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Comparison between different modeling techniques for assessing the role of environmental variables in predicting the catches of major pelagic fishes off India's north-west coast

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Supplementary Tables

Table S1 — Summary of environmental variables used in fish prediction modelling

Environmental variable	Purposes	Authors
Chl-*a*	Use of different approaches to model catch per unit effort (CPUE) abundance of fish	Yadav *et al*.[4]
SST	Prediction of swordfish (*Xiphias gladius*) catch rates	Damalas *et al*.[6]
SST (Mean, Maximum, Minimum)	Forecasting the loliginid and ommastrephid landings	Georgakarakos *et al*.[9]
Chl-*a* and Kd	A comparison of different fuzzy inference systems for prediction of Catch per Unit Effort (CPUE) of fish	Yadav *et al*.[14]
SST, Chl-*a*, and PAR	Prediction of mackerel Landings	Madhavan *et al*.[18]
SST, Air temperature, wind speed, and sea level pressure	Modeling and forecasting monthly fisheries catches: comparison of regression, univariate and multivariate time series methods	Stergiou *et al*.[19]

a)

Table S2 — (a-c) A matrix containing input – hidden-output neuron connection weights

Hidden neuron → / Input & output ↓	1	2	3
sst	0.1021	6.8783	-0.0078
chl	3.4919	1.5134	-2.2749
kd	-0.455	1.7011	-0.7688
par	2.9345	-0.4079	-0.9806
Output(Indian Mackerel catch/landing)	-1.3414	-0.0923	-0.4522

b)

Hidden neuron → / Input & output ↓	1	2	3
sst	-1.7505	-0.3909	0.5943
chl	4.8738	0.979	1.524
kd	1.4973	2.245	1.7134
par	-0.9898	0.8679	1.2841
Output(Horse Mackerel catch/landing)	-0.604	0.0578	-0.6338

c)

Hidden neuron → / Input & output ↓	1	2	3
sst	2.3909	-18.0816	-9.3533
chl	1.0071	8.6775	-5.7215
kd	-1.7979	2.5825	6.6857
par	-1.5086	12.423	-16.7278
Output(Bombay duck catch/landing)	-10.4715	-0.3626	0.5138

Table S3 — Canonical correlations between two sets of variables (Gujarat region)

Root no.	Eigen value	Pct	Cum.Pct	Canon. Cor.	Sq. Cor.
1	1.2300	72.02	72.02	0.74	0.55
2	0.0292	17.146	89.17	0.47	0.22
3	0.1074	6.292	95.46	0.31	0.09
4	0.0775	4.53	100.00	0.26	0.07

(Pct – percentage; CumPct - Cumulative percentage; Canon. Cor. - Canonical correlation; Sq. Cor. - Square correlation)

Table S4 — Dimension reduction analysis (Gujarat region)

Roots	Wilks lambda	F	Sig. of F (*P*-value)
1 TO 4	0.29061	2.91606	0.00
2 TO 4	0.64815	1.46245	0.11
3 TO 4	0.83799	1.05332	0.40
4 TO 4	0.92806	1.12396	0.35

Table S5 — Variance in dependent variables explained by canonical variables (Gujarat region)

Canonical Variable	Pct Var DEP	Cum Pct DEP	Var COV	Cum Pct COV
1	27.52724	27.52724	5.18494	15.18494
2	9.19074	36.71798	2.08208	17.26702
3	18.12729	54.84527	1.75929	19.02631
4	23.81259	78.65785	1.71304	20.73934

(Pct Var DEP - Percent variance in dependent variables; Cum Pct DEP - Cumulative percent variance in dependent variable; Var COV - percent variance in covariates or independent variables; Cum Pct COV - Cumulative percent variance in covariates or independent variables)

Table S6 — Variance in independent variables explained by canonical variables (Gujarat region)

Canonical Variable	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	15.10619	15.10619	27.38449	27.38449
2	4.75063	19.85682	20.97031	48.35479
3	2.75461	22.61143	28.38276	76.73756
4	1.67346	24.28489	23.26244	100.0000

Table S7 — Correlations between the variables and related canonical variates (canonical loadings; Gujarat region)

