SARDINE GENOMICS AND PARASITE UPDATE

CD van der Lingen

IFSAW, UCT Nov/Dec 2022

Table S2. Sites at which samples of *Sardinops sagax* were collected for the genome and transcriptome datasets (N = sample size, Lat = Latitude, Long = Longitude). Please see 'Identification of candidate and nuclear SNPs' for information on the environmental parameters shown in subsequent columns. Sample numbers in brackets are site numbers of genome data for sites that were represented in both datasets.

Dataset	Region	Site no.	N	Date	Lat	Long	5th percentile SST	95th percentile SST	Salinity	DO_2	N	P	Si
Genomic	W	1	13	28-May-15	-31.45	17.45	13.57	15.64	34.90	261	5.8	0.66	6.40
		2	5	18-May-14	-32.12	18.27	13.08	15.79	34.87	258	4.2	0.68	6.40
		3	17	3-Jun-15	-33.26	18.09	12.54	16.49	35.08	253	4.2	0.66	6.50
		4	6	27-Oct-15	-33.59	17.71	14.00	17.60	35.21	249	4	0.64	6.60
		5	11	4-Jun-15	-33.59	18.00	12.54	16.49	35.08	253	4.2	0.66	6.50
		6	3	5-Jun-15	-33.75	18.26	12.49	16.60	35.16	249	4.4	0.66	6.50
	SW	7	7	28-Oct-15	-34.47	18.34	14.64	17.60	35.27	247	4.6	0.65	6.30
		8	3	9-Jun-15	-34.63	18.50	15.35	18.16	35.33	245	4.6	0.64	6.30
		9	9	29-Oct-15	-34.64	18.80	14.70	17.65	35.33	245	4.5	0.63	6.20
		10	9	29-Oct-15	-34.46	18.97	14.70	17.65	35.33	245	4.5	0.63	6.30
		11	9	10-Jun-15	-34.67	18.92	15.29	18.14	35.33	245	4.4	0.62	6.20
		12	5	11-Jun-15	-34.56	19.32	15.46	17.81	35.35	244	4.1	0.60	6.10
		13	4	18-Jun-15	-34.94	18.38	14.89	17.90	35.39	243	4.1	0.60	6.10
	S	14	3	6-Jun-14	-35.26	20.17	16.14	18.86	35.38	238	3.1	0.49	5.80
		15	4	7-Jun-14	-35.80	20.48	15.98	18.60	35.40	235	2.5	0.44	5.70
		16	8	11-Nov-15	-34.51	21.25	16.94	18.85	35.25	239	3.1	0.47	5.80
		17	5	19-Jun-15	-34.62	21.04	15.46	17.61	35.27	239	3.1	0.48	5.80
		18	6	10-Nov-15	-35.44	21.24	17.68	21.71	35.27	235	2.5	0.42	5.60
		19	10	19-Jun-15	-35.63	21.14	16.17	19.95	35.36	235	2.4	0.42	5.60
		20	4	20-Jun-15	-35.01	21.66	16.08	19.80	35.30	236	2.6	0.42	5.60
		21	10	15-Nov-15	-34.85	22.24	17.82	20.20	35.28	236	2.5	0.39	5.60
		22	3	21-Jun-15	-34.39	22.35	15.27	19.88	35.24	238	2.7	0.40	5.60
		23	2	21-Jun-15	-34.70	22.74	15.27	19.88	35.24	238	2.7	0.40	5.60
		24	7	18-Nov-15	-34.57	23.52	17.66	20.70	35.27	238	2.5	0.34	5.40
		25	3	23-Jun-15	-34.07	23.64	16.13	20.54	35.18	239	2.7	0.36	5.50
		26	3	23-Jun-15	-34.09	23.86	16.13	20.54	35.19	238	2.7	0.35	5.50
		27	3	23-Jun-15	-34.54	24.42	17.22	22.38	35.31	235	2.5	0.33	5.30
		28	2	24-Jun-15	-34.27	24.74	17.22	22.27	35.27	235	2.6	0.34	5.30
		29	3	25-Jun-15	-34.14	25.33	18.01	21.82	35.28	232	2.5	0.35	5.30
		30	2	26-Jun-15	-34.12	25.81	18.01	21.85	35.28	229	2.4	0.35	5.30
		31	10	25-Nov-15	-34.49	25.45	17.47	21.65	35.31	231	2.5	0.33	5.30
		32	8	25-Nov-15	-34.20	26.01	19.71	23.10	35.30	229	2.5	0.35	5.20
		33	2	28-Oct-14	-33.92	25.85	15.31	17.34	35.22	229	2.4	0.35	5.30
	SE	34	3	27-Jun-15	-33.69	26.85	17.36	21.68	35.30	224	1.9	0.35	5.20
		35	5	26-Nov-15	-33.50	27.19	21.37	23.82	35.32	222	1.8	0.34	5.10
		36	6	28-Nov-15	-32.77	28.16	22.70	24.37	35.38	218	1.4	0.30	5.00
	E1	37	23	30-Jun-18	-30.14	30.84	21.00	23.35	35.37	213	0.9	0.15	3.10
		38	22	18-Jul-15	-30.12	30.85	21.63	24.17	35.37	213	0.9	0.15	3.10
	E2	39	14	5-May-18	-30.06	30.89	24.70	26.46	35.37	213	0.9	0.15	3.10
		40	14	14-Jul-15	-29.99	30.96	21.60	24.17	35.37	213	0.9	0.15	3.00
Transcriptomic	W	1 (1)	6	28-May-15	-31.45	17.45	13.57	15.64					
	SW	2	1	4-Nov-14	-34.48	18.51	14.06	17.73					
	S	3 (19)	1	19-Jun-15	-35.63	21.14	16.17	19.95					
		4 (22)	1	21-Jun-15	-34.39	22.35	15.27	19.88					
		5 (29)	1	25-Jun-15	-34.14	25.33	18.01	21.82					
		6 (34)	1	27-Jun-15	-33.69	26.85	17.36	21.68					
	SE	7	3	21-Jun-15	-32.13	29.07	20.31	23.48					
	E3	8	3	03-Jul-19	-30.28	30.76	21.34	23.77					
		9	3	07-Jul-19	-30.15	30.85	21.32	23.30					

