Reviews in Fish Biology and Fisheries

The biology and ecology of tropical marine sardines and herrings in Indo-West Pacific fisheries: a review

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Supplementary Information

Online Resource 1: Reported clupeoid capture production in Indo-West Pacific marine areas (FAO fishing areas 51, 57 and 71)

Data used in Figure 1.

DATA SOURCES AND TREATMENT OF EXTRACTED DATA FOR FIGURE 1A

Capture production data extracted from FAO FishstatJ (FAO 2019)

FAO (2019). Fishery and Aquaculture Statistics. Global capture production 1950-2017 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2019. www.fao.org/fishery/statistics/software/fishstatj/en

51 Indian Ocean, Western
57 Indian Ocean, Eastern
71 Pacific Ocean, Western Central

Data used in Fig. 1A	Data source	Extract criteria	Extracted data description	Treatment of extracted data		
1. Annual clupeoid capture production in the IWP, by family (updated classification) (all years)	FAO (2019)	FAO fishing areas: 51, 57, 71 - all marine (inland areas not included) Order: Clupeiformes All data (1950-2017)	Annual Clupeiform production (in marine areas) in the Indo-West Pacific disaggregated by species	**(1) Family classifications updated** Families of 3 species revised to current taxonomy: <u>Species (Family in FAO 2019)</u> — <u>Family (updated)</u> *Etrumeus teres* (CLUPEIDAE) — DUSSUMIERIIDAE *Dussumieria acuta* (CLUPEIDAE) — DUSSUMIERIIDAE *Spratelloides gracilis* (CLUPEIDAE) — SPRATELLOIDIDAE (Families of all other species remained the same)	**(2) "Diadromous fish' (ISSCAAP division) separated out** <u>Marine family groups</u>: CLUPEIDAE, Clupeoidei (nei), ENGRAULIDAE, CHIROCENTRIDAE, DUSSUMIERIIDAE, SPRATELLOIDIDAE <u>Diadromous family groups</u>: CLUPEIDAE (diadromous), Clupeoidei (nei) (diadromous), PRISTIGASTERIDAE (diadromous)	**(3) Aggregated by family** Data aggregated by family (using updated classification) with marine and diadromous species in separate groups.
2. Annual IWP clupeoid capture production as a % of all IWP fish landings (all years)	FAO (2019)	FAO fishing areas: 51, 57, 71 - all marine (inland areas not included) ISSCAAP division: marine fishes & diadromous fishes All data (1950-2017)	Annual capture production of all marine & diadromous fish (in marine areas) in the Indo-West Pacific (aggregated)	**Calculated the percent of global clupeoid landings caught in the IWP for each year of available data (1950-2017)** Data set 1 (Annual clupeoid capture production in the IWP (aggregated) / Annual capture production of all marine & diadromous fish (in marine areas) in the Indo-West Pacific (aggregated) x 100		
3. Annual IWP clupeoid capture production as a % of global clupeiform landings in marine areas	FAO (2019)	FAO fishing areas: marine areas (inland areas not included) Order: Clupeiformes All data (1950-2017)	Annual global Clupeiform capture production in marine areas (aggregated)	**Calculated the percent of global clupeoid landings caught in the IWP for each year of available data (1950-2017)** Data set 1 (Annual clupeoid capture production in the IWP (aggregated) / Annual global Clupeiform capture production in marine areas (aggregated) x 100		

DATA SOURCES AND TREATMENT OF EXTRACTED DATA FOR FIGURE 1B

Capture production data extracted from FAO FishstatJ (FAO 2019)

FAO. 2019. Fishery and Aquaculture Statistics. Global capture production 1950-2017 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2019. www.fao.org/fishery/statistics/software/fishstatj/en

Data used in Fig. 1B	Data source	Extract criteria	Extracted data description	Treatment of extracted data	
Average annual clupeoid capture production in the IWP (2008-2017) - by family (updated classification). - for Clupeidae family, by species grouping & country.	FAO (2019) With some "Sardinella spp." and "Clupeoidei nei" landings disaggregated using: Philippines: Bureau of Fisheries and Aquatic Resources (2008-2017) India: Central Marine Fisheries Research Institute (2008-2017) Australia: Mobsby and Koduah (2017) Malaysia: Department of Fisheries Malaysia reports (2008-14, 16-17) *(Further details in data tables below)*	FAO fishing areas: 51, 57, 71 - all marine (inland areas not included) Order: Clupeiformes Last 10 years (2008-2017)	Annual clupeoid production in the IWP disaggregated by species & country (last 10 years of data)	***FIGURE 1B ORIGINAL DATASET*** Source: FAO 2019 with updated family classification **Family classifications updated** Families of 3 species revised to current taxonomy: <u>Species (Family in FAO 2019)</u> — <u>Family (updated)</u> *Etrumeus teres* (CLUPEIDAE) — DUSSUMIERIIDAE *Dussumieria acuta* (CLUPEIDAE) — DUSSUMIERIIDAE *Spratelloides gracilis* (CLUPEIDAE) — SPRATELLOIDIDAE (Families of all other species remained the same) **'Diadromous fish' (ISSCAAP division) separated out** <u>Marine family groups</u>: CLUPEIDAE, Clupeoidei (nei), ENGRAULIDAE, CHIROCENTRIDAE, DUSSUMIERIIDAE, SPRATELLOIDIDAE <u>Diadromous family groups</u>: CLUPEIDAE (diadromous), Clupeoidei (nei) (diadromous), PRISTIGASTERIDAE (diadromous)	***FIGURE 1B COMPILED DATASET (used for Figure 1B)*** Source: FAO 2019 with some "Sardinella spp." and "Clupeoidei nei" landings disaggregated using National Reports National reports of countries with high landings recorded as aggregated "Sardinella spp." and "Clupeoidei" were used (where available) to estimate species composition of these categories for each country (see Tables below). *Reports were available for:* **Philippines:** Bureau of Fisheries and Aquatic Resources (2008-2017) **India:** Central Marine Fisheries Research Institute (2008-2017) **Australia:** Mobsby and Koduah (2017) Australian fisheries and aquaculture statistics 2016 Fisheries Research and Development Corporation project 2017-095. ABARES, Canberra **Malaysia:** Department of Fisheries Malaysia reports (2008-14, 16-17) A "FIGURE 1B COMPILED DATASET" was created to include this disaggregated data. Where total landings volumes differed between FAO and National reports, FAO volumes were retained but disaggregated using species % composition from National reports. Average annual production (2008-2017) (from FIGURE 1B COMPILED DATASET) was calculated and used to create Figure 1B.

FIGURE 1B ORIGINAL DATASET: Annual clupeoid marine capture production in the Indo-West Pacific (FAO fishing areas 51, 57 and 71), disaggregated by species & country, last 10 years of available data (2008-2017)
(Source: FAO 2019; with updated family classification)

Country (Country)	Species (ASFIS species)	Species (ISSCAAP division)	Family (FAO data)	Family (updated classification)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
Iran (Islamic Rep. of)	Chirocentrus nudus	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	5168	5920	8014	5824	6540	6623	8242	9032	5990	7349	**6870**
Tanzania, United Rep. of	Chirocentrus nudus	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	0	0	397	381	377	398	319	680	672	707	**393**
Saudi Arabia	Chirocentrus nudus	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	43	29	19	27	28	39	30	31	36	40	**32**
Thailand	Chirocentrus dorab	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	5201	5048	5693	4836	4969	3178	3274	3119	6100	6222	**4764**
Pakistan	Chirocentrus dorab	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	1288	1151	1228	1324	1503	1615	2621	2783	1697	1842	**1705**
India	Chirocentrus spp	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	37470	37391	32051	23041	29944	39381	20282	16922	17657	18566	**27271**
Indonesia	Chirocentrus spp	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	20742	16934	16254	14272	14377	13838	13835	21778	9771	16698	**15850**
Malaysia	Chirocentrus spp	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	5381	5301	5743	5665	4518	4535	4097	3814	4844	5154	**4905**
Philippines	Chirocentrus spp	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	383	430	444	423	405	387	346	324	333	288	**376**
Iraq	Chirocentrus spp	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	270	318	30	5	530	180	405	215	190	171	**231**
Singapore	Chirocentrus spp	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	17	43	37	27	42	42	48	39	55	31	**38**
Kenya	Chirocentrus spp	Marine fishes	CHIROCENTRIDAE	CHIROCENTRIDAE	0	0	0	0	0	0	0	0	0	246	**25**
Indonesia	Stolephorus spp	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	199675	192966	175726	204839	203220	191094	199226	206635	191842	292657	**205788**
Philippines	Stolephorus spp	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	73235	81842	80183	75867	71165	68425	71855	64007	55761	50174	**69251**
Malaysia	Stolephorus spp	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	19600	20735	18605	19085	19452	20643	24837	22093	36027	33094	**23417**
India	Stolephorus spp	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	0	0	0	0	0	0	0	63382	61571	64859	**18981**
United Arab Emirates	Stolephorus spp	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	696	3	0	525	0	0	0	0	0	0	**122**
Thailand	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	144074	144732	138643	142834	129382	116710	127691	102108	129608	125051	**130083**
India	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	108029	105911	107536	113916	114449	124276	143545	82905	79863	80354	**106078**
Pakistan	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	6016	6053	6112	6224	6245	6348	6382	6452	6632	6655	**6312**
Oman	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	1596	889	5898	3015	3590	4274	7925	7700	8171	8102	**5116**
Zanzibar	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	1235	1247	1257	1775	1096	1170	1605	1344	1454	1550	**1373**
Comoros	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	1100	1100	1100	1100	1000	500	14	14	14	0	**594**
Kenya	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	0	0	0	0	0	0	0	0	0	263	**26**
Australia	Engraulidae	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	0	0	0	0	0	0	1	0	0	1	**0**
Egypt	Encrasicholina punctifer	Marine fishes	ENGRAULIDAE	ENGRAULIDAE	5336	4230	3775	1719	338	3058	3408	3110	3152	3300	**3143**
Indonesia	Dussumieria acuta	Marine fishes	CLUPEIDAE	DUSSUMIERIIDAE	19213	20570	20790	15334	25123	31549	29138	27862	38821	12548	**24095**
Philippines	Dussumieria acuta	Marine fishes	CLUPEIDAE	DUSSUMIERIIDAE	11426	10614	10178	10730	7186	7309	6697	5814	7891	6066	**8391**
India	Sardinella longiceps	Marine fishes	CLUPEIDAE	CLUPEIDAE	318614	323955	320227	381713	404298	376189	544684	265667	244992	337390	**351773**
Oman	Sardinella longiceps	Marine fishes	CLUPEIDAE	CLUPEIDAE	33466	36602	32070	27931	43549	52544	63439	82654	94142	121800	**58820**
Iran (Islamic Rep. of)	Sardinella longiceps	Marine fishes	CLUPEIDAE	CLUPEIDAE	27244	21187	20838	32359	33263	45218	58839	59055	69144	87706	**45485**
Yemen	Sardinella longiceps	Marine fishes	CLUPEIDAE	CLUPEIDAE	17731	43462	36477	39031	55740	52704	47367	38850	33000	28050	**39241**
Pakistan	Sardinella longiceps	Marine fishes	CLUPEIDAE	CLUPEIDAE	31474	26937	20127	22659	23304	23654	27372	27782	26640	26993	**25694**
Indonesia	Sardinella gibbosa	Marine fishes	CLUPEIDAE	CLUPEIDAE	231289	237090	255593	246175	161839	175883	166670	148050	186980	78923	**188849**
Indonesia	Sardinella lemuru	Marine fishes	CLUPEIDAE	CLUPEIDAE	82417	108772	71611	32475	45807	45740	53895	68102	40069	39682	**58857**
Philippines	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	369199	467853	448556	338076	346938	323744	354423	378897	361794	325419	**371490**
Thailand	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	96455	100027	92588	62580	73325	71897	75359	81051	72729	71794	**79781**
Tanzania, United Rep. of	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	11832	14300	8015	7697	7619	8040	8004	8023	1784	1786	**7710**
Egypt	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	3281	7295	4701	4840	5328	4146	4587	5091	6888	7100	**5326**
United Arab Emirates	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	3263	758	819	773	1470	1200	900	900	900	900	**1188**
Zanzibar	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	1166	1172	1199	1369	799	936	1076	1045	1098	1191	**1105**
Comoros	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	1150	1150	1150	1150	1150	1180	1216	1228	45	83	**950**
Bahrain	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	5	6	44	20	68	1	101	95	95	95	**53**
Qatar	Sardinella spp	Marine fishes	CLUPEIDAE	CLUPEIDAE	0	0	0	0	0	0	0	0	0	47	**5**
Indonesia	Amblygaster sirm	Marine fishes	CLUPEIDAE	CLUPEIDAE	5618	4893	4318	6791	49110	45851	46578	25473	40387	11794	**24081**
Fiji	Herklotsichthys quadrimaculat.	Marine fishes	CLUPEIDAE	CLUPEIDAE	30	25	15	12	15	15	15	15	16	16	**17**
South Africa	Sardinops ocellatus	Marine fishes	CLUPEIDAE	CLUPEIDAE	0	12	0	0	0	0	0	0	0	0	**1**

Country (Country)	Species (ASFIS species)	Species (ISSCAAP division)	Family (FAO data)	Family (updated classification)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
India	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	91328	89637	89236	93330	100299	93959	292875	339106	266307	301544	**175762**
Sri Lanka	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	66890	71580	74310	101810	118160	125680	132829	128895	132460	127305	**107992**
Malaysia	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	40315	35957	33407	37126	37507	44562	39642	41689	38423	47170	**39580**
Australia	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	33121	31658	39673	38225	41319	38436	35866	38759	44898	44301	**38626**
Pakistan	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	16254	14818	17323	18959	19470	19862	20779	21326	15614	16168	**18057**
Indonesia	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	0	0	0	0	0	0	0	10499	18804	0	**2930**
Zanzibar	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	2405	2446	2473	2026	1893	1987	2047	2140	2160	2187	**2176**
Iran (Islamic Rep. of)	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	310	903	586	1144	1365	1163	1603	1950	2824	3171	**1502**
Philippines	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	505	592	601	537	497	458	391	362	442	406	**479**
Kenya	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	142	121	139	153	162	170	168	167	1339	575	**314**
Eritrea	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	300	300	300	300	300	300	300	300	300	300	**300**
Saudi Arabia	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	332	396	196	216	211	290	267	256	279	280	**272**
Brunei Darussalam	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	0	0	0	0	0	0	0	273	292	0	**57**
Kiribati	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	13	1	0	0	0	0	17	18	20	18	**9**
Singapore	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	1	1	1	1	0	1	0	0	0	0	**1**
Réunion	Clupeoidei	Marine fishes		Clupeoidei (not disaggregated)	0	0	0	0	2	0	0	1	0	0	**0**
Bahrain	Nematalosa nasus	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	263	216	205	221	289	364	300	285	285	285	**271**
Kuwait	Tenualosa ilisha	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	84	110	164	75	73	137	122	112	129	117	**112**
Iraq	Tenualosa ilisha	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	793	679	1126	156	1918	390	1086	153	900	1718	**892**
Iran (Islamic Rep. of)	Tenualosa ilisha	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	4179	4672	6431	5719	4406	3118	4148	2366	1878	1689	**3861**
India	Tenualosa ilisha	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	20369	17607	74855	30304	17840	14556	5247	20659	93679	63437	**35855**
Pakistan	Tenualosa ilisha	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	255	188	195	254	266	269	513	526	1269	1312	**505**
United Arab Emirates	Nematalosa nasus	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	29	41	45	50	61	50	40	40	40	40	**44**
Indonesia	Tenualosa toli	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	4641	4418	3084	2699	512	161	730	2385	736	2053	**2142**
Malaysia	Anodontostoma chacunda	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	4124	3042	4510	6649	5601	6990	10338	9839	10996	11642	**7373**
Indonesia	Anodontostoma chacunda	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	5526	7133	9978	8371	15252	13993	14017	15641	14395	18177	**12248**
Bangladesh	Tenualosa ilisha	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	200100	202957	198574	225325	232037	252575	257626	251815	254195	278948	**235415**
Philippines	Anodontostoma chacunda	Diadromous fishes	CLUPEIDAE	CLUPEIDAE (diadromous)	1150	1127	1197	1206	1131	1146	1111	1127	1089	1039	**1132**
Malaysia	Pellona ditchela	Diadromous fishes	PRISTIGASTERIDAE	PRISTIGASTERIDAE (diadromous)	15705	12301	10256	10076	13703	17620	19497	19662	18414	18933	**15617**
Philippines	Pellona ditchela	Diadromous fishes	PRISTIGASTERIDAE	PRISTIGASTERIDAE (diadromous)	1207	1313	1341	1198	1104	1163	1057	947	983	905	**1122**
Malaysia	Clupeoidei	Diadromous fishes	Diadromous clupeoids nei	Diadromous clupeoids nei	850	1025	1422	1236	1399	1292	2559	3389	2060	1334	**1657**
National reports with disaggregated landings available (see below).				**TOTAL 'MARINE' CLUPEOID PRODUCTION IN IWP**	2153344	2307363	2216306	2152266	2220286	2201382	2657132	2429882	2373017	2426182	**2313716**
National reports with disaggregated landings not available/located.				**TOTAL 'DIADROMOUS' CLUPEOID PRODUCTION IN IWP**	259275	256829	313383	293539	295592	313824	318391	328946	401048	401629	**318246**
Non-highlighted rows indicate landings not considered for disaggregation (smaller catch volumes).				**TOTAL CLUPEOID PRODUCTION IN IWP**	**2412619**	**2564192**	**2529689**	**2445805**	**2515878**	**2515206**	**2975523**	**2758828**	**2774065**	**2827811**	2631962

11%

Average annual clupeoid marine capture production in the Indo-West Pacific (FAO fishing areas 51, 57 and 71) (2007-2018) - by family
SUPPLEMENTARY FIGURE S1 (BELOW) BASED ON ORIGINAL DATASET (updated family classification)

Family (updated classification)	Average (2008-2017)
CLUPEIDAE	1260427
CLUPEIDAE (diadromous)	299851
ENGRAULIDAE	570286
CHIROCENTRIDAE	62461
DUSSUMIERIIDAE	32486
PRISTIGASTERIDAE (diadromous)	16739
Clupeoidei (not disaggregated)	388056
Diadromous clupeoids nei	1657
SPRATELLOIDIDAE	0
TOTAL	**2631962**

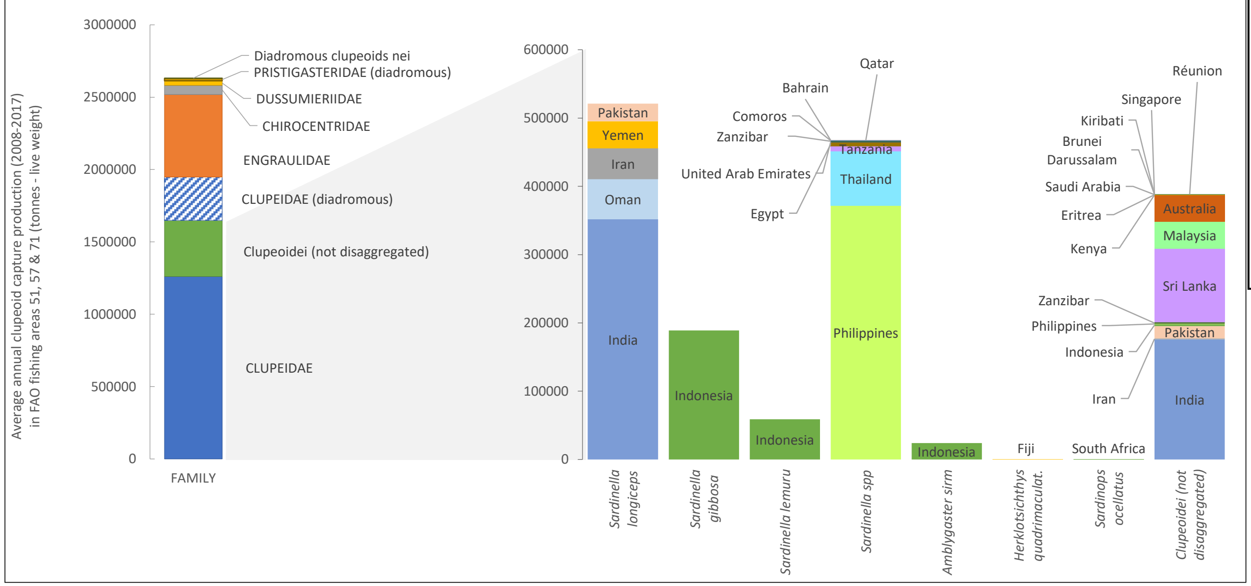
Average annual Clupeidae family (marine species) capture production in the IWP (2007-2018) - by species & country
SUPPLEMENTARY FIGURE S1 (BELOW) BASED ON ORIGINAL DATASET (updated family classification)

Country / Species	*Sardinella longiceps*	*Sardinella gibbosa*	*Sardinella lemuru*	*Sardinella spp*	*Amblygaster sirm*	*Herklotsichthys quadrimaculat.*	*Sardinops ocellatus*	*Clupeoidei (not disaggregated)*
India	351773							175762
Oman	58820							
Iran	45485							1502
Yemen	39241							
Pakistan	25694							18057
Indonesia		188849	58857		24081			2930
Philippines				371490				479
Thailand				79781				
Tanzania				7710				
Egypt				5326				
United Arab Emirates				1188				
Zanzibar				1105				2176
Comoros				950				
Bahrain				53				
Qatar				5				
Fiji						17		
South Africa							1	
Sri Lanka								107992
Malaysia								39580
Australia								38626
Kenya								314
Eritrea								300
Saudi Arabia								272
Brunei Darussalam								57
Kiribati								9
Singapore								1
Réunion								0
TOTAL	**521013**	**188849**	**58857**	**467607**	**24081**	**17**	**1**	**388056**

Supplementary Figure *Source: FAO 2019 (with updated family classification)*

Average annual clupeoid marine capture production in the Indo -West Pacific (FAO fishing areas 51, 57 and 71) (2007-2018)

(Left) By family **(Right) Clupeidae family (marine species), by reported species and country**



DETAILS OF NATIONAL REPORT DATA INCLUDED IN "FIGURE 1B COMPILED DATASET"
National reports from countries with high landings recorded as aggregated "Sardinella spp." and "Clupeoidei" were used (where available) to disaggregate landings in these categories.

PHILIPPINES

From FAO 2019

Species (ASFIS) - FAO	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
Sardinella spp	369199	467853	448556	338076	346938	323744	354423	378897	361794	325419	**371490**
Clupeoidei	505	592	601	537	497	458	391	362	442	406	**479**
TOTAL	**369704**	**468445**	**449157**	**338613**	**347435**	**324202**	**354814**	**379259**	**362236**	**325825**	**371969**

Philippines fisheries profiles - Bureau of Fisheries and Aquatic Resources (BFAR)
(https://www.bfar.da.gov.ph/publication)

Species name - BFAR reports	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
"Indian Sardines (Tamban)"											
Commerical (marine)	166995	260378	265811	167014	175160	158841	190390	217758	205986	170395	**197873**
Municipal (marine)	68675	63751	68219	65893	70898	70394	65706	72896	74487	71118	**69204**
TOTAL	**235670**	**324128**	**334030**	**232907**	**246058**	**229235**	**256096**	**290655**	**280473**	**241512**	**267077**
"Fimbriated Sardines (Tunsoy)"											
Commerical (marine)	66372	75608	55176	51670	48441	47780	53285	43114	39343	42062	**52285**
Municipal (marine)	61514	61957	52839	47124	47088	41356	39985	40728	37243	37360	**46719**
TOTAL	**127886**	**137565**	**108015**	**98794**	**95529**	**89136**	**93270**	**83842**	**76586**	**79422**	**99004**
SARDINELLA TOTAL	**363556**	**461693**	**442046**	**331702**	**341587**	**318371**	**349366**	**374497**	**357058**	**320934**	**366081**

Compiled disaggregated data	Species (ASFIS) - FAO	Record in national report	Species group assigned	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)	Compiled (*)
Philippines	Sardinella spp	"Indian Sardines (Tamban)"	Sardinella (round; subg. Sardinella)	235670	324128	334030	232907	246058	229235	256096	290655	280473	241512	**267077**	*
Philippines	Sardinella spp	"Fimbriated Sardines (Tunsoy)"	Sardinella (flat; subg. Clupeonia)	127886	137565	108015	98794	95529	89136	93270	83842	76586	79422	**99004**	*
Philippines	Sardinella spp	NA [remainder]	Sardinella (flat; subg. Clupeonia)	5643	6160	6510	6374	5351	5373	5057	4400	4736	4485	**5409**	*
Philippines	Clupeoidei	NA	Clupeoidei (unknown)	505	592	601	537	497	458	391	362	442	406	**479**	(as per orig.)
			TOTAL	**369704**	**468445**	**449157**	**338613**	**347435**	**324202**	**354814**	**379259**	**362236**	**325825**	**371969**	

Notes:

"Indian sardines (Tamban)" landings have been assigned to Sardinella lemuru, a round Sardinella (subg. Sardinella).
-- This is consistent with reporting on this dataset by Willette et al. (2011).
-- While "tamban" is noted as *Amblygaster sirm* in the list of local names in Willette et al. (2011), the most abundant species of sardine in the Philippines is reported as *S. lemuru / S. longiceps* (Willette & Santos 2013; Villanoy et al. 2011).
-- While "Indian sardine" is generally used for *S. longiceps*, this species does not occur in the Philippines; rather the highly similar *S. lemuru* is present (Willette and Santos 2013).

