Table S1a–S1l. The fitted model output from the Dirichlet regressions on the Narragansett Bay residence patterns of the 12 selected species. The common parameterization with a log link function was used for all fits. The standard error for each coefficient estimate is given in parentheses.

a. Longhorn sculpin

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	1.592 (0.135)	4.109 (1.143)	2.779 (0.234)
CPUE		0.272 (0.068)	
NAO		-0.239 (0.091)	
NBBT		-0.242 (0.010)	
AMO			0.951 (0.333)
Spring rain			-0.072 (0.017)
Observations	57		
Log-Likelihood	113.8		
Degrees of Freedom	8		
BIC	-195.2		

b. Ocean pout

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	4.861 (0.757)	6.636 (0.875)	2.025 (0.168)
CPUE		0.163 (0.040)	
Oct OS	-0.208 (0.062)		
Winter TA	0.259 (0.084)		
NBBT		-0.398 (0.078)	
Spring TA		-0.305 (0.090)	
Observations	36		
Log-Likelihood	89.03		
Degrees of Freedom	8		
BIC	-149.4		

c. Atlantic herring

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	0.278 (0.140)	0.931 (0.311)	0.259 (0.140)
CPUE		0.295 (0.117)	
Observations	55		
Log-Likelihood	93.23		
Degrees of Freedom	4		
BIC	-170.4		

d. Red hake

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	-2.729 (1.090)	2.716 (0.274)	0.314 (0.142)
CPUE		0.191 (0.119)	
Oct MS	0.278 (0.095)		
AMO		-2.207 (0.692)	
NAO		-0.450 (0.123)	
Winter TA		-0.236 (0.090)	
Observations	53		
Log-Likelihood	210.9		
Degrees of Freedom	8		
BIC	-390.0		

e. Tautog

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	0.399 (0.135)	1.263 (0.199)	0.885 (0.137)
CPUE		0.377 (0.128)	
Observations	58		
Log-Likelihood	92.72		
Degrees of Freedom	4		
BIC	-169.2		

f. Northern searobin

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	2.797 (0.320)	3.181 (0.178)	2.661 (0.144)
CPUE		-0.069 (0.0545)	
Apr RNS	-0.196 (0.063)		
Observations	49		
Log-Likelihood	136.0		
Degrees of Freedom	5		
BIC	-252.6		

g. Fourspot flounder

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	3.789 (0.617)	3.012 (0.297)	2.021 (0.145)
CPUE		0.136 (0.069)	
Apr OS	-0.231 (0.061)		
Fall rain		-0.035 (0.014)	
Observations	49		
Log-Likelihood	127.2		
Degrees of Freedom	6		
BIC	-231.0		

h. Scup

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	4.447 (0.319)	4.018 (0.243)	3.751 (0.143)
CPUE		0.065 (0.039)	
Apr OS	-0.133 (0.029)		
Fall TA		0.062 (0.022)	
NAO		0.124 (0.038)	
Observations	49		
Log-Likelihood	196.3		
Degrees of Freedom	7		
BIC	-365.5		

i. Butterfish

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	3.116 (0.262)	3.349 (0.205)	3.016 (0.207)
CPUE		0.096 (0.034)	
Apr RNS	-0.136 (0.048)		
Fall TA		0.089 (0.035)	
$RSWT_{lag=2}$			-0.047 (0.017)
Summer rain			-0.045 (0.014)
Observations	49		
Log-Likelihood	164.8		
Degrees of Freedom	8		
BIC	-298.5		

j. Summer flounder

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	2.135 (0.137)	-0.285 (0.765)	4.186 (0.525)
CPUE		0.263 (0.062)	
$RSWT_{lag=2}$	-0.075 (0.017)		
NBBT		0.286 (0.070)	
Summer TA		-0.27 (0.076)	
Fall rain			0.025 (0.010)
Oct RNS			-0.115 (0.035)
Observations	54		
Log-Likelihood	162.6		
Degrees of Freedom	9		
BIC	-289.3		