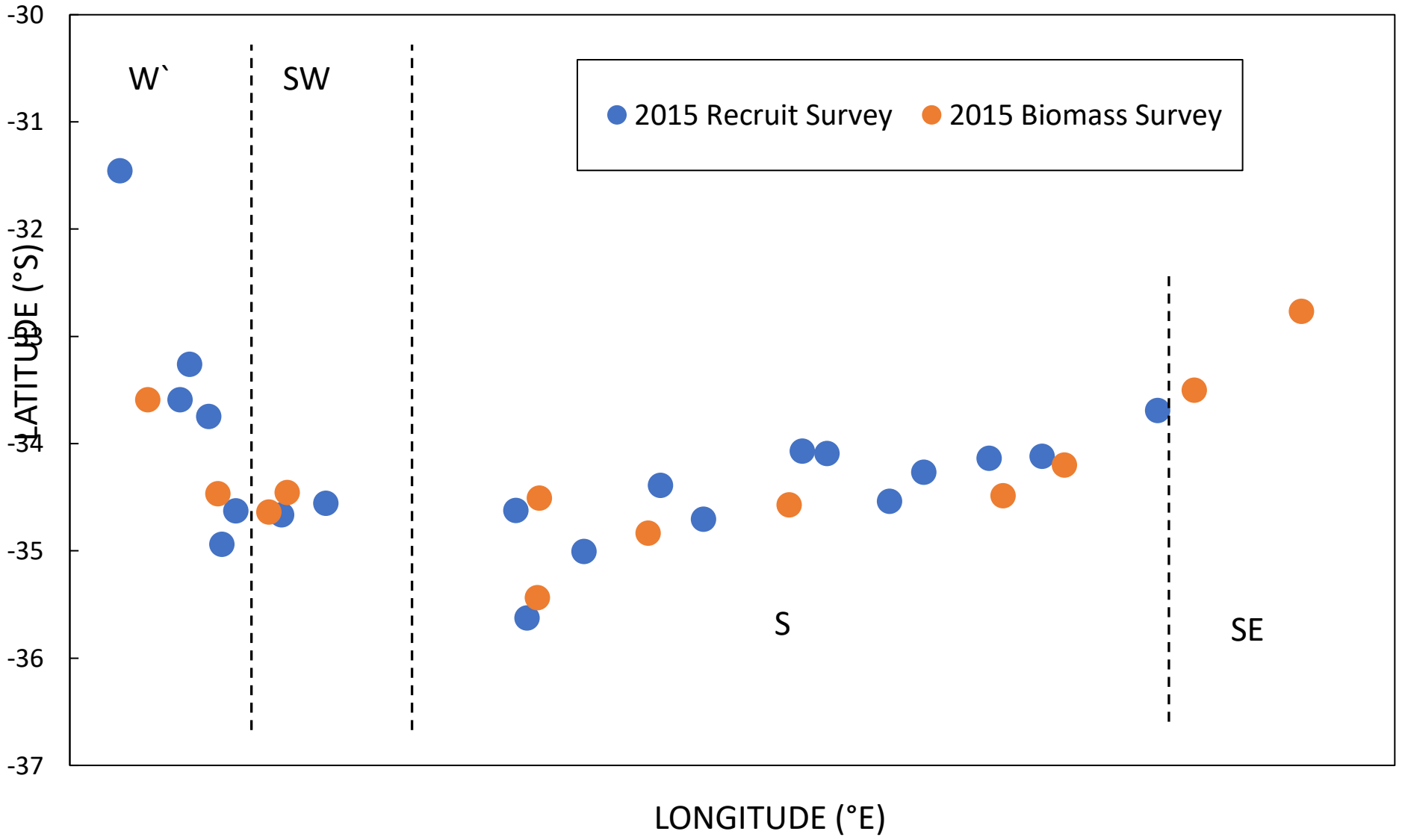
Aut/Spr 2014

Aut/Win 2018

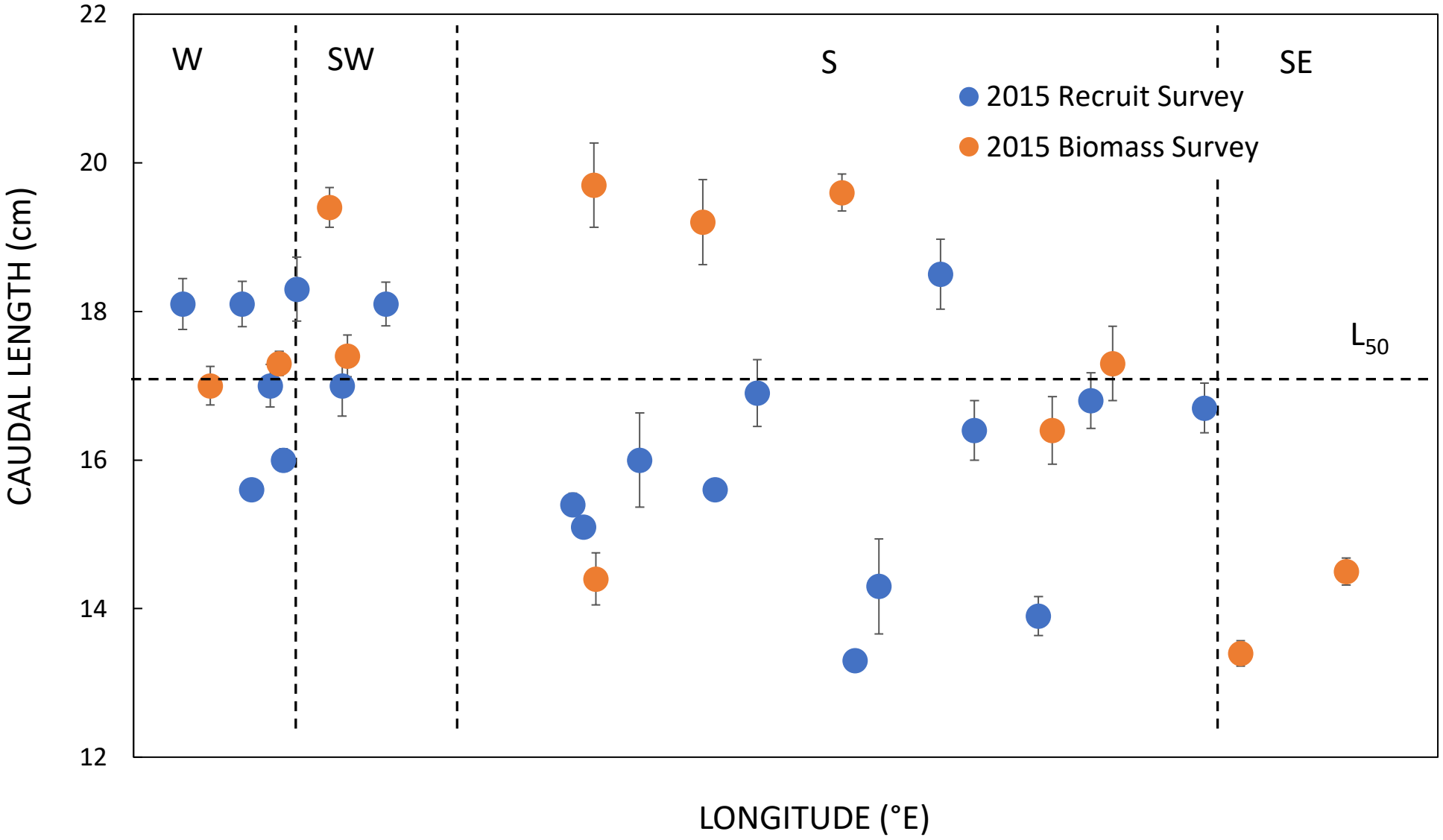
Win 2019