	V1	**V2**	**V3**	**V4**		**U1**	**U2**	**U3**	**U4**
Indian Mackerel	0.1257	0.2674	-0.5360	0.5872	SST	-0.8035	-0.8951	0.1638	-0.4914
Horse Mackerel	0.1996	-0.4787	0.5037	0.6861	Chl	0.4136	0.0610	**-0.6127**	0.6705
Bombay duck	0.6989	0.4826	0.3909	0.1806	Kd	0.3336	0.0716	**-0.7573**	0.5568
Other sardine	0.2841	0.1677	-0.4357	0.6571	PAR	-0.7802	-0.1694	0.3992	-0.0386

(V1, V2, V3, V4 represents canonical variates for dependent variables; and U1, U2, U3, U4 represents canonical variate for independent variables)

Table S8 — Correlation matrix among independent and dependent variables

	Chl	SST	PAR	Kd	Indian mackerels	Bombay duck	horse mackerel	Other sardine
Chl	1							
SST	-.406**	1						
PAR	-.658**	.187	1					
Kd	.991**	-.399**	-.667**	1				
Indian_mackeral	.290*	-.359**	-.148	.290*	1			
Bombay duck	.321**	-.174	-.415**	.363**	.353**	1		
horse mackerel	.082	.162	-.017	.056	.123	.079	1	
other_sardine	.292*	.297*	-.155	-.251*	.660**	.371**	.222	1

**. Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed)

Table S9 — Canonical correlations between two sets of variables (Maharashtra region)

Root no.	Eigen value	Pct	Cum. Pct	Canon. Cor.	Sq. Cor.
1	0.5170	75.1102	75.1102	0.5838	0.3408
2	0.1271	18.4696	93.5798	0.3358	0.1128
3	0.0390	5.6753	99.2551	0.1939	0.0376
4	0.0051	0.7448	100	0.0714	0.0051

Table S10 — Dimension reduction analysis (Maharashtra region)

Roots	Wilks Lambda	F	Sig. of F (*P*-value)
1 TO 4	0.55996	1.81505	0.021
2 TO 4	0.84948	0.8148	0.635
3 TO 4	0.95749	0.43182	0.856
4 TO 4	0.9949	0.15383	0.858

Table S11 — Variance in dependent variables explained by canonical variables (Maharashtra region)

Canonical Variable	Pct Var DEP	Cum Pct DEP	Var COV	Cum Pct COV
1	26.9098	26.9098	9.1715	9.1715
2	21.1402	48.0500	2.3846	11.5562
3	16.4468	64.4968	0.6183	12.1746
4	19.0900	83.5869	0.0973	12.272

Table S12 — Variance in independent variables explained by canonical variables (Maharashtra region)

Canonical Variable	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	8.1803	8.1803	24.0014	24.0014
2	3.2612	11.4415	28.9112	52.9126
3	0.9829	12.4245	26.1434	79.0561
4	0.1068	12.5313	20.9439	100.000

Table S13 — Correlations between the variables and related canonical variates (canonical loadings; Maharashtra region)

	V1	V2	V3	V4		U1	U2	U3	U4
Indian Mackerel	-0.4128	-0.5058	0.5286	-0.2999	SST	-0.7621	0.9306	-0.1166	0.1000
Horse Mackerel	-0.6365	0.1212	-0.3063	0.6837	Chl	-0.2512	0.4935	0.8225	-0.5015
Oil Sardine	0.1509	-0.6205	-0.3440	0.0951	Kd	-0.4807	-0.1951	0.5838	-0.6244
Bombay duck	0.8499	-0.3378	0.3931	0.0323	PAR	-0.7453	0.3935	-0.1212	0.4315

Table S14 — Quarterly average (from the year -1997 to 2013) Chl-*a* (in mg/m^3) for Gujarat & Maharashtra region

Quarter of Year → / Region ↓	1st quarter	2nd Quarter	3rd Quarter	4th Quarter
Gujarat	2.44	1.48	2.87	2.49
Maharashtra	2.42	1.76	3.50	2.87

