Supporting Information.

Appendix S1.

Additional information on datasets used for each drought cycle model and model results.

Figure S1: Map of the San Francisco Estuary, indicating sampling locations for the FMWT survey used in this study and associated station numbers.

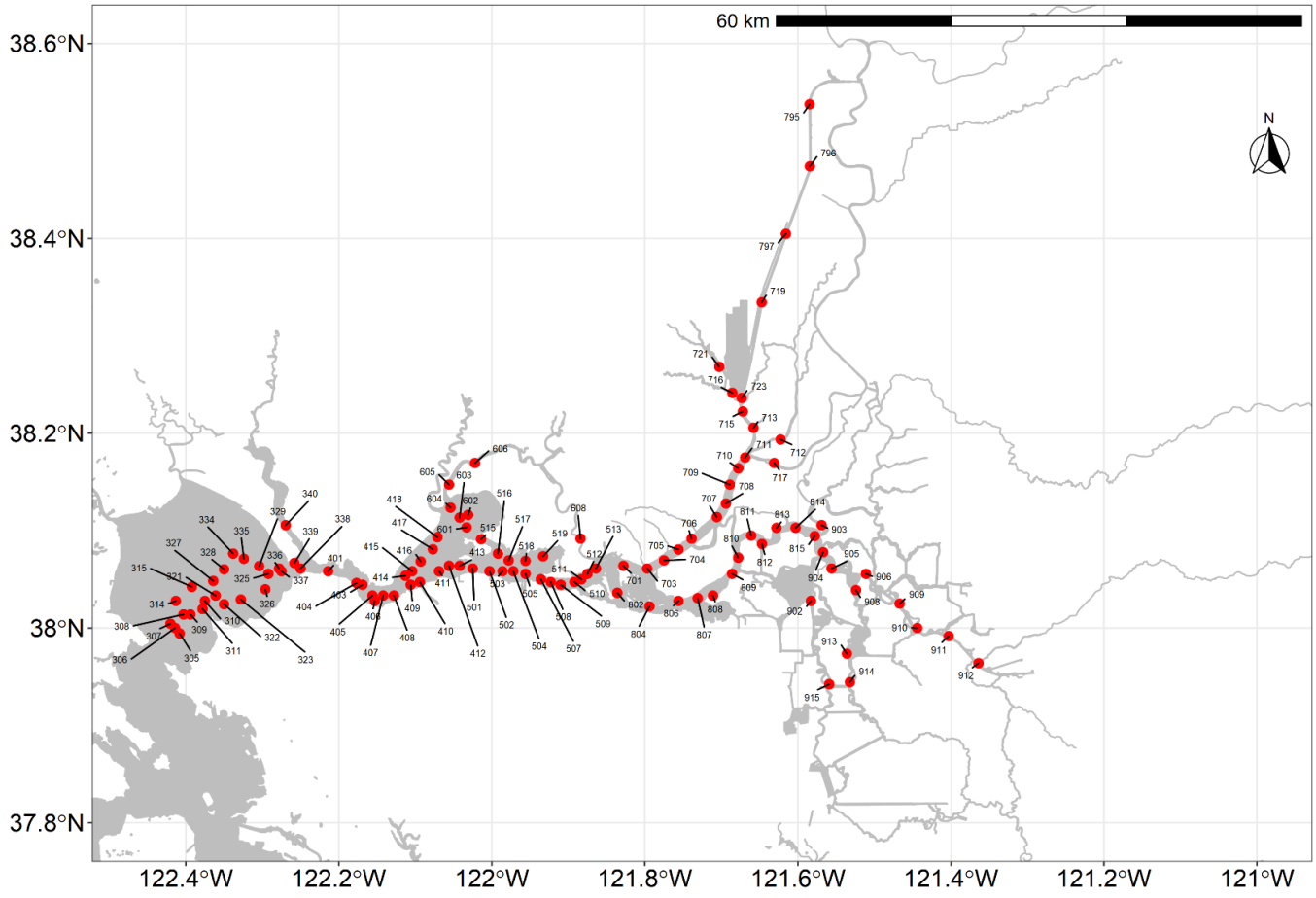

Figure S2: Map of the upper San Francisco Estuary and its watershed, indicating sampling locations for the DJFMP beach seine survey used in this study and associated station codes.