Mostly Autumn/Winter and Spring 2015

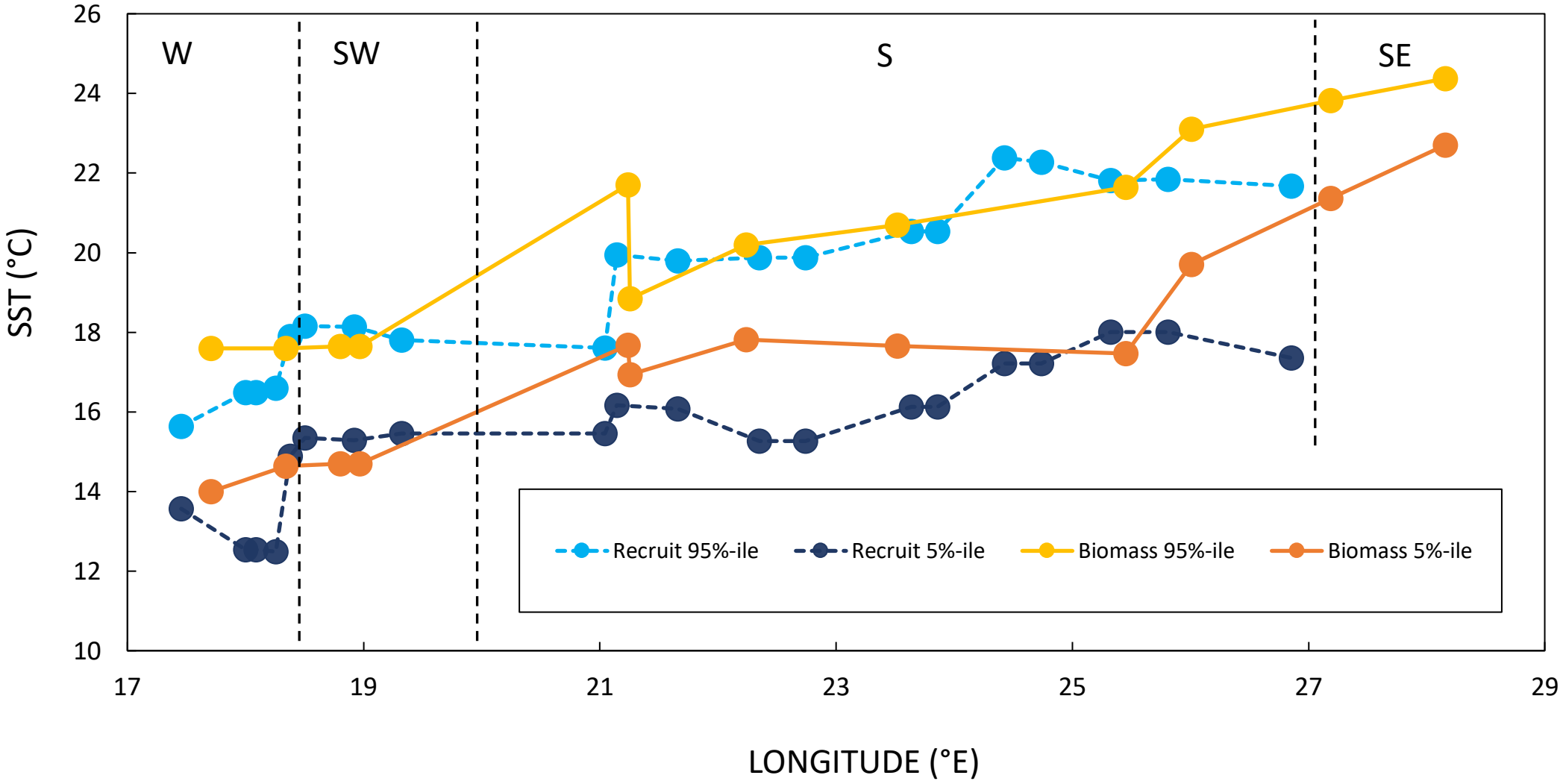
SARDINE GENOMICS 2015 Surveys only: location