Table S15 — Quarterly average (from the year -1997 to 2013) SST (in °C) & PAR (in Einstein/m^2/day) for Gujarat & Maharashtra region

Quarter of Year → / Region ↓	1st quarter		2nd Quarter		3rd Quarter		4th Quarter	
	SST	PAR	SST	PAR	SST	PAR	SST	PAR
Gujarat	24.80	43.29	28.43	50.09	28.10	41.18	27.57	38.30
Maharashtra	26.64	44.62	29.39	51.87	28.76	42.60	28.42	39.73

Supplementary Figures

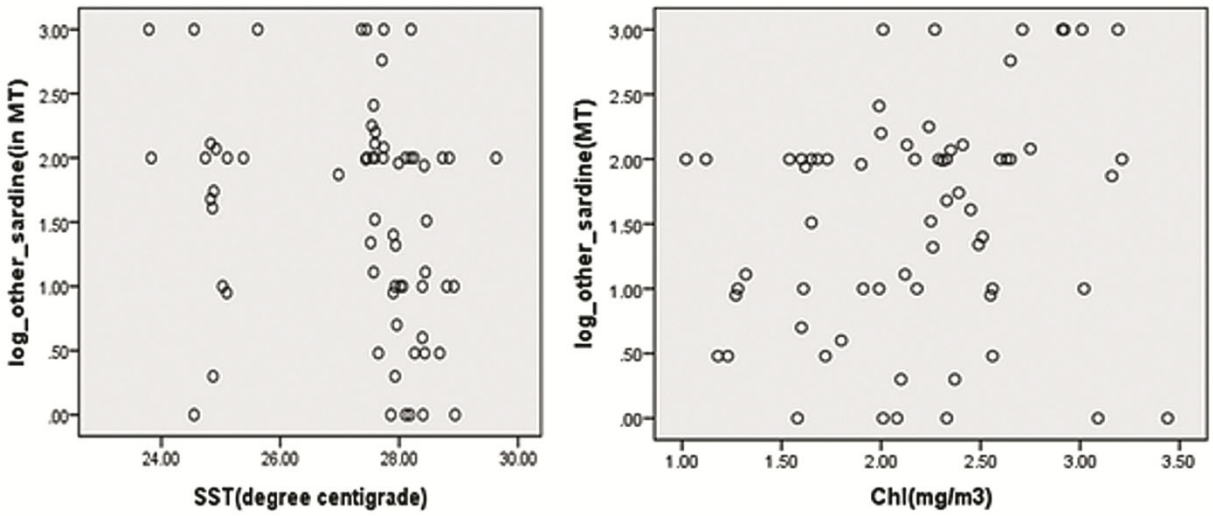