"Fimbriated Sardines (Tunsoy)" landings have been assigned to 'Sardinella fimbriata' in the flat Sardinella group (subg. Clupeonia).
-- This is consistent with reporting on this dataset by Willette et al. (2011).
-- However, based on the list of local names in Willette et al. (2011), local name "Tunsoy" is used for *S. albella*, *S. fimbriata*, *S. gibbosa* as well as *S. lemuru.*
-- On the basis that this group is differentiated from "Indian sardines (Tamban)", these are assumed not to be *S. lemuru.*

The remaining volume after subtracting "Indian Sardines (Tamban)" and "Fimbriated Sardines (Tunsoy)" landings (BFAR data) from "Sardinella spp" (FAO 2019), have been assigned to Sardinella (flat) group.
-- On the basis that these are not "Indian sardines (Tamban)" landings, these are assumed not to be S. lemuru, which are the only round Sardinellas in this region (all other Sardinellas are flat (subg. Clupeonia)). [Although could also potentially be Amblygaster or Herklotsichthys spp.]

INDIA

From FAO 2019

	Species (ASFIS) - FAO	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
	Chirocentrus spp	37470	37391	32051	23041	29944	39381	20282	16922	17657	18566	**27271**
	Sardinella longiceps	318614	323955	320227	381713	404298	376189	544684	265667	244992	337390	**351773**
	Clupeoidei	91328	89637	89236	93330	100299	93959	292875	339106	266307	301544	**175762**
	Engraulidae	108029	105911	107536	113916	114449	124276	143545	82905	79863	80354	**106078**
	Stolephorus spp	0	0	0	0	0	0	0	63382	61571	64859	**18981**
Diadromous fishes	Tenualosa ilisha	20369	17607	74855	30304	17840	14556	5247	20659	93679	63437	**35855**
	TOTAL	**575810**	**574501**	**623905**	**642304**	**666830**	**648361**	**1006633**	**788641**	**764069**	**866150**	**715720**

Central Marine Fisheries Research Institute (CMFRI) reports

(http://www.cmfri.org.in)

	Species name - CMFRI reports	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)	
CLUPEIDS	Wolf herring	23232	22169	20368	23985	20042	20994	20282	16922	17657	18566	**20422**	
CLUPEIDS	Oil sardine	445407	414759	488204	609111	720270	595392	544684	265667	244992	337390	**466588**	
CLUPEIDS	Other sardines	115293	101057	90846	122935	149022	159580	206232	256016	195163	226970	**162311**	
CLUPEIDS	Other shads	7476	6019	7643	14621	10653	14641	16578	19446	12565	6967	**11661**	
CLUPEIDS - anchovies	Coilia	31233	30542	31992	37629	24960	30767	29751	26825	30618	33574	**30789**	
CLUPEIDS - anchovies	Setipinna	10043	13038	12293	15239	8640	8507	4850	5446	6990	8777	**9382**	
CLUPEIDS - anchovies	Stolephorus	87676	56837	81012	64603	68197	69481	57893	63382	61571	64859	**67551**	
CLUPEIDS - anchovies	Thrissina	5		0						0	0	**1**	
CLUPEIDS - anchovies	Thryssa	36324	38217	39277	36120	42246	42351	51051	50634	42255	38003	**41648**	
Other clupeids	Other clupeids	70087	83070	75094	81240	83322	71424	69987	63644	58579	67607	**72405**	
CLUPEIDS	Hilsa shad	58970	52151	84269	21901	9981	41448	5247	20659	93679	63437	**45174**	Diadromous
	TOTAL	**885746**	**817859**	**930998**	**1027384**	**1137333**	**1054585**	**1006555**	**788641**	**764069**	**866150**	**927932**	

Disaggregation of 'Clupeoidei (FAO)' (outlined in red above)

-- In last 3 years (2015, 2016 & 2017), Clupeoidei (FAO) landings = Other sardines, other shads & other clupeids (CFMRI) landings; other years differ (as for other categories).

-- 'Clupeoidei (FAO)' disaggregated based on percentage breakdown (CMFRI data) applied to 'Clupeoidei (FAO)' annual landings volume.

Species name - CMFRI reports	*As a percentage of total 'Other sardines' & 'Other shads' & 'Other clupeids'*										
Other sardines	60%	53%	52%	56%	61%	65%	70%	75%	73%	75%	**64%**
Other clupeids	36%	44%	43%	37%	34%	29%	24%	19%	22%	22%	**31%**
Other shads	4%	3%	4%	7%	4%	6%	6%	6%	5%	2%	**5%**

Compiled disaggregated data	Species (ASFIS) - FAO	Record in national report	Species group assigned	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)	Compiled (*)
India	Chirocentrus spp	Wolf herring	CHIROCENTRIDAE	37470	37391	32051	23041	29944	39381	20282	16922	17657	18566	**27271**	(as per orig.)
India	Sardinella longiceps	Oil sardine	Sardinella (round; subg. Sardinella)	318614	323955	320227	381713	404298	376189	544684	265667	244992	337390	**351773**	(as per orig.)
India	Engraulidae	Coilia, Setipinna, Thrissina & Thryssa	ENGRAULIDAE	108029	105911	107536	113916	114449	124276	143545	82905	79863	80354	**106078**	(as per orig.)
India	Stolephorus spp	Stolephorus	ENGRAULIDAE	0	0	0	0	0	0	0	63382	61571	64859	**18981**	(as per orig.)
India	Clupeoidei	Other sardines	Sardinella (flat; subg. Clupeonia)	54598	47639	46702	52439	61510	61039	206287	256016	195163	226970	**120836**	*
India	Clupeoidei	Other clupeids	Clupeoidei (unknown)	33190	39160	38605	34654	34392	27320	70006	63644	58579	67607	**46716**	*
India	Tenualosa ilisha	Hilsa shad	CLUPEIDAE (diadromous)	20369	17607	74855	30304	17840	14556	5247	20659	93679	63437	**35855**	(as per orig.)
India	Clupeoidei	Other shads	CLUPEIDAE (diadromous)	3540	2837	3929	6237	4397	5600	16582	19446	12565	6967	**8210**	*
			TOTAL	**575810**	**574501**	**623905**	**642304**	**666830**	**648361**	**1006633**	**788641**	**764069**	**866150**	**715720**	

Notes:

Other sardines (CMFRI) category assigned to Sardinella (flat; subg. Clupeonia) on the basis that they are not S. longiceps (i.e. not round Sardinellas), and the majority are likely to be flat Sardinellas (see note below).

-- Sardines other than *S. longiceps* are commonly referred to as 'lesser sardines' in India.

-- Lesser sardines consist of flat sardinellas (subg. Clupeonia) - Sardinella gibbosa, S. fimbriata, S. albella, S. dayi, S. sindensis, S. melanura and S. jonesi - as well as Amblygaster sirm & A. clupeoides {Bennet 1992}.

-- The majority of lesser sardine landings consist of flat Sardinellas; Amblygasters (particularly *A. sirm*) have accounted for 10-24% of lesser sardine landings in some locations in Indian waters in the past (1984-88) {Bennet 1992}.

AUSTRALIA

From FAO 2019

Species (ASFIS) - FAO	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
Clupeoidei	33121	31658	39673	38225	41319	38436	35866	38759	44898	44301	**38626**

From National report

Mobsby, D and Koduah, A (2017) Australian fisheries and aquaculture statistics 2016

Fisheries Research and Development Corporation project 2017-095. ABARES, Canberra

Species name - national report	2013-14	2014-15	2015-16
Australian sardine	35867	38759	44898

Compiled disaggregated data	Species (ASFIS) - FAO	Record in national report	Species group assigned	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)	Compiled (*)
Australia	Clupeoidei	Australian sardine	Sardinops (temperate)	33121	31658	39673	38225	41319	38436	35866	38759	44898	44301	**38626**	*

Notes:

Species name: *Sardinops sagax* (formerly *S. neopilchardus*)

Temperate species - caught in temperate part of fishing area 57 (>90% caught in South Australia) (Mobsby and Koduah 2017))

MALAYSIA

From FAO 2019

Species (ASFIS) - FAO	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
Chirocentrus spp	5381	5301	5743	5665	4518	4535	4097	3814	4844	5154	**4905**
Clupeoidei	40315	35957	33407	37126	37507	44562	39642	41689	38423	47170	**39580**
Engraulidae	-	-	-	-	-	-	-	-	-	...	
Stolephorus spp	19600	20735	18605	19085	19452	20643	24837	22093	36027	33094	**23417**
TOTAL	**65296**	**61993**	**57755**	**61876**	**61477**	**69740**	**68576**	**67596**	**79294**	**85418**	**67902**

From National reports	**Species name - national report**	**Local name translation (FishBase)**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Average (2008-2017)**	*Clupeoidei %*
Department of Fisheries Malaysia	Tamban Sisek	Sardinella spp.	17797	30069	22701	24538	28716	33855	29367	NA	26080	31692	**27202**	70%
(https://www.dof.gov.my/index.php/pages/view/82)	Tamban Buluh Bulat	Dussumieria elopsoides	4134	5168	9710	9908	7694	9105	7705	NA	9000	8851	**7919**	21%
	Tamban/Cincang Rebong	Dussumieria acuta	17297	196	227	254	71	83	1149	NA	1929	1596	**2534**	7%
	Tamban Beluru	Amblygaster spp.	1088	525	768	2427	1025	1519	1421	NA	1414	1730	**1324**	3%
	Bilis/Bunga Air	Stolephorus / Encrasicholina	18303	18343	16412	16524	17456	18824	23096	NA	33774	28198	**21214**	
	Parang-Parang	Chirocentrus dorab	5381	5301	5743	5665	4518	4535	4097	NA	4844	5154	**5026**	
	Bulan-Bulan	Megalops cyprinoides	533	91	137	631	321	334	343	NA	405	460	**362**	Non-clupeoid
	Impirang	Setipinna sp.	1297	2392	2194	2561	1996	1819	1742	NA	2253	3069	**2147**	
	Bulu Ayam	Coilia spp.	698	6226	4425	6064	4980	6149	7532	NA	6336	4896	**5256**	
		TOTAL	**65995**	**68220**	**62180**	**67941**	**66456**	**75889**	**76109**		**85630**	**85186**	**72623**	Excl. 'Bulan-B'
		Difference with FAO totals	*699*	*6227*	*4425*	*6065*	*4979*	*6149*	*7533*		*6336*	*-232*		*~'Bulu Ayam'*

Compiled disaggregated data	**Species (ASFIS) - FAO**	**Record in national report**	**Species group assigned**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Average (2008-2017)**	Compiled (*)
Malaysia	Chirocentrus spp	Parang-Parang	CHIROCENTRIDAE	5381	5301	5743	5665	4518	4535	4097	3814	4844	5154	**4905**	(as per orig.)
Malaysia	Clupeoidei	Tamban Sisek	Sardinella (unknown)	17797	30069	22701	24538	28716	33855	29367	28990	26080	32801	**27491**	*
Malaysia	Clupeoidei	Tamban Buluh Bulat	DUSSUMIERIIDAE	4134	5168	9710	9908	7694	9105	7705	8556	9000	9681	**8066**	*
Malaysia	Clupeoidei	Tamban/Cincang Rebong	DUSSUMIERIIDAE	17297	196	227	254	71	83	1149	2768	1929	3131	**2710**	*
Malaysia	Clupeoidei	Tamban Beluru	Amblygaster spp.	1088	525	768	2427	1025	1519	1421	1376	1414	1557	**1312**	*
Malaysia	Stolephorus spp	Bilis + Impirang (predom.)	ENGRAULIDAE	19600	20735	18605	19085	19452	20643	24837	22093	36027	33094	**23417**	(as per orig.)
			TOTAL	**65297**	**61994**	**57754**	**61877**	**61476**	**69740**	**68576**	**67596**	**79294**	**85418**	**67902**	

Notes:

'Clupeoidei (FAO)' annual landings (FAO 2019) = Tamban Sisek, Tamban Buluh Bulat, Tamban/Cincang Rebong & Tamban Beluru annual landings (DOF reports) in all years except 2017; 2015 national report not available online (December 2019).

-- 2015 and 2017 disaggregation of 'Clupeoidei' estimated based on average percentage composition in other years.

Local name translations obtained from FishBase

Data re-compiled

All families other than Clupeidae -> Average annual volumes aggregated by Family
For Clupeidae family -> Assigned species grouping (used in Review)

Species name	Species group assigned	Taxonomic details	
Sardinella longiceps	Round-bodied Sardinellas	Sardinella (subg. Sardinella) species	
Sardinella lemuru	Round-bodied Sardinellas	Sardinella (subg. Sardinella) species	
Sardinella gibbosa	Flat-bodied Sardinellas	Sardinella (subg. Clupeonia)	
Sardinella fimbriata	Flat-bodied Sardinellas	Sardinella (subg. Clupeonia)	
Other sardines (not S. longiceps)	Flat-bodied Sardinellas	Sardinella (subg. Clupeonia)	*May include some Amblygasters*
Amblygaster sirm	Amblygasters	Amblygaster species	
Herklotsichthys quadrimaculat.	Tropical Herrings	Herklotsichthys spp.	
Sardinops ocellatus	NA	Sardinops (temperate)	

FIGURE 1B COMPILED DATASET (COMPLETE): Annual marine clupeoid capture production in the Indo-West Pacific (FAO fishing areas 51, 57 and 71), disaggregated by species & country, last 10 years of available data (2008-2017)

Source: FAO 2019 with some disaggregation using national reports (yellow highlighted rows); all total volumes retained from FAO 2019.

Country (Country)	Species (ASFIS species) (FAO 2019)	Family (updated classification)	Species (National report)	SPECIES GROUP ASSIGNED	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)
VARIOUS	Aggregated	CHIROCENTRIDAE		CHIROCENTRIDAE	75963	72565	69910	55825	63233	70216	53499	58737	47345	57314	**62461**
VARIOUS	Aggregated	DUSSUMIERIIDAE		DUSSUMIERIIDAE	30639	31184	30968	26064	32309	38858	35835	33676	46712	18614	**32486**
Malaysia	Clupeoidei [disaggregated]	DUSSUMIERIIDAE	Tamban Buluh Bulat	DUSSUMIERIIDAE	4134	5168	9710	9908	7694	9105	7705	8556	9000	9681	**8066**
Malaysia	Clupeoidei [disaggregated]	DUSSUMIERIIDAE	Tamban/Cincang Rebong	DUSSUMIERIIDAE	17297	196	227	254	71	83	1149	2768	1929	3131	**2710**
VARIOUS	Aggregated	ENGRAULIDAE		ENGRAULIDAE	560592	559708	538835	570899	549937	536498	586489	559750	574095	666060	**570286**
Sri Lanka	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	66890	71580	74310	101810	118160	125680	132829	128895	132460	127305	**107992**
India	Clupeoidei [disaggregated]	Clupeoidei (not disaggregated)	Other clupeids	Clupeoidei (unknown)	33190	39160	38605	34654	34392	27320	70006	63644	58579	67607	**46716**
Pakistan	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	16254	14818	17323	18959	19470	19862	20779	21326	15614	16168	**18057**
Indonesia	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	0	0	0	0	0	0	0	10499	18804	0	**2930**
Zanzibar	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	2405	2446	2473	2026	1893	1987	2047	2140	2160	2187	**2176**
Iran (Islamic Rep. of)	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	310	903	586	1144	1365	1163	1603	1950	2824	3171	**1502**
Philippines	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	505	592	601	537	497	458	391	362	442	406	**479**
Kenya	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	142	121	139	153	162	170	168	167	1339	575	**314**
Eritrea	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	300	300	300	300	300	300	300	300	300	300	**300**
Saudi Arabia	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	332	396	196	216	211	290	267	256	279	280	**272**
Brunei Darussalam	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	0	0	0	0	0	0	0	273	292	0	**57**
Kiribati	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	13	1	0	0	0	0	17	18	20	18	**9**
Singapore	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	1	1	1	1	0	1	0	0	0	0	**1**
Réunion	Clupeoidei	Clupeoidei (not disaggregated)		Clupeoidei (unknown)	0	0	0	0	2	0	0	1	0	0	**0**
India	Sardinella longiceps	CLUPEIDAE		Sardinella (round; subg. Sardinella)	318614	323955	320227	381713	404298	376189	544684	265667	244992	337390	**351773**
Philippines	Sardinella spp [disaggregated]	CLUPEIDAE	"Indian Sardines (Tamban)"	Sardinella (round; subg. Sardinella)	235670	324128	334030	232907	246058	229235	256096	290655	280473	241512	**267077**
Indonesia	Sardinella lemuru	CLUPEIDAE		Sardinella (round; subg. Sardinella)	82417	108772	71611	32475	45807	45740	53895	68102	40069	39682	**58857**
Oman	Sardinella longiceps	CLUPEIDAE		Sardinella (round; subg. Sardinella)	33466	36602	32070	27931	43549	52544	63439	82654	94142	121800	**58820**
Iran (Islamic Rep. of)	Sardinella longiceps	CLUPEIDAE		Sardinella (round; subg. Sardinella)	27244	21187	20838	32359	33263	45218	58839	59055	69144	87706	**45485**
Yemen	Sardinella longiceps	CLUPEIDAE		Sardinella (round; subg. Sardinella)	17731	43462	36477	39031	55740	52704	47367	38850	33000	28050	**39241**
Pakistan	Sardinella longiceps	CLUPEIDAE		Sardinella (round; subg. Sardinella)	31474	26937	20127	22659	23304	23654	27372	27782	26640	26993	**25694**
Indonesia	Sardinella gibbosa	CLUPEIDAE		Sardinella (flat; subg. Clupeonia)	231289	237090	255593	246175	161839	175883	166670	148050	186980	78923	**188849**
India	Clupeoidei [disaggregated]	CLUPEIDAE	Other sardines	Sardinella (flat; subg. Clupeonia)	54598	47639	46702	52439	61510	61039	206287	256016	195163	226970	**120836**
Philippines	Sardinella spp [disaggregated]	CLUPEIDAE	"Fimbriated Sardines (Tunsoy)"	Sardinella (flat; subg. Clupeonia)	127886	137565	108015	98794	95529	89136	93270	83842	76586	79422	**99004**
Philippines	Sardinella spp [disaggregated]	CLUPEIDAE	NA [remainder]	Sardinella (flat; subg. Clupeonia)	5643	6160	6510	6374	5351	5373	5057	4400	4736	4485	**5409**
Thailand	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	96455	100027	92588	62580	73325	71897	75359	81051	72729	71794	**79781**
Malaysia	Clupeoidei [disaggregated]	CLUPEIDAE	Tamban Sisek	Sardinella (unknown)	17797	30069	22701	24538	28716	33855	29367	28990	26080	32801	**27491**
Tanzania, United Rep. of	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	11832	14300	8015	7697	7619	8040	8004	8023	1784	1786	**7710**
Egypt	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	3281	7295	4701	4840	5328	4146	4587	5091	6888	7100	**5326**
United Arab Emirates	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	3263	758	819	773	1470	1200	900	900	900	900	**1188**
Zanzibar	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	1166	1172	1199	1369	799	936	1076	1045	1098	1191	**1105**
Comoros	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	1150	1150	1150	1150	1150	1180	1216	1228	45	83	**950**
Bahrain	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	5	6	44	20	68	1	101	95	95	95	**53**
Qatar	Sardinella spp	CLUPEIDAE		Sardinella (unknown)	0	0	0	0	0	0	0	0	0	47	**5**
Indonesia	Amblygaster sirm	CLUPEIDAE		Amblygaster spp.	5618	4893	4318	6791	49110	45851	46578	25473	40387	11794	**24081**
Malaysia	Clupeoidei [disaggregated]	CLUPEIDAE	Tamban Beluru	Amblygaster spp.	1088	525	768	2427	1025	1519	1421	1376	1414	1557	**1312**
Fiji	Herklotsichthys quadrimaculat.	CLUPEIDAE		Herklotsichthys spp.	30	25	15	12	15	15	15	15	16	16	**17**
Australia	Clupeoidei [disaggregated]	CLUPEIDAE	Australian sardine	Sardinops (temperate)	33121	31658	39673	38225	41319	38436	35866	38759	44898	44301	**38626**
South Africa	Sardinops ocellatus	CLUPEIDAE		Sardinops (temperate)	0	12	0	0	0	0	0	0	0	0	**1**
VARIOUS	Aggregated	CLUPEIDAE (diadromous)		CLUPEIDAE (diadromous)	241513	242190	300364	281029	279386	293749	295278	304948	379591	380457	**299851**
India	Clupeoidei [disaggregated]	CLUPEIDAE (diadromous)	Other shads	CLUPEIDAE (diadromous)	3540	2837	3929	6237	4397	5600	16582	19446	12565	6967	**8210**
VARIOUS	Aggregated	PRISTIGASTERIDAE (diadromous)		PRISTIGASTERIDAE (diadromous)	16912	13614	11597	11274	14807	18783	20554	20609	19397	19838	**16739**
VARIOUS	Aggregated	Diadromous clupeoids nei		Clupeoidei (unknown) (diadromous)	850	1025	1422	1236	1399	1292	2559	3389	2060	1334	**1657**
				TOTAL 'MARINE' CLUPEOID PRODUCTION IN IWP	2149805	2304527	2212376	2146030	2215888	2195782	2640550	2410436	2360452	2419215	**2305506**
Highlighted rows indicate data disaggregated from National reports.				**TOTAL 'DIADROMOUS' CLUPEOID PRODUCTION IN IWP**	262815	259666	317312	299776	299989	319424	334973	348392	413613	408596	**326456**
				TOTAL CLUPEOID PRODUCTION IN IWP	**2412620**	**2564193**	**2529688**	**2445806**	**2515877**	**2515206**	**2975523**	**2758828**	**2774065**	**2827811**	**2631962**
				Landing volume check: Total clupeoid production in IWP (from FIGURE 1B ORIGINAL DATASET)	*2412619*	*2564192*	*2529689*	*2445805*	*2515878*	*2515206*	*2975523*	*2758828*	*2774065*	*2827811*	*2631962 +/- 1*

FIGURE 1B COMPILED DATASET (AGGREGATED BY FAMILY): Annual marine clupeoid capture production in the Indo-West Pacific (FAO fishing areas 51, 57 and 71) by family (updated classification), last 10 years of available data (2008-2017)

Source: FAO 2019 with some disaggregation using national reports; all total volumes retained from FAO 2019.

Country (Country)	Species (ASFIS species)	Family (updated classification)	FAMILY	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)	*% comp.*
VARIOUS	Agreggated	CLUPEIDAE	CLUPEIDAE (marine)	1340838	1505387	1428192	1323280	1386192	1363791	1727466	1517119	1448258	1446398	**1448692**	55%
VARIOUS	Agreggated	ENGRAULIDAE	ENGRAULIDAE	560592	559708	538835	570899	549937	536498	586489	559750	574095	666060	**570286**	22%
VARIOUS	Agreggated	CHIROCENTRIDAE	CHIROCENTRIDAE	75963	72565	69910	55825	63233	70216	53499	58737	47345	57314	**62461**	2%
VARIOUS	Agreggated	DUSSUMIERIIDAE	DUSSUMIERIIDAE	52070	36548	40905	36226	40074	48046	44689	44999	57641	31426	**43262**	2%
VARIOUS*	Clupeoidei (unknown)	Clupeoidei (not disaggregated)	Clupeoidei (not specified)	120342	130318	134534	159800	176452	177231	228407	229831	233113	218017	**180804**	7%
VARIOUS	Agreggated	SPRATELLOIDIDAE	SPRATELLOIDIDAE	0	0	0	0	0	0	0	0	0	0	**0**	
VARIOUS	Agreggated	CLUPEIDAE (diadromous)	CLUPEIDAE (diadromous)	245053	245027	304293	287266	283783	299349	311860	324394	392156	387424	**308061**	12%
VARIOUS	Agreggated	PRISTIGASTERIDAE (diadromous)	PRISTIGASTERIDAE	16912	13614	11597	11274	14807	18783	20554	20609	19397	19838	**16739**	1%
VARIOUS	Agreggated	Diadromous clupeoids nei	Clupeoidei (diadromous, not specified	850	1025	1422	1236	1399	1292	2559	3389	2060	1334	**1657**	0%
*Sri Lanka 60%, India 26%, Pakistan 10% & 11 others			**TOTAL CLUPEOID PRODUCTION IN IWP**	**2412620**	**2564193**	**2529688**	**2445806**	**2515877**	**2515206**	**2975523**	**2758828**	**2774065**	**2827811**	**2631962**	

FIGURE 1B COMPILED DATASET (FAMILY CLUPEIDAE ONLY): Annual marine clupeid (Family Clupeidae) capture production in the Indo-West Pacific (FAO fishing areas 51, 57 and 71) by species grouping (used in review) & country (2008-2017)

Source: FAO 2019 with some disaggregation using national reports; all total volumes retained from FAO 2019.