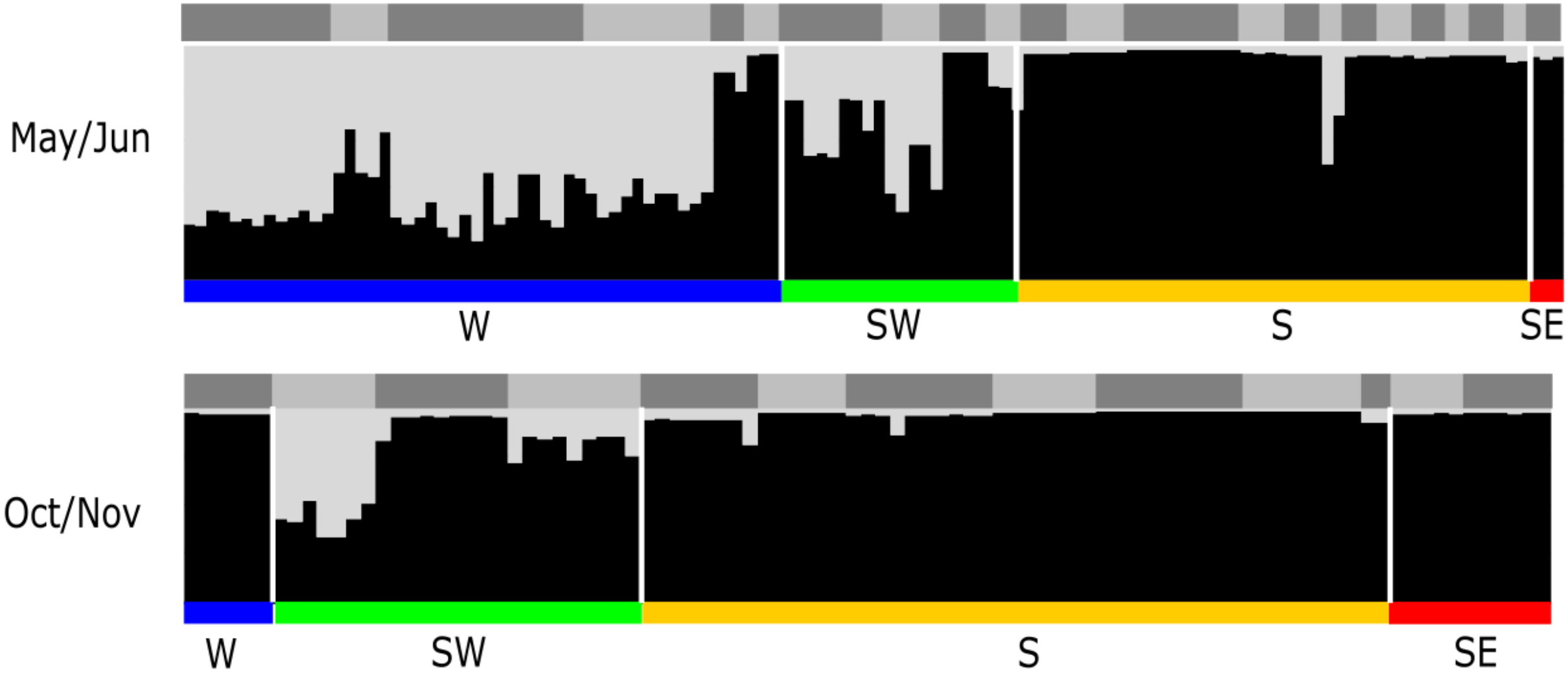
SARDINE GENOMICS 2015 Surveys only: average caudal length (± std. err.)



SARDINE GENOMICS 2015 Surveys only: sea surface temperature (5%-ile and 95%-ile)