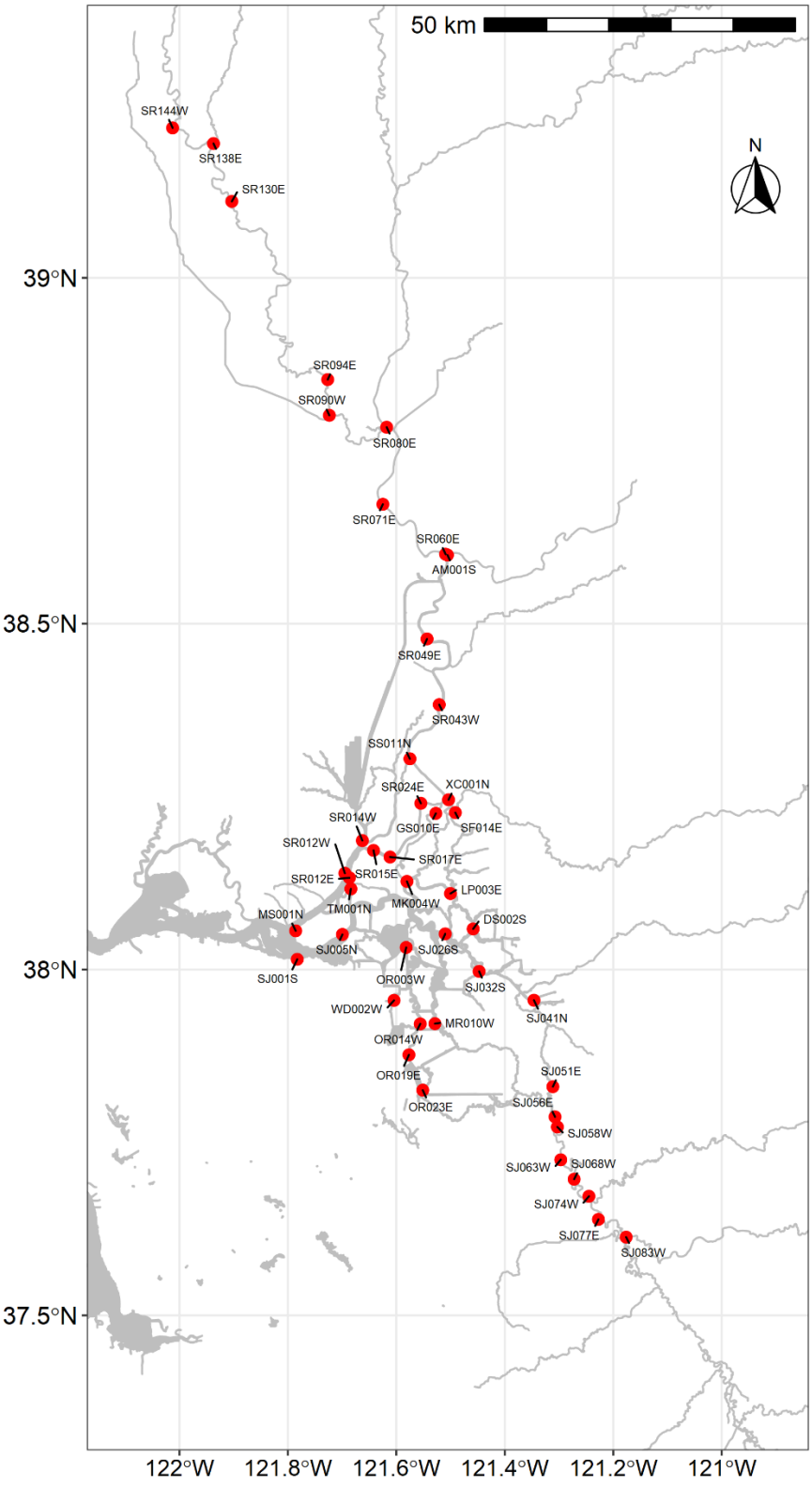

Figure S3. Annual summary of centroid day of outflow as described in Table 1 for our study period (1967-2017). Unit for y-axis is the number of days since October 1st. Water year classification was based on California Department of Water Resources index as seen in Figure 2.