	Country (Country)	Species (ASFIS species)	Family (updated classification)	SPECIES GROUP ASSIGNED	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average (2008-2017)	*% comp.*
	India	Sardinella longiceps	CLUPEIDAE	Sardinella (round; subg. Sardinella)	318614	323955	320227	381713	404298	376189	544684	265667	244992	337390	**351773**	58%
35%, 27%, 23%, 15% resp.	Oman, Iran, Yemen, Pakistan	Sardinella longiceps	CLUPEIDAE	Sardinella (round; subg. Sardinella)	109915	128188	109512	121980	155856	174120	197017	208341	222926	264549	**169240**	
	Philippines	Sardinella spp [disaggregated]	CLUPEIDAE	Sardinella (round; subg. Sardinella)	235670	324128	334030	232907	246058	229235	256096	290655	280473	241512	**267077**	
	Indonesia	Sardinella lemuru	CLUPEIDAE	Sardinella (round; subg. Sardinella)	82417	108772	71611	32475	45807	45740	53895	68102	40069	39682	**58857**	
	Indonesia	Sardinella gibbosa	CLUPEIDAE	Sardinella (flat; subg. Clupeonia)	231289	237090	255593	246175	161839	175883	166670	148050	186980	78923	**188849**	29%
	India	Clupeoidei [disaggregated]	CLUPEIDAE	Sardinella (flat; subg. Clupeonia)	54598	47639	46702	52439	61510	61039	206287	256016	195163	226970	**120836**	
95% '*S. fimbriata*	Philippines	Sardinella spp [disaggregated]	CLUPEIDAE	Sardinella (flat; subg. Clupeonia)	133529	143725	114526	105169	100880	94509	98327	88242	81321	83907	**104413**	
	Thailand	Sardinella spp	CLUPEIDAE	Sardinella (unknown)	96455	100027	92588	62580	73325	71897	75359	81051	72729	71794	**79781**	9%
	Malaysia (63%) & 7 others	Clupeoidei [disaggregated]	CLUPEIDAE	Sardinella (unknown)	38494	54750	38629	40387	45150	49358	45251	45372	36890	44003	**43828**	
	Indonesia (95%) & Malaysia (5%)	Amblygaster sirm	CLUPEIDAE	Amblygaster spp.	6706	5418	5086	9218	50135	47370	47999	26849	41801	13351	**25393**	2%
	Fiji	Herklotsichthys quadrimaculat.	CLUPEIDAE	Herklotsichthys spp.	30	25	15	12	15	15	15	15	16	16	**17**	0.001%
	Australia (>99%) & South Africa (<1%)	Clupeoidei [disaggregated]	CLUPEIDAE	Sardinops (temperate)	33121	31670	39673	38225	41319	38436	35866	38759	44898	44301	**38627**	3%
			TOTAL CLUPEIDAE PRODUCTION IN IWP		**1340838**	**1505387**	**1428192**	**1323280**	**1386192**	**1363791**	**1727466**	**1517119**	**1448258**	**1446398**	**1448692**	

Online Resource 2: Growth parameters for species from the Clupeidae family

Table S2.1 provides a summary of growth parameters for tropical marine clupeids from the Indo-West Pacific (as per Table 1 in the main text) as well as *Sardinella* species from the Atlantic Ocean and selected non-tropical species. Tables S2.2–S2.4 provide the individual records on which these summaries are based. Citation details for these individuals records are provided in Tables S2.5–S2.6.

Table S2.1 Summary of growth and reproductive parameters for tropical marine clupeids from genera *Amblygaster*, *Herklotsichthys* and *Sardinella* in the Indo-West Pacific and genera *Sardinella* in the Atlantic Ocean (ATL), as well as selected non-tropical species (Non-trop.). Species-groups refer to Tropical Pilchards (TP), Tropical Herrings (TH), Flat-bodied Sardinellas (FBS) and Round-bodied Sardinellas (RBS). 'Maximum length' and 'Maximum longevity' for each species were obtained from FishBase (Froese and Pauly 2021). Length measurements are provided in Standard Length (SL) and Total length (TL). Where necessary length conversions were carried out using the relevant length-length table in FishBase. Summary growth parameters were calculated from available studies (*n*) that had estimated von Bertalanffy growth function parameters asymptotic length (L_∞) and K, sourced from FishBase and other published sources (see Online Resource 2, Tables S2.2–S2.4). The growth performance index (ϕ') was calculated for each record following Pauly and Munro (1984) as $\phi' = \log_{10}K + 2\log_{10}L_\infty$. Maximum longevity was estimated following Taylor (1958) as $T_{max} = t_0 + 3/K$, where t_0 was estimated from $\log(-t_0) = -0.3922 - 0.2752 \log L_\infty - 1.038 \log K$ following Pauly (1979) (both cited in Froese and Pauly 2000). Summary reproductive parameters were calculated from available published studies (*n*) that had estimated length at first maturity (Lm). The mean Lm to L_∞ ratio was averaged from studies (or closely related studies) that provided estimates for both Lm and L_∞ (i.e. paired records). For individual data records included, refer to Online Resource 4, Tables S4.1 and S4.2. The Standard Error (SE) of each summary statistic is also provided. '?' indicates a potentially questionable record based on other data presented for that species.

Species-group	Species	Summary of growth parameters									Summary of reproductive parameters				Maximum length [a] (FishBase)		Maximum longevity recorded (years) (FishBase)	Common length [b] (Whitehead 1985)	
		n	Mean L_∞ (cm TL)	SE	Mean K ($year^{-1}$)	SE	Mean ϕ' [calculated]	SE	Mean longevity (Tmax, years) [calculated]	SE	*n*	Mean Lm (cm TL)	SE	Mean Lm/L_∞ *(n, paired records)*	SL (cm)	TL (cm)		SL (cm)	TL (cm)
TP	*A. clupeoides*	*1*	24.5	-	1.82	-	3.04	-	1.4	-	*2*	19.3	1.20	0.84 *(1)*	21.0	25.4	-	15	18.1
TP	*A. sirm*	*30*	25.1	0.4	1.35	0.15	2.85	0.05	3.2	0.5	*8*	18.8	0.90	0.68 *(2)*	27.0	32.5	[?] 8	20	24.1
TH	*E. thoracata*	*4*	11.5	0.3	1.91	0.09	2.40	0.04	1.3	0.1	*2*	7.5	0.45	0.67 *(1)*	10.0	11.8	1	8	9.5
TH	*H. quadrimaculatus*	*11*	14.0	0.8	3.05	0.60	2.69	0.04	1.1	0.3	*5*	10.4	0.53	0.72 *(3)*	[?] 25.0	[?] 30.3	-	10	12.1
FBS	*S. albella*	*9*	15.8	1.0	1.40	0.10	2.52	0.05	2.0	0.2	*2*	11.1	0.90	- *(0)*	14.0	16.9	-	10	12.0
FBS	*S. fimbriata*	*6*	21.2	1.2	0.99	0.12	2.62	0.07	3.1	0.5	*2*	13.9	0.67	0.66 *(2)*	13.0	16.2	-	11	13.7
FBS	*S. fimbriata* (now *S. pacifica*)	*13*	20.4	0.8	1.02	0.06	2.61	0.04	2.9	0.2	*1*	15.5	NA	0.78 *(1)*	[?] 10.5	[?] 13.1		NA	
FBS	*S. gibbosa*	*18*	19.1	0.6	1.45	0.21	2.63	0.05	2.8	0.5	*8*	13.8	0.48	0.68 *(5)*	23.8	29.6	[?] 7	15	18.7
FBS	*S. jussieu*	*2*	21.5	3.3	0.51	0.14	2.35	0.26	6.2	1.8	-	-	-	-	16.5	20.8	-	10	12.6
FBS	*S. melanura*	*1*	[?] 27.4	-	0.70	-	2.72	-	4.1	-	-	-	-	-	20.3	24.7	-	10	12.2
FBS	*S. sindensis*	*5*	19.8	0.6	1.09	0.14	2.61	0.07	2.9	0.6	-	-	-	-	17.0	20.6	-	14	17.0
FBS	*S. zunasi*	*2*	16.3	0.6	0.56	0.06	2.17	0.02	5.2	0.6	-	-	-	-	14.3	18.0	-	10	12.6
RBS	*S. lemuru*	*24*	21.7	0.5	1.00	0.04	2.66	0.02	3.0	0.2	*3*	16.6	0.73	0.80 *(3)*	23.0	28.0	-	20	24.4
RBS	*S. longiceps*	*33*	22.0	0.4	1.26	0.16	2.71	0.03	3.0	0.3	*3*	15.3	0.49	0.67 *(2)*	23.0	26.6	3	20	23.1
RBS-ATL	*S. aurita* [c]	*43*	28.4	0.7	0.54	0.04	2.58	0.03	6.6	0.4	*11*	16.1	0.63	0.69 *(4)*	34.1	41.0	7	25	30.1
FBS-ATL	*S. maderensis*	*10*	34.4	2.1	0.49	0.08	2.70	0.05	7.4	1.0	*11*	14.2	0.90	0.65 *(1)*	30.0	39.9	-	25	33.2
Non-Trop.	*Sardina pilchardus*	*67*	20.1	0.3	0.43	0.02	2.20	0.02	7.9	0.4	*17*	14.1	0.38	0.69 *(9)*	27.5	32.6	15	20	23.7
Non-Trop.	*Sardinops sagax*	*77*	27.4	0.6	0.48	0.02	2.51	0.02	7.2	0.3	*12*	19.4	1.54	0.71 *(6)*	39.5	46.6	25	20	23.6
Non-Trop.	*Sprattus sprattus*	*27*	14.8	0.3	0.54	0.04	2.03	0.04	6.6	0.7	*14*	10.6	0.47	0.73 *(8)*	16.0	17.6	6	12	13.2

[a] All maximum lengths were originally described in SL except for *S. gibbosa*, *S. zunasi* and *S. aurita* which were in TL.

[b] All common lengths were originally described in SL.

[c] Summary statistics include records for former *S. brasiliensis*, now considered a synonym of *S. aurita* (Fricke et al. 2020; Stern et al. 2018).

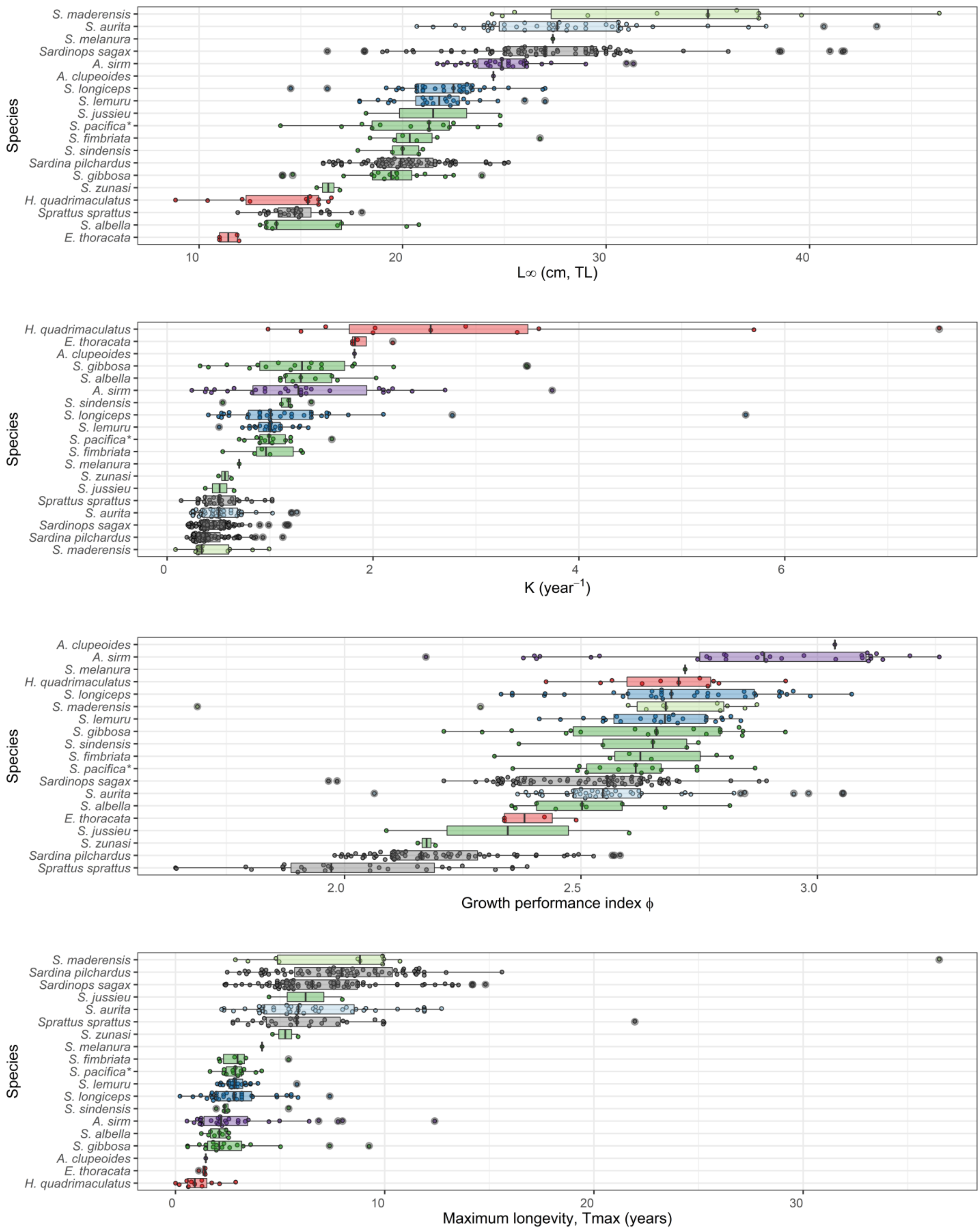


Fig S2.1 Comparison of growth parameters across marine clupeid species: (from top to bottom) von Bertalanffy asymptotic length parameter, L∞; von Bertalanffy growth coefficient, K; growth performance index, ϕ' (calculated); and maximum longevity, Tmax (calculated). See Tables S2.2–S2.4 for data sources and equations for calculated parameters. Box-plots are ordered by the median value for each species. Colours correspond to species-groups: IWP Tropical Herrings (red), IWP Tropical Pilchards (purple), IWP Flat-bodied Sardinellas (dark green), IWP Round-bodied Sardinellas (dark blue), Atlantic Flat-bodied Sardinellas (light green), Atlantic Round-bodied Sardinellas (light blue) and selected non-tropical clupeids (grey). *S. pacifica** observations are all from the Philippines and were described in original studies as *S. fimbriata*.

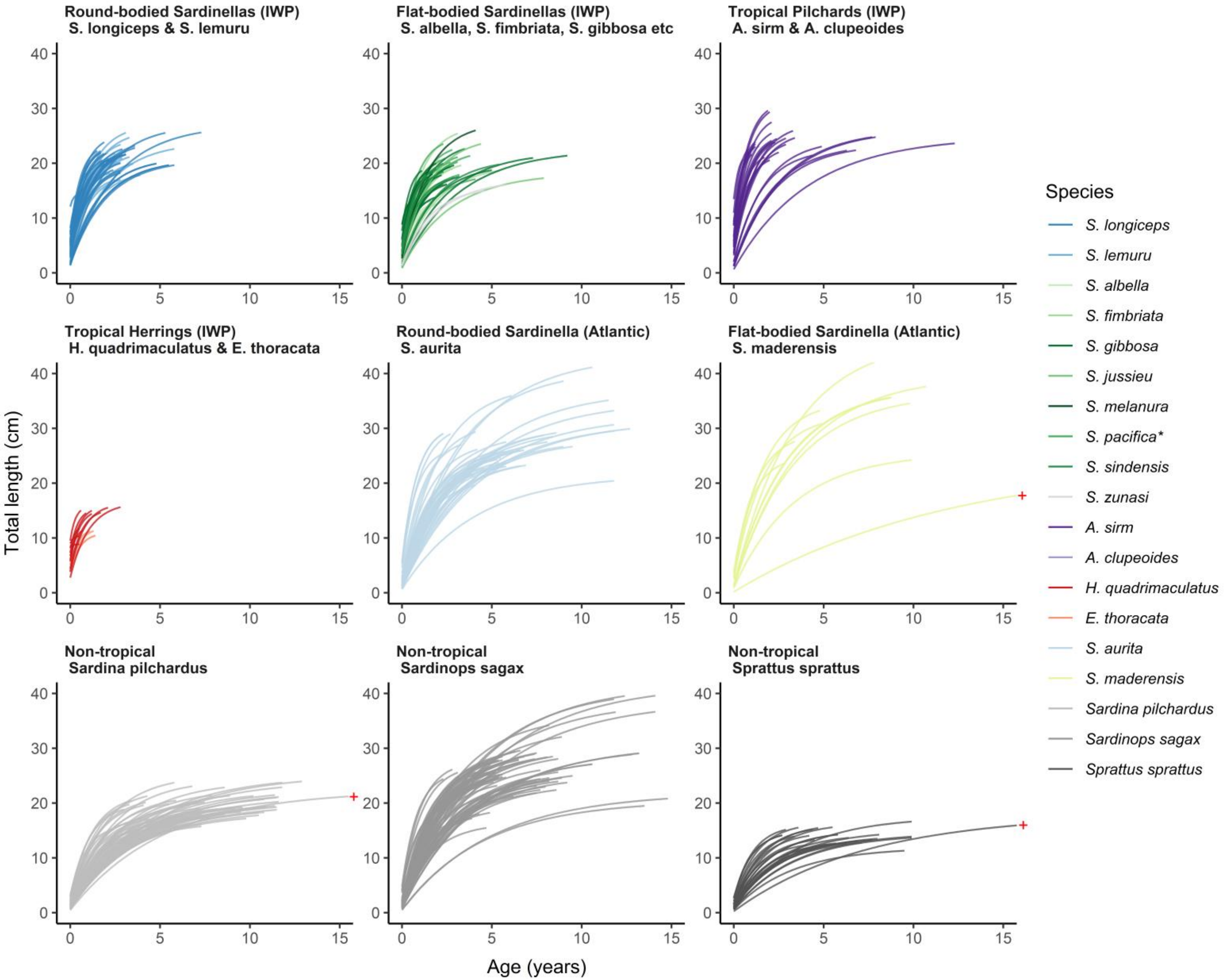


Fig S2.2 von Bertalanffy growth curves of tropical IWP clupeids from the genera *Sardinella*, *Amblygaster*, *Herklotsichthys* and *Escualosa*; *Sardinella* species from the Atlantic; and selected non-tropical species. Each curve represents a single population or study where growth parameters L∞ and K have been determined. The length of each curve reflects the estimated maximum longevity in years, the endpoint being where Age = T_{max}, estimated following Taylor (1958) as $T_{max} = t_0 + 3/K$ (note: three of the curves extend beyond the x-axis limit of 15 years, as indicated by a red '+' symbol); parameter 't_0' has been estimated following Pauly (1979) whereby $\log(-t_0) = -0.3922 - 0.2752 \log L\infty - 1.038 \log K$ (both equations cited in Froese and Pauly 2000). Data and data sources are provided in Table S2.2–S2.4.

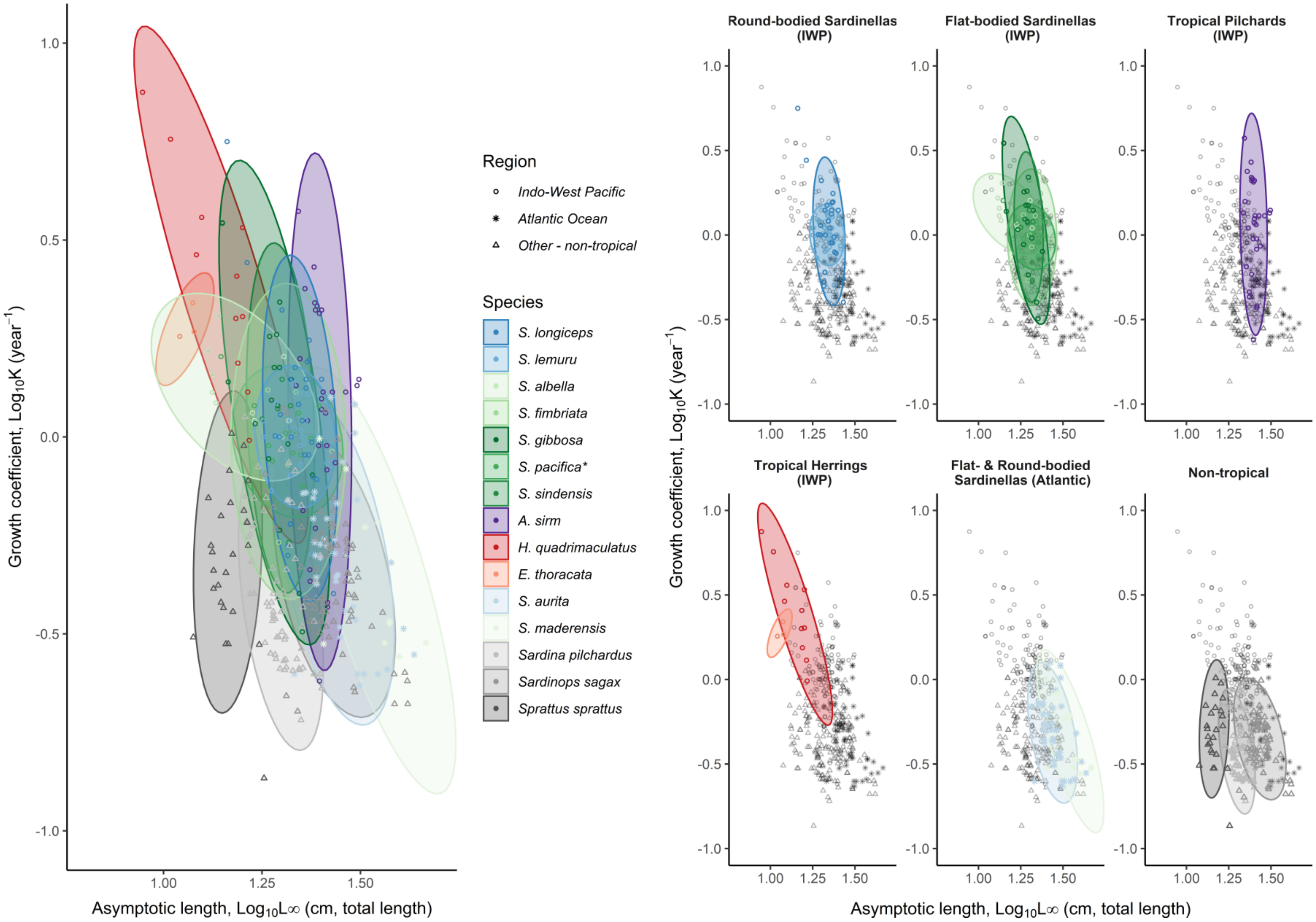


Fig S2.3 Auximetric plots comparing growth of individual tropical marine IWP clupeid species from the *Sardinella*, *Amblygaster*, *Herklotsichthys* and *Escualosa* genera, with *Sardinella* species from the Atlantic Ocean and three selected non-tropical clupeids also included for comparison. The large plot on the left shows all species, while the smaller plots on the right are grouped by species-group used in this review. Ellipses represent 95% data ellipses. Data and data sources are provided in Tables S2.2, S2.3 and S2.4.