k. Striped searobin

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	2.220 (0.144)	-1.238 (0.802)	2.912 (0.214)
CPUE		-0.106 (0.071)	
NBBT		0.400 (0.069)	
Spring TA		-0.213 (0.065)	
Summer rain			-0.046 (0.015)
Observations	49		
Log-Likelihood	132.9		
Degrees of Freedom	7		
BIC	-238.5		

l. Longfin squid

Covariates	*Dependent Variable*		
	Pre-First Observation Beta Coefficients	Residence Time Beta Coefficients	Post-Last Observation Beta Coefficients
Intercept	3.913 (0.206)	3.998 (0.170)	5.307 (0.438)
CPUE		0.135 (0.025)	
Apr RNS	-0.150 (0.032)		
Fall TA			-0.120 (0.025)
Oct RNS			-0.124 (0.028)
Observations	49		
Log-Likelihood	199.8		
Degrees of Freedom	7		
BIC	-372.4		

Table S2a–S2l. The fitted model output from the GAMs on the Narragansett Bay catch distribution of the 12 selected species. All fits were conducted using beta-distributed errors and a logit link function. Significant p-values for each coefficient estimate are designated by the symbols: *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$.

a. Longhorn sculpin

Parametric terms	
Covariates	Coefficients
Intercept	-1.249***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	3.375***
s(Temperature Gradient)	1.002
s(Year)	1.001***
Observations	605
Restricted Maximum Likelihood	1185.1
Deviance Explained	37.0%
R^2 adj.	0.09
BIC	-3300.2

b. Ocean pout

Parametric terms	
Covariates	Coefficients
Intercept	-2.519***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	1.001
s(Temperature Gradient)	1.000
s(Year)	1.000
Observations	500
Restricted Maximum Likelihood	1266.9
Deviance Explained	69.7%
R^2 adj.	0.00
BIC	-3541.5

c. Atlantic herring

Parametric terms	
Covariates	Coefficients
Intercept	-0.317***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	3.362***
s(Temperature Gradient)	1.001***
s(Year)	1.001***
Observations	902
Restricted Maximum Likelihood	1782.7
Deviance Explained	21.6%
R^2 adj.	0.15
BIC	-4973.4

d. Red hake

Parametric terms	
Covariates	Coefficients
Intercept	-0.830***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	2.715***
s(Temperature Gradient)	1.001
s(Year)	4.630***
Observations	1247
Restricted Maximum Likelihood	2897.5
Deviance Explained	35.0%
R^2 adj.	0.14
BIC	-8078.7

e. Tautog

Parametric terms	
Covariates	Coefficients
Intercept	1.274***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	2.806*
s(Temperature Gradient)	1.293*
s(Year)	1.932*
Observations	624
Restricted Maximum Likelihood	1577.9
Deviance Explained	57.5%
R^2 adj.	0.11
BIC	-4393.4

f1. Northern searobin (1959-2016)

Parametric terms	
Covariates	Coefficients
Intercept	-0.279***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	2.027***
s(Temperature Gradient)	1.001
s(Year)	4.652***
Observations	867
Restricted Maximum Likelihood	1089.9
Deviance Explained	25.2%
R^2 adj.	0.24
BIC	-3022.7

f2. Northern searobin (1959-1989)