Fig. S1 — Scatter plot of other sardines with SST and Chl-*a* for Gujarat region

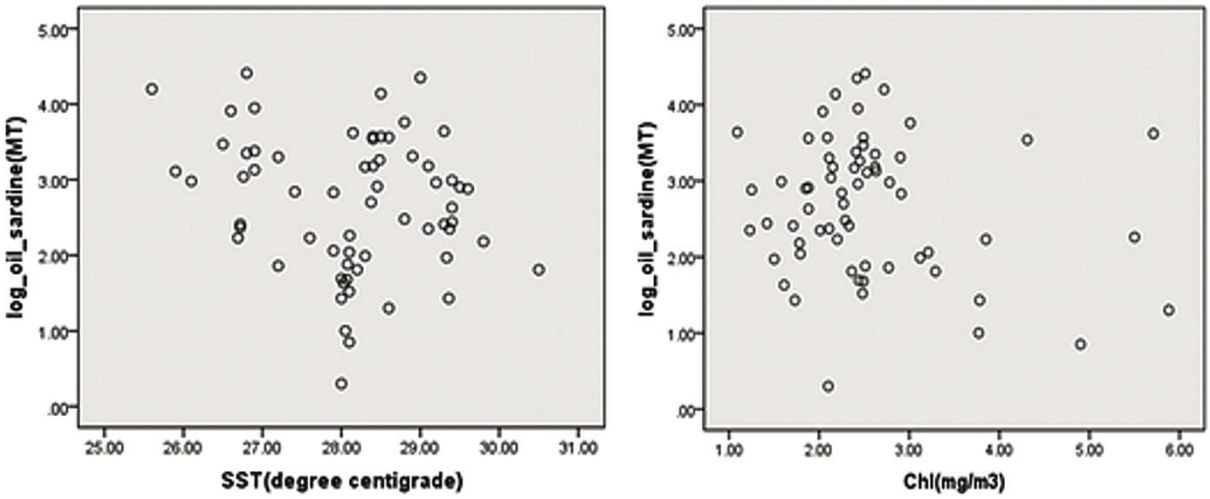

Fig. S2 — Scatter plot of Oil sardine with SST and Chl-*a* for Maharashtra region

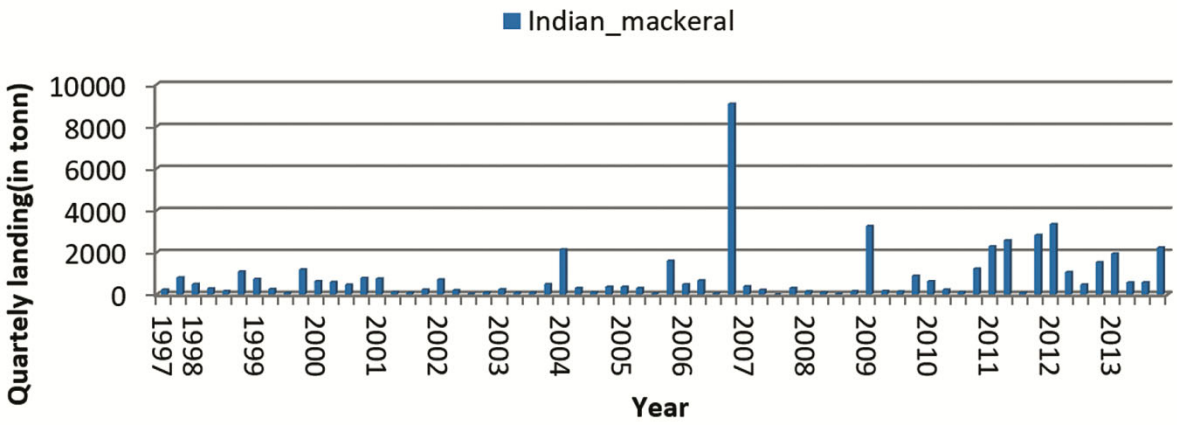

Fig. S3 — Variation of Indian mackerel of Gujarat region over all the quarters of the years

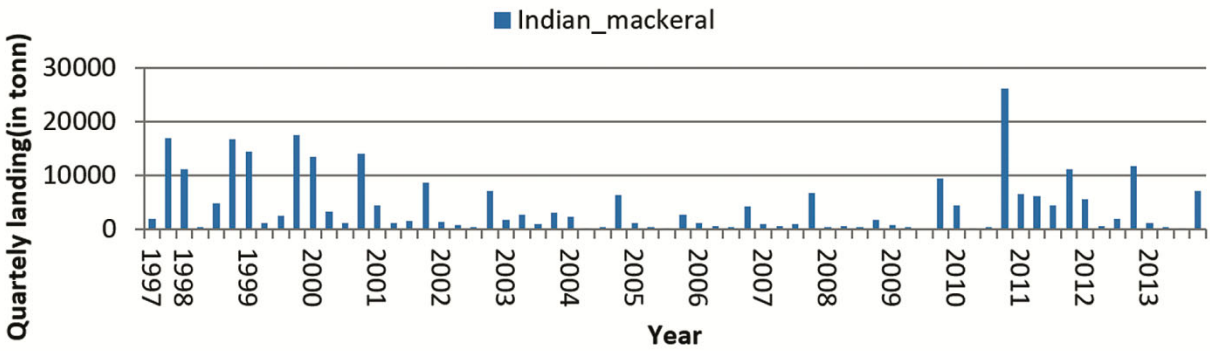

Fig. S4 — Variation of Indian mackerel of Maharashtra region over all the quarters of the years