Table S2.2. Growth parameters of the von Bertalanffy growth function (L_∞, K, t_0), data sources, estimation methods and calculated growth performance index and maximum longevity for tropical marine species of the family Clupeidae in the Indo-West Pacific region, from genera *Amblygaster*, *Herklotsichthys*, *Escualosa* and *Sardinella*. Data have been obtained from the FishBase database (version 04.2019), accessed through R package 'rfishbase' on 4 January 2021 and checked against the online database (version 12.2019); these data are indicated by 'FishBase record?' = yes (Y). Where 'FishBase record?' = Y*, some data has been added or replaced based on the original cited source. Data were also added from other published sources. Species have been categorised into 'Species-groups' based on the groupings used in this review: Tropical Herrings (TH), Tropical Pilchards (TP), Flat-bodied Sardinellas (FBS) and Round-bodied Sardinellas (RBS); 'FBS-FW' refers to Freshwater *Sardinella tawilis*. Asymptotic length (L_∞) types obtained from cited references refer to total length (TL), fork length (FL) and standard length (SL), all in cm. Where necessary, lengths were converted to TL using the relevant parameters available in FishBase 'Length-Length tables' (Froese and Pauly 2021). Parameter 't_0 calc.' was estimated following Pauly (1979) whereby, $\log(-t_0) = -0.3922 - 0.2752 \log L_\infty - 1.038 \log K$, and used to estimate maximum longevity following Taylor (1958) whereby, $T_{max} = t_0 + 3/K$ (both cited in Froese and Pauly 2000). The growth performance index was calculated following Pauly (1979) and Pauly and Munro (1984) as, $\phi' = \log_{10}K + 2\log_{10}L_\infty$. 'Source data used' in age and growth estimates include: length-frequencies (LF), otolith increments (OT), annual scale rings (ASR), other annual rings (OAR), other methods (Other), and several data types (Sev.). The 'Method(s) used to estimate growth parameters' include: ELEFAN I software (ELEFAN I), non-linear regression (non-linear reg.), Ford-Walford plot (F-W plot), other linearizations of the von Bertalanffy growth function (Other VBGF linear.), FISAT II software (FISAT II), Modal Class Progression Analysis (MCPA), other methods (Other), or the method was not specified in the cited reference (NA). References are provided for both the source of growth parameters ('Main ref. for growth parameters') and the original data source on which the parameters are based ('Data ref.'); numbered references refer to the Fishbase 'RefNo', while 'letter' references correspond to other sources – for citation details see Tables S2.5 and S2.6. Where 'Comment' is 'Excluded', data have been excluded from Table S2.1 summary statistics.

#	Species-group [this review]	Species	Location	L_∞ (cm) & original length type	L_∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated, this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated, this review]	Maximum longevity T_{max} (years) [calculated, this review]	FishBase record?	Main ref. for growth parameters	Data ref.	Comment [this review] [f]
1	TP	*A. clupeoides*	New Caledonia	24.5 (TL)	24.5	1.82	-0.05	-0.20	LF	-	3.04	1.45	-	(f)	(f)	
2	TP	*A. sirm*	Egypt	26.1 (?)	26.1	0.37	-	-0.12	-	-	2.40	7.98	Y	1442	1442	
3	TP	*A. sirm*	Egypt (Red Sea)	22.6 (TL)	22.6	0.65	-	-0.15	LF	Non-linear reg.	2.52	4.46	Y	312	762	
4	TP	*A. sirm*	Fiji (Viti Levu)	20.0 (SL?)	24.1	2.70	0.01	-0.22	OT	Non-linear reg.	3.20	0.89	-	(r)	(r)	
5	TP	*A. sirm*	India (Gulf of Mannar)	24.3 (TL)	24.3	2.10	0.09	-0.21	LF	F-W plot	3.09	1.22	-	(a)	(a)	
6	TP	*A. sirm*	Indonesia (Java Sea)	25.2 (TL)	25.2	1.18	-	-0.17	LF	ELEFAN I	2.87	2.38	Y	1447	1447	
7	TP	*A. sirm*	Indonesia (Java Sea)	23.3 (FL)	25.4	1.30	-	-0.18	LF	ELEFAN I	2.92	2.13	Y	10861	10861	
8	TP	*A. sirm*	Indonesia (Natuna Sea)	26.0 (TL)	26.0	0.83	-	-0.16	LF	ELEFAN I	2.75	3.48	Y	93920	93920	
9	TP	*A. sirm*	Indonesia (Java Sea)	25.8 (TL)	25.8	1.15	-	-0.17	LF	ELEFAN I	2.88	2.44	Y	1314		
10	TP	*A. sirm*	Indonesia (Java Sea)	24.3 (TL)	24.3	0.59	-	-0.14	LF	Other	2.54	4.97	Y	312	823	
11	TP	*A. sirm*	Kiribati	26.0 (SL)	31.3	1.40	-	-0.17	OT	Non-linear reg.	3.14	1.97	Y	36847		
12	TP	*A. sirm*	Mozambique	22.0 (?)	22.0	3.74	-	-0.25	OT	-	3.26	0.55	Y	2178	1443	
13	TP	*A. sirm*	New Caledonia (Dumbea Bay)	21.7 (TL)	21.7	1.35	-0.03	-0.19	OT	Other	2.80	2.03	Y	1439	1439	
14	TP	*A. sirm*	New Caledonia (Lagoons)	22.2 (TL)	22.2	1.58	0.00	-0.20	OT	Other	2.89	1.70	Y	1439	1439	
15	TP	*A. sirm*	New Caledonia (St. Vincent)	23.2 (TL)	23.2	1.10	-0.14	-0.18	OT	Other	2.77	2.55	Y	1439	1439	
16	TP	*A. sirm*	Philippines (Camotes Sea)	29.0 (?)	29.0	1.30	-	-0.17	LF	ELEFAN I	3.04	2.13	Y	3785	3785	
17	TP	*A. sirm*	Philippines (Camotes Sea)	31.0 (TL)	31.0	1.35	-	-0.17	LF	Non-linear reg.	3.11	2.05	Y	13304	13304	
18	TP	*A. sirm*	Philippines (Palawan)	27.3 (TL)	27.3	0.86	-	-0.16	LF	ELEFAN I	2.81	3.33	Y	1263		
19	TP	*A. sirm*	Philippines (South Sulu Sea)	25.2 (TL)	25.2	2.10	-	-0.21	LF	ELEFAN I	3.13	1.22	Y	13304	13304	
20	TP	*A. sirm*	Sri Lanka (Negombo)	22.9 (TL)	22.9	2.38	-0.08	-0.22	OT	Other	3.10	1.04	Y	36269	1444	
21	TP	*A. sirm*	Sri Lanka (Negombo)	24.8 (TL)	24.8	0.95	-	-0.17	LF	ELEFAN I	2.77	2.99	Y*	(z)	(z)	
22	TP	*A. sirm*	Sri Lanka (South Coast)	23.8 (FL)	26.0	0.95	-	-0.16	LF	-	2.81	2.99	Y	36269	46351	
23	TP	*A. sirm*	Sri Lanka (South-west coast)	22.5 (FL)	24.5	2.15	-	-0.21	LF	-	3.11	1.19	Y	36269	46352	
24	TP	*A. sirm*	Sri Lanka (South-west coast)	22.8 (FL)	24.9	2.06	-	-0.21	LF	-	3.11	1.25	Y	36269	46352	
25	TP	*A. sirm*	Sri Lanka (South-west coast)	24.6 (FL)	26.8	1.30	-	-0.18	LF	-	2.97	2.13	Y	36269	46364	
26	TP	*A. sirm*	Sri Lanka (West coast)	24.2 (TL)	24.2	2.19	-0.07	-0.21	LF	F-W plot	3.11	1.16	-	(n)	(n)	
27	TP	*A. sirm*	Sri Lanka (Western coast)	25.2 (TL)	25.2	1.25	-	-0.18	LF	ELEFAN I	2.90	2.22	Y	5763	5763	
28	TP	*A. sirm*	Sudan (near Egyptian border)	26.1 (TL)	26.1	0.38	-0.27	-0.13	-	-	2.41	7.77	Y	1442	1442	
29	TP	*A. sirm*	Tanzania (Zanzibar)	21.6 (FL)	23.6	0.43	-	-0.13	-	-	2.38	6.84	Y	12148	12147	
30	TP	*A. sirm*	Indonesia (Sunda Strait)	23.5 (TL)	23.5	0.46	-0.20	-0.14	LF	FISAT II & F-W plot	2.41	6.39	-	(o)	(o)	

#	Species-group [this review]	Species	Location	L∞ (cm) & original length type	L∞ (cm, TL)	K ($year^{-1}$)	t_0 (years)	t_0 calc. (years) [calculated, this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated, this review]	Maximum longevity T_{max} (years) [calculated, this review]	FishBase record?	Main ref. for growth parameters	Data ref.	Comment [this review] [f]
31	TP	*A. sirm*	Indonesia (Sunda Strait)	24.9 (TL)	24.9	0.24	-0.38	-0.11	LF	FISAT II & F-W plot	2.17	12.39	-	(o)	(o)	
32	TH	*E. thoracata*	India (Kerala)	11.9 (TL)	11.9	2.19	0.00	-0.26	LF	ELEFAN I	2.49	1.11	Y	119271	119271	
33	TH	*E. thoracata*	India (Mumbai)	11.0 (TL)	11.0	1.80	-	-0.25	LF	ELEFAN I	2.34	1.42	-	(v)	(v)	
34	TH	*E. thoracata*	India (Mumbai)	12.0 (TL)	12.0	1.85	-	-0.24	LF	ELEFAN I	2.42	1.38	Y	114865	114865	
35	TH	*E. thoracata*	India (Mumbai)	11.0 (TL)	11.0	1.80	-	-0.25	-	-	2.34	1.42	Y	114865	117570	
36	TH	*H. quadrimaculatus* [d]	Marshall Is.	13.1 (SL)	15.9	3.40	-	-0.27	OT	-	2.93	0.61	-	(s)	(l)	
37 [a]	TH	*H. quadrimaculatus*	Fiji (Vanua Levu)	12.6 (SL)	15.3	2.00	-0.13	-0.23	OT	Other VBGF linear.	2.67	1.27	Y	4382	4382	
38 [a]	TH	*H. quadrimaculatus*	Fiji (Vanua Levu)	13.1 (SL)	15.9	2.02	-	-0.23	LF	ELEFAN I	2.71	1.25	-	(g)	(g)	
39	TH	*H. quadrimaculatus*	Fiji (Viti Levu)	13.5 (SL?)	16.4	1.30	-0.13	-0.20	OT	Non-linear reg.	2.54	2.11	-	(r)	(r)	
40	TH	*H. quadrimaculatus*	Kiribati	10.0 (SL)	12.1	2.90	-	-0.28	OT	Non-linear reg.	2.63	0.76	Y	36847		
41	TH	*H. quadrimaculatus*	New Caledonia	12.5 (?)	12.5	3.61	0.01	-0.29	OT	-	2.75	0.54	Y	4382	4532	
42	TH	*H. quadrimaculatus*	New Caledonia	15.5 (TL)	15.5	1.54	-0.01	-0.22	LF	-	2.57	1.73	-	(f)	(f)	
43	TH	*H. quadrimaculatus*	Philippines (Camotes Sea)	16.5 (TL)	16.5	0.98	-	-0.19	LF	ELEFAN I	2.43	2.87	Y	13304	13304	
44	TH	*H. quadrimaculatus*	Seychelles	13.3 (FL)	15.4	2.56	-	-0.25	-	-	2.78	0.92	Y	12145	12146	
45	TH	*H. quadrimaculatus*	Solomon Is. (Munda)	08.6 (SL)	10.4	5.70	-	-0.35	OT	Non-linear reg.	2.79	0.18	-	(s)	(s)	
46	TH	*H. quadrimaculatus*	Solomon Is. (Vona Vona)	07.3 (SL)	8.8	7.50	-	-0.40	OT	Non-linear reg.	2.77	0.00	-	(s)	(s)	
47	FBS	*S. albella*	India (Gulf of Mannar)	13.0 (TL)	13.0	1.65	-	-0.23	LF	Other	2.45	1.58	Y	312	809	
48	FBS	*S. albella*	India (Gulf of Mannar)	13.3 (TL)	13.3	1.30	-	-0.21	LF	Other	2.36	2.10	Y	312	809	
49	FBS	*S. albella*	India (Gulf of Mannar)	20.8 (TL)	20.8	1.10	0.01	-0.18	LF	F-W plot	2.68	2.55	-	(a)	(a)	
50	FBS	*S. albella*	India (Gulf of Mannar (?))	17.0 (TL)	17.0	1.10	-	-0.19	LF	-	2.50	2.54	Y	312	810	
51	FBS	*S. albella*	India (Mandapam)	13.3 (TL)	13.3	1.44	-	-0.22	-	-	2.41	1.86	Y	811	811	
52	FBS	*S. albella*	India (Mandapam area)	13.6 (TL)	13.6	1.22	-	-0.21	LF	-	2.35	2.25	Y	2178	3560	
53	FBS	*S. albella*	Philippines (Tawi-Tawi)	20.2 (TL)	20.2	1.60	-	-0.20	LF	ELEFAN I	2.81	1.67	-	(c)	(c)	
54	FBS	*S. albella*	Sri Lanka	13.8 (TL)	13.8	2.03	-0.01	-0.24	OT	Other VBGF linear.	2.59	1.24	Y	1444	1444	
55	FBS	*S. albella*	Tanzania (Dar es Salaam)	16.8 (TL)	16.8	1.15	-	-0.19	LF	ELEFAN I	2.51	2.41	Y	4330	4330	
56	FBS	*S. fimbriata*	India (Karwar)	18.4 (TL)	18.4	1.32	-	-0.20	LF	Non-linear reg.	2.65	2.08	Y	312	817	
57	FBS	*S. fimbriata*	India (East coast)	20.7 (TL)	20.7	0.85	-0.02	-0.17	LF	ELEFAN I	2.56	3.36	Y	114772		
58	FBS	*S. fimbriata*	India (Visakhapatnam)	21.7 (TL)	21.7	1.30	-0.06	-0.19	LF	ELEFAN I	2.79	2.12	Y	27806	27806	
59	FBS	*S. fimbriata*	Indonesia (Bali Strait)	19.6 (TL)	19.6	0.54	-0.15	-0.15	LF	FISAT II	2.32	5.41	-	(d)	(d)	
60	FBS	*S. fimbriata*	Indonesia (East Java)	26.8 (TL)	26.8	0.92	-0.18	-0.16	LF	FISAT II	2.82	3.10	-	(e)	(e)	
61	FBS	*S. fimbriata*	Indonesia (Madura Strait)	20.0 (TL)	20.0	1.00	-	-0.18	LF	MCPA	2.60	2.82	-	(u)	(u)	
62	FBS	*S. fimbriata* [e]	Philippines (Guimaras Strait)	18.9 (?)	18.9	0.87	-	-0.17	LF	-	2.49	3.27	Y	1392		
63	FBS	*S. fimbriata* [e]	Philippines (Guimaras Strait)	22.3 (TL)	22.3	0.90	-	-0.17	LF	ELEFAN I	2.65	3.17	Y	13304	13304	
64	FBS	*S. fimbriata* [e]	Philippines (Leyte Gulf)	20.4 (?)	20.4	1.02	-	-0.18	LF	-	2.63	2.76	Y	1392		
65	FBS	*S. fimbriata* [e]	Philippines (Leyte Gulf)	21.3 (?)	21.3	0.91	-	-0.17	LF	-	2.62	3.13	Y	1392		
66	FBS	*S. fimbriata* [e]	Philippines (Leyte Gulf)	23.7 (TL)	23.7	0.99	-	-0.17	LF	ELEFAN I	2.75	2.86	Y	13304	13304	
67	FBS	*S. fimbriata* [e]	Philippines (Manila Bay)	17.0 (?)	17.0	1.20	-	-0.20	LF	-	2.54	2.30	Y	1392		
68	FBS	*S. fimbriata* [e]	Philippines (Manila Bay)	18.0 (TL)	18.0	0.70	-	-0.17	LF	ELEFAN I	2.36	4.12	Y	1263		
69	FBS	*S. fimbriata* [e]	Philippines (Manila Bay)	18.5 (TL)	18.5	0.95	-	-0.18	LF	ELEFAN I	2.51	2.98	-	(h)	(h)	
70	FBS	*S. fimbriata* [e]	Philippines	14.0 (TL)	14.0	1.60	-	-0.22	-	-	2.50	1.65	Y	312	818	
71	FBS	*S. fimbriata* [e]	Philippines (Palawan)	22.0 (TL)	22.0	1.15	-	-0.18	LF	ELEFAN I	2.75	2.43	Y	1263		
72	FBS	*S. fimbriata* [e]	Philippines (Tawi-Tawi)	22.5 (TL)	22.5	0.75	-	-0.16	LF	ELEFAN I	2.58	3.84	-	(c)	(c)	
73	FBS	*S. fimbriata* [e]	Philippines (Tayabas Bay)	24.8 (TL)	24.8	1.20	-	-0.18	LF	ELEFAN I	2.87	2.32	Y	13304	13304	
74	FBS	*S. fimbriata* [e]	Philippines (Visayan Sea)	21.3 (?)	21.3	1.03	-	-0.18	LF	-	2.67	2.74	Y	1392		
75	FBS	*S. gibbosa*	Egypt (Red Sea)	22.1 (TL)	22.1	0.40	-0.80	-0.13	LF	Other VBGF linear.	2.29	7.37	Y	1529	1529	
76	FBS	*S. gibbosa*	India (East coast)	19.1 (TL)	19.1	1.50	-	-0.20	LF	ELEFAN I	2.74	1.80	Y	27806	27806	

#	Species-group [this review]	Species	Location	L_∞ (cm) & original length type	L_∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated, this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, φ' [calculated, this review]	Maximum longevity T_{max} (years) [calculated, this review]	FishBase record?	Main ref. for growth parameters	Data ref.	Comment [this review] [f]
77	FBS	*S. gibbosa*	India (Goa-Karnataka)	21.1 (TL)	21.1	1.40	-	-0.19	LF	ELEFAN I	2.79	1.95	Y	27806	27806	
78	FBS	*S. gibbosa*	India (Gulf of Mannar)	19.4 (TL)	19.4	1.82	0.00	-0.21	LF	F-W plot	2.83	1.44	-	(a)	(a)	
79	FBS	*S. gibbosa*	India (Kerala)	19.7 (TL)	19.7	1.50	-	-0.20	LF	ELEFAN I	2.77	1.80	Y	27806	27806	
80	FBS	*S. gibbosa*	India (Mandapam)	17.1 (TL)	17.1	1.08	-	-0.19	-	-	2.50	2.59	Y	1751	811	
81	FBS	*S. gibbosa*	India (Mandapam area)	14.6 (?)	14.6	1.38	-	-0.21	LF	-	2.47	1.96	Y	2178	3560	
82	FBS	*S. gibbosa*	India (East coast)	20.7 (TL)	20.7	0.96	-0.02	-0.17	LF	ELEFAN I	2.61	2.95	Y	114772		
83	FBS	*S. gibbosa*	India (Tamil Nadu)	18.8 (?)	18.8	1.24	-	-0.19	-	-	2.64	2.23	Y	116321		
84	FBS	*S. gibbosa*	Indonesia (Riau Waters)	19.5 (TL)	19.5	1.20	-	-0.19	LF	ELEFAN I	2.66	2.31	Y	1314		
85	FBS	*S. gibbosa*	Mozambique	14.1 (?)	14.1	3.50	-	-0.28	OT	-	2.84	0.58	Y	2178	1443	
86	FBS	*S. gibbosa*	Philippines (Guimaras Strait)	20.6 (FL)	23.9	0.80	-	-0.16	LF	ELEFAN I	2.66	3.59	Y	5730	5730	
87	FBS	*S. gibbosa*	Philippines (Manila Bay)	18.5 (TL)	18.5	0.88	-	-0.18	LF	ELEFAN I	2.48	3.23	-	(h)	(h)	
88	FBS	*S. gibbosa*	Sri Lanka	14.1 (TL)	14.1	3.49	-0.02	-0.28	OT	Other VBGF linear.	2.84	0.58	Y	1444	1444	
89	FBS	*S. gibbosa*	Sri Lanka (Negombo)	17.0 (FL)	19.7	2.20	-	-0.22	LF	-	2.93	1.14	Y	36269	46366	
90	FBS	*S. gibbosa*	Tanzania (Dar es Salaam)	18.6 (TL)	18.6	1.80	-	-0.21	LF	Other VBGF linear.	2.79	1.45	Y	4330	4330	
91	FBS	*S. gibbosa*	Tanzania (Zanzibar)	17.0 (FL)	19.7	0.58	-	-0.15	LF	-	2.35	5.02	Y	4331	4331	
92	FBS	*S. gibbosa*	Tanzania (Zanzibar)	19.4 (FL)	22.5	0.32	-	-0.12	-	-	2.21	9.25	Y	12148	12147	
93	FBS	*S. jussieu*	Egypt (Gulf of Suez)	24.8 (TL)	24.8	0.65	-	-0.15	LF	Other VBGF linear.	2.60	4.47	Y	53465	53465	
94	FBS	*S. jussieu*	Taiwan	18.2 (TL)	18.2	0.37	-	-0.14	-	-	2.09	7.97	Y	104735	104735	
95	FBS	*S. melanura*	Philippines (Palawan)	22.5 (SL)	27.4	0.70	-	-0.15	LF	ELEFAN I	2.72	4.14	Y	1263		
96	FBS	*S. sindensis*	Iran (Gulf of Oman)	19.5 (TL)	19.5	1.18	-	-0.19	LF	-	2.65	2.35	Y	105100	117661	
97	FBS	*S. sindensis*	Iran (Gulf of Oman)	20.0 (TL)	20.0	1.40	-	-0.20	LF	-	2.75	1.95	Y	105100	117663	
98	FBS	*S. sindensis*	Iran (Persian Gulf & Oman Sea)	21.0 (TL)	21.0	1.20	-0.14	-0.18	LF	ELEFAN I	2.72	2.32	-	(y)	(y)	
99	FBS	*S. sindensis*	Iran (Qeshm Island)	17.8 (TL)	17.8	1.11	-	-0.19	LF	-	2.55	2.51	Y	105100	117662	
100	FBS	*S. sindensis*	Iran (Qeshm Island)	20.8 (TL)	20.8	0.54	-0.54	-0.15	OT	Non-linear reg.	2.37	5.41	Y	105100	105100	
101	FBS-FW	*S. tawilis*	Philippines (Taal Lake)	18.3 (TL)	18.3	0.78	-	-0.17	LF	ELEFAN I	2.42	3.68	Y	80723	80723	Excluded
102	FBS	*S. zunasi*	Japan (Seto Inland Sea)	13.4 (SL)	16.9	0.50	-0.71	-0.15	ASR	-	2.15	5.86	Y	96716	96716	
103	FBS	*S. zunasi*	Japan (Seto Inland Sea)	12.5 (SL)	15.8	0.63	-0.53	-0.17	ASR	-	2.19	4.63	Y	96716	96716	
104 [b]	RBS	*S. lemuru*	Australia (West Aust.)	16.6 (FL)	18.8	0.73	-	-0.17	OT	-	2.41	3.94	Y*	(k)	(k)	
105 [b]	RBS	*S. lemuru*	Australia (West Aust.)	17.3 (FL)	19.6	1.00	-	-0.18	LF	ELEFAN I	2.58	2.82	Y*	(k)	(k)	
106	RBS	*S. lemuru*	Indonesia (Bali Strait)	21.1 (TL)	21.1	0.80	-	-0.16	LF	ELEFAN I	2.55	3.59	Y	1314		
107	RBS	*S. lemuru*	Indonesia (Bali Strait)	22.3 (TL)	22.3	0.85	-	-0.16	LF	ELEFAN I	2.63	3.36	Y	1314		
108	RBS	*S. lemuru*	Indonesia (Bali Strait)	22.5 (TL)	22.5	1.00	-	-0.17	LF	ELEFAN I	2.70	2.83	Y	1314		
109	RBS	*S. lemuru*	Indonesia (Bali Strait)	23.2 (TL)	23.2	1.28	-	-0.18	LF	ELEFAN I	2.84	2.16	Y	1314		
110	RBS	*S. lemuru*	Indonesia (Bali Strait)	21.2 (TL)	21.2	1.01	-0.38	-0.18	-	MCPA	2.66	2.81	-	(aa)	(af)	
111	RBS	*S. lemuru*	Indonesia (Bali Strait)	21.4 (TL)	21.4	1.37	-	-0.19	-	ELEFAN I	2.80	2.00	-	(aa)	(ac)	
112	RBS	*S. lemuru*	Indonesia (Bali Strait)	22.7 (TL)	22.7	0.96	-0.18	-0.17	-	ELEFAN I	2.70	2.95	-	(q)	(ad)	
113	RBS	*S. lemuru*	Indonesia (Bali Strait)	22.1 (TL)	22.1	1.29	-0.08	-0.19	-	ELEFAN I	2.80	2.14	-	(aa)	(ae)	
114	RBS	*S. lemuru*	Indonesia (Bali Strait)	21.8 (FL)	24.7	1.00	-	-0.17	LF	ELEFAN I	2.78	2.83	-	(aa)	(aa)	
115	RBS	*S. lemuru*	Indonesia (Bali Strait)	18.1 (SL)	22.2	0.95	-	-0.17	-	-	2.67	2.99	Y	3268	3268	
116	RBS	*S. lemuru*	Indonesia (Madura Strait)	21.0 (TL)	21.0	0.80	-	-0.16	LF	MCPA	2.55	3.59	-	(u)	(u)	
117	RBS	*S. lemuru*	Indonesia (Bali Strait)	23.8 (TL)	23.8	0.51	0.00	-0.14	LF	Other VBGF linear.	2.46	5.80	Y	819	819	
118	RBS	*S. lemuru*	Philippines (Manila Bay)	21.0 (TL)	21.0	1.10	-	-0.18	LF	ELEFAN I	2.69	2.55	Y	1263		
119	RBS	*S. lemuru*	Philippines	19.3 (?)	19.3	1.22	-	-0.19	OT	-	2.66	2.27	Y	3784		
120	RBS	*S. lemuru*	Philippines (Palawan)	23.0 (TL)	23.0	1.10	-	-0.18	LF	ELEFAN I	2.76	2.55	Y	1263		
121	RBS	*S. lemuru*	Philippines (Ragay Gulf)	15.8 (FL)	17.9	1.00	-	-0.18	LF	ELEFAN I	2.51	2.82	Y	1449	1449	
122	RBS	*S. lemuru*	Philippines (South Sulu Sea)	19.4 (TL)	19.4	1.00	-	-0.18	LF	ELEFAN I	2.58	2.82	Y	13304	13304	