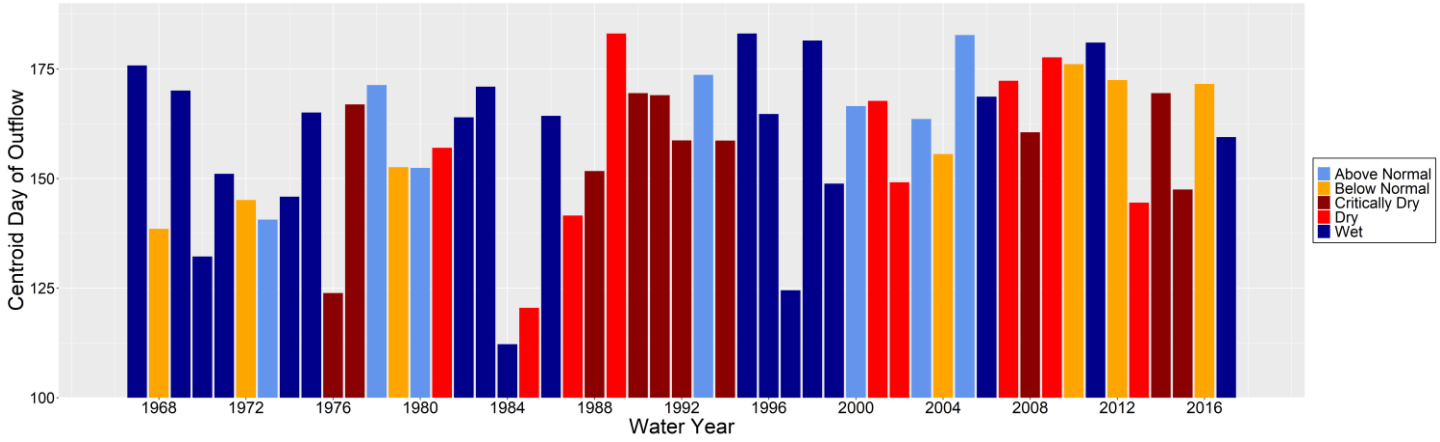

Figure S4. Annual summary of centroid day of Delta precipitation as described in Table 1 for our study period (1967-2017). Unit for y-axis is the number of days since October 1st. Water year classification was based on California Department of Water Resources index as seen in Figure 2.

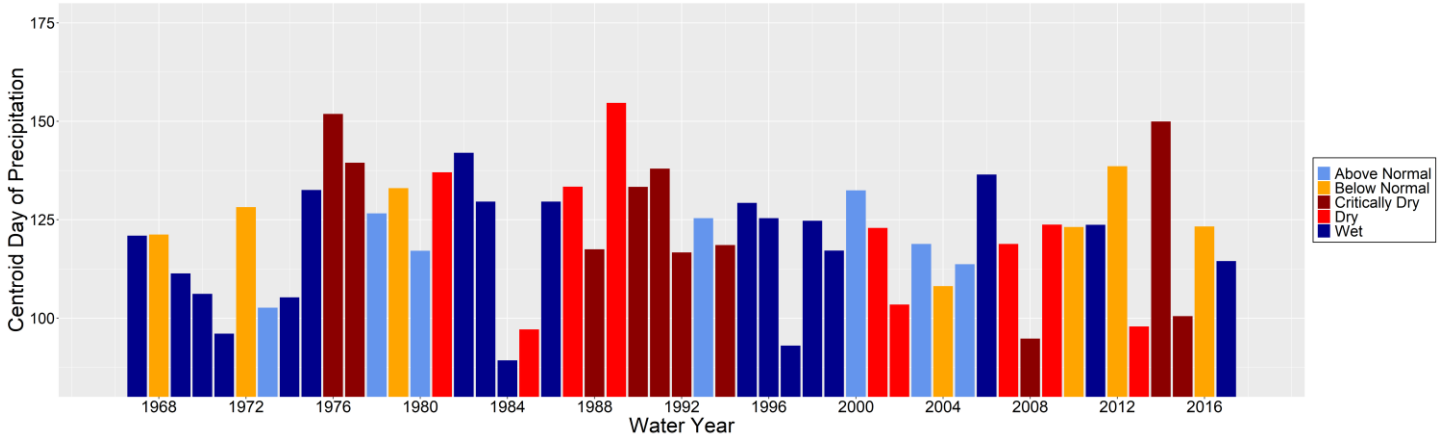

Figure S5. Annual summary of mean daily water export from the Sacramento-San Joaquin Delta as described in Table 1 for our study period (1967-2017). Unit for y-axis is in cubic feet per second. Water year classification was based on California Department of Water Resources index as seen in Figure 2.