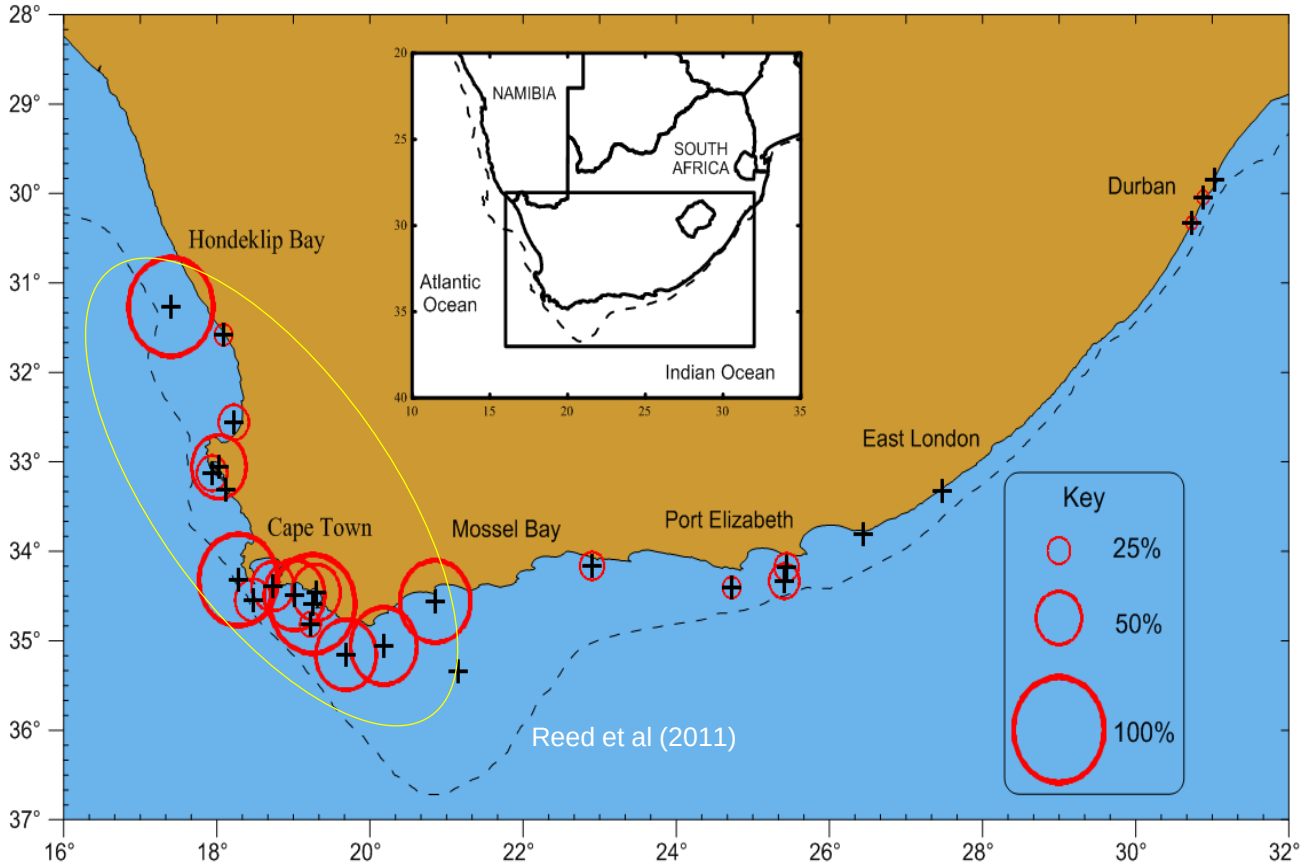


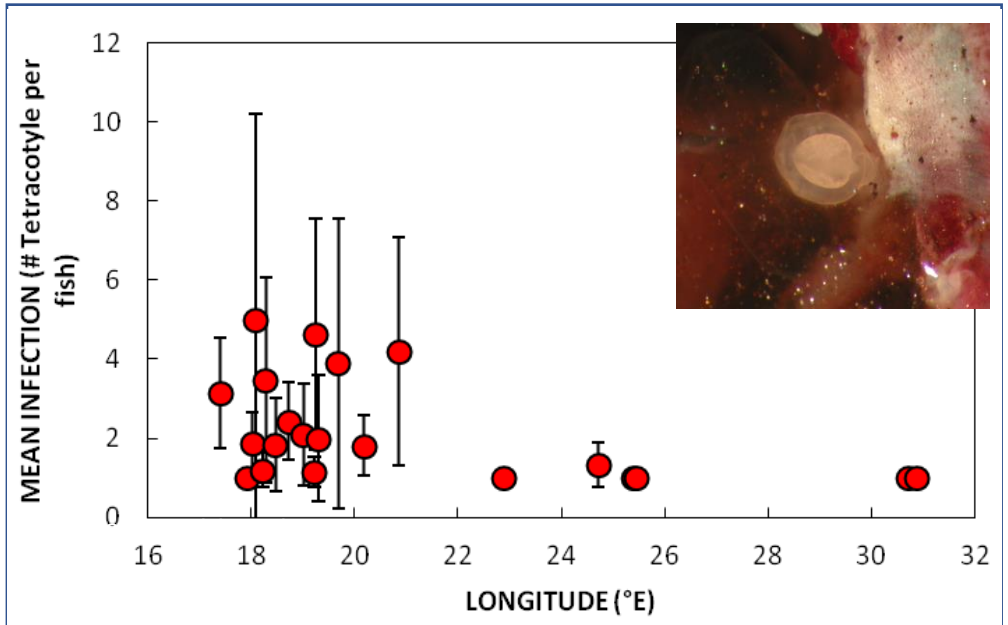
SARDINE GENOMICS 2015 Surveys only: ancestry proportions

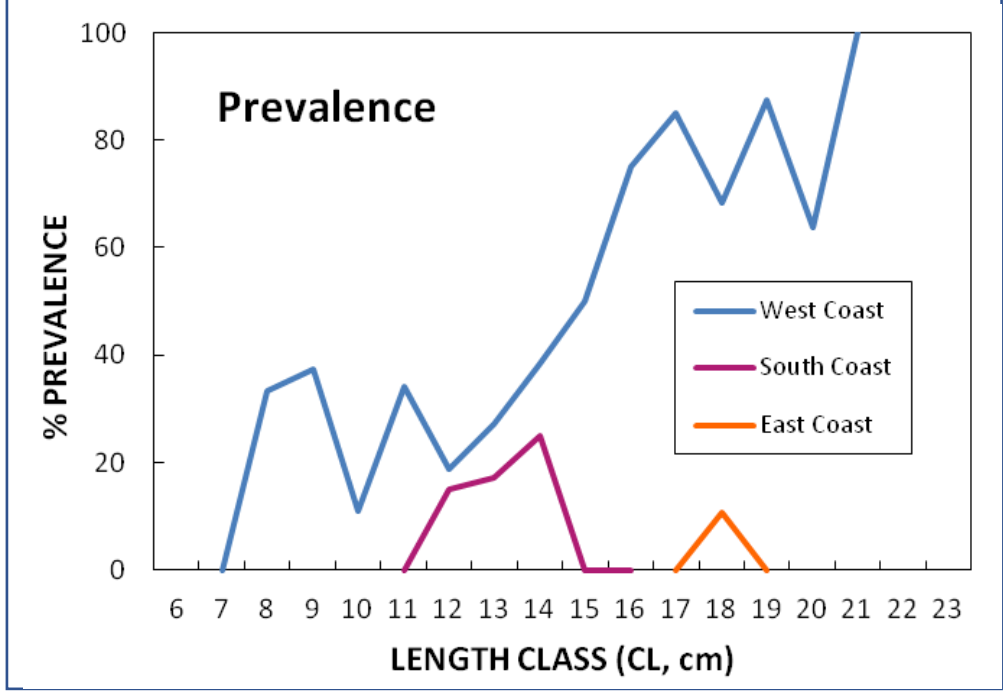


PARASITE BIOTAG (i)

Examination of ~500 fish from 26 locations (2012) showed higher prevalence and higher infection intensity in sardine from the west compared to south or east coasts (none in Namibian fish)