Parametric terms	
Covariates	Coefficients
Intercept	0.087**
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	2.227***
s(Temperature Gradient)	2.131**
s(Year)	3.065***
Observations	417
Restricted Maximum Likelihood	377.39
Deviance Explained	35.8%
R^2 adj.	0.31
BIC	-1026.9

g. Fourspot flounder

Parametric terms	
Covariates	Coefficients
Intercept	-1.41***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	3.488**
s(Temperature Gradient)	1.777
s(Year)	3.161***
Observations	987
Restricted Maximum Likelihood	2215.3
Deviance Explained	47.6%
R^2 adj.	0.06
BIC	-6165.5

h. Scup

Parametric terms	
Covariates	Coefficients
Intercept	0.395***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	4.889***
s(Temperature Gradient)	4.892***
s(Year)	1.320**
Observations	1246
Restricted Maximum Likelihood	1011.3
Deviance Explained	53.2%
R^2 adj.	0.46
BIC	-2787.2

i. Butterfish

Parametric terms	
Covariates	Coefficients
Intercept	-0.675***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	1.559***
s(Temperature Gradient)	1.002***
s(Year)	1.735*
Observations	1336
Restricted Maximum Likelihood	1558.7
Deviance Explained	16.5%
R^2 adj.	0.09
BIC	-4345.8

j. Summer flounder

Parametric terms	
Covariates	Coefficients
Intercept	0.087*
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature, Year)	16.492***
s(Temperature Gradient)	3.253***
Observations	1058
Restricted Maximum Likelihood	938.7
Deviance Explained	47.8%
R^2 adj.	0.37
BIC	-2557.7

k. Striped searobin

Parametric terms	
Covariates	Coefficients
Intercept	0.081
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature)	1.001
s(Temperature Gradient)	3.023***
s(Year)	1.248***
Observations	796
Restricted Maximum Likelihood	1048.1
Deviance Explained	21.4%
R^2 adj.	0.16
BIC	-2912.7

l. Longfin squid

Parametric terms	
Covariates	Coefficients
Intercept	-0.279***
Smooth terms	
Covariates	Estimated Degrees of Freedom
s(Mean Temperature, Temperature Gradient)	20.823***
s(Year)	2.424**
Observations	1384
Restricted Maximum Likelihood	1043.8
Deviance Explained	50.2%
R^2 adj.	0.38
BIC	-2852.3