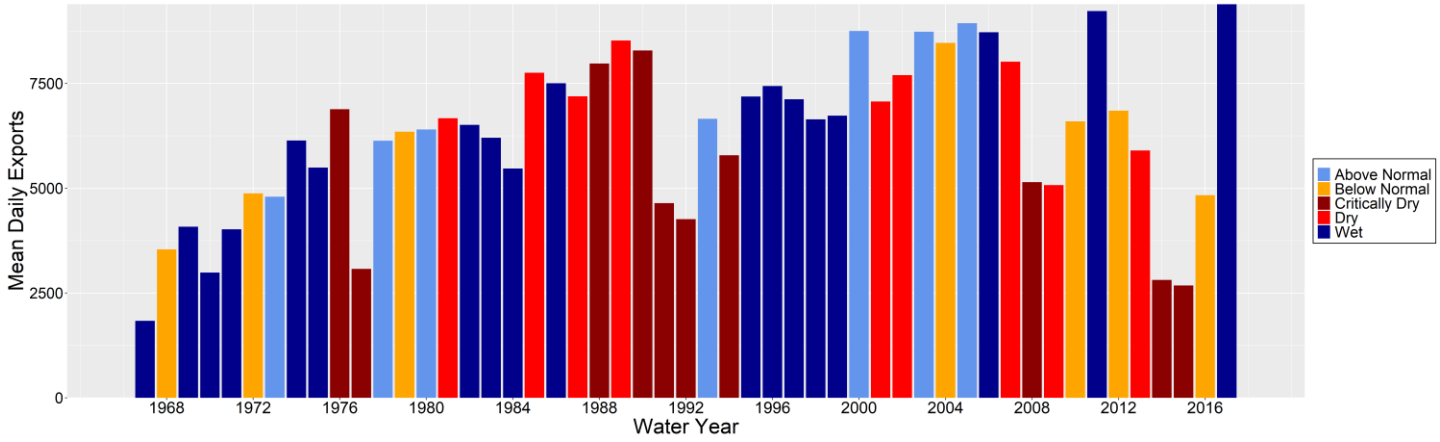

Figure S6: Resistance and resilience coefficients from Bayesian logistic regression models, sorted by species and drought cycle number. Lines extending from each point indicate the 95% credible intervals for each term. Black dots indicate 95% credible intervals that did not include 0.