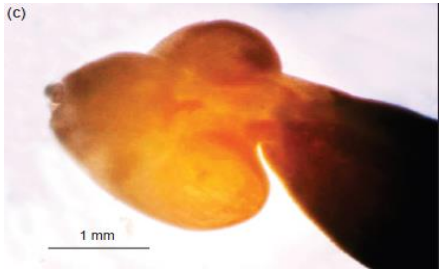


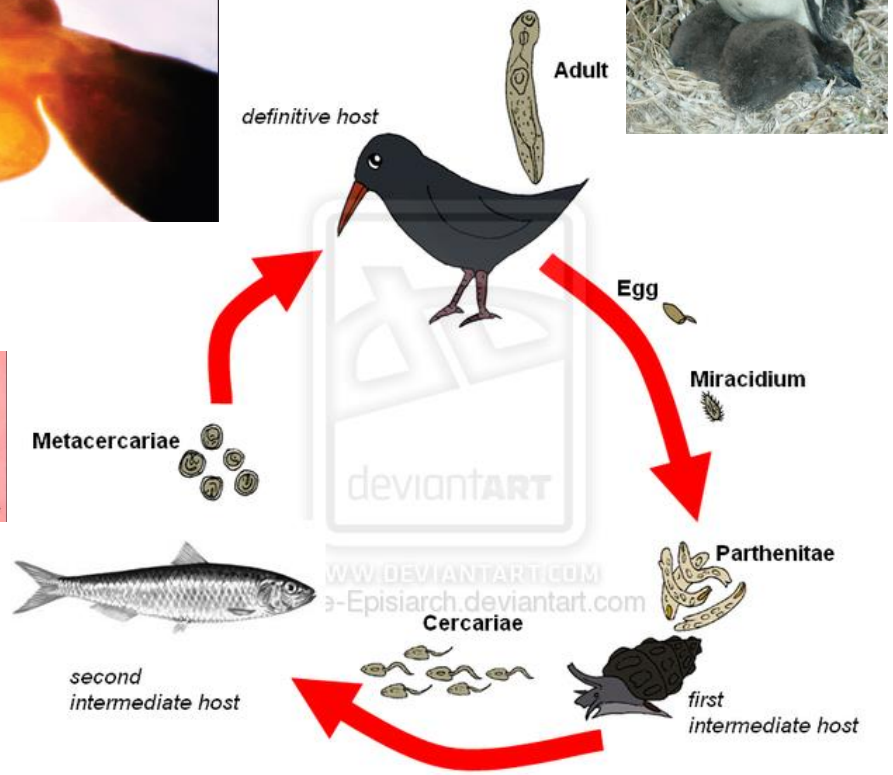


PARASITE BIOTAG (ii)

Cardiocephaloides physalis

Life-cycle includes a gastropod 1st intermediate host, a fish (sardine) 2nd intermediate host and a seabird definitive host (no fish-to-fish transmission)





African penguin host to adult *C. physalis*

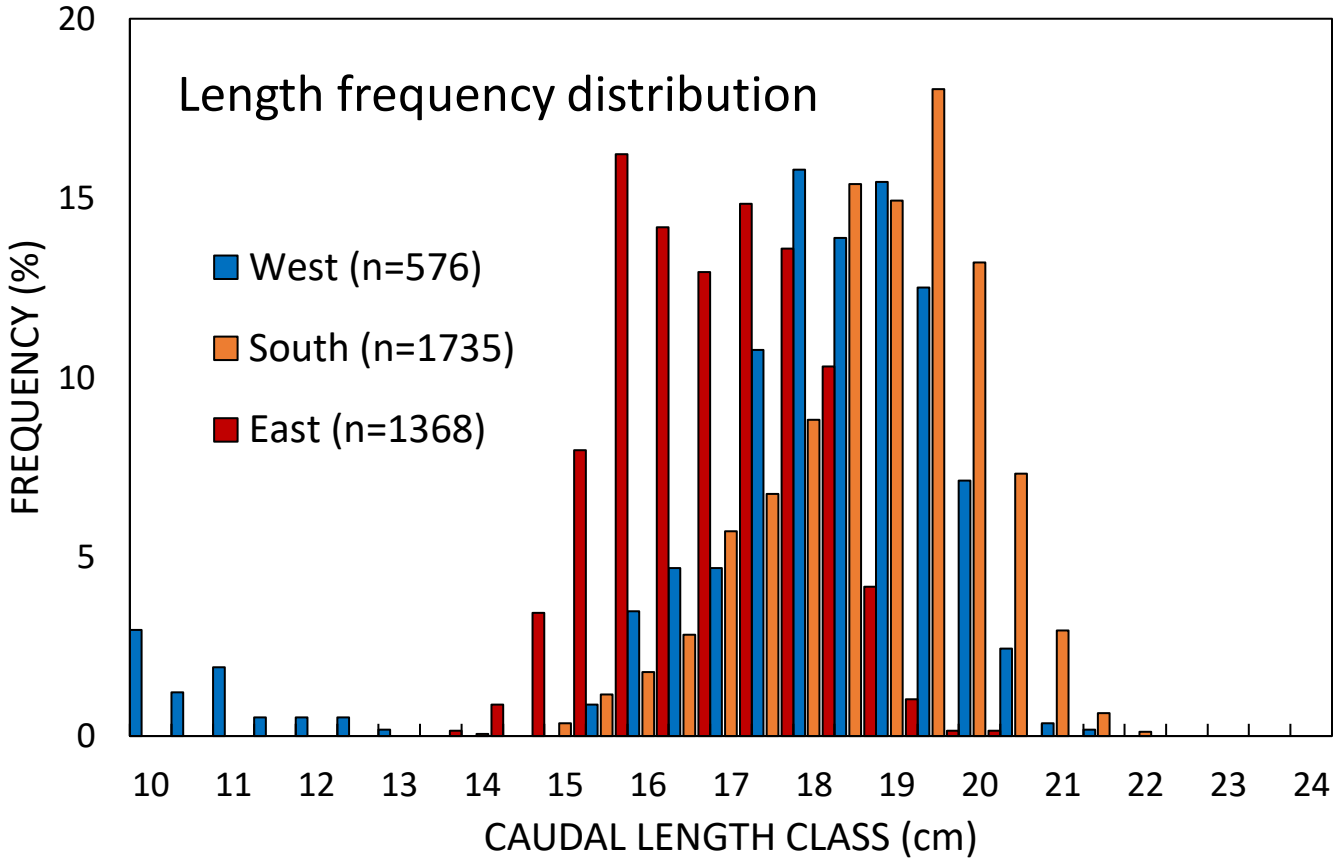
1st intermediate host unknown: hypothesized *Burnapaena papyracea,* abundant subtidal gastropod between Cape Agulhas and Lüderitz

PARASITE BIOTAG (iii)

Numbers of fish (table) and combined LF distribution (histograms) by region (3 679 fish in total)