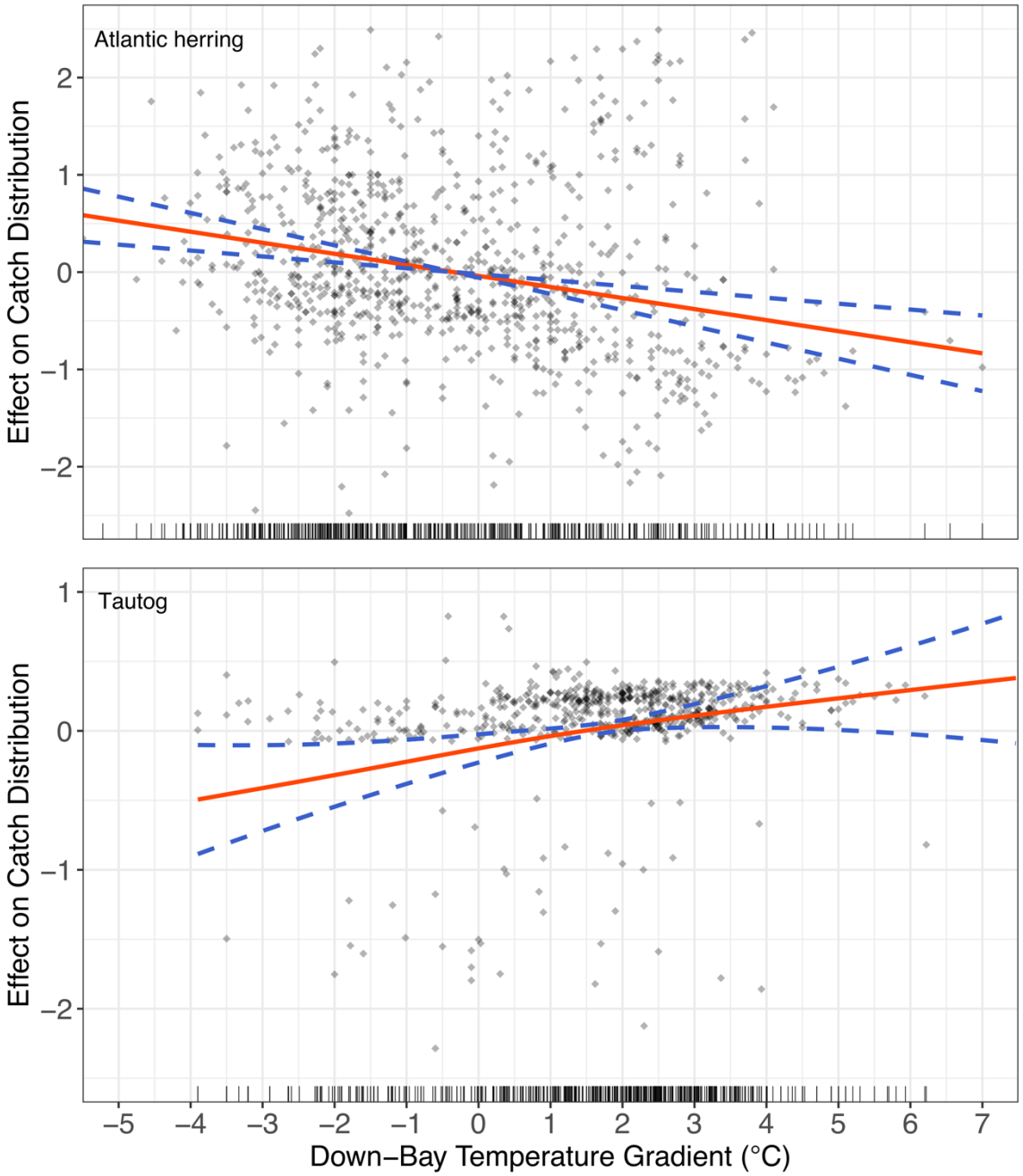

Figure S1a–S1b. The fitted GAM effect (red) and 95% confidence interval (blue) of the down-bay temperature gradient, measured as the difference in bottom temperature between the mid-Bay and outer-Bay stations of the URI GSO trawl survey in Narragansett Bay, on the proportion of catch of Atlantic herring (top) and tautog (bottom) coming from the mid-Bay station. The observations used to fit the GAM are depicted by gray points and a rug plot on the x-axis. Positive gradient values indicate that the mid-Bay station was warmer than the outer-Bay station. Positive y-axis values indicate increased catch at the mid-Bay station.