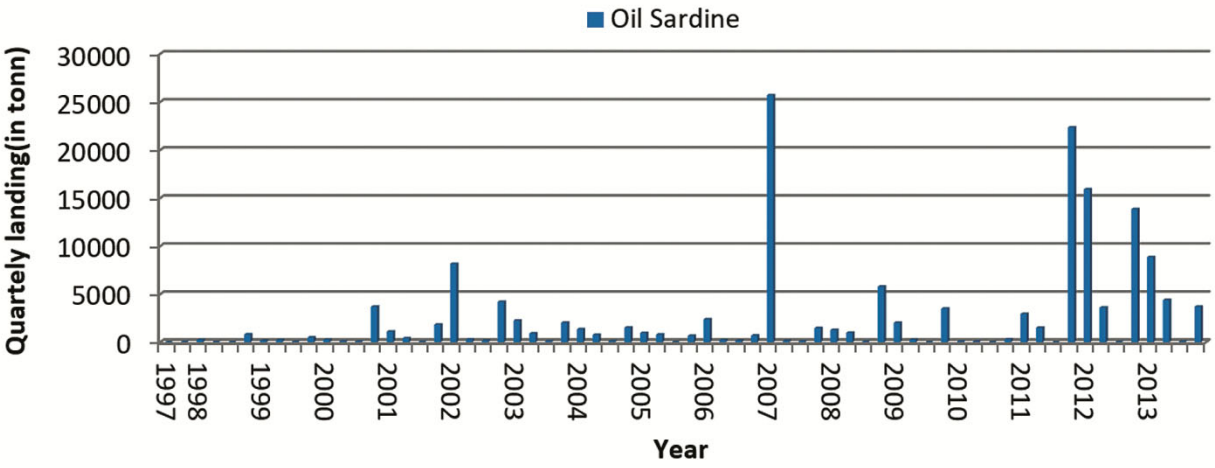

Fig. S5 — Variation of Oil sardine of Maharashtra region over all the quarters of the years

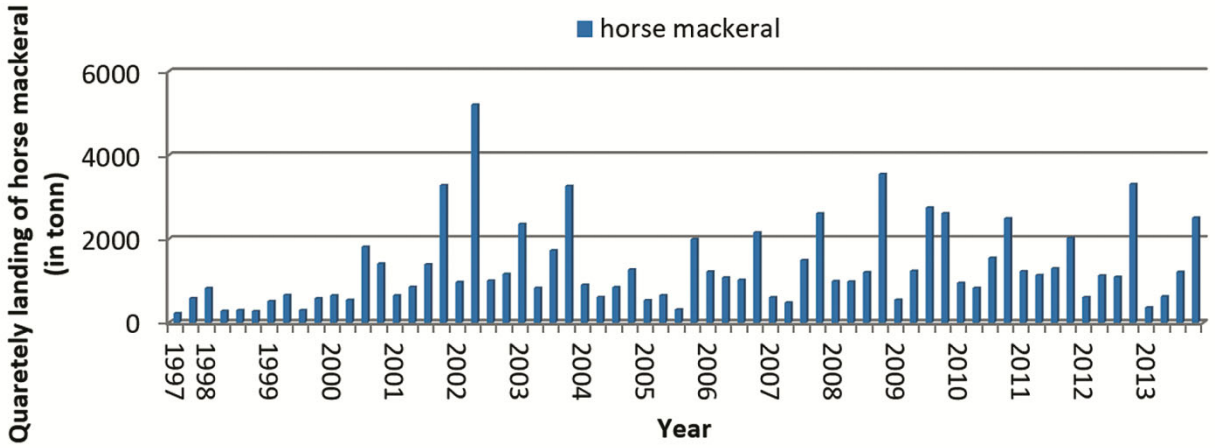

Fig. S6 — Variation of Horse mackerel of Maharashtra region over all the quarters of the years