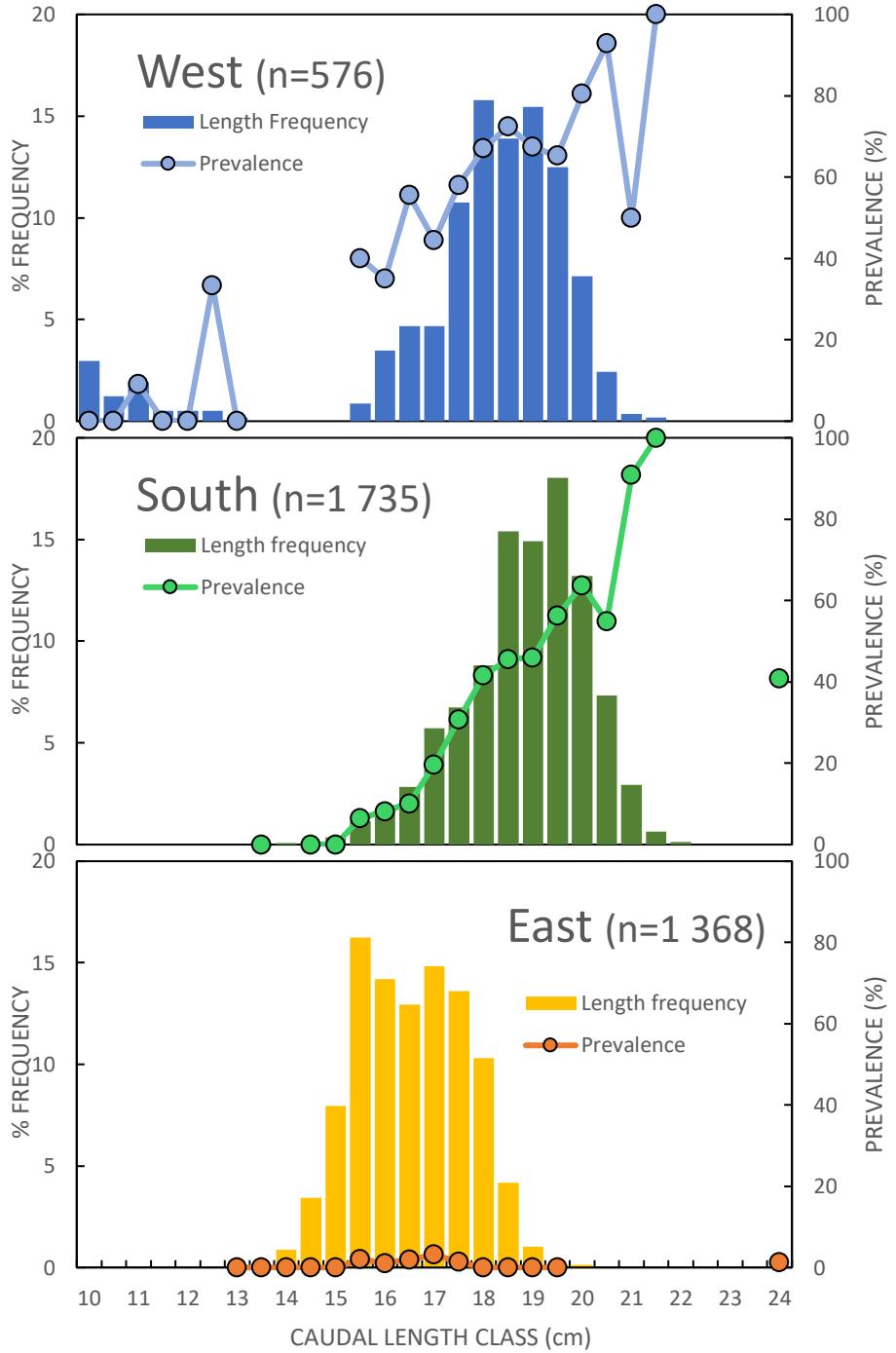
Year	West	South	East
2011	127	50	160
2012	138	174	154
2013		125	
2014	131	326	
2015	105	202	259
2016	30	600	
2017		114	283
2018	45	144	512
	576	**1735**	**1368**

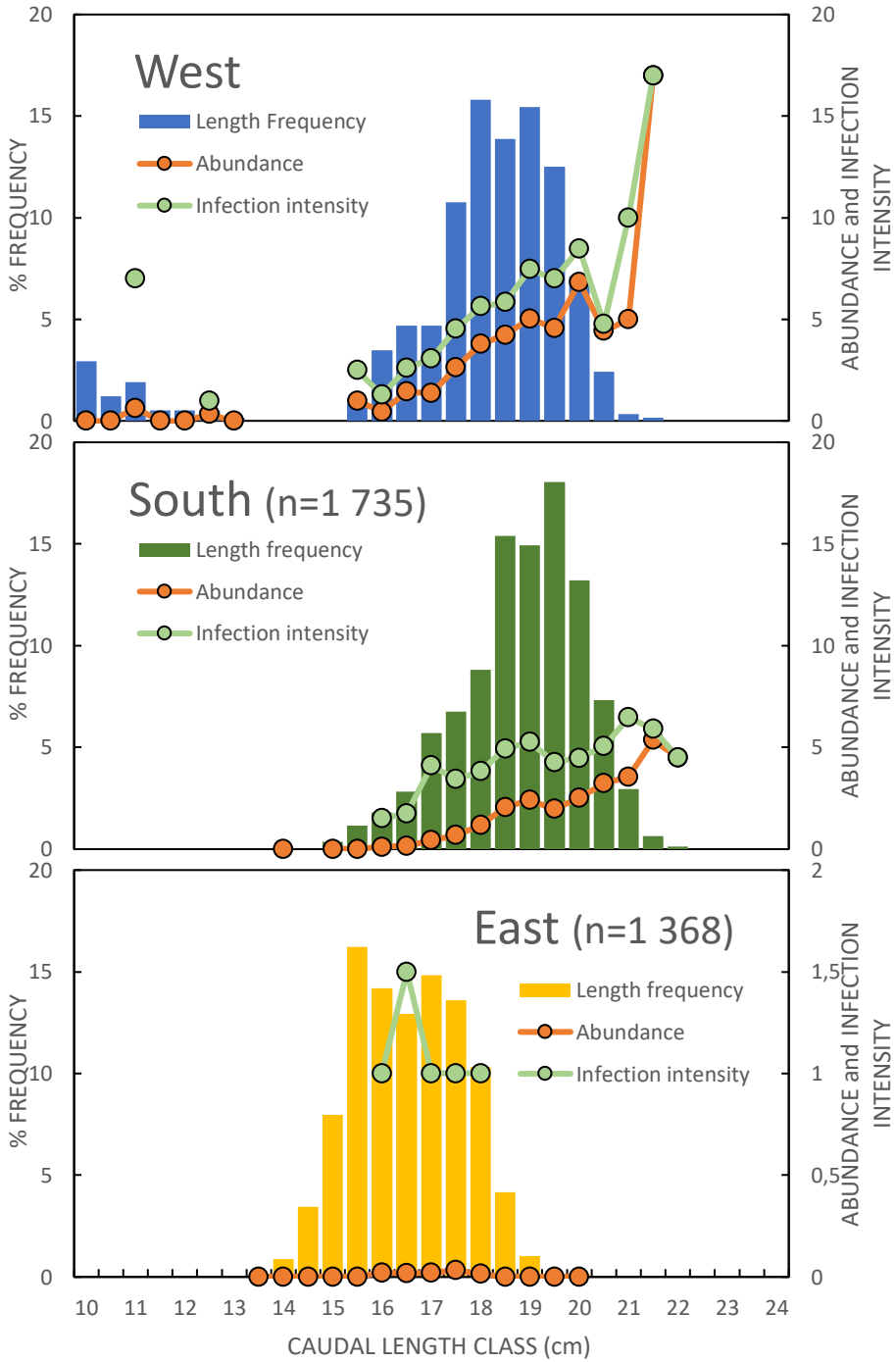
Comparing *C. physalis* prevalence and infection intensity in sardine from the West and South (recruit survey; commercial catches), and E (sardine run) coasts for Jun-Aug (winter) only, 2011-2018