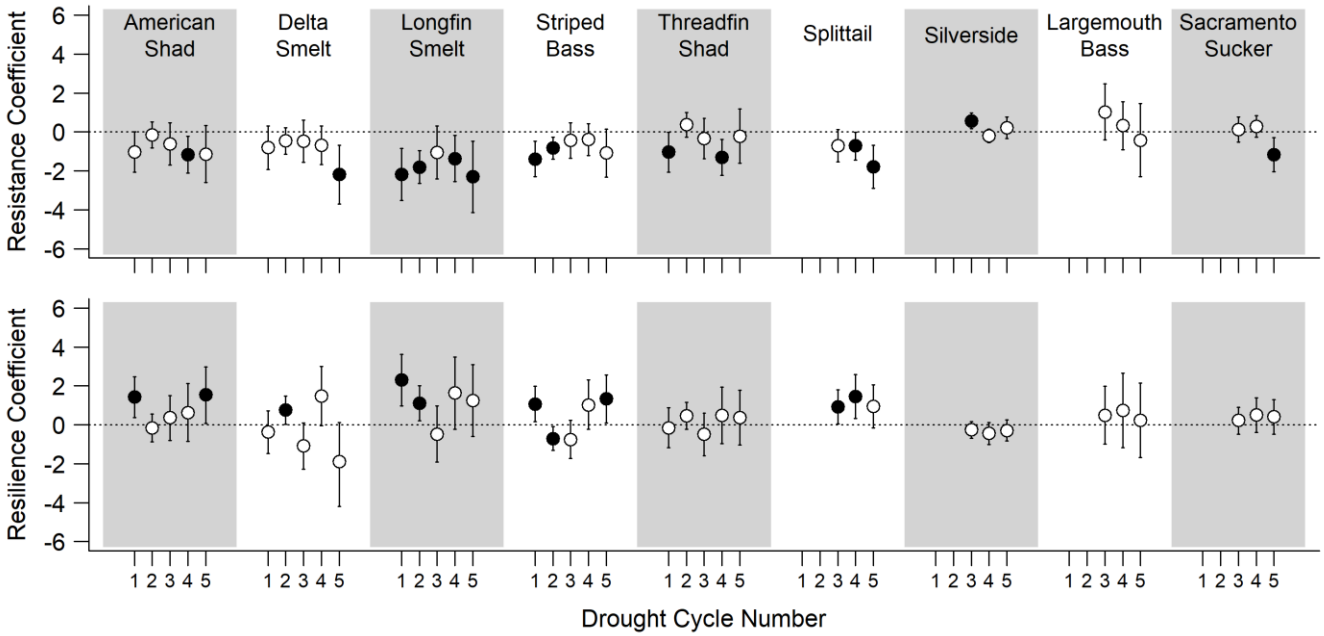

Table S1. List of FMWT stations, with + symbol indicating which stations have data in all three phases (pre-drought, drought, post-drought) of a drought cycle.

Station	Drought Cycle 1: 1967-1986	Drought Cycle 2: 1978-2000	Drought Cycle 3: 1995-2006	Drought Cycle 4: 2006-2011	Drought Cycle 5: 2011-2017
305	+	+	+	+	+
306	+	+	+	+	+
307	+	+	+	+	+
308	+	+	+	+	+
309	+	+	+	+	+
310	+	+	+	+	+
311	+	+	+	+	+
314	+	+	+	+	+
315	+	+	+	+	+
321	+	+	+	+	+
322	+	+	+	+	+
323	+	+	+	+	+
325	+	+	+	+	+
326	+	+	+	+	+
327	+	+	+	+	+
328	+	+	+	+	+
329	+	+	+	+	+
334	+	+	+	+	+
335	+	+	+	+	+
336	+	+	+	+	+
337	+	+	+	+	+
338	+	+	+	+	+
339	+	+	+	+	+
340	+	+	+	+	+
401	+	+	+	+	+
403	+	+	+	+	+
404	+	+	+	+	+
405	+	+	+	+	+
406	+	+	+	+	+
407	+	+	+	+	+
408	+	+	+	+	+
409	+	+	+	+	+
410	+	+	+	+	+
411	+	+	+	+	+
412	+	+	+	+	+
413	+	+	+	+	+
414	+	+	+	+	+

415	+	+	+	+	+
416	+	+	+	+	+
417	+	+	+	+	+
418	+	+	+	+	+
501	+	+	+	+	+
502	+	+	+	+	+
503	+	+	+	+	+
504	+	+	+	+	+
505	+	+	+	+	+
507	+	+	+	+	+
508	+	+	+	+	+
509	+	+	+	+	+
510	+	+	+	+	+
511	+	+	+	+	+
512	+	+	+	+	+
513	+	+	+	+	+
515	+	+	+	+	+
516	+	+	+	+	+
517	+	+	+	+	+
518	+	+	+	+	+
519	+	+	+	+	+
601	+	+	+	+	+
602	+	+	+	+	+
603	+	+	+	+	+
604	+	+	+	+	+
605	+	+	+	+	+
606	+	+	+	+	+
608	+	+	+	+	+
701	+	+	+	+	+
703	+	+	+	+	+
704	+	+	+	+	+
705	+	+	+	+	+
706	+	+	+	+	+
707	+	+	+	+	+
708	+	+	+	+	+
709	+	+	+	+	+
710	+	+	+	+	+
711	+	+	+	+	+
802	+	+	+	+	+
804	+	+	+	+	+
806	+	+	+	+	+
807	+	+	+	+	+
808	+	+	+	+	+

809	+	+	+	+	+
810	+	+	+	+	+
811	+	+	+	+	+
812	+	+	+	+	+
813	+	+	+	+	+
814	+	+	+	+	+
815	+	+	+	+	+
902	+	+	+	+	+
903	+	+	+	+	+
904	+	+	+	+	+
905	+	+	+	+	+
906	+	+	+	+	+
908	+	+	+	+	+
909	+	+	+	+	+
910	+	+	+	+	+
911	+	+	+	+	+
912	+	+	+	+	+
913	+	+	+	+	+
914	+	+	+	+	+
915	+	+	+	+	+
712	-	-	+	+	+
713	-	-	+	+	+
715	-	-	+	+	+
716	-	-	+	+	+
717	-	-	+	+	+
719	-	-	-	+	+
721	-	-	-	+	+
723	-	-	-	+	+
795	-	-	-	+	+
796	-	-	-	+	+
797	-	-	-	+	+

Table S2. List of DJFMP stations, with + symbol indicating which stations have data in all three phases (pre-drought, drought, post-drought) of a drought cycle.