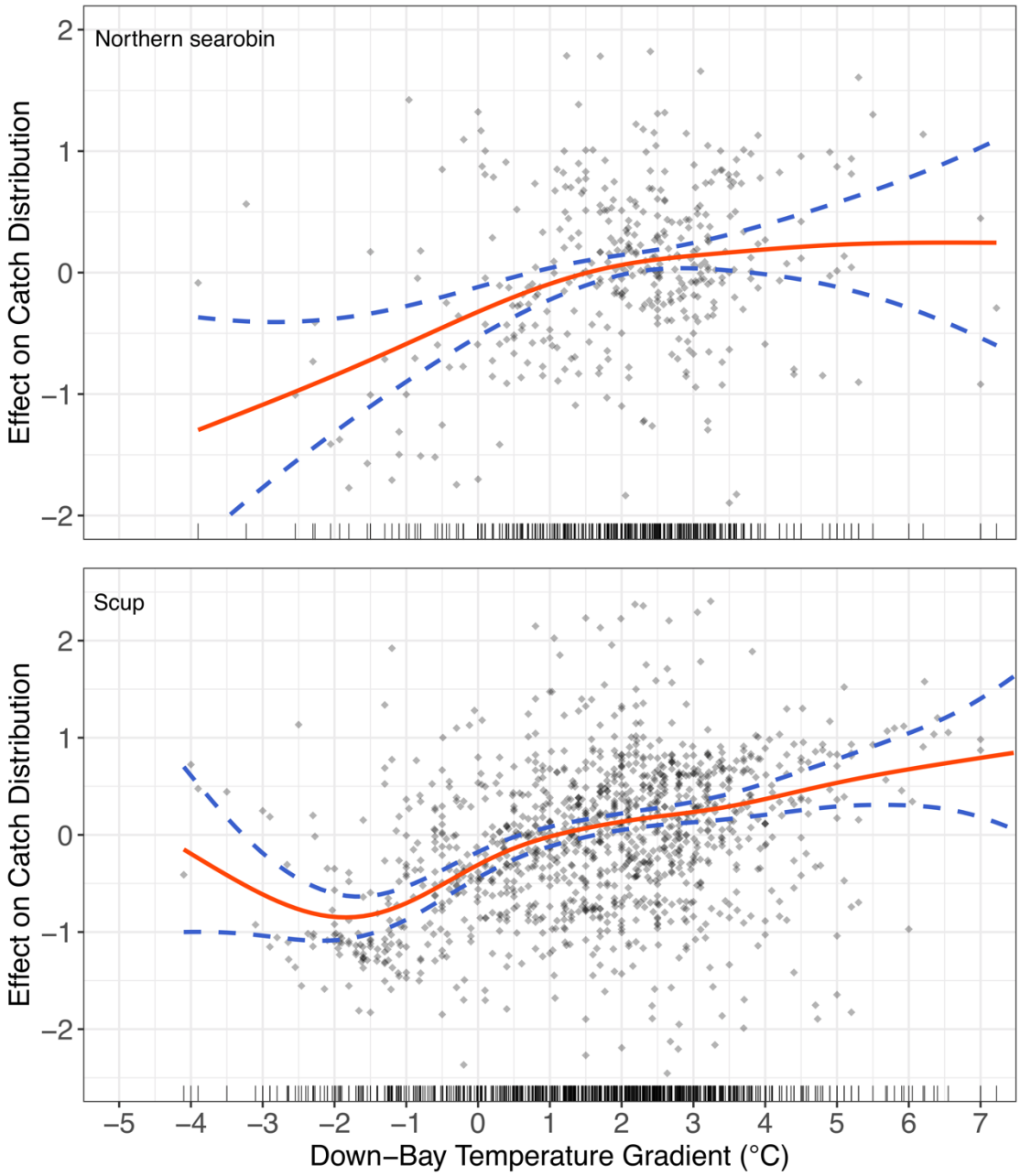

Figure S1c–S1d. The fitted GAM effect (red) and 95% confidence interval (blue) of the down-bay temperature gradient, measured as the difference in bottom temperature between the mid-Bay and outer-Bay stations of the URI GSO trawl survey in Narragansett Bay, on the proportion of catch of northern searobin (top) and scup (bottom) coming from the mid-Bay station. The GAM fit for northern searobin incorporates data up to 1990. Following 1990, the mean distribution of northern searobin shifted toward the outer-Bay and the temperature gradient effect became insignificant. The observations used to fit the GAM are depicted by gray points and a rug plot on the x-axis. Positive gradient values indicate that the mid-Bay station was warmer than the outer-Bay station. Positive y-axis values indicate increased catch at the mid-Bay station.