PARASITE BIOTAG (iv)

Prevalence-at-length (left), and infection intensity (# parasites/infected fish)- and abundance (# parasites/fish)-at-length (right)

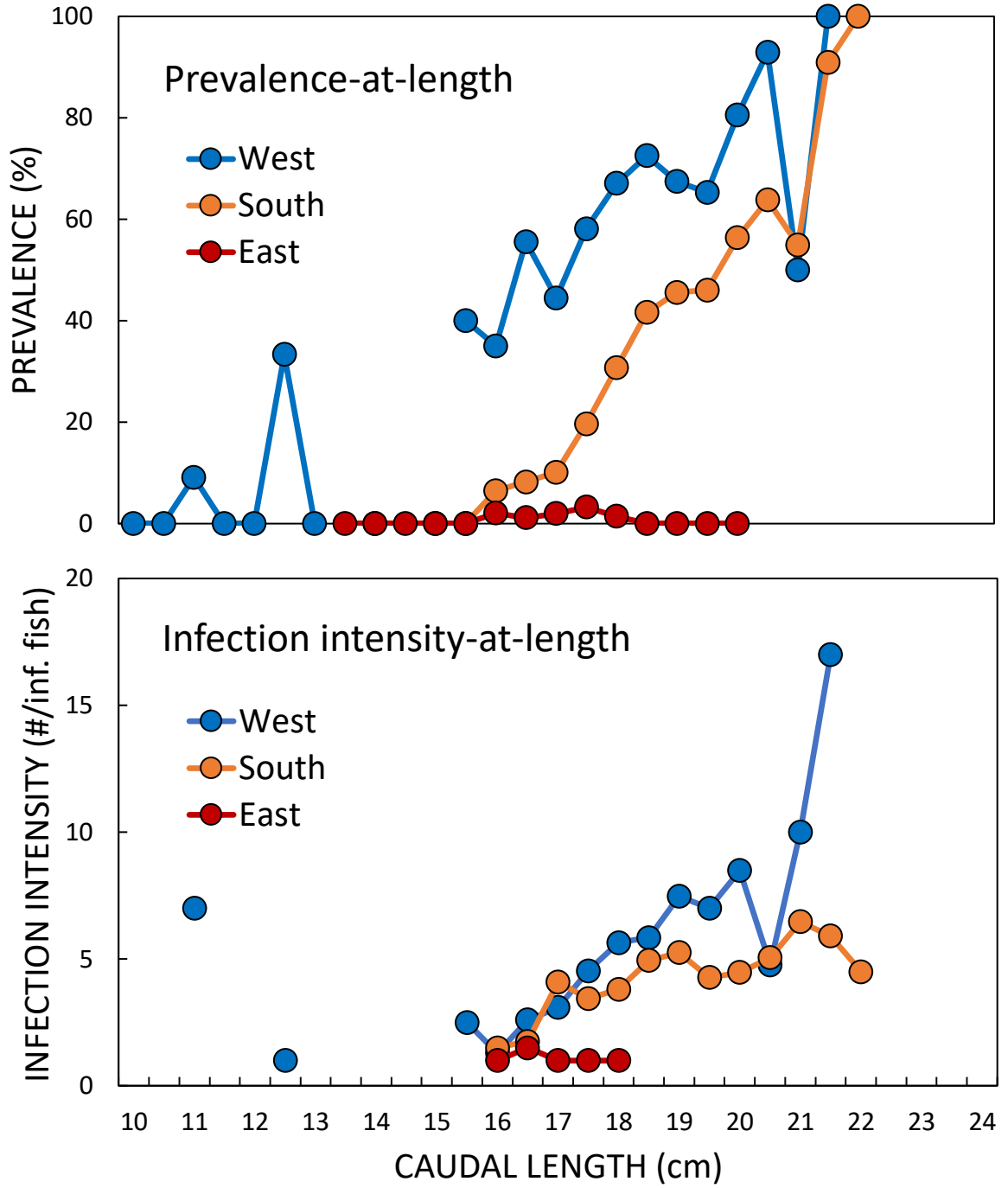




PARASITE BIOTAG (v)

Overall prevalence (not adjusted for fish size effect)
West: 348/576 = 64,4%
South: 709/1735 = 40,9%
East: 18/1386 = 1,3%

Prevalence-at-length highest in sardine from West and then South coasts; very low in sardine from East coast



PARASITE BIOTAG (vi)

Sardine become infected at a smaller size (9,0 cm here but infection at 7,0 cm observed) off the West than the South (11,5 cm) coast; higher prevalence at length for fish off the West than South coast

PBS data used as input for stock assessment model

Comparing prevalence-at-length of sardine off West and South coasts from Pelagic Biomass (spring) surveys and commercial catch samples (Oct-Nov), 2010-2018