Station	Region	Drought Cycle 3: 1995-2006	Drought Cycle 4: 2006-2011	Drought Cycle 5: 2011-2017	Notes
SR071E	1	+	+	+	
SR080E	1	+	+	+	
SR090W	1	+	+	+	
SR094E	1	+	+	+	
SR130E	1	+	+	+	
SR138E	1	+	+	+	
SR144W	1	+	+	+	
MS001N	2	+	+	+	
AM001S	2	+	+	+	
SR049E	2	+	+	+	
SR060E	2	+	+	+	
SR012E/SR012W	2	+	+	+	Station SR012E was replaced by SR012W, treated as replicates of one another.
SR014W	2	+	+	+	
SR017E	2	+	+	+	
SR024E	2	+	+	+	
SR043W	2	+	+	+	
SS011N	2	+	+	+	
LP003E	3	+	+	+	
MK004W	3	+	+	+	
SJ001S	3	+	+	+	
SJ005N	3	+	+	+	
TM001N	3	+	+	+	
DS002S	3	+	+	+	
SF014E	3	+	+	+	
GS010E	3	+	+	+	
XC001N	3	+	+	+	
SJ051E	4	+	+	+	
MR010W	4	+	+	+	
SJ026S	4	-	+	+	
SJ032S	4	+	+	+	
SJ041N	4	+	+	+	
OR003W	4	+	+	+	
OR014W	4	+	+	+	
OR019E	4	+	+	+	
WD002W	4	+	+	+	
OR023E	4	+	+	+	
SJ068W	5	+	+	-	
SJ056E	5	+	+	+	
SJ058W	5	+	+	+	

SJ063W	5	+	+	+	
SJ074W	5	+	+	+	
SJ077E	5	+	+	+	
SJ083W	5	+	+	+	

Table S3: Summary of Bayesian logistic regression model parameters and simulation accuracy rates for (a) American Shad, (b) Delta Smelt, (c) Longfin Smelt, (d) Striped Bass, (e) Threadfin Shad, (f) Sacramento Splittail, (g) Mississippi Silverside, (h) Largemouth Bass, and (i) Sacramento Sucker. Columns in parameter summaries represent the marginal posterior mean (Mean), standard deviation (SD), and 95% credible interval lower (Lower CI) and upper (Upper CI) bounds. Simulated observation accuracy rates are summarized below parameter summaries. Columns in accuracy rate summaries represent the minimum (Min), first quartile (Q1), median (Median), mean (Mean), third quartile (Q3), and maximum (Max) accuracy rates. Potential scale reduction factors across all parameters and random effects, across all models, range from 0.99 to 1.003.

(a) American Shad

Parameter	Mean	SD	Lower CI	Upper CI
α	0.339566	0.329999	-0.30043	0.981609
$\Delta_{1,c=1}$	-1.03519	0.532164	-2.07879	0.01428
$\Delta_{2,c=1}$	1.424331	0.534204	0.365761	2.470715
$\Delta_{1,c=2}$	-0.1525	0.338066	-0.8143	0.514756
$\Delta_{2,c=2}$	-0.16073	0.365494	-0.87914	0.558788
$\Delta_{1,c=3}$	-0.62202	0.548991	-1.69602	0.475807
$\Delta_{2,c=3}$	0.36252	0.581167	-0.7933	1.501221
$\Delta_{1,c=4}$	-1.16559	0.479438	-2.1035	-0.22382
$\Delta_{2,c=4}$	0.632476	0.749888	-0.84382	2.122832
$\Delta_{1,c=5}$	-1.14006	0.731737	-2.5872	0.318821
$\Delta_{2,c=5}$	1.538865	0.732524	0.082079	2.98254
σ_m	0.34834	0.257076	0.126658	0.991246
σ_r	0.660078	0.080936	0.522281	0.837567
σ_s	0.764015	0.057209	0.661026	0.884225

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0235	0.4595	0.6385	0.6104	0.7770	0.9875

(b) Delta Smelt

Parameter	Mean	SD	Lower CI	Upper CI
α	-1.41394	0.37003	-2.13311	-0.71119
$\Delta_{1,c=1}$	-0.80903	0.562932	-1.92605	0.316146
$\Delta_{2,c=1}$	-0.3762	0.5549	-1.46739	0.722872
$\Delta_{1,c=2}$	-0.45803	0.34301	-1.14207	0.221872
$\Delta_{2,c=2}$	0.763445	0.372045	0.020603	1.487862