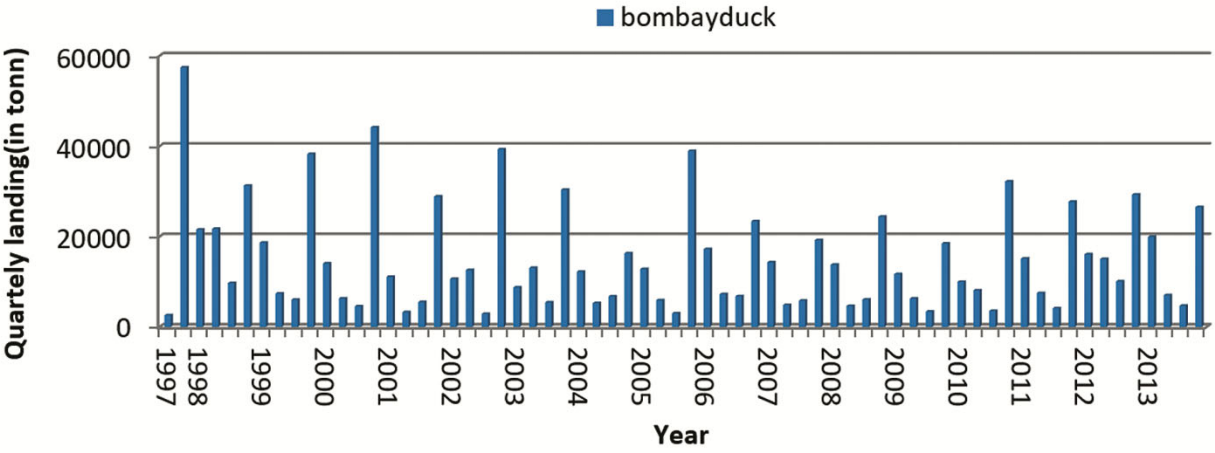

Fig. S7 — Variation of Bombay duck of Gujarat region over all the quarters of the years

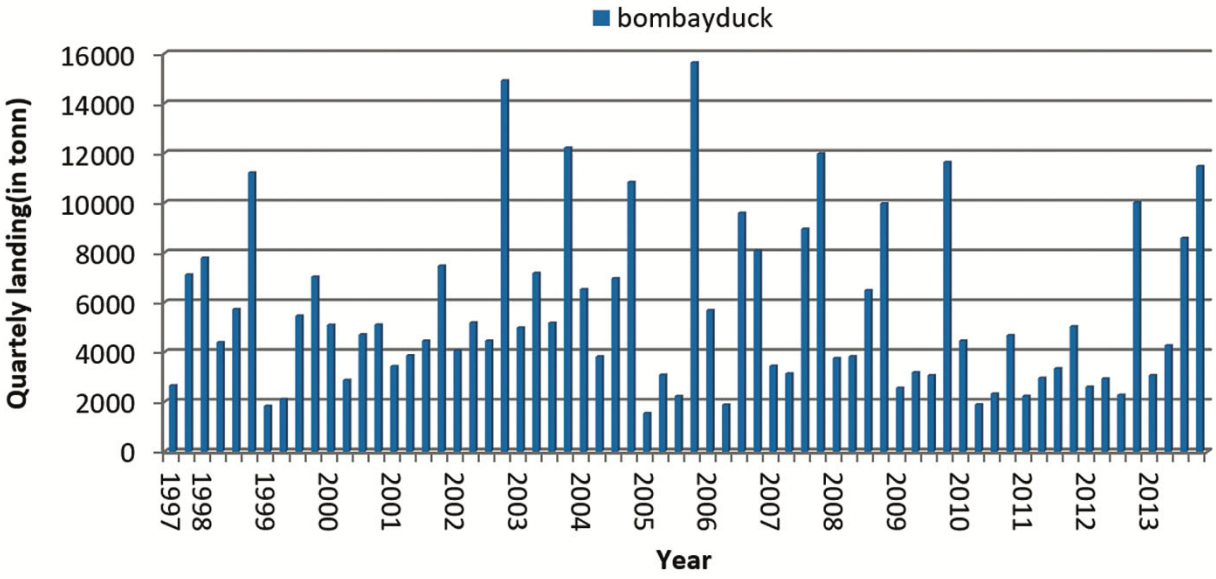

Fig. S8 — Variation of Bombay duck of Maharashtra region over all the quarters of the years