#	Species-group [this review]	Species	Location	L∞ (cm) & original length type	L∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated, this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated, this review]	Maximum longevity T_{max} (years) [calculated, this review]	FishBase record?	Main ref. for growth parameters	Data ref.	Comment [this review] [f]
123	RBS	*S. lemuru*	Philippines (Sulu Sea)	22.3 (TL)	22.3	1.04	-	-0.17	LF	ELEFAN I	2.72	2.71	-	(p)	(p)	
124	RBS	*S. lemuru*	Philippines (Tawi-Tawi)	26.0 (TL)	26.0	0.86	-	-0.16	LF	ELEFAN I	2.76	3.33	-	(c)	(c)	
125	RBS	*S. lemuru*	Philippines (Visayan Sea)	21.5 (?)	21.5	1.05	-	-0.18	LF	-	2.69	2.68	Y	1392		
126	RBS	*S. lemuru*	Philippines (Visayan Sea)	27.0 (?)	27.0	0.90	-	-0.16	LF	-	2.82	3.17	Y	1392		
127	RBS	*S. lemuru*	Philippines (Visayas)	15.8 (FL)	17.9	1.10	-	-0.19	LF	ELEFAN I	2.55	2.54	Y	5381	5381	
128 [c]	RBS	*S. longiceps*	India (all regions)	23.4 (TL)	23.4	1.57	-0.11	-0.19	LF	FISAT II	2.94	1.72	-	(x)	(x)	
129 [c]	RBS	*S. longiceps*	India (all regions)	23.4 (TL)	23.4	1.76	-0.11	-0.20	OT	FISAT II	2.99	1.50	-	(x)	(x)	
130	RBS	*S. longiceps*	India (Andhra Pradesh)	23.4 (?)	23.4	0.90	-	-0.17	-	-	2.69	3.17	Y	116211		
131	RBS	*S. longiceps*	India (Calicut)	21.0 (TL)	21.0	0.60	-	-0.15	LF	F-W plot	2.42	4.85	Y	820	820	
132	RBS	*S. longiceps*	India (Goa)	22.9 (?)	22.9	0.90	-	-0.17	-	-	2.67	3.17	Y	116140		
133	RBS	*S. longiceps*	India (Gulf of Mannar)	23.2 (TL)	23.2	1.55	0.09	-0.19	LF	F-W plot	2.92	1.74	-	(a)	(a)	
134	RBS	*S. longiceps*	India (Karnataka)	22.8 (TL)	22.8	0.90	-0.01	-0.17	LF	ELEFAN I	2.67	3.17	-	(w)	(w)	
135	RBS	*S. longiceps*	India (Karnataka)	22.8 (?)	22.8	0.90	-0.11	-0.17	-	-	2.67	3.17	Y	116321		
136	RBS	*S. longiceps*	India (Karnataka)	23.2 (?)	23.2	1.55	-0.11	-0.19	-	-	2.92	1.74	Y	116211		
137	RBS	*S. longiceps*	India (Karwar)	21.0 (TL)	21.0	0.60	-	-0.15	LF	-	2.42	4.83	Y	1478	1478	
138	RBS	*S. longiceps*	India (Maharashtra)	21.1 (TL)	21.1	1.00	-	-0.18	-	-	2.65	2.82	Y	116140		
139	RBS	*S. longiceps*	India (Maharashtra)	19.7 (?)	19.7	1.00	-	-0.18	-	-	2.59	2.82	Y	116321		
140	RBS	*S. longiceps*	India (Malabar Coast)	20.7 (TL)	20.7	0.50	-	-0.14	LF	-	2.33	5.86	Y	1751	822	
141	RBS	*S. longiceps*	India (Malabar coast)	20.0 (TL)	20.0	2.10	-	-0.22	-	-	2.92	1.21	-	(j)	(ag)	
142	RBS	*S. longiceps*	India	27.0 (TL)	27.0	0.40	-	-0.13	LF	-	2.46	7.37	Y	312	810	
143	RBS	*S. longiceps*	India (Northeast coast)	24.0 (?)	24.0	0.79	-	-0.16	-	-	2.66	3.64	Y	116211		
144	RBS	*S. longiceps*	India (South-west coast)	21.0 (TL)	21.0	1.40	-	-0.19	LF	F-W plot	2.79	1.95	Y	2900	2900	
145	RBS	*S. longiceps*	India (South-west coast)	19.8 (TL)	19.8	1.14	-0.05	-0.19	LF	ELEFAN I	2.65	2.45	-	(i)	(i)	
146	RBS	*S. longiceps*	India (Southern waters)	20.7 (TL)	20.7	0.53	-	-0.15	LF	-	2.35	5.54	Y	1139	821	
147	RBS	*S. longiceps*	India (Visakhapatnam)	21.6 (TL)	21.6	1.50	-	-0.20	LF	ELEFAN I	2.84	1.80	-	(j)	(j)	
148	RBS	*S. longiceps*	India (Visakhapatnam)	22.5 (?)	22.5	1.10	-	-0.18	-	-	2.75	2.55	Y	116321		
149	RBS	*S. longiceps*	India (West coast)	19.2 (TL)	19.2	1.01	-	-0.18	LF	Other	2.57	2.80	Y	1373	1373	
150	RBS	*S. longiceps*	India (West coast)	20.7 (TL)	20.7	0.53	-	-0.15	LF	-	2.35	5.54	Y	821	821	
151	RBS	*S. longiceps*	Oman (Mahout)	23.0 (TL)	23.0	1.33	-0.09	-0.19	LF	ELEFAN I	2.85	2.07	-	(m)	(m)	
152	RBS	*S. longiceps*	Oman	22.0 (TL)	22.0	1.21	-	-0.18	-	-	2.77	2.30	Y	105100	117660	
153	RBS	*S. longiceps*	Oman (Sohar)	23.0 (TL)	23.0	1.40	-0.15	-0.19	LF	ELEFAN I & Other	2.87	1.95	-	(ab)	(ab)	
154	RBS	*S. longiceps*	Oman	22.0 (TL)	22.0	1.21	-0.01	-0.18	LF	ELEFAN I & Other	2.77	2.30	-	(b)	(b)	
155	RBS	*S. longiceps*	Pakistan	25.2 (TL)	25.2	1.40	-0.93	-0.18	LF	ELEFAN I	2.95	1.96	-	(t)	(t)	
156	RBS	*S. longiceps*	Sri Lanka (East coast)	16.3 (TL)	16.3	2.77	-0.03	-0.25	OT	Other VBGF linear.	2.87	0.83	Y	1444	1444	
157	RBS	*S. longiceps*	Yemen (Gulf of Aden)	14.5 (TL)	14.5	5.62	-0.03	-0.32	OT	Other VBGF linear.	3.07	0.22	Y	1444	1444	
158	RBS	*S. longiceps*	Yemen (Gulf of Aden)	23.8 (TL)	23.8	0.97	0.70	-0.17	ASR	Other VBGF linear.	2.74	2.92	Y	2897	2897	
159	RBS	*S. longiceps*	Yemen (Gulf of Aden)	24.0 (FL)	26.9	0.55	0.09	-0.14	OAR	-	2.60	5.32	Y	3626	3626	
160	RBS	*S. longiceps*	Yemen (Mukalla-Ras Fartak)	24.5 (TL)	24.5	0.78	-	-0.16	LF	Other	2.67	3.69	Y	1477	1477	

[a, b & c] These pairs of records are from the same study, but based on different aging methods (e.g. otoliths and length-frequencies).

[d] Named *H. punctatus* in the original reference, but referred to by subsequent authors as *H. quadrimaculatus* (e.g. by Milton et al. 1994b).

[e] *S. fimbriata* in the Philippines has recently been found to be distinct from *S. fimbriata* in the Indian Ocean, and has been re-described as new species *S. pacifica* (Hata and Motomura 2019).

[f] Reasons for excluding observations: #12, ϕ' is an outlier (i.e. larger than 1.5 times the interquartile range of ϕ' for IWP tropical clupeids); #101, freshwater *Sardinella* species, not the focus of this review. #156 and #157, limited length range of fish sampled using gill net (low L∞).

Table S2.3. Growth parameters of the von Bertalanffy growth function (L_∞, K, t_0), data sources, estimation methods, and calculated growth performance index and maximum longevity, for tropical marine species of the family Clupeidae in the Atlantic Ocean, from the genus *Sardinella*. Data have been obtained from the FishBase database (version 04.2019), accessed through R package 'rfishbase' on 4 January 2021. For description of column headings and abbreviations, refer to the caption for Table S2.2.

#	Species-group [this review]	Species	Location	L_∞ (cm) & original length type	L_∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated, this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated, this review]	Maximum longevity T_{max} (years) [calculated, this review]	FishBase record?	Main ref. for growth parameters	Data ref.	Comment [this review] [b]
161	RBS-ATL	*S. aurita*	Algeria	25.0 (TL)	25.0	0.53	-	-0.14	-	Other VBGF linear.	2.52	5.48	Y	312	830	
162	RBS-ATL	*S. aurita*	Angola	43.3 (?)	43.3	0.28	-	-0.10	-	-	2.72	10.61	Y	6425	6432	
163	RBS-ATL	*S. aurita*	Brazil	24.5 (TL)	24.5	0.42	-1.23	-0.13	-	Non-linear reg.	2.40	6.96	Y	312	828	
164	RBS-ATL	*S. aurita*	Canary Is.	37.0 (TL)	37.0	0.26	-0.82	-0.10	-	Non-linear reg.	2.55	11.57	Y	312	826	
165	RBS-ATL	*S. aurita*	Congo	30.6 (TL)	30.6	1.02	-0.09	-0.16	-	-	2.98	2.77	Y	824	824	
166	RBS-ATL	*S. aurita*	Congo	30.6 (TL)	30.6	1.21	-0.03	-0.17	-	-	3.05	2.32	Y	824	824	
167	RBS-ATL	*S. aurita*	Congo	31.0 (TL)	31.0	0.69	-	-0.14	-	Non-linear reg.	2.82	4.19	Y	312	815	
168	RBS-ATL	*S. aurita*	Egypt	31.5 (TL)	31.5	0.23	-1.10	-0.10	-	Non-linear reg.	2.37	12.72	Y	96811		
169	RBS-ATL	*S. aurita*	Egypt	26.0 (?)	26.0	0.53	-	-0.14	-	-	2.55	5.52	Y	5760	5792	
170	RBS-ATL	*S. aurita*	Egypt	25.6 (TL)	25.6	0.55	-	-0.14	OT	-	2.56	5.31	Y	105100	117655	
171	RBS-ATL	*S. aurita*	France	27.2 (?)	27.2	0.51	-0.96	-0.13	-	Non-linear reg.	2.57	5.79	Y	96811		
172	RBS-ATL	*S. aurita*	Ghana	21.5 (TL)	21.5	0.25	-	-0.12	LF	ELEFAN I	2.06	11.88	Y	116923	116923	
173	RBS-ATL	*S. aurita*	Greece	29.0 (TL)	29.0	0.50	-	-0.13	-	-	2.62	5.87	Y	1836	829	
174	RBS-ATL	*S. aurita*	Greece	25.0 (TL)	25.0	0.49	-0.86	-0.14	ASR	Non-linear reg.	2.49	5.94	Y	56797	56797	
175	RBS-ATL	*S. aurita*	Israel	31.1 (TL)	31.1	0.25	-1.81	-0.11	-	Non-linear reg.	2.38	11.89	Y	312	827	
176	RBS-ATL	*S. aurita*	Mauritania	40.7 (TL)	40.7	0.33	-	-0.11	-	-	2.73	9.10	Y	825	825	
177	RBS-ATL	*S. aurita*	Senegal	30.6 (?)	30.6	1.21	-	-0.17	-	-	3.05	2.31	Y	5760	5906	
178	RBS-ATL	*S. aurita*	Sierra Leone	32.0 (FL)	37.9	0.48	-	-0.12	LF	ELEFAN I	2.84	6.13	Y	30305	30305	
179	RBS-ATL	*S. aurita*	Spain	27.4 (?)	27.4	0.44	-	-0.13	-	-	2.52	6.69	Y	7164	7167	
180	RBS-ATL	*S. aurita*	Spain	30.3 (?)	30.3	0.37	-	-0.12	-	-	2.53	7.99	Y	7164	7168	
181	RBS-ATL	*S. aurita*	Spain	27.7 (TL)	27.7	0.45	-1.41	-0.13	-	Non-linear reg.	2.54	6.58	Y	312	826	
182	RBS-ATL	*S. aurita*	Taiwan	28.1 (TL)	28.1	0.31	-	-0.12	-	-	2.39	9.56	Y	104735	104735	
183	RBS-ATL	*S. aurita*	Tunisia	29.0 (TL)	29.0	0.36	-0.92	-0.12	ASR	-	2.48	8.17	Y	2285	2286	
184	RBS-ATL	*S. aurita*	Venezuela	24.0 (TL)	24.0	0.70	-	-0.15	-	-	2.61	4.13	Y	813	813	
185	RBS-ATL	*S. aurita*	Venezuela	27.6 (TL)	27.6	0.68	-	-0.15	-	Other	2.71	4.28	Y	312	861	
186	RBS-ATL	*S. aurita*	Venezuela	28.5 (TL)	28.5	0.86	-	-0.15	-	Other	2.85	3.32	Y	312	861	
187	RBS-ATL	*S. aurita*	Venezuela	24.2 (TL)	24.2	0.73	-	-0.15	ASR	F-W plot	2.63	3.98	Y	812	812	
188	RBS-ATL	*S. aurita*	Venezuela	27.4 (FL)	32.3	0.25	-1.66	-0.10	OT	-	2.42	11.90	Y	11824	12012	
189	RBS-ATL	*S. aurita*	Venezuela	26.6 (TL)	26.6	1.26	-	-0.18	LF	ELEFAN I	2.95	2.21	Y	8987	8987	
190	RBS-ATL	*S. aurita*	Algeria	24.2 (TL)	24.2	0.54	-	-0.14	LF	Other	2.50	5.41	Y	58043	58043	
191	RBS-ATL	*S. aurita*	Spain	35.0 (TL)	35.0	0.25	-	-0.10	-	-	2.49	11.90	Y	1836	718	
192	RBS-ATL	*S. aurita*	Turkey	23.9 (FL)	28.1	0.33	-4.39	-0.12	OT	Non-linear reg.	2.41	9.00	Y	57591	57591	
193	RBS-ATL	*S. aurita*	Algeria	20.7 (TL)	20.7	0.69	-	-0.16	LF	Other	2.47	4.18	Y	58043	58043	
194	RBS-ATL	*S. aurita*	Spain	30.0 (TL)	30.0	0.35	-	-0.12	-	-	2.50	8.45	Y	312	718	
195	RBS-ATL	*S. aurita*	Turkey	26.1 (FL)	30.7	0.34	-5.36	-0.12	OT	Non-linear reg.	2.51	8.63	Y	57591	57591	
196	RBS-ATL	*S. aurita* [a]	Brazil	24.0 (TL)	24.0	0.62	-0.59	-0.15	-	-	2.55	4.69	Y	7011	7014	
197	RBS-ATL	*S. aurita* [a]	Brazil	24.3 (TL)	24.3	0.50	-	-0.14	-	-	2.47	5.86	Y	7011	7015	
198	RBS-ATL	*S. aurita* [a]	Brazil	24.4 (TL)	24.4	0.44	-	-0.13	-	-	2.42	6.69	Y	7011	7013	
199	RBS-ATL	*S. aurita* [a]	Brazil	26.0 (TL)	26.0	0.62	-0.59	-0.14	-	-	2.62	4.69	Y	7011	7012	
200	RBS-ATL	*S. aurita* [a]	Brazil	27.2 (TL)	27.2	0.55	-	-0.14	OT	Non-linear reg.	2.61	5.32	Y	13011	13011	
201	RBS-ATL	*S. aurita* [a]	Brazil	22.6 (TL)	22.6	0.72	-0.34	-0.16	OT	-	2.56	4.02	Y	7011	7011	

#	Species-group [this review]	Species	Location	L∞ (cm) & original length type	L∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated, this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated, this review]	Maximum longevity T_{max} (years) [calculated, this review]	FishBase record?	Main ref. for growth parameters	Data ref.	Comment [this review] [b]
202	RBS-ATL	*S. aurita* [a]	Brazil	23.0 (TL)	23.0	0.72	-0.25	-0.16	OT	-	2.58	4.00	Y	7011	7011	
203	RBS-ATL	*S. aurita* [a]	Brazil	27.4 (TL)	27.4	0.43	-0.83	-0.13	OT	-	2.51	6.85	Y	54999		
204	FBS-ATL	*S. maderensis*	Cameroon	32.5 (TL)	32.5	0.59	-	-0.13	LF	Other VBGF linear.	2.79	4.95	Y	3781	3781	
205	FBS-ATL	*S. maderensis*	Cameroon	29.1 (TL)	29.1	0.83	-	-0.15	LF	ELEFAN I	2.85	3.46	Y	3779	3779	
206	FBS-ATL	*S. maderensis*	Congo	24.9 (TL)	24.9	0.99	-	-0.17	ASR	-	2.79	2.86	Y	816	816	
207	FBS-ATL	*S. maderensis*	Congo	39.6 (TL)	39.6	0.28	-	-0.10	-	Non-linear reg.	2.64	10.73	Y	312	815	
208	FBS-ATL	*S. maderensis*	Congo Dem Rp	24.4 (?)	24.4	0.08	0.29	-0.08	-	-	1.69	36.50	Y	72458	816	Yes
209	FBS-ATL	*S. maderensis*	Nigeria	37.5 (TL)	37.5	0.34	-	-0.11	-	F-W plot	2.67	8.82	Y	26112	26122	
210	FBS-ATL	*S. maderensis*	Nigeria	37.5 (?)	37.5	0.34	-	-0.11	-	-	2.68	8.71	Y	3779		
211	FBS-ATL	*S. maderensis*	Senegal	35.0 (TL)	35.0	0.61	-	-0.13	-	Non-linear reg.	2.87	4.80	Y	312	814	
212	FBS-ATL	*S. maderensis*	Senegal	37.5 (FL)	46.4	0.30	-	-0.10	LF	ELEFAN I	2.81	9.90	Y	1382	1382	
213	FBS-ATL	*S. maderensis*	Sierra Leone	29.6 (FL)	36.4	0.30	-	-0.11	LF	ELEFAN I	2.60	9.89	Y	30305	30305	
214	FBS-ATL	S. maderensis	Tunisia	25.5 (TL)	25.5	0.30	-1.15	-0.12	ASR	-	2.29	9.95	Y	2285	2286	

[a] Listed in FishBase as *S. brasiliensis*, which has been recently found to be a synonym of *S. aurita* (Fricke et al. 2020; Stern et al. 2018).

[b] Reasons for excluding observations: #208, ϕ' is an outlier (i.e. less than 1.5 times the interquartile range of ϕ' for non-IWP tropical clupeids).

Table S2.4. Growth parameters of the von Bertalanffy growth function (L_∞, K, t_0), data sources, estimation methods, and calculated growth performance index and maximum longevity, for three temperate (or non-tropical) marine species from the family Clupeidae, *Sardina pilchardus*, *Sardinops sagax* and *Sprattus sprattus*. Data have been obtained from the FishBase database (version 04.2019), accessed through R package 'rfishbase' on 4 January 2021. For description of column headings and abbreviations, refer to the caption for Table S2.2.