$\Delta_{1,c=3}$	-0.48376	0.559758	-1.56435	0.616448
$\Delta_{2,c=3}$	-1.07902	0.601699	-2.27606	0.104404
$\Delta_{1,c=4}$	-0.68179	0.508472	-1.68551	0.305145
$\Delta_{2,c=4}$	1.467152	0.774322	-0.05265	2.996772
$\Delta_{1,c=5}$	-2.18775	0.766358	-3.69699	-0.68081
$\Delta_{2,c=5}$	-1.89428	1.093792	-4.18401	0.120542
σ_m	0.244076	0.209587	0.069768	0.743751
σ_r	0.667145	0.086411	0.519599	0.858904
σ_s	2.170643	0.182431	1.845681	2.56008

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0055	0.7660	0.9530	0.8332	0.9920	1.0000

(c) Longfin Smelt

Parameter	Mean	SD	Lower CI	Upper CI
α	-0.48995	0.735107	-1.911	0.955233
$\Delta_{1,c=1}$	-2.18323	0.681677	-3.52544	-0.83921
$\Delta_{2,c=1}$	2.299461	0.680935	0.959203	3.633429
$\Delta_{1,c=2}$	-1.80387	0.42566	-2.64658	-0.96745
$\Delta_{2,c=2}$	1.116844	0.458603	0.209342	2.017708
$\Delta_{1,c=3}$	-1.0487	0.695128	-2.41542	0.308781
$\Delta_{2,c=3}$	-0.47303	0.732072	-1.90239	0.977323
$\Delta_{1,c=4}$	-1.36793	0.604375	-2.56109	-0.18104
$\Delta_{2,c=4}$	1.632744	0.945469	-0.23158	3.495049
$\Delta_{1,c=5}$	-2.29879	0.930623	-4.14041	-0.47397
$\Delta_{2,c=5}$	1.243881	0.936374	-0.6016	3.092838
σ_m	1.100915	0.653116	0.489193	2.671729
σ_r	0.832059	0.103145	0.657305	1.059648
σ_s	1.827552	0.142778	1.570089	2.131115

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0020	0.6410	0.8635	0.7702	0.9725	1.0000

(d) Striped Bass

Parameter	Mean	SD	Lower CI	Upper CI
α	0.588785	0.274201	0.05006	1.131826
$\Delta_{1,c=1}$	-1.38985	0.462659	-2.29129	-0.4738
$\Delta_{2,c=1}$	1.073011	0.461853	0.163379	1.977504
$\Delta_{1,c=2}$	-0.82484	0.286822	-1.38805	-0.26104
$\Delta_{2,c=2}$	-0.70525	0.310922	-1.31768	-0.09666
$\Delta_{1,c=3}$	-0.43199	0.467101	-1.35091	0.476697
$\Delta_{2,c=3}$	-0.75213	0.498109	-1.73297	0.228434
$\Delta_{1,c=4}$	-0.39487	0.41342	-1.21713	0.410656

$\Delta_{2,c=4}$	1.028201	0.64385	-0.22279	2.307765
$\Delta_{1,c=5}$	-1.07847	0.629874	-2.32527	0.15624
$\Delta_{2,c=5}$	1.339235	0.628918	0.101599	2.56816
σ_m	0.205095	0.164533	0.061575	0.630916
σ_r	0.555579	0.070294	0.436996	0.710327
σ_s	1.2221	0.089511	1.060936	1.412607

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0080	0.5550	0.7850	0.7116	0.9130	0.9995

(e) Threadfin Shad

Parameter	Mean	SD	Lower CI	Upper CI
α	-0.15176	0.519937	-1.16385	0.835282
$\Delta_{1,c=1}$	-1.02558	0.522385	-2.06691	-0.00469
$\Delta_{2,c=1}$	-0.16241	0.522677	-1.18462	0.876297
$\Delta_{1,c=2}$	0.377242	0.322312	-0.26602	1.005948
$\Delta_{2,c=2}$	0.45644	0.349223	-0.22248	1.146
$\Delta_{1,c=3}$	-0.33193	0.526483	-1.37547	0.697014
$\Delta_{2,c=3}$	-0.49165	0.557342	-1.58173	0.603841
$\Delta_{1,c=4}$	-1.29926	0.466788	-2.22636	-0.37737
$\Delta_{2,c=4}$	0.491869	0.734804	-0.95857	1.945763
$\Delta_{1,c=5}$	-0.22191	0.712093	-1.61768	1.178814
$\Delta_{2,c=5}$	0.373226	0.713848	-1.04504	1.771688
σ_m	0.788552	0.436714	0.34266	1.894736
σ_r	0.629926	0.079009	0.495955	0.806623
σ_s	1.531019	0.11204	1.329675	1.769612