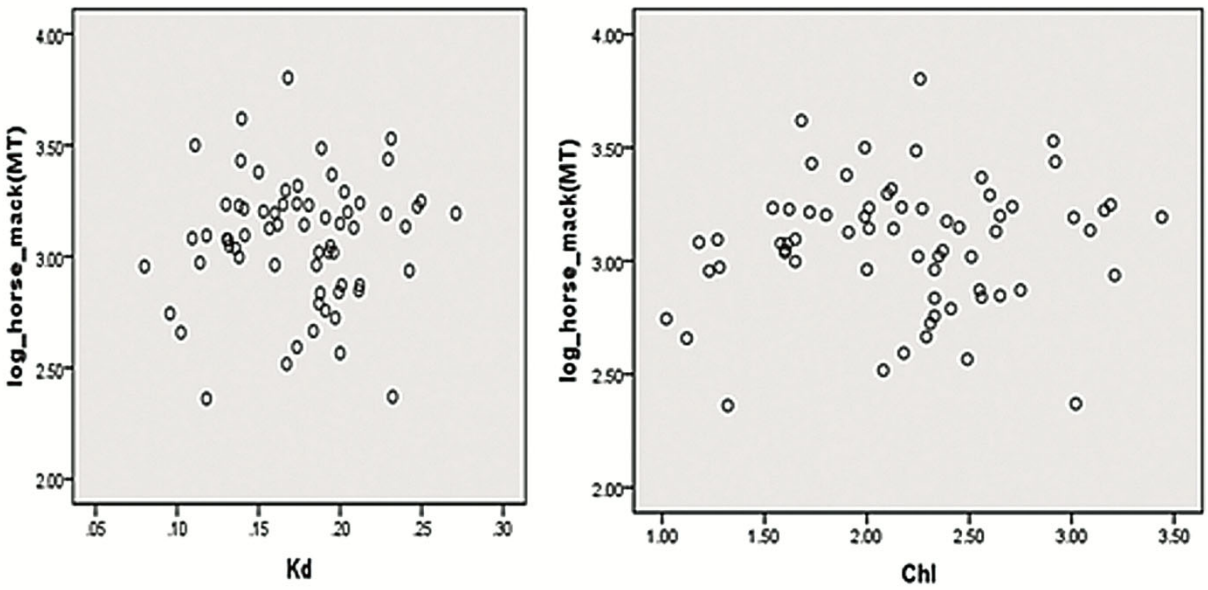

Fig. S9 — Scatter plot of Horse mackerel with Kd and Chl-*a* for Gujarat region

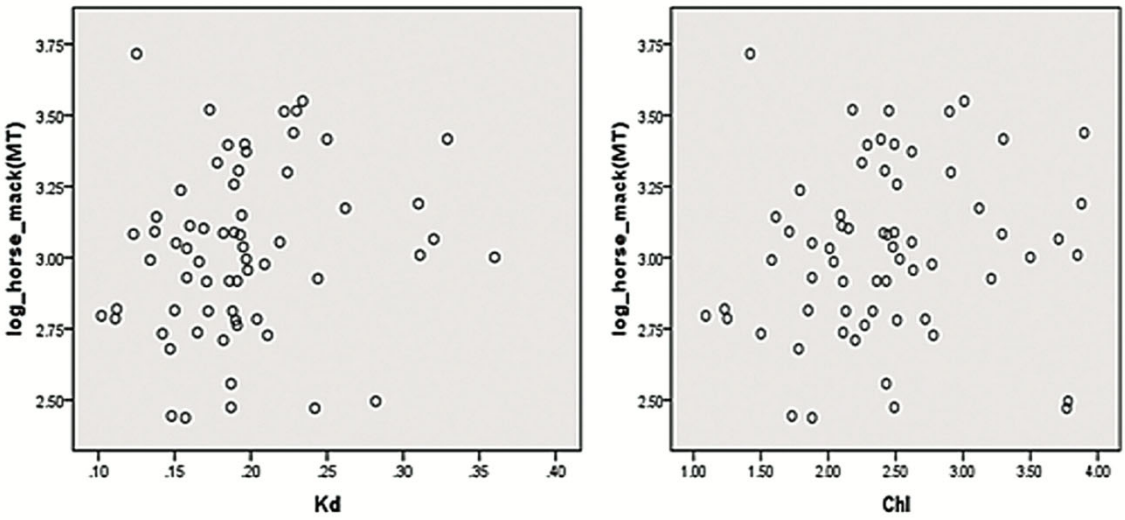

Fig. S10 — Scatter plot of Horse mackerel with Kd and Chl-*a* for Maharashtra region