#	Species-group [this review]	Species	Location	L∞ (cm) & original length type	L∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated this review]	Maximum longevity T_{max} (years) [calculated this review]	FishBase record?	Main ref. for growth parameters	Data ref.
215	Other	*Sardina pilchardus*	(Biscay)	25.0 (TL)	25.0	0.25	-	-0.11	-	-	2.19	11.89	Y	312	718
216	Other	*Sardina pilchardus*	(Biscay)	20.0 (TL)	20.0	0.32	-	-0.13	-	-	2.11	9.25	Y	312	718
217	Other	*Sardina pilchardus*	(Gulf of Lion)	16.4 (TL)	16.4	0.56	-0.66	-0.16	-	Non-linear reg.	2.18	5.23	Y	312	804
218	Other	*Sardina pilchardus*	(Aegean)	16.6 (TL)	16.6	0.40	-1.64	-0.14	-	Non-linear reg.	2.04	7.37	Y	312	800
219	Other	*Sardina pilchardus*	(Castellon)	16.6 (TL)	16.6	0.57	-1.03	-0.16	-	Non-linear reg.	2.19	5.15	Y	312	803
220	Other	*Sardina pilchardus*	(Aegean Sea)	16.7 (TL)	16.7	0.48	-1.31	-0.15	-	Non-linear reg.	2.13	6.06	Y	312	800
221	Other	*Sardina pilchardus*	(off Split)	17.0 (TL)	17.0	0.40	-	-0.14	-	-	2.06	7.36	Y	312	806
222	Other	*Sardina pilchardus*	(Mediterranean Coast)	17.0 (TL)	17.0	0.60	-	-0.16	-	-	2.24	4.84	Y	312	805
223	Other	*Sardina pilchardus*	(Upper Adriatic)	17.0 (TL)	17.0	0.70	-1.02	-0.17	-	Non-linear reg.	2.31	4.12	Y	312	801
224	Other	*Sardina pilchardus*	(Bay of Biscay)	19.0 (TL)	19.0	0.40	-	-0.14	-	-	2.16	7.36	Y	312	805
225	Other	*Sardina pilchardus*	(Castellon)	19.6 (TL)	19.6	0.31	-	-0.13	-	Non-linear reg.	2.08	9.55	Y	312	802
226	Other	*Sardina pilchardus*	(French Mediterranean Coast)	19.9 (TL)	19.9	0.36	-1.09	-0.13	-	Non-linear reg.	2.15	8.20	Y	312	797
227	Other	*Sardina pilchardus*	(Alicante)	20.1 (TL)	20.1	0.41	-1.86	-0.14	-	Non-linear reg.	2.21	7.27	Y	312	799
228	Other	*Sardina pilchardus*	(Barcelona)	20.4 (TL)	20.4	0.27	-2.21	-0.12	-	Non-linear reg.	2.05	10.91	Y	312	808
229	Other	*Sardina pilchardus*	(Alicante)	20.9 (TL)	20.9	0.53	-1.11	-0.15	-	Non-linear reg.	2.36	5.52	Y	312	799
230	Other	*Sardina pilchardus*		21.6 (TL)	21.6	0.49	-	-0.14	-	Non-linear reg.	2.36	5.98	Y	312	798
231	Other	*Sardina pilchardus*	(Formentera)	22.5 (TL)	22.5	0.33	-1.81	-0.13	-	Non-linear reg.	2.22	8.97	Y	312	803
232	Other	*Sardina pilchardus*	(Vinaroz-Castellon-Columbretes)	20.3 (TL)	20.3	0.31	-1.54	-0.13	ASR	-	2.10	9.68	Y	807	807
233	Other	*Sardina pilchardus*	(North Sea/Channel)	25.0 (TL)	25.0	0.50	-	-0.14	-	-	2.49	5.86	Y	833	805
234	Other	*Sardina pilchardus*		19.4 (TL)	19.4	0.43	-0.82	-0.14	ASR	-	2.21	6.84	Y	2285	2286
235	Other	*Sardina pilchardus*		19.0 (TL)	19.0	0.36	-1.21	-0.13	ASR	-	2.11	8.20	Y	2285	2286
236	Other	*Sardina pilchardus*	(Algerian coasts)	20.3 (TL)	20.3	0.26	-	-0.12	ASR	Non-linear reg.	2.02	11.60	Y	5533	5558
237	Other	*Sardina pilchardus*	(Algerian coasts)	18.7 (TL)	18.7	0.28	-1.99	-0.13	ASR	Non-linear reg.	1.99	10.51	Y	5533	5558
238	Other	*Sardina pilchardus*	(Castellon)	19.4 (TL)	19.4	0.31	-	-0.13	-	-	2.07	9.55	Y	5533	5561
239	Other	*Sardina pilchardus*	(Galicia)	24.1 (TL)	24.1	0.34	-	-0.12	-	-	2.30	8.70	Y	5760	5900
240	Other	*Sardina pilchardus*	(Galicia)	22.6 (TL)	22.6	0.37	-	-0.13	-	-	2.28	7.98	Y	5760	5900
241	Other	*Sardina pilchardus*		21.2 (TL)	21.2	0.68	-	-0.16	-	-	2.49	4.26	Y	5760	5772
242	Other	*Sardina pilchardus*	(Northwest Africa)	21.6 (TL)	21.6	0.82	-0.13	-0.16	OT	F-W plot	2.58	3.49	Y	27643	5784
243	Other	*Sardina pilchardus*	(Alicante)	22.4 (TL)	22.4	0.29	-	-0.12	-	-	2.16	10.22	Y	5760	5826
244	Other	*Sardina pilchardus*		22.4 (TL)	22.4	0.67	-	-0.15	-	-	2.53	4.32	Y	5760	5771
245	Other	*Sardina pilchardus*	(Galicia)	24.3 (TL)	24.3	0.43	-	-0.13	-	-	2.40	6.84	Y	5760	5905
246	Other	*Sardina pilchardus*		25.2 (TL)	25.2	0.23	-	-0.11	-	-	2.16	12.93	Y	5760	5861
247	Other	*Sardina pilchardus*	(Central Adriatic Sea)	20.5 (TL)	20.5	0.46	-0.50	-0.14	OT	-	2.29	6.38	Y	6104	6122
248	Other	*Sardina pilchardus*	(Mediterranean)	21.2 (TL)	21.2	0.39	-	-0.13	-	-	2.24	7.56	Y	6425	6435
249	Other	*Sardina pilchardus*	(Gulf of Lion)	20.4 (TL)	20.4	0.31	-1.16	-0.13	-	-	2.11	9.52	Y	7253	
250	Other	*Sardina pilchardus*	(Gulf of Lion)	18.9 (TL)	18.9	0.34	-1.05	-0.13	-	-	2.09	8.66	Y	7253	
251	Other	*Sardina pilchardus*	(Aegean and Ionian Seas)	18.1 (TL)	18.1	0.30	-3.21	-0.13	ASR	Non-linear reg.	1.99	9.87	Y	27030	27061
252	Other	*Sardina pilchardus*	(Beni-Saf)	19.9 (FL)	22.3	0.19	-2.34	-0.11	ASR	Non-linear reg.	1.98	15.60	Y	57565	57565
253	Other	*Sardina pilchardus*	(Beni-Saf)	17.6 (FL)	19.8	0.26	-2.00	-0.12	ASR	Non-linear reg.	2.00	11.51	Y	57565	57565
254	Other	*Sardina pilchardus*	(Izmir Bay)	17.2 (FL)	19.3	0.27	-3.53	-0.12	OT	Non-linear reg.	2.01	10.87	Y	57592	57592
255	Other	*Sardina pilchardus*	(Izmir Bay)	15.0 (FL)	16.8	0.59	-1.76	-0.16	OT	Non-linear reg.	2.23	4.90	Y	57592	57592

#	Species-group [this review]	Species	Location	L∞ (cm) & original length type	L∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, φ' [calculated this review]	Maximum longevity T_{max} (years) [calculated this review]	FishBase record?	Main ref. for growth parameters	Data ref.
256	Other	*Sardina pilchardus*	(N. W. Aegean Sea)	20.8 (TL)	20.8	0.86	-	-0.17	LF	ELEFAN I	2.57	3.32	Y	52385	52385
257	Other	*Sardina pilchardus*	(Algerian coasts)	22.6 (TL)	22.6	0.26	-	-0.12	LF	Other	2.12	11.47	Y	58040	58040
258	Other	*Sardina pilchardus*	(Algerian coasts)	18.9 (TL)	18.9	0.46	-	-0.14	LF	Other	2.22	6.32	Y	58040	58040
259	Other	*Sardina pilchardus*		21.8 (TL)	21.8	0.27	-2.93	-0.12	OT	-	2.11	10.87	Y	58174	58174
260	Other	*Sardina pilchardus*		21.3 (TL)	21.3	0.26	-2.79	-0.12	OT	-	2.06	11.65	Y	58174	58174
261	Other	*Sardina pilchardus*	(Oran)	19.2 (TL)	19.2	0.35	-	-0.13	LF	-	2.10	8.56	Y	58175	58175
262	Other	*Sardina pilchardus*	(Oran)	18.3 (TL)	18.3	0.38	-	-0.14	LF	-	2.10	7.78	Y	58175	58175
263	Other	*Sardina pilchardus*	(Alger)	19.0 (TL)	19.0	0.35	-	-0.13	LF	-	2.10	8.39	Y	58175	58175
264	Other	*Sardina pilchardus*	(Alger)	18.5 (TL)	18.5	0.37	-	-0.14	LF	-	2.10	7.95	Y	58175	58175
265	Other	*Sardina pilchardus*	(Al Hoceima)	22.2 (TL)	22.2	0.26	-	-0.12	LF	-	2.10	11.60	Y	58175	58175
266	Other	*Sardina pilchardus*	(Balearic Islands)	22.1 (TL)	22.1	0.26	-	-0.12	LF	-	2.10	11.51	Y	58175	58175
267	Other	*Sardina pilchardus*	(Alboran Sea)	19.1 (TL)	19.1	0.35	-	-0.13	LF	-	2.10	8.46	Y	58175	58175
268	Other	*Sardina pilchardus*	(Beni-Saf)	20.2 (TL)	20.2	0.27	-2.26	-0.12	OT	-	2.04	10.99	Y	58187	58187
269	Other	*Sardina pilchardus*	(Beni-Saf)	20.5 (TL)	20.5	0.26	-	-0.12	LF	-	2.04	11.42	Y	58187	58187
270	Other	*Sardina pilchardus*	(Beni-Saf)	19.2 (TL)	19.2	0.28	-	-0.12	LF	-	2.01	10.59	Y	58187	58187
271	Other	*Sardina pilchardus*	(Alboran Sea)	20.7 (TL)	20.7	0.69	-0.64	-0.16	OT	Non-linear reg.	2.47	4.19	Y	58239	58239
272	Other	*Sardina pilchardus*	(Vera Gulf)	19.9 (TL)	19.9	0.93	-0.32	-0.17	OT	Non-linear reg.	2.57	3.05	Y	58239	58239
273	Other	*Sardina pilchardus*	(Alicante)	17.4 (TL)	17.4	0.84	-0.57	-0.18	OT	Non-linear reg.	2.41	3.40	Y	58239	58239
274	Other	*Sardina pilchardus*	(Valencia)	18.0 (TL)	18.0	0.65	-0.67	-0.16	OT	Non-linear reg.	2.32	4.45	Y	58239	58239
275	Other	*Sardina pilchardus*	(Lion Gulf)	18.2 (TL)	18.2	0.70	-0.94	-0.16	OT	Non-linear reg.	2.37	4.12	Y	58239	58239
276	Other	*Sardina pilchardus*	(Western Mediterranean)	24.1 (TL)	24.1	0.25	-2.66	-0.11	-	-	2.16	11.89	Y	93100	
277	Other	*Sardina pilchardus*	(Northern Adriatic)	18.8 (TL)	18.8	0.38	-2.30	-0.14	-	-	2.13	7.76	Y	93100	
278	Other	*Sardina pilchardus*	(Aegean Sea)	19.5 (TL)	19.5	0.39	-0.48	-0.14	-	-	2.17	7.56	Y	93100	93187
279	Other	*Sardina pilchardus*	(South of Sicily)	21.4 (TL)	21.4	0.40	-	-0.13	-	-	2.26	7.37	Y	96306	
280	Other	*Sardina pilchardus*		16.1 (TL)	16.1	0.71	0.01	-0.17	-	Non-linear reg.	2.26	4.08	Y	96811	
281	Other	*Sardina pilchardus*	(Bou-Ismail Gulf)	16.1 (TL)	16.1	1.12	-0.02	-0.20	-	Non-linear reg.	2.46	2.47	Y	96811	
282	Other	*Sardinops sagax*	(California)	31.0 (TL)	31.0	0.46	-	-0.13	-	-	2.65	6.40	Y	312	837
283	Other	*Sardinops sagax*	(California)	29.0 (TL)	29.0	0.60	-	-0.14	-	-	2.70	4.86	Y	312	837
284	Other	*Sardinops sagax*	(British Columbia)	25.1 (TL)	25.1	0.57	-	-0.14	-	-	2.56	5.12	Y	312	841
285	Other	*Sardinops sagax*	(California)	27.0 (TL)	27.0	0.70	-	-0.15	-	-	2.71	4.14	Y	312	842
286	Other	*Sardinops sagax*	(British Columbia)	29.1 (TL)	29.1	0.55	-	-0.14	-	-	2.67	5.32	Y	312	841
287	Other	*Sardinops sagax*	(British Columbia)	29.3 (TL)	29.3	0.52	-	-0.13	-	-	2.65	5.64	Y	312	841
288	Other	*Sardinops sagax*	(British Columbia)	29.3 (TL)	29.3	0.54	-	-0.13	-	-	2.67	5.42	Y	312	841
289	Other	*Sardinops sagax*	(California)	29.5 (TL)	29.5	0.40	-2.10	-0.12	-	Non-linear reg.	2.54	7.41	Y	312	838
290	Other	*Sardinops sagax*	(British Columbia)	30.0 (TL)	30.0	0.52	-	-0.13	-	-	2.67	5.64	Y	312	841
291	Other	*Sardinops sagax*	(California)	30.5 (TL)	30.5	0.40	-0.59	-0.12	-	Non-linear reg.	2.57	7.45	Y	312	837
292	Other	*Sardinops sagax*	(California)	29.3 (TL)	29.3	0.45	-	-0.13	-	-	2.59	6.54	Y	839	839
293	Other	*Sardinops sagax*	(Pacific coast)	26.0 (TL)	26.0	0.50	-	-0.14	-	-	2.53	5.86	Y	840	840
294	Other	*Sardinops sagax*	(California)	30.0 (TL)	30.0	0.35	-	-0.12	-	Non-linear reg.	2.50	8.45	Y	1139	838
295	Other	*Sardinops sagax*	(California)	25.7 (TL)	25.7	0.55	-	-0.14	-	-	2.56	5.31	Y	1836	841
296	Other	*Sardinops sagax*	(California)	26.0 (TL)	26.0	0.54	-	-0.14	-	-	2.56	5.42	Y	1836	841
297	Other	*Sardinops sagax*	(California)	26.1 (TL)	26.1	0.52	-	-0.14	-	-	2.55	5.63	Y	1836	841
298	Other	*Sardinops sagax*	(California)	26.8 (TL)	26.8	0.59	-	-0.14	-	-	2.63	4.94	Y	1836	841
299	Other	*Sardinops sagax*	(California)	26.9 (TL)	26.9	0.56	-	-0.14	-	-	2.61	5.22	Y	1836	841

#	Species-group [this review]	Species	Location	L_∞ (cm) & original length type	L_∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated this review]	Maximum longevity T_{max} (years) [calculated this review]	FishBase record?	Main ref. for growth parameters	Data ref.
300	Other	*Sardinops sagax*	(California)	27.6 (TL)	27.6	0.53	-	-0.14	-	-	2.61	5.52	Y	1836	841
301	Other	*Sardinops sagax*	(British Columbia)	30.2 (TL)	30.2	0.53	-	-0.13	-	Non-linear reg.	2.68	5.53	Y	1836	841
302	Other	*Sardinops sagax*	(Gulf of California)	23.6 (TL)	23.6	0.34	-0.26	-0.12	OT	-	2.28	8.70	Y	34034	3731
303	Other	*Sardinops sagax*	(Gulf of California)	22.5 (SL)	26.6	0.60	-	-0.14	LF	ELEFAN I	2.63	4.86	Y	3730	3730
304	Other	*Sardinops sagax*		27.0 (TL)	27.0	0.65	-	-0.14	-	-	2.68	4.47	Y	831	831
305	Other	*Sardinops sagax*	(N. West Pacific)	27.0 (TL)	27.0	0.90	-	-0.16	-	-	2.82	3.17	Y	833	832
306	Other	*Sardinops sagax*	(N. West Pacific)	29.0 (TL)	29.0	0.50	-	-0.13	-	-	2.62	5.87	Y	833	833
307	Other	*Sardinops sagax*	(off SE Hokkaido)	20.5 (SL)	24.2	0.37	-	-0.13	-	-	2.33	8.05	Y	2197	2197
308	Other	*Sardinops sagax*	(off SE Hokkaido)	20.6 (SL)	24.3	0.46	-	-0.14	-	-	2.44	6.37	Y	2197	2197
309	Other	*Sardinops sagax*	(off SE Hokkaido)	21.2 (SL)	25.0	0.32	-	-0.12	-	-	2.30	9.28	Y	2197	2197
310	Other	*Sardinops sagax*	(off SE Hokkaido)	21.2 (SL)	25.0	0.65	-	-0.15	-	-	2.61	4.49	Y	2197	2197
311	Other	*Sardinops sagax*	(off SE Hokkaido)	22.5 (SL)	26.6	0.52	-	-0.14	-	-	2.57	5.61	Y	2197	2197
312	Other	*Sardinops sagax*	(off SE Hokkaido)	22.5 (SL)	26.6	0.53	-	-0.14	-	-	2.57	5.54	Y	2197	2197
313	Other	*Sardinops sagax*		22.4 (?)	22.4	0.59	-	-0.15	-	-	2.47	4.94	Y	5760	5820
314	Other	*Sardinops sagax*		21.9 (TL)	21.9	0.20	-	-0.11	-	F-W plot	1.98	14.82	Y	312	859
315	Other	*Sardinops sagax*	(New South Wales)	22.4 (TL)	22.4	0.47	-0.09	-0.14	-	Non-linear reg.	2.37	6.29	Y	312	857
316	Other	*Sardinops sagax*	(Victoria)	20.5 (TL)	20.5	0.22	-	-0.11	-	-	1.97	13.52	Y	796	858
317	Other	*Sardinops sagax*	(Southeastern coast)	16.3 (?)	16.3	0.61	-	-0.16	-	-	2.21	4.75	Y	5760	5868
318	Other	*Sardinops sagax*	(Western Australia)	17.2 (FL)	19.0	0.66	-	-0.16	Other	-	2.38	4.36	Y	10851	10851
319	Other	*Sardinops sagax*	(South Western Australia)	17.4 (FL)	19.2	0.58	-	-0.15	OT	-	2.33	4.98	Y	10851	
320	Other	*Sardinops sagax*	(Western Australia)	16.4 (FL)	18.1	0.73	-	-0.17	Other	-	2.38	3.95	Y	10851	10851
321	Other	*Sardinops sagax*	(South Western Australia)	16.4 (FL)	18.1	0.81	-	-0.17	OT	-	2.42	3.56	Y	10851	
322	Other	*Sardinops sagax*	(Western Cape)	29.5 (TL)	29.5	0.45	-	-0.13	-	-	2.59	6.54	Y	312	836
323	Other	*Sardinops sagax*	(Walvis Bay)	36.0 (TL)	36.0	0.36	-0.24	-0.11	-	Non-linear reg.	2.67	8.27	Y	312	834
324	Other	*Sardinops sagax*	(Walvis Bay)	30.6 (TL)	30.6	0.23	-	-0.10	OT	-	2.32	13.23	Y	835	835
325	Other	*Sardinops sagax*		30.4 (TL)	30.4	0.23	-	-0.10	-	Other	2.33	12.88	Y	3669	3670
326	Other	*Sardinops sagax*	(Southeast Africa)	28.5 (TL)	28.5	0.28	-	-0.11	-	-	2.36	10.60	Y	5760	5883
327	Other	*Sardinops sagax*	(Southeast Africa)	28.5 (TL)	28.5	0.28	-	-0.11	-	-	2.36	10.60	Y	5760	5883
328	Other	*Sardinops sagax*	(Western Cape waters)	30.6 (TL)	30.6	0.23	-1.51	-0.10	OT	F-W plot	2.32	13.23	Y	5769	5769
329	Other	*Sardinops sagax*		31.2 (TL)	31.2	0.44	-	-0.12	-	-	2.63	6.69	Y	5888	5892
330	Other	*Sardinops sagax*		33.8 (TL)	33.8	0.33	-	-0.11	-	-	2.58	8.98	Y	5888	5893
331	Other	*Sardinops sagax*		38.5 (TL)	38.5	0.25	-	-0.10	OT	-	2.57	11.90	Y	5888	5891
332	Other	*Sardinops sagax*		41.0 (TL)	41.0	0.25	-	-0.10	LF	ELEFAN I	2.63	11.81	Y	5888	5888
333	Other	*Sardinops sagax*		41.6 (TL)	41.6	0.24	-	-0.10	LF	-	2.62	12.40	Y	5888	5890
334	Other	*Sardinops sagax*	(Mexico)	17.1 (SL)	20.2	1.18	-0.01	-0.19	OT	Other	2.68	2.36	Y	33192	33192
335	Other	*Sardinops sagax*	(Mexico)	17.4 (SL)	20.5	1.15	-0.01	-0.18	OT	Other	2.69	2.43	Y	33192	33192
336	Other	*Sardinops sagax*	(Gulf of California)	27.0 (TL)	27.0	0.60	-	-0.14	LF	ELEFAN I	2.64	4.86	Y	34034	34059
337	Other	*Sardinops sagax*	(Gulf of California)	30.0 (TL)	30.0	0.43	-	-0.12	LF	ELEFAN I	2.59	6.85	Y	34034	34063
338	Other	*Sardinops sagax*	(Gulf of California)	29.0 (TL)	29.0	0.43	-	-0.13	LF	ELEFAN I	2.56	6.85	Y	34034	34066
339	Other	*Sardinops sagax*	(Gulf of California)	23.6 (TL)	23.6	0.38	-1.42	-0.13	ASR	Other VBGF linear.	2.33	7.77	Y	34034	34067
340	Other	*Sardinops sagax*	(Gulf of California)	24.4 (TL)	24.4	0.55	-0.74	-0.14	OT	Non-linear reg.	2.52	5.31	Y	34034	34068
341	Other	*Sardinops sagax*	(Gulf of California)	27.0 (TL)	27.0	0.34	-	-0.12	LF	Other	2.39	8.70	Y	34034	34034
342	Other	*Sardinops sagax*	(Gulf of California)	25.7 (TL)	25.7	0.38	-	-0.13	LF	Other	2.40	7.77	Y	34034	34034
343	Other	*Sardinops sagax*	(Gulf of California)	25.3 (TL)	25.3	0.36	-	-0.12	LF	Other	2.36	8.21	Y	34034	34034

#	Species-group [this review]	Species	Location	L∞ (cm) & original length type	L∞ (cm, TL)	K (year^{-1})	t_0 (years)	t_0 calc. (years) [calculated this review]	Source data used	Method(s) used to estimate growth parameters	Growth performance index, ϕ' [calculated this review]	Maximum longevity T_{max} (years) [calculated this review]	FishBase record?	Main ref. for growth parameters	Data ref.
344	Other	*Sardinops sagax*	(Gulf of California)	24.4 (TL)	24.4	0.39	-	-0.13	LF	Other	2.37	7.56	Y	34034	34034
345	Other	*Sardinops sagax*	(Gulf of California)	26.3 (TL)	26.3	0.31	-	-0.12	LF	Other	2.33	9.56	Y	34034	34034
346	Other	*Sardinops sagax*	(Gulf of California)	25.2 (TL)	25.2	0.39	-	-0.13	LF	Other	2.39	7.56	Y	34034	34034
347	Other	*Sardinops sagax*	(Gulf of California)	23.0 (TL)	23.0	0.39	-	-0.13	LF	Other	2.31	7.56	Y	34034	34034
348	Other	*Sardinops sagax*	(Gulf of California)	25.9 (TL)	25.9	0.33	-	-0.12	LF	Other	2.35	8.97	Y	34034	34034
349	Other	*Sardinops sagax*	(Gulf of California)	27.4 (TL)	27.4	0.38	-	-0.12	LF	Other	2.46	7.77	Y	34034	34034
350	Other	*Sardinops sagax*	(Gulf of California)	25.2 (TL)	25.2	0.34	-	-0.12	LF	Other	2.33	8.70	Y	34034	34034
351	Other	*Sardinops sagax*		38.6 (TL)	38.6	0.21	-	-0.09	-	-	2.50	14.19	Y	5888	5894
352	Other	*Sardinops sagax*		41.7 (TL)	41.7	0.21	-	-0.09	-	-	2.56	14.19	Y	5888	46517
353	Other	*Sardinops sagax*	(South West Africa)	21.9 (SL)	25.8	1.17	0.02	-0.17	Sev.	Other	2.89	2.40	Y	27758	27758
354	Other	*Sardinops sagax*	(South West Africa)	23.4 (SL)	27.6	0.99	-0.03	-0.16	Sev.	Other	2.88	2.88	Y	27758	27758
355	Other	*Sardinops sagax*	(South West Africa)	29.9 (TL)	29.9	0.36	-0.25	-0.12	ASR	-	2.51	8.17	Y	27758	47223
356	Other	*Sardinops sagax*	(Southern California)	26.0 (SL)	30.7	0.39	-	-0.12	OT	-	2.57	7.57	Y	54657	54657
357	Other	*Sardinops sagax*	(Sea of Japan & East China Sea)	25.0 (SL)	29.5	0.34	-1.53	-0.12	ASR	Non-linear reg.	2.47	8.71	Y	93556	93556
358	Other	*Sardinops sagax*	(Sea of Japan & East China Sea)	21.9 (SL)	25.8	0.36	-2.36	-0.12	ASR	Non-linear reg.	2.38	8.21	Y	93556	93556
359	Other	*Sprattus sprattus*	(Black Sea)	11.9 (TL)	11.9	0.31	-0.83	-0.15	-	Non-linear reg.	1.64	9.53	Y	312	850
360	Other	*Sprattus sprattus*	(Southern waters)	14.2 (TL)	14.2	0.37	-2.30	-0.15	-	Non-linear reg.	1.87	8.01	Y	312	1366
361	Other	*Sprattus sprattus*	(Northern Adriatic)	14.4 (TL)	14.4	0.45	-	-0.16	OT	Non-linear reg.	1.97	6.48	Y	312	852
362	Other	*Sprattus sprattus*		16.0 (TL)	16.0	0.65	-	-0.17	-	-	2.22	4.45	Y	312	846
363	Other	*Sprattus sprattus*	(Gulf of Biscay)	17.5 (TL)	17.5	0.30	-	-0.13	-	F-W plot	1.96	9.97	Y	312	853
364	Other	*Sprattus sprattus*	(Black Sea)	18.0 (TL)	18.0	0.14	-2.05	-0.10	-	Non-linear reg.	1.64	21.96	Y	312	849
365	Other	*Sprattus sprattus*	(North Sea)	13.0 (TL)	13.0	0.70	-	-0.18	-	Non-linear reg.	2.07	4.10	Y	796	851
366	Other	*Sprattus sprattus*	(Western England)	14.0 (TL)	14.0	0.63	-	-0.17	-	-	2.09	4.59	Y	847	847
367	Other	*Sprattus sprattus*	(Western England)	16.4 (TL)	16.4	0.53	-	-0.16	-	-	2.15	5.50	Y	847	847
368	Other	*Sprattus sprattus*	(Kiel Bight)	14.9 (TL)	14.9	1.02	-0.04	-0.19	-	-	2.35	2.75	Y	848	848
369	Other	*Sprattus sprattus*	(Western Baltic)	14.4 (TL)	14.4	0.30	-	-0.14	-	-	1.79	9.93	Y	1139	1771
370	Other	*Sprattus sprattus*	(Baltic)	14.9 (TL)	14.9	1.02	-	-0.19	-	-	2.35	2.75	Y	1139	848
371	Other	*Sprattus sprattus*	(Gullmarsfjord)	14.7 (?)	14.7	0.82	-	-0.18	OT	-	2.25	3.47	Y	4554	4555
372	Other	*Sprattus sprattus*	(Gullmarsfjord)	16.0 (?)	16.0	0.95	-	-0.19	OT	-	2.39	2.97	Y	4554	4555
373	Other	*Sprattus sprattus*	(Kattegat)	16.3 (?)	16.3	0.61	-	-0.16	OT	-	2.21	4.79	Y	4554	4555
374	Other	*Sprattus sprattus*	(Kattegat)	16.4 (?)	16.4	0.78	-	-0.17	OT	-	2.32	3.70	Y	4554	4555
375	Other	*Sprattus sprattus*	(North Sea)	13.2 (?)	13.2	0.53	-	-0.17	-	-	1.97	5.49	Y	5760	5815
376	Other	*Sprattus sprattus*	(Western Baltic)	14.8 (TL)	14.8	0.68	-	-0.17	OT	Non-linear reg.	2.17	4.24	Y	47114	47114
377	Other	*Sprattus sprattus*	(Northeast Baltic Sea)	13.3 (TL)	13.3	0.51	-1.46	-0.16	OT	Non-linear reg.	1.96	5.72	Y	52153	
378	Other	*Sprattus sprattus*	(Southern Black Sea)	13.8 (TL)	13.8	0.42	-1.13	-0.15	OT	F-W plot	1.90	6.99	Y	56751	56751
379	Other	*Sprattus sprattus*	(Southern Black Sea)	14.0 (TL)	14.0	0.38	-1.20	-0.15	OT	F-W plot	1.87	7.75	Y	56751	56751
380	Other	*Sprattus sprattus*	(Southern Black Sea)	13.4 (TL)	13.4	0.41	-1.30	-0.15	OT	F-W plot	1.87	7.13	Y	56764	56764
381	Other	*Sprattus sprattus*	(Southern Black Sea)	14.6 (TL)	14.6	0.30	-1.88	-0.14	OT	F-W plot	1.80	9.93	Y	56764	56764
382	Other	*Sprattus sprattus*	(North Sea)	15.0 (TL)	15.0	0.50	-0.49	-0.16	-	-	2.05	5.81	Y	94462	94462
383	Other	*Sprattus sprattus*	(Baltic Sea)	15.0 (TL)	15.0	0.36	-1.00	-0.14	-	-	1.91	8.19	Y	94462	94462
384	Other	*Sprattus sprattus*	(Baltic Sea)	13.4 (TL)	13.4	0.46	-	-0.16	-	-	1.92	6.39	Y	115041	
385	Other	*Sprattus sprattus*	(North Sea)	15.0 (?)	15.0	0.50	-0.49	-0.16	-	-	2.05	5.81	Y	94462	114862

Table S2.6. Short citations for FishBase database records referred to in Tables S2.1-3. For full citation refer to the online database (Froese and Pauly 2021). "RefNo" refers to the FishBase 'Reference number'.

