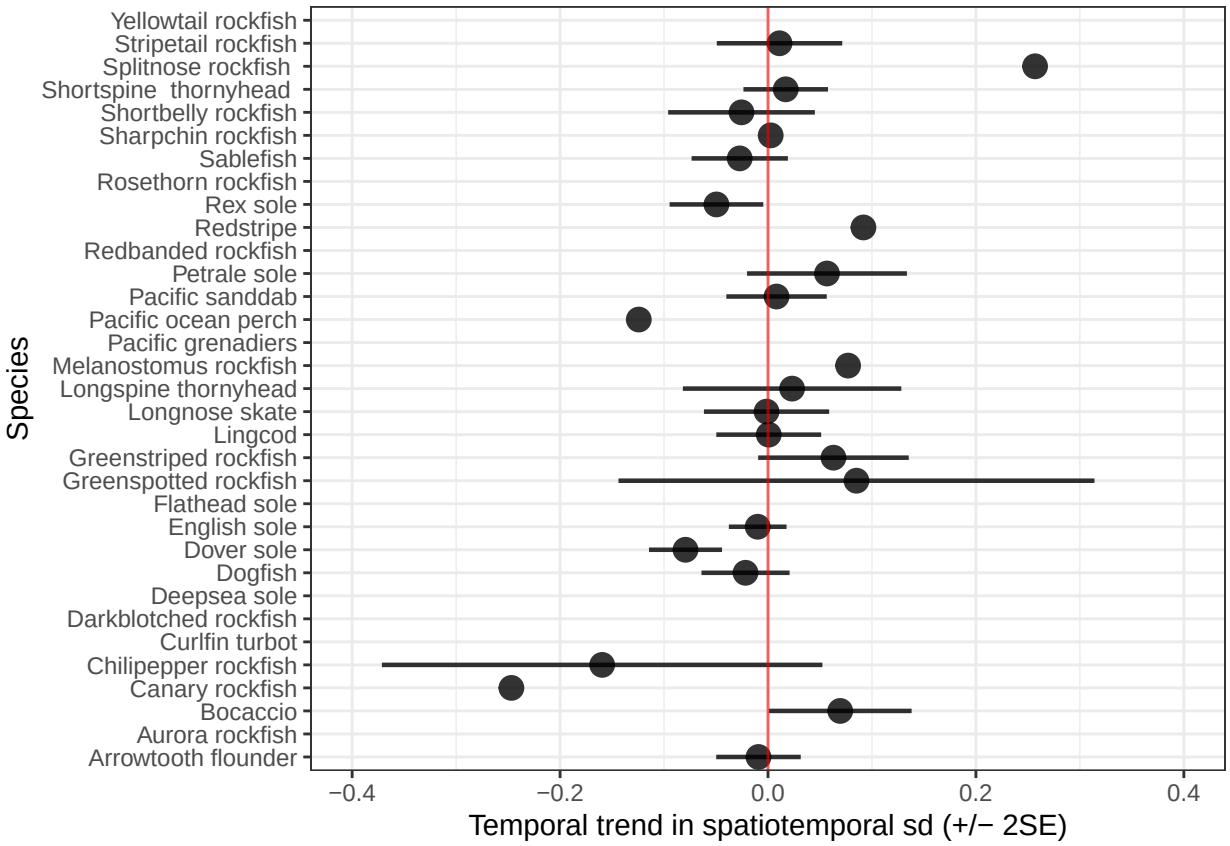
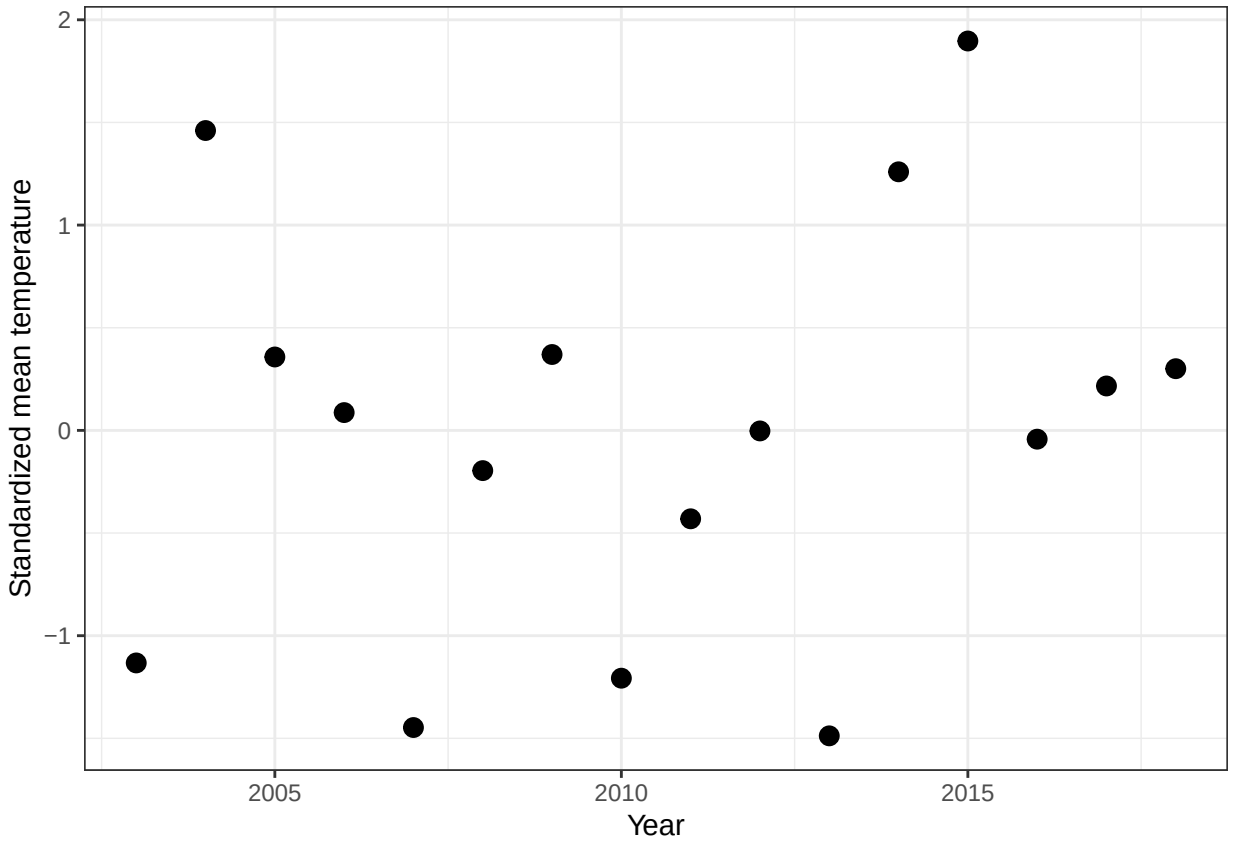


Figure 3: Temporal trend in epsilon, for models with positive catch rate as a response



We can also look at the time series of estimated epsilon values by year,