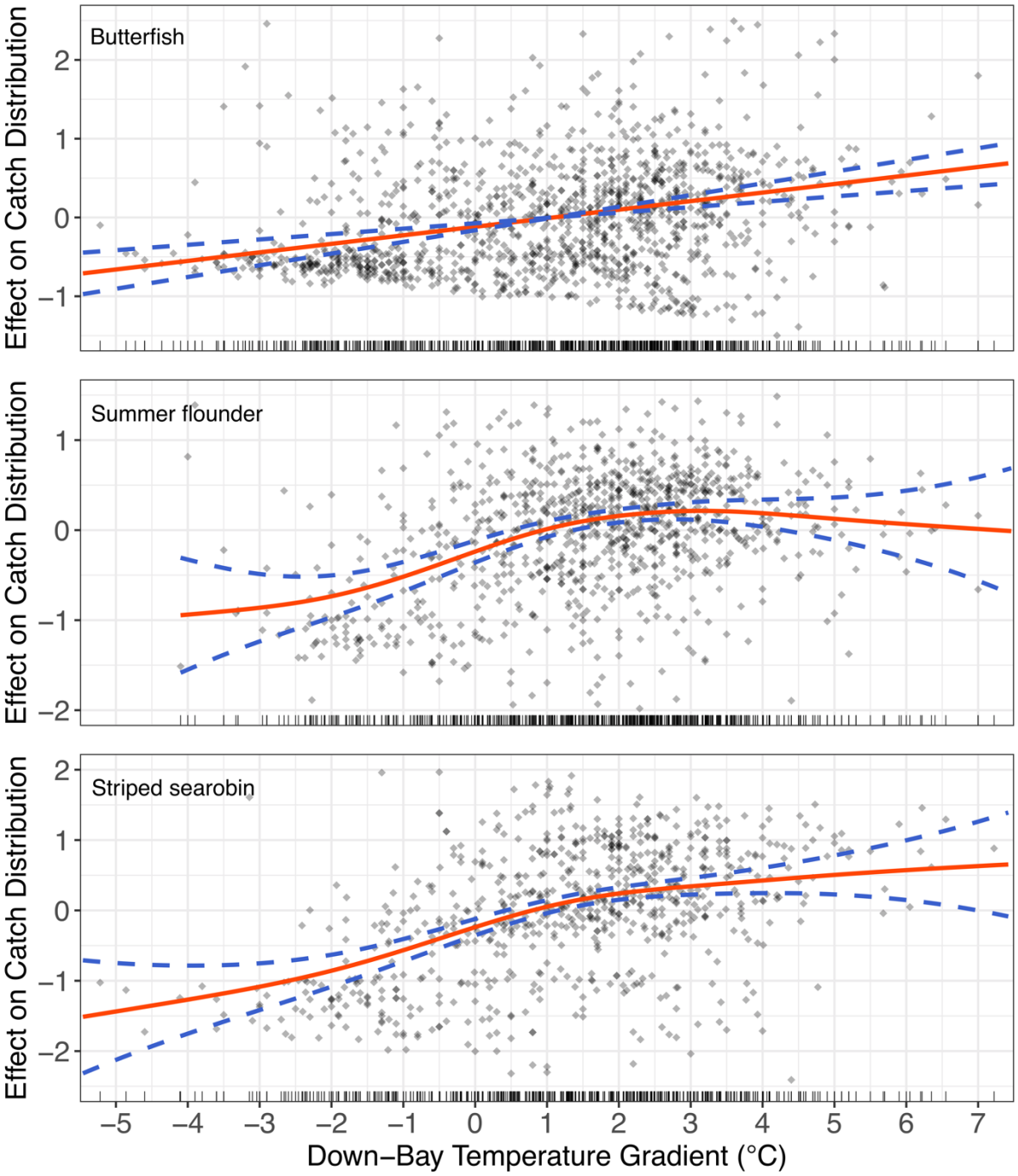

Figure S1e–S1g. The fitted GAM effect (red) and 95% confidence interval (blue) of the down-bay temperature gradient, measured as the difference in bottom temperature between the mid-Bay and outer-Bay stations of the URI GSO trawl survey in Narragansett Bay, on the proportion of catch of butterfish (top), summer flounder (middle), striped searobin (bottom) coming from the mid-Bay station. The observations used to fit the GAM are depicted by gray points and a rug plot on the x-axis. Positive gradient values indicate that the mid-Bay station was warmer than the outer-Bay station. Positive y-axis values indicate increased catch at the mid-Bay station.