RefNo	Citation
312	Pauly (1978)
718	D'Ancona (1937)
762	Rafail (1972)
796	Beverton et al. (1959)
797	Lee (1961)
798	Belveze (1972)
799	Rodriguez-Roda et al. (1955)
800	Laskaridis (1948)
801	Mozzi et al. (1958)
802	Larrañeta et al. (1958)
803	Andreu et al. (1950)
804	Fage (1920)
805	Bougis (1952)
806	Muzinic (1957)
807	Larrañeta (1965)
808	Lopez (1963)
809	Bennett (1961)
810	Nair (1960)
811	Sekharan (1955)
812	Heald et al. (1967)
813	Simpson (1971)
814	Postel (1955)
815	Rossignol (1955)
816	Gheno et al. (1968)
817	Radhakrishnan (1964)
818	Ronquillo (1960)
819	Dwiponggo (1974)
820	Antony Raja (1970)
821	Banerji (1973)
822	Hornell et al. (1924)
823	Burhanuddin et al. (1974)
824	Gheno (1975)
825	Pham et al. (1975)
826	Navarro (1932)
827	Ben-Tuvia (1956)
828	Richardson et al. (1960)
829	Ananiades (1952)
830	Dieuzeide et al. (1957)
831	Tokai Laboratory (1960)
832	Nakai (1960)
833	Holt (1960)
834	Matthew (1960)
835	Newman (1970)
836	Davies (1958)
837	Phillips (1948)
838	Marr (1960)
839	Beverton (1963)
840	Granados (1958)
841	Felin (1954)
842	Silliman (1943)
846	Sund (1911)
847	Iles et al. (1962)
848	Hohendorf (1966)
849	Aslanova (1954)
850	Berg et al. (1949)
851	Robertson (1938)
852	Zavodnik (1969)
853	Porche (1976)
857	Blackburn (1949)
858	Blackburn (1950)
859	Baker (1972)
861	Martin et al. (1960)
1139	Pauly (1980)
1263	Ingles et al. (1984)
1314	Dwiponggo et al. (1986)
1366	Furnestin (1948)
1373	Kurup et al. (1989)
1382	Samb (1988)
1392	Tandog-Edralin et al. (1988)
1439	Conand (1991)
1442	Sanders et al. (1984)
1443	Gjøsaeter et al. (1984)
1444	Dayaratne et al. (1986)
1447	Sadhotomo et al. (1985)
1449	Corpuz et al. (1985)
1477	Sanders et al. (1984)
1478	Annigeri (1969)
1529	Sanders et al. (1984)
1751	Banerji et al. (1973)
1771	Rechlin (1974)
1836	Pauly (1979)
2178	Dalzell et al. (1987)
2197	Wada et al. (1989)
2285	Conseil Général des Pêches pour la Méditerranée (1982)
2286	Kartas (1981)
2897	Edwards et al. (1987)
2900	Biradar et al. (1989)
3268	Ritterbush (1975)
3560	Sekharan (1968)
3626	Edwards et al. (1991)
3669	Torres (1991)
3670	van der Elst (1981)
3730	Cisneros et al. (1990)
3731	Estrada-G. et al. (1986)
3779	Djama et al. (1989)
3781	Djama et al. (1989)
3784	Morales-Nin (1988)
3785	Dalzell (1988)
4330	Makwaia et al. (1992)
4331	Nhwani et al. (1987)
4382	Dalzell et al. (1987)
4532	Conand (1984)
4554	Lindquist (1978)
4555	Lindquist (1973)
5381	Federizon (1993)
5533	Djabali et al. (1993)
5558	Mouhoub (1986)
5561	Penas Lado (1978)
5730	Padilla (1991)
5760	Erzini (1991)
5763	Karunasinghe et al. (1991)
5769	Baird (1970)
5771	Barraca et al. (1985)
5772	Belveze et al. (1978)
5784	Delgado et al. (1981)
5792	El-Maghraby et al. (1970)
5815	Johnson (1970)
5820	Kim et al. (1984)
5826	Larrañeta (1975)
5861	Rodriguez-Roda (1979)
5868	Stevens et al. (1984)
5883	Wysokinski et al. (1977)
5888	Cárdenas et al. (1985)
5890	Burd (1982)
5891	Cardenas (1982)
5892	Saldaña (1983)
5893	Samamé (1977)
5894	Serra et al. (1979)
5900	Perez et al. (1985)
5905	Porteiro et al. (1985)
5906	Boely et al. (1982)
6104	Stergiou (1991)
6122	Sinovcic (1983)
6432	Wysokinski (1986)
6435	GFCM (1981)
7011	Saccardo et al. (1988)
7012	Matsuura (1983)
7013	Matsuura (1977)
7014	PDP/SUDEPE (1985)
7015	Santos et al. (1965)
7164	Girardin et al. (1986)
7167	Oliver et al. (1952)
7168	Navarro (1927)
7253	Campillo (1992)
8987	Mendoza (1994)
10851	Fletcher (1995)
10861	Suwarso et al. (1995)
11824	Claro et al. (1994)
12012	González (1985)
12145	Lablache et al. (1988)
12146	Moussac de et al. (1986)
12147	van Nierop et al. (1986)
12148	Jiddawi et al. (1988)
13011	Cergole (1995)
13304	Lavapie-Gonzales et al. (1997)
26112	King (1997)
26122	Marcus (1984)
27030	Stergiou et al. (1997)
27061	Tserpes et al. (1991)
27643	Erzini (1994)
27758	Thomas (1985)
27806	Bennet et al. (1992)
30305	Showers (1996)
33192	Uraga (1986)
34034	De Anda-Montañez et al. (1999)
34059	Cisneros-Mata et al. (1990)
34063	Cisneros-Mata et al. (1991)
34066	Nevárez et al. (1993)
34067	Gallardo et al. (1991)
34068	Jiménez (1991)
36269	Dayaratne (1998)
36847	Milton et al. (1993)
46351	Karunasinghe (1986)
46352	Dayaratne (1990)
46364	Dayaratne et al. (1994)
46366	Dayaratne (1997)
46517	Anonymous (1983)
47114	Jenkins (1902)
47223	Nawratil (1961)
52153	Ojaveer et al. (2003)
52385	Voulgaridou et al. (2003)
53465	Mehanna et al. (2003)
54657	Childress et al. (1980)
54999	Cergole et al. (2005)
56751	Avsar (1995)
56764	Sahin (1999)
56797	Tsikliras et al. (2005)
57565	Bouchereau et al. (1988)
57591	Mater et al. (2003)
57592	Akyol et al. (1996)
58040	Brahmi et al. (1998)
58043	Bouaziz et al. (1998)
58174	Idrissi (1987)
58175	Bouchereau et al. (1985)
58187	Djabali et al. (1990)
58239	Alemany et al. (1993)
72458	Jarzhombek (2007)
80723	Mutia et al. (2005)
93100	Colloca et al. (2013)
93187	STECF (2009)
93556	Ohshimo et al. (2009)
93920	Atmaja et al. (2004)
94462	Froese et al. (2013)
96306	STECF (2013)
96716	Oda (2007)
96811	Apostolidis et al. (2014)
104735	Hu et al. (2015)
105100	Dehghani et al. (2015)
114772	Ghosh et al. (2013)
114862	ICES (2013)
114865	Rahangdale et al. (2016)
115041	Bartolino et al. (2016)
116140	CMFRI (2015)
116211	CMFRI (2016)
116321	CMFRI (2012)
116923	Amponsah et al. (2017)
117570	Raje et al. (1994)
117655	Mehanna et al. (2011)
117660	Al-Anbouri et al. (2011)
117661	Salarpouri et al. (2008)
117662	Salarpouri et al. (2008)
117663	Farkhondeh et al. (2010)
119271	Abdussamad et al. (2018)

Table S2.7. Short citations for additional data sources referred to in Tables S2.1-3. For full citations refer to the Reference list at the end of this document.

Ref	Citation
(a)	Abdussamad et al. (2010)
(b)	Al-Anbouri et al. (2013)
(c)	Aripin and Showers (2000)
(d)	Bintoro et al. (2019)
(e)	Bintoro et al. (2020)
(f)	Conand (1988)
(g)	Dalzell et al. (1987)
(h)	Dicdiquin et al. (2017)
(i)	G. Nair et al. (2016)
(j)	Ganga and Pillai (2006)
(k)	Gaughan and Mitchell (2000)
(l)	Hida and Uchiyama (1977)
(m)	Jayabalan et al. (2014)
(n)	Jayasuriya (1989)
(o)	Kartini et al. (2017)
(p)	Mamalangkap et al. (2018)
(q)	Merta et al. (2000)
(r)	Milton and Blaber (1993)
(s)	Milton et al. (1993)
(t)	Nadeem et al. (2017)
(u)	Pet et al. (1997)
(v)	Raje et al. (1994)
(w)	Rohit and Bhat (2003)
(x)	Rohit et al. (2018)
(y)	Salarpouri et al. (2019)
(z)	Siddeek et al. (1985)
(aa)	Wudianto et al. (2013)
(ab)	Zaki et al. (2013)
(ac)	Budihardjo et al. (1990) cited in Wudianto et al. (2013)
(ad)	Merta (1992) cited in Merta et al. (2000)
(ae)	Setyohadi (2010) cited in Wudianto et al. (2013)
(af)	Sujastani (1982) cited in Wudianto et al. (2013)
(ag)	Yohannan (1999) cited in Ganga and Pillai (2006)

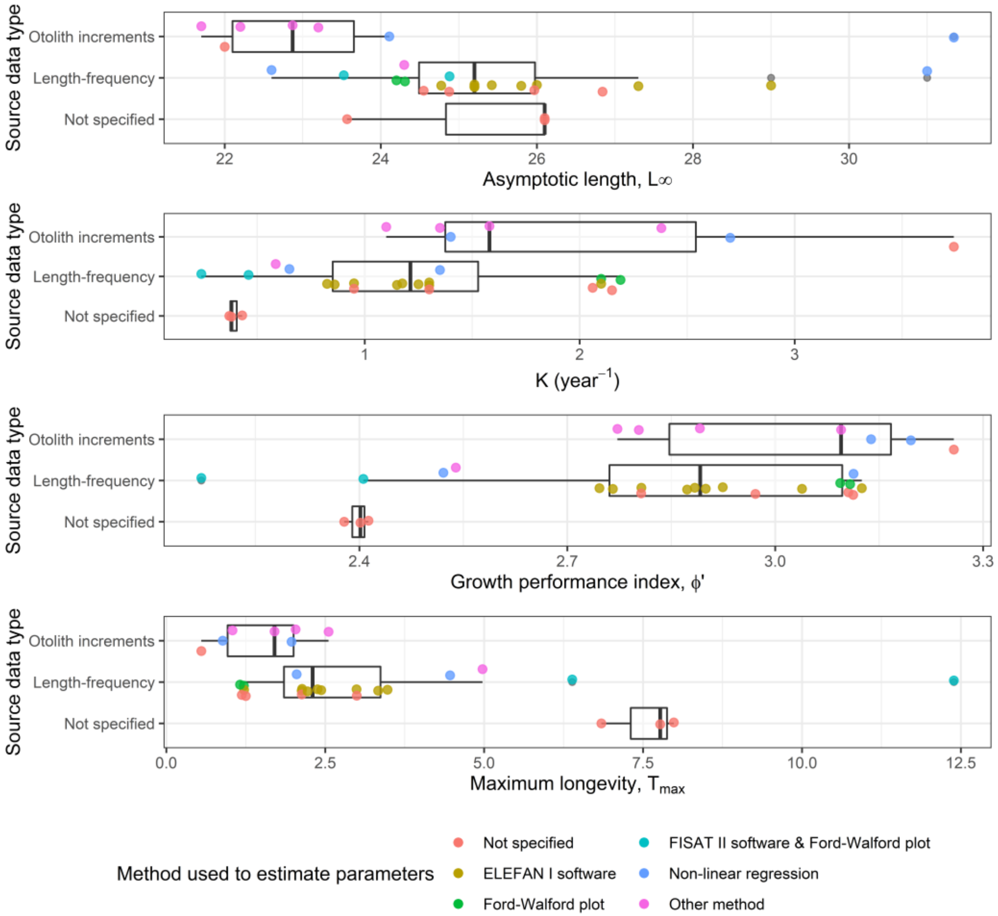


Fig S2.4 Comparison of growth parameter estimates for *Amblygaster sirm* from different data source types. Each point represents an observation listed in Table S2.2 for *A. sirm*

Online Resource 3: Estimated lengths at first maturity for species from the Clupeidae family

Table S3.1 contains maturity parameters for tropical marine clupeids from the Indo-West Pacific. Table S4.2 contains maturity parameters for tropical marine clupeids from the Atlantic Ocean and selected non-tropical clupeids.

Table S3.1. Estimated lengths at first maturity (L_m) for tropical marine Indo-West Pacific clupeids from genera *Amblygaster*, *Herklotsichthys*, *Escualosa* and *Sardinella*. Original length types used in cited data sources refer to fork length (FL) and standard length (SL), all in cm. Where necessary, lengths were converted to total length (TL) using the species relevant parameters available in FishBase 'Length-Length tables' (Froese and Pauly 2021). Asymptotic length (L_∞) has been included when available from the same or related study; in these instances, the ratio of L_m to L_∞ has also been calculated. Methods used to determine length at maturity ('Method of estimation') include: [A] Length at which 50% of the sample were classified as mature (i.e. median length); [B] "Length for which at least three specimens showed a gonadosomatic index above 50% of the mean of the ten maximum observed values" (Pet et al. 1997); [C] Length at which GSI increased sharply; [D] Length some fish ready to spawn; and [E] Minimum size at which fish had ripe oocytes; '?' indicates method was not described in the original data source. Data sources are specified in columns 'L_m Ref.' and 'L_∞ Ref.', with the corresponding short citation provided below the table. For a summary of parameters refer to Table S2.1.

Group	Species	Location	Latitude	Original L_m (cm) & length type (if converted)	L_m (cm TL, female)	Stage considered 'mature'	Method of estimation	L_m Ref. [b]	L_∞ (cm TL)	L_∞ Ref. [b]	Ratio L_m/L_∞ [calculated this review]
Round-bodied Sardinellas	*S. longiceps*	Oman	24°N	16.3 (TL)	16.3	≥ III	[A]	[1]	23.0	[2]	0.71
	S. longiceps	India (SW coast)	8-12°N	15 (TL)	15.0	-	?	[3]	-	-	-
	S. longiceps	India (SW coast)	8-12°N	14.7 (TL)	14.7	≥ III	[A]	[4]	23.4	[4]	0.63
	S. lemuru	Indonesia (Madura Str.)	7°S	15.5 (TL)	15.5	≥ III	[B]	[5]	21.0	[5]	0.74
	S. lemuru	Indonesia (Bali Strait)	8°S	18 (TL)	18.0	-	?	[6]	22.7	[7]	0.79
	S. lemuru	Australia (W coast)	28°S	14.5 (FL)	16.4	> I	[A]	[8]	19.2	[8]	0.86
Flat-bodied Sardinellas	*S. gibbosa*	India (E coast)	16-20°N	13.03 (TL)	13.0	≥ III	[A]	[9]	20.7	[9]	0.63
	S. fimbriata	India (E coast)	16-20°N	13.27 (TL)	13.3	≥ III	[A]	[9]	20.7	[9]	0.64
	S. fimbriata	India (E coast)	17°N	14.6 (TL)	14.6	-	[A]	[10]	21.7	[10]	0.67
	S. gibbosa	India (E coast)	17°N	13.6 (TL)	13.6	-	[A]	[10]	19.1	[10]	0.71
	S. gibbosa	India (W coast)	14°N	13.55 (TL)	13.6	-	[A]	[10]	21.1	[10]	0.64
	S. gibbosa	India (SE coast)	8°N	13.83 (TL)	13.8	-	[A]	[10]	19.1	[10]	0.72
	S. gibbosa	India (SW coast)	8°N	13.55 (TL)	13.6	-	[A]	[10]	19.7	[10]	0.69
	S. gibbosa	Tanzania	6°S	10.5 (SL)	13.1	-	?	[11]	-	-	-
	S. albella	Tanzania	6°S	10 (SL)	12.0	-	?	[11]	-	-	-
	S. gibbosa	Indonesia (Java Sea)	4-6°S	14.7 (SL)	18.3	≥ IV	[A]	[12]	-	-	-
	S. fimbriata [a]	Indonesia (Madura Str.)	7°S	15.5 (TL)	15.5	≥ III	[B]	[5]	20.0	[5]	0.78
	S. albella	Australia (NE coast)	9°S	8.5 (SL)	10.2	-	?	[13]	-	-	-
	S. brachysoma	Australia (NE coast)	9°S	9.5 (SL)	11.4	-	?	[13]	-	-	-
	S. gibbosa	Australia (NE coast)	9°S	10.3 (SL)	12.8	-	?	[13, 14]	-	-	-
	S. marquesensis	Marquesas Islands	9°S	10.5 (FL)	12.1	'ripe' [V]	[A] recalc.	[15]	-	-	-
Tropical Pilchards	*A. sirm*	India (W coast)	8°N	20.7 (TL)	20.7	≥ III	[A]	[16]	-	-	-
	A. sirm	Sri Lanka (W coast)	7°N	15 (TL?)	15.0	-	[A]	[17]	-	-	-
	A. sirm	Kiribati	0°	18 (SL)	21.7	≥ V	[A]	[18]	31.3	[19]	0.69
	A. sirm	Indonesia (Java Sea)	4-6°S	18.6 (FL)	20.3	≥ IV	[A]	[12]	-	-	-
	A. sirm	Indonesia (Java Sea)	4-6°S	21 (TL)	21.0	-	[A]	[20]	-	-	-
	A. sirm	Australia (NE coast)	9°S	14.8 (SL)	17.8	-	?	[13, 14]	-	-	-
	A. sirm	Fiji	17°S	15 (SL?)	18.1	≥ IV	?	[21]	-	-	-
	A. sirm	New Caledonia	21°S	15.5 (TL)	15.5	≥ IV	[A]	[22, 23]	22.9	[22]	0.68
	A. clupeoides	Malaysia (E coast)	3°N	18.1 (TL)	18.1	NA	[C]	[24]	-	-	-
	A. clupeoides	New Caledonia	21°S	20.5 (TL)	20.5	≥ IV	[A]	[22]	24.5	[22]	0.84
Tropical Herrings	*H. quadrimaculatus*	Hawaii	21°N	9 (SL)	10.9	'ready to spawn' [VI]	[D]	[25]	14.4	[25]	0.76
	H. quadrimaculatus	Kiribati	0°	7 (SL)	8.5	≥ IV	[E]	[18]	12.1	[19]	0.70
	H. quadrimaculatus	Fiji	17°S	9.5 (SL)	11.5	-	?	[26]	-	-	-
	H. quadrimaculatus	Fiji	17°S	10 (TL?)	10.0	≥ IV	?	[21]	-	-	-
	H. quadrimaculatus	New Caledonia	21°S	11 (TL)	11.0	≥ IV	[A]	[22]	15.5	[22]	0.71
	H. castelnaui	Australia (NE coast)	9°S	8 (SL)	10.2	-	?	[13]	-	-	-
	H. koningsbergeri	Australia (NE coast)	9°S	9 (SL)	11.1	-	?	[13]	-	-	-
	H. lippa	Australia (NE coast)	9°S	13 (SL)	15.4	-	?	[13]	-	-	-
	E. thoracata	India (SW)	9°N	8 (TL)	8.0	-	[A]	[27]	11.9	[27]	0.67
	E. thoracata	Australia (NE coast)	9°S	6 (SL)	7.1	-	?	[13]	-	-	-

[a] Species distribution has been revised or questioned (Hata and Motomura 2019) since cited document was published.

[b] References: [1] Zaki et al. (2012); [2] Zaki et al. (2013); [3] Jayaprakash and Pillai (2000); [4] Rohit et al. (2018); [5] Pet et al. (1997); [6] Merta (1995); [7] Merta, 1992 in Merta et al. (2000); [8] Gaughan and Mitchell (2000); [9] Ghosh et al. (2013); [10] Bennet et al. (1992); [11] Okera (1974); [12] Atmaja et al. (1995); [13] Cappo (1995b); [14] Cappo (1995a); [15] Nakamura and Wilson (1970); [16] Lazarus (1990); [17] Karunasinghe, 1990 in Dayaratne (1997); [18] Milton et al. (1994b); [19] Milton et al. (1993); [20] Widodo et al., 1993 in Widodo (1997); [21] Milton and Blaber (1993); [22] Conand (1988); [23] Conand (1991); [24] Rahman (2017); [25] Williams and Clarke (1983); [26] Lewis, 1983 in Milton et al. (1994b); [27] Abdussamad et al. (2018). For full citations, refer to the Reference list at the end of this document.

Table S4.2. Estimated lengths at first maturity (Lm) for *Sardinella* species from the Atlantic and selected non-tropical clupeids. Data have been obtained from the FishBase database (version 04.2019), accessed through R package 'rfishbase' on 3 February 2021. In particular, data were obtained from the 'Maturity' (M) tables, with records from the 'PopGrowth' (PG) tables added where both values of length at first maturity (Lm) and asymptotic length (L∞) were available; duplicates were removed where identified. Where necessary, lengths were converted to total length (TL) using the species relevant parameters in FishBase 'Length-Length tables' (Froese and Pauly 2021). For records where L∞ was available, the ratio of Lm to L∞ has been calculated. The 'Fishbase RefNo.' corresponds to the original data source(s) listed; see online database (Froese and Pauly 2021) for citation details. For a summary of parameters refer to Table S2.1.