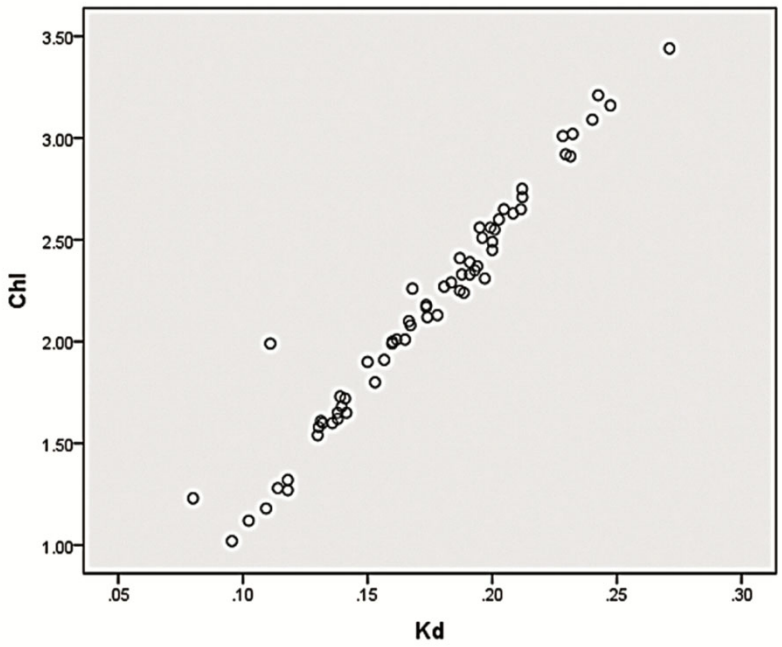

Fig. S11 — Scatter plot of Kd and Chl-*a* for Gujarat region

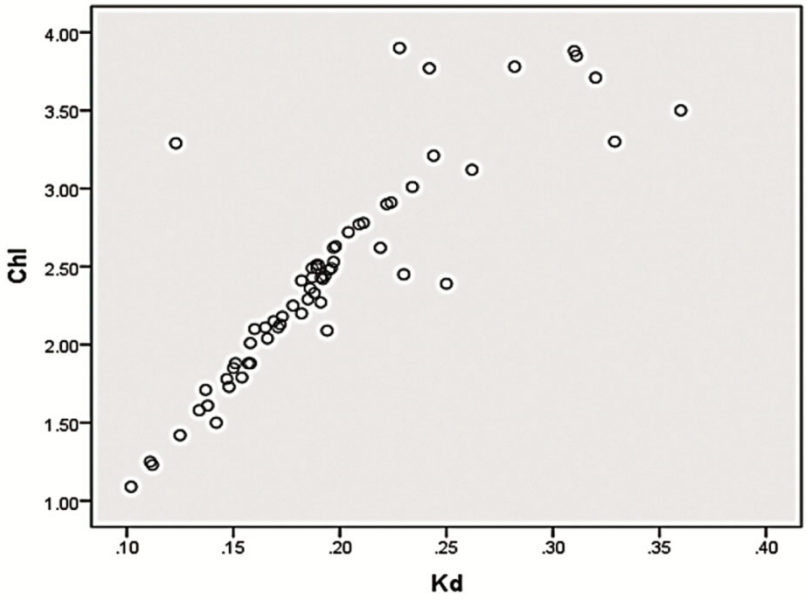

Fig. S12 — Scatter plot of Chl-*a* and Kd for Maharashtra region