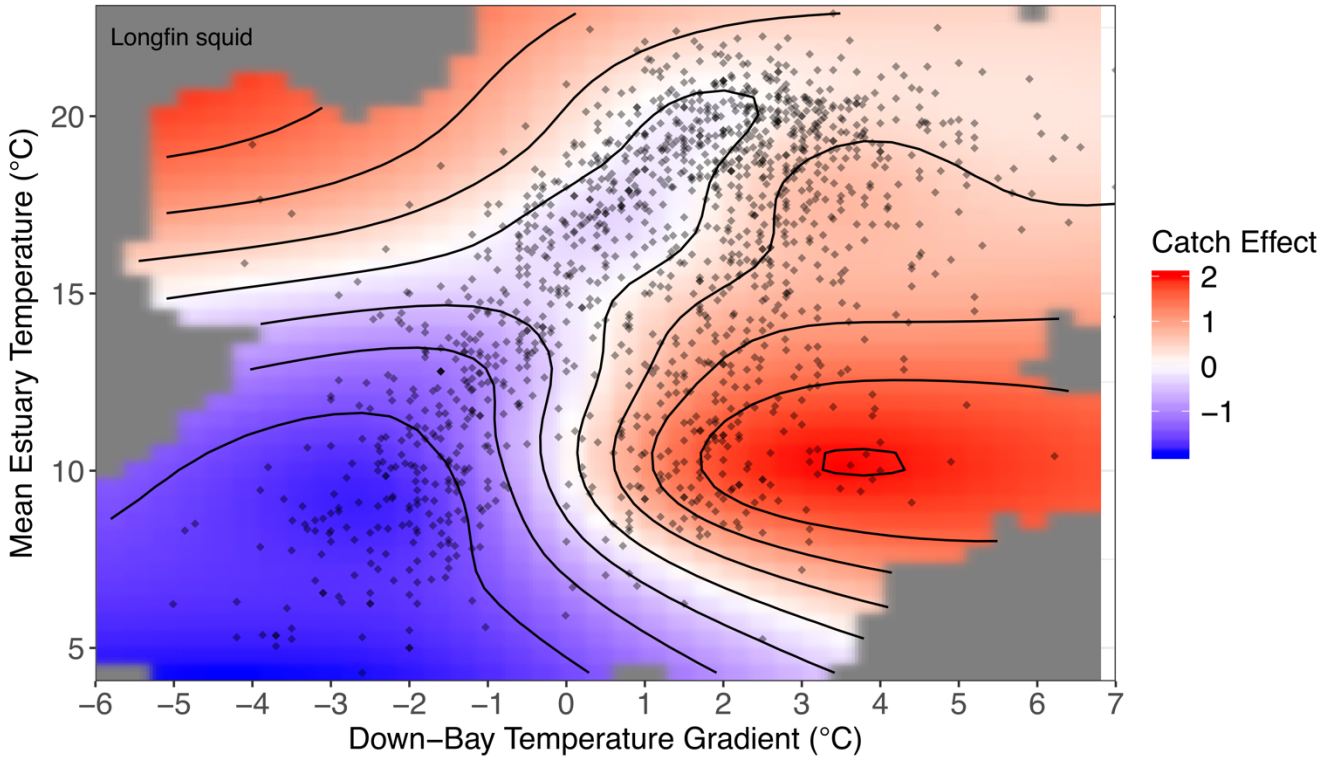

Figure S1h. The fitted GAM effect of the interaction of the mean Narragansett Bay temperature and the down-bay temperature gradient, measured as the difference in bottom temperature between the mid-Bay and outer-Bay stations of the URI GSO trawl survey in Narragansett Bay, on the proportion of catch of longfin squid coming from the mid-Bay station. The observations used to fit the GAM are depicted by gray points. Positive gradient values indicate that the mid-Bay station was warmer than the outer-Bay station. Positive catch effect values (warm colors) indicate increased catch at the mid-Bay station. Gray areas represent portions of the effect surface that could not be estimated due to a lack of observations in these regions of the covariate space.