Species	Locality	Lm (cm, TL)	L∞ (cm, TL)	Lm/L∞ ratio [calculated]	Fishbase RefNo.	Fishbase table
Sardinella aurita	Tunisia	12.0			2285	M
Sardinella aurita	Tunisia	13.0			2285	M
Sardinella aurita	Kavala Gulf	16.8			75694	M
Sardinella aurita	Kavala Gulf	15.5			75694	M
Sardinella aurita	Greece	16.8	25.0	0.67	56797	PG
Sardinella aurita [a]	Brazil	16.8	27.2	0.62	13011, 31494	M, PG
Sardinella aurita [a]	Southern region	15.6			54999, 54994	M
Sardinella aurita [a]	Rio de Janeiro	19.2			103182, 104243	M
Sardinella aurita [a]	Rio de Janeiro	18.2			103182, 104243	M
Sardinella aurita [a]	Brazil	16.8	22.6	0.74	7011	PG
Sardinella aurita [a]	Brazil	16.8	23.0	0.73	7011	PG
Sardinella maderensis	Tunisia	16.5	25.5	0.65	2285, 2286	M, PG
Sardinella maderensis	Rio Buba	11.0			27160, 27166	M
Sardinella maderensis	Bijagos	13.0			27160, 27167	M
Sardinella maderensis	-	18.5			27160, 27168	M
Sardinella maderensis	Rio Grande de Buba	14.5			27160	M
Sardinella maderensis	Rio Buba	10.7			27160, 27166	M
Sardinella maderensis	Rio Grande de Buba	14.4			27160	M
Sardinella maderensis	Gambia river	15.0			27160, 27165	M
Sardinella maderensis	off Senegal	19.3			28203	M
Sardinella maderensis	Sine-Saloum	12.2			28587	M
Sardinella maderensis	Sine-Saloum	10.8			28587	M
Sardina pilchardus	Levante	15.0			839, 803	M
Sardina pilchardus	Tunisia	14.7	19.4	0.76	2285, 2286	M, PG
Sardina pilchardus	Tunisia	14.2	19.0	0.75	2285, 2286	M, PG
Sardina pilchardus	Gulf of Biscay	15.0			6014	M
Sardina pilchardus	Gulf of Biscay	15.0			6014	M
Sardina pilchardus	Adriatic Sea	14.0	20.5	0.68	6104, 6122	M, PG
Sardina pilchardus	Northwest Africa	15.4			28710	M
Sardina pilchardus	Bay of Biscay	15.0			40546, 10166	M
Sardina pilchardus	Baie d'Oran	11.1			40546, 40552	M
Sardina pilchardus	Mediterranean Sea	14.0			40546, 6122	M
Sardina pilchardus	Bay of Biscay	16.8			90884	M
Sardina pilchardus		15.4	21.6	0.71	312, 798	PG
Sardina pilchardus	(Algerian coasts)	12.6	20.3	0.62	5533, 5558	PG
Sardina pilchardus	(Algerian coasts)	11.9	18.7	0.64	5533, 5558	PG
Sardina pilchardus	(Northwest Africa)	15.4	21.6	0.71	27643, 5784	PG
Sardina pilchardus	(Izmir Bay)	12.1	19.3	0.63	57592	PG
Sardina pilchardus	(Izmir Bay)	12.1	16.8	0.72	57592	PG
Sardinops sagax	California	21.5			265, 11063	M
Sardinops sagax	California	18.5			796	M
Sardinops sagax	South Africa	23.0			839, 6238	M
Sardinops sagax	Lakes Entrance	8.0			6390, 858	M
Sardinops sagax	Port Phillip Bay	10.0			6390, 858	M
Sardinops sagax	Peru	26.0			10964	M
Sardinops sagax	(California)	21.5	29.5	0.73	312, 838	PG
Sardinops sagax	(California)	18.5	27.0	0.69	312, 842	PG
Sardinops sagax	(California)	18.5	30.5	0.61	312, 837	PG
Sardinops sagax	(California)	22.5	29.3	0.77	839	PG
Sardinops sagax	(California)	21.5	30.0	0.72	1139, 838	PG
Sardinops sagax	(Western Cape)	23.0	29.5	0.78	312, 836	PG
Sprattus sprattus	North Sea	10.0	13.0	0.77	796, 851	M, PG
Sprattus sprattus	Norwegian coast	13.0			839	M
Sprattus sprattus	Baltic Sea	12.0			40546, 10142	M
Sprattus sprattus	North Sea	11.5			40546, 40548	M
Sprattus sprattus	Northern regions of the Baltic	11.0			52153	M
Sprattus sprattus	North Sea	8.5	15.0	0.57	94462, 114862	M, PG
Sprattus sprattus	North Sea	8.5	15.0	0.57	94462	M, PG
Sprattus sprattus	Baltic Sea	8.1			94462, 114862	M
Sprattus sprattus	Baltic Sea	8.1			94462	M
Sprattus sprattus	-	13.0	16.0	0.81	312, 846	PG
Sprattus sprattus	(Western Baltic)	12.0	14.4	0.83	1139, 1771	PG
Sprattus sprattus	(Gullmarsfjord)	12.0	16.0	0.75	4554, 4555	PG
Sprattus sprattus	(North Sea)	10.0	13.2	0.76	5760, 5815	PG
Sprattus sprattus	(Baltic Sea)	11.2	15.0	0.75	94462	PG

[a] Formerly *S. brasiliensis*, which is now considered a synonym of *S. aurita* (Fricke et al. 2020; Stern et al. 2018).

Online Resource 4: Habitat associations, seasonal movement and migrations of tropical marine Indo-West Pacific clupeids

Table S4.1

	Location and species	Distribution and habitat associations	Seasonal variation in habitat conditions (and fisheries)	Migrations and habitat use at various life stages and/or seasons	Spawning grounds & diurnal movement
Round-bodied Sardinellas	India *S. longiceps*	Distributed along west and east coasts, generally in waters less than 40 m deep, but up to 100 m; occasionally in estuaries (Rohit et al. 2018 and references therein). Highest landings, suggesting highest abundance, occur off the SW coast (Malabar region) which is subject to strong seasonal upwelling (Kripa et al. 2018; Madhupratap et al. 1994), and associated wide variations in water temperature (22-33°C), salinity (15-36 psu), primary production and dissolved oxygen (Kripa et al. 2018).	Seasonally reversing winds and currents: upwelling of cool, nutrient-rich, low oxygenated waters occur in varying intensity along west and east coasts during the wet southwest monsoon season (May/June onset in the south, later in north; to Sept) resulting in high primary production and food availability. Peak landings occur post-SW monsoon (Manjusha et al. 2013; Rohit et al. 2018). The northeast monsoon (Dec-Mar) is associated with lower primary production (Hood et al. 2017; Madhupratap et al. 1994; Menon et al. 2019).	Based on descriptions of early fisheries on the SW coast (restricted to coastal waters by boats/gear used), *S. longiceps* adults migrate seasonally to coastal waters (<15 km from shore, 15-20 m deep) coinciding with SW monsoon onset and upwelling-associated phytoplankton blooms. Following the monsoon (Sept. to Dec.) there are fewer adults but large shoals of juveniles (spawned the same year) in coastal waters (Antony Raja 1969; Longhurst and Wooster 1990 and references therein; Madhupratap et al. 1994); some adults may move very nearshore (accessible by shore-based fisheries) (NORAD/IMR 1976). As water temperatures increase and the thermocline deepens (Feb-Mar), sardine schools disappear from coastal areas and are assumed to stay offshore over summer (Mar-May) (Antony Raja 1969; Devaraj et al. 1997). In studies on seasonality in coastal habitats, *S. longiceps* could occur in coastal waters (east coast; <10 km from shore, 5-30 m depth) in any season, but less frequently post-monsoon (Biswas et al. 2014); small *S. longiceps* (caught in 30 mm gillnet) were also present in estuary habitat all seasons (Sreekanth et al. 2017). It has also been suggested that the main population of adults remains between 18-46 km offshore (NORAD/IMR 1976) and/or in the 30-40 m depth zone, while juveniles move along shore in shallow coastal waters (Rohit et al. 2018 and references therein). Various hypotheses, on along-shore migrations versus progressive offshore-inshore movement (in response to progressive onset and withdrawal of the monsoon) and/or range extensions and contractions as a result of changes in abundance, require further investigation (Rohit et al. 2018). Tagging studies carried out in the 1960s had limited recoveries (Devaraj et al. 1997).	SW coast: spawning/spent fish and larvae have been found ~15 km offshore, in water 30 m deep; eggs and larvae have also been noted nearshore (12 m, Jayaprakash and Pillai 2000 and references therein) and spawning reported to occur 'close to shore' in certain parts of the coast (NORAD/IMR 1976). Schools descend to deeper water in daytime (Devaraj et al. 1997). Surface aggregations in SW monsoon form possibly due to oxygen-deficient upwelled water (Longhurst and Wooster 1990; NORAD/IMR 1976).
	Philippines *S. lemuru*	Distribution is associated with areas of high primary production stimulated primarily by seasonal coastal upwelling, and occasionally river discharge (Villanoy et al. 2011; Willette et al. 2011). Large landings, suggesting high abundance, occur off the Zamboanga Peninsula, where there is a strong seasonal upwelling (Rola et al. 2018; Villanoy et al. 2011).	Northeast monsoon (Dec-Mar) creates a band of upwelling and high primary productivity off the Zamboanga Peninsula (NW-facing coast; extending 25-30 km from shore, approx. 2,300 km^2 in area). Upwelling coincides with peak landings (Deauna and Villanoy, unpubl. cited in Metillo et al. 2018; Villanoy et al. 2011); although a lag before peak landings has also been suggested (Naguit 2016).	Off the northern Zamboanga Peninsula, *S. lemuru* is thought to spawn inshore (<100 m depth?) during the NE monsoon and larvae are transported offshore (>500 m deep?) with surface currents – high larval concentrations are found seaward of the upwelling zone (i.e. >25 km offshore) (Campos et al., 2017 cited in Metillo et al. 2018). Early-juveniles move inshore, possibly with tidal currents, to feed on zooplankton in the upwelling area (Metillo et al. 2018). Based on stable isotope and gut content analysis, early juveniles (1.99-3.14 cm SL) and 'adults' (9.80-11.90 cm SL; not specified if mature) were found to feed in shared inshore habitats (<100 m deep) influenced by terrestrial input; while juveniles (3.15-9.79 cm SL) also feed inshore, but in deeper parts influenced by upwelling (Metillo et al. 2018). Other research suggests there may (also?) be along-shore movement of larvae. During NE monsoon, larvae spawned in the north are transported south with currents. They grow and mature in the south, then spawn (aged 4-6 months) during the SW monsoon, which transports resultant larvae north, to grow and mature by the next NE monsoon. Mature fish were only found in the northern area during NE monsoon, but were present in the south in June and NE monsoon (Naguit 2016; Rola et al. 2018).	Spawning grounds are suggested to be located in inshore areas (distance from shore?) including in bays (Campos et al., 2017 cited in Metillo et al. 2018).
	Indonesia *S. lemuru*	Dense schools of *S. lemuru* only occur in areas associated with upwelling – such as the Bali Strait (Venema 1996). Acoustic surveys in the Bali Strait indicate highest abundance in waters less than 100 m deep, and rarely at depths greater than 200 m (Merta et al. 2000). Water temperature ranges from 24-30°C (Gaughan and Mitchell 2000 and references therein).	Seasonal upwelling in Bali Strait occurs during the southeast monsoon (~June-Sept) bringing cool, nutrient-rich water to the surface, which fuels growth of phytoplankton and zooplankton. Phytoplankton biomass (indicated by chlorophyll-a) peaks June-Sept. Peak sardine landings occur from Aug/Sept to Nov/Dec (Hendiarti et al. 2005; Merta et al. 2000; Pet et al. 1997; Sartimbul et al. 2010).	Bali Strait: juveniles inhabit shallow coastal bays and are most abundant May-Sept (at times to Dec). Larger fish (>15 cm) occur in deeper waters and are more abundant in southern, oceanic areas (Merta et al. 2000). Migration patterns and key parts of the life cycle are not well understood. Early studies suggested that after the SE monsoon, *S. lemuru* moves from deep water in the southern Strait to northern coastal areas, spawns in less saline coastal areas during wet NW monsoon (Nov-Dec), then moves back south to deeper water (Pet et al. 1997; Venema 1996). However mature fish are rarely caught in northern Bali Strait (Merta 1995; Pet et al. 1997; Venema 1996); and while *S. lemuru* spawns in Nov-Dec in Madura Strait (Pet et al. 1997), this may be a separate stock spawning in response to different hydrological conditions. Gonad maturity studies suggest spawning in June-July (coinciding with upwelling and high food availability), and presume this takes place in deep waters out of reach from fishing gear (Buchary 2010; Merta 1995); young juveniles may then move to coastal areas. Two spawning periods could also occur: two peak periods of recruitment to the fishery are noted (Wudianto et al. 2013) and sometimes a second minor peak in catches (Hendiarti et al. 2005).	Some studies suggest spawning grounds are in deep water (Buchary 2010; Merta 1995); others suggest spawning occurs in lower salinity coastal waters (Pet et al. 1997; Venema 1996). *S. lemuru* generally form dense schools near the bottom during daytime, and scattered schools near the surface at night (Merta et al. 2000).
	Western Australia (mid-west coast) *S. lemuru*	Fishing grounds (target adults) are ~50 km offshore. Near to southern/poleward distribution limit; water temp. 19-23°C. No consistent upwelling or major riverine inputs in fishery area (Gaughan and Mitchell 2000). Sporadic localised upwelling can occur. Downwelling eddies, created by meanders in the Leeuwin Current, can also result in high primary productivity, but transport larvae to deep off-shelf waters (Hood et al. 2017).	Wind and current vary seasonally. The Leeuwin Current (~50 km wide, ~300 m deep) flows south along west Australian coast (downwelling-favourable), usually along the shelf break, carrying warm, low salinity water. Flow is stronger in winter (Jul-Aug); and weaker in summer (Dec-Jan) when prevailing southerly winds drive localised upwelling and a weak northward flowing current along coast (Gaughan and Mitchell 2000; Hood et al. 2017).	Habitat use and movement are not well understood, however hypotheses have been explored based on observations and knowledge of local oceanographic conditions (Gaughan and Mitchell 2000). In the mid-west coast region, spawning (peak in Jan-Feb) occurs over the outer half of the continental shelf (~50 km offshore). Eggs and larvae are likely transported north (towards equator) and offshore from spawning grounds due to a net north-west (i.e. offshore) movement of surface water driven by prevailing southerly winds. Juveniles are not generally found in lagoons or off beaches on the mainland or offshore islands, and are suggested to occur further offshore and/or north in areas of localised higher nutrient and food availability associated with breakaway eddies, intrusions, mixing and fronts from the main Leeuwin current. This is supported by oxygen-isotope analysis which found smaller fish (<145 mm FL) had lived in warmer waters than larger fish (Gaughan and Mitchell 2000). No evidence to suggest *S. lemuru* migrate inshore in the mid-west coast region; however, further south (~400 km, Fremantle) commercial quantities often occur within a few kilometres from shore. There is also some evidence of a possible north-south shift or extension in distribution when waters in these southern areas (poleward) are sufficiently warm (Gaughan and Mitchell 2000).	Eggs are typically found widely distributed over the outer half of the continental shelf (~50 km offshore) (Gaughan and Mitchell 2000). Usually form dense schools from late afternoon until midnight, then disperse and are scattered throughout the water column during the day; although occasionally do not form schools at night, without any obvious seasonality (Gaughan and Mitchell 2000).

	Location and species	Distribution and habitat associations	Seasonal variation in habitat conditions (and fisheries)	Migrations and habitat use at various life stages and/or seasons	Spawning grounds & diurnal movement
Flat-bodied Sardinellas	India & Sri Lanka *S. gibbosa* *S. fimbriata* *S. albella* *S. melanura*	India: species occur within 50 km of the coast. Appear to have discontinuous distributions, with one to several species abundant in different regions, and with some fisheries more productive than others (Bennet et al. 1986). Sri Lanka: occur in coastal areas, *S. gibbosa* at 12-26 m depths; *S. albella* in shallower waters (12-20 m) (Dayaratne 1997).	Seasonally variable, monsoon-driven currents, wind and rainfall (Hood et al. 2017). Indian shore-based and coastal fisheries (<50 km from shore, <60 m depth) are generally seasonal, although good landings can occur year-round at some locations (Bennet et al. 1986; Bennet et al. 1992).	Occurrence in coastal waters is thought to be influenced by ocean circulation and food availability (Luther 2001), and varies by species. Off east coast (<10 km from shore, 5-30 m depth), *S. fimbriata* was common pre-monsoon (Jun-Sep) and very common during monsoon (Oct-Jan); *S. melanura* was very common pre- and during monsoon and common post-monsoon (Feb-May); *S. albella* occurred only pre-monsoon (Biswas et al. 2014). Alongshore migration is also reported – e.g. seasonal southward migration of *S. fimbriata* and *S. albella* (Anon., 1974 cited in Devaraj et al. 1997). Movement is also influenced by variation in environmental conditions: in acoustic surveys, Flat-bodied Sardinellas generally occurred at ~20-40 m depth, however in the lead-up to and during SW monsoon mainly occurred in surface waters, possibly due to upwelling of oxygen-deficient waters (Anon., 1974 cited in Devaraj et al. 1997). Fishery-based evidence suggests different habitat use at different life stages. Off the east coast, *S. fimbriata* juveniles and both *S. gibbosa* juveniles and adults occur in coastal landings (<60 m depth); but mature adult *S. fimbriata* are rarely caught suggesting it spawns further offshore (Luther 2001). Off the south-east coast *S. gibbosa* and *S. albella* adults occur and spawn in deeper oceanic waters of the Gulf of Mannar; then young juveniles move into the shallow, enclosed Palk Bay where they feed and grow (Bennet et al. 1986).	India: spawning grounds vary by species & location: *S. gibbosa* in coastal waters (<60 m depth), *S. fimbriata* further offshore (east coast, Luther 2001). *S. gibbosa* eggs have also been seen ~20 km off the east coast (Sekharan et al. 1969). Off the south-east coast *S. gibbosa* and *S. albella* adults may spawn in oceanic waters. Juveniles are reported to move to surface waters during darker nights (Bennet et al. 1986).
	Western Indian Ocean *S. gibbosa* *S. melanura* *S. albella*	*S. gibbosa* and *S. melanura* are common in shallow shelf areas (<200 m deep) (Groeneveld and Koranteng 2017). *S. albella* has been noted in catches near Zambezi River mouth (Johnsen et al. 2008); *S. gibbosa* in mangrove creeks ((Nyunja et al. 2002).	Strong SE monsoon winds mix water column layers (May-Oct); weaker NE monsoon winds cause stratification but allow formation of nitrogen-fixing algal blooms (Nov-Mar); seasonal river flow also fuels primary productivity (Groeneveld and Koranteng 2017).	Seasonal migration and distribution patterns are not yet well understood (Groeneveld and Koranteng 2017). *S. gibbosa* has been recorded in mangrove-lined creek and inshore channel habitats in Kenya during both the northeast and southeast monsoon periods (Nyunja et al. 2002). *S. gibbosa* and *S. albella* are two of the main fish species caught in nearshore and coastal fisheries in Kenya and Mozambique; and *S. gibbosa* in Madagascar. Information about seasonality is not yet documented (FAO 2019).	
	Indonesia *S. gibbosa* *S. fimbriata* [a]	Coastal; tolerate varying salinity (Potier and Nurhakim 1995). *S. gibbosa* occurs at 10-70 m depths (Pauly et al. 1996).	Higher primary production in Java Sea during SE monsoon upwelling (Jun-Oct), and wet season (Dec-Mar) from river runoff (Hendiarti et al. 2004; Hendiarti et al. 2005).	Landings of Flat-bodied Sardinellas are seasonal and not explained by patterns of adverse fishing conditions (Hendiarti et al. 2005; Pet et al. 1997), suggesting seasonal fish movements between habitats.	
	Australia (north-east coast) *S. gibbosa* *S. brachysoma* *S. albella*	Coastal habitats including mangrove estuaries, sandflats and rocky headlands; bay (5-10 m) waters and offshore (~40 km from shore, 30-40 m deep). Distribution varies by species and life-stage (Williams and Cappo 1990).	Prevailing south-easterly trade winds in winter (Jul-Aug) create eddies that retain and concentrate larvae & food particles. Under certain conditions, nutrient-rich water from nearshore habitats moves offshore, fuelling primary production (Cappo 1995a).	A five-year study with regular, multi-gear sampling found juvenile *S. gibbosa*, *S. albella* and *S. brachysoma* occurred in shallow nearshore habitats (sandflat and rocky headland) but only *S. albella* and *S. brachysoma* entered the mangrove estuary. Adult *S. albella* and *S. brachysoma* occurred in nearshore habitats and bay waters (5-20 m deep), but not further offshore. Adult *S. gibbosa* occurred only in bay waters and offshore (~40 km from shore, 30-40 m deep). *S. gibbosa* appeared to move progressively offshore with life-stage and season: in Oct-Dec, young juveniles appeared nearshore (<100 m from shore) over sandflats, near rocky headlands and river mouths; by Apr-May subadults were in deeper bay waters. By Sept. large aggregations of mature adults occurred further offshore in an area probably seasonally nutrient-enriched by local circulation patterns. Spawning coincided with SE trade winds, peaking in spring (~Sep-Oct). Larvae were assumed to swim or move by passive transport towards shore – larvae >38 mm were mainly absent from areas 9-18 km offshore and slightly larger juveniles only occurred nearshore (Cappo 1995a; Cappo 1995b).	*S. gibbosa* spawns in offshore waters (40 km from shore, 30-40 m deep). Spawning grounds unknown for *S. brachysoma* and *S. albella* – not in same offshore habitat (Cappo 1995b) and possibly also not in creeks (Robertson and Duke 1990).
	Philippines *S. gibbosa* *S. albella* *S. pacifica* (formerly *S. fimbriata*)	Coastal shelf waters (depths <200 m) (Willette et al. 2011). *S. fimbriata* (now *S. pacifica*) was the most abundant species in several bays, including Butuan Bay, until 2008 (Naguit 2016).	Seasonal, monsoon-driven currents, wind, rainfall and assoc. environmental conditions. Primary productivity in Butuan Bay is fuelled by riverine nutrient input, peaking in the northeast monsoon (Dec-Mar) (Villanoy et al. 2011).	There are anecdotal reports of migrations by *Sardinella* species (Willette et al. 2011).	
	Marquesas Islands *S. marquesensis*	Habitats incl. turbid, low salinity bays, to clear oceanic water off sandy beaches. Water temp. 25-31°C; salinity 8.5-36 psu (Nakamura and Wilson 1970).	Seasonal nutrient enrichment from upwelling-favourable eddies in the lee of islands and enhanced by terrestrial runoff (Martinez 2004).	Highest abundance of small fish occurred in the western-most of three bays, possibly due to westward transport of eggs and larvae by prevailing currents and resultant juveniles returning to westernmost bay first (Nakamura and Wilson 1970).	
Trop. Pilch.	India, Sri Lanka and Western Indian Ocean *A. sirm*	Sri Lanka: occurs in coastal and offshore waters; dominant species in nets set at 20 m and 26 m depths (Dayaratne 1997). Kenya, Madagascar, Tanzania & Somalia: coastal (FAO 2019).	Seasonally variable, monsoon-driven currents, wind and rainfall (Hood et al. 2017). Peak catch rates in Apr-Nov coinciding with SW monsoon (Karunasinghe and Wijeyaratne 1996).	Sri Lanka: juveniles occur in shore-based fisheries in some months (Dayaratne 1997). India: off southeast coast, mature fish disappear from inshore landings (Mar-Jun) so are assumed to move offshore to spawn (Bennet et al. 1986). Off the southwest coast, mature adults, eggs, larvae and juveniles are seen in inshore waters, suggesting adults migrate nearshore to spawn (Dec-Feb); adults leave in Mar-Apr, while juveniles (from recent spawning event) are still present in Apr-May (Lazarus 1990).	India: off southeast coast, assumed to spawn offshore (Bennet et al. 1986); off southwest coast, spawning occurs nearshore (Lazarus 1990).

	Location and species	Distribution and habitat associations	Seasonal variation in habitat conditions (and fisheries)	Migrations and habitat use at various