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0115	0.5785	0.8115	0.7261	0.9300	0.9995

(f) Sacramento Splittail

Parameter	Mean	SD	Lower CI	Upper CI
α	-2.13831	0.827352	-3.80742	-0.48053
$\Delta_{1,c=3}$	-0.69787	0.416914	-1.52772	0.127507
$\Delta_{2,c=3}$	0.923123	0.440722	0.044831	1.794463
$\Delta_{1,c=4}$	-0.71502	0.360312	-1.43478	-0.0056
$\Delta_{2,c=4}$	1.455668	0.569459	0.324346	2.59293
$\Delta_{1,c=5}$	-1.78677	0.555154	-2.89062	-0.67642
$\Delta_{2,c=5}$	0.939173	0.557272	-0.15646	2.044629
σ_m	1.866096	0.670616	1.038918	3.56124
σ_r	0.488287	0.098032	0.335891	0.719014
σ_s	0.849066	0.100492	0.676588	1.069203

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0045	0.6548	0.8980	0.7849	0.9760	1.0000

(g) Mississippi Silverside

Parameter	Mean	SD	Lower CI	Upper CI
α	-0.29792	0.490118	-1.25459	0.657765
$\Delta_{1,c=3}$	0.560092	0.205147	0.159107	0.968285
$\Delta_{2,c=3}$	-0.25194	0.215827	-0.68118	0.175065
$\Delta_{1,c=4}$	-0.19711	0.174969	-0.5442	0.149228
$\Delta_{2,c=4}$	-0.44338	0.282351	-1.01007	0.115478
$\Delta_{1,c=5}$	0.217579	0.27805	-0.33392	0.769231
$\Delta_{2,c=5}$	-0.29053	0.275321	-0.83864	0.257068
σ_m	1.001401	0.388836	0.540378	1.943098
σ_r	0.230088	0.051104	0.150189	0.349732
σ_s	1.299914	0.146764	1.049617	1.62495

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0105	0.4940	0.6995	0.6559	0.8518	0.9920

(h) Largemouth Bass

Parameter	Mean	SD	Lower CI	Upper CI
α	-3.30259	0.570882	-4.44555	-2.1899
$\Delta_{1,c=3}$	1.013338	0.723776	-0.4075	2.47019
$\Delta_{2,c=3}$	0.492431	0.751942	-0.99756	1.979308
$\Delta_{1,c=4}$	0.324989	0.621951	-0.90992	1.561287
$\Delta_{2,c=4}$	0.743051	0.969871	-1.17862	2.651333
$\Delta_{1,c=5}$	-0.42866	0.949462	-2.30634	1.461823
$\Delta_{2,c=5}$	0.239003	0.96569	-1.68975	2.13735
σ_m	0.888408	0.338321	0.475593	1.743517
σ_r	0.85841	0.176471	0.580907	1.26898
σ_s	1.268143	0.150049	1.014581	1.601833

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0005	0.6052	0.8440	0.7518	0.9540	1.0000

(i) Sacramento Sucker

Parameter	Mean	SD	Lower CI	Upper CI
α	-2.43486	0.619205	-3.68081	-1.21983
$\Delta_{1,c=3}$	0.116804	0.325651	-0.52434	0.767566
$\Delta_{2,c=3}$	0.224579	0.348358	-0.47162	0.911669
$\Delta_{1,c=4}$	0.280208	0.284107	-0.28051	0.844964
$\Delta_{2,c=4}$	0.507728	0.449647	-0.38825	1.39621

$\Delta_{1,c=5}$	-1.16406	0.44227	-2.04249	-0.29194
$\Delta_{2,c=5}$	0.413483	0.445414	-0.47102	1.290471
σ_m	1.089949	0.406157	0.591328	2.110748
σ_r	0.38291	0.079352	0.259993	0.570275
σ_s	2.430824	0.307347	1.911024	3.113715

Accuracy rate summary:

Min	Q1	Median	Mean	Q3	Max
0.0055	0.5795	0.8215	0.7458	0.9690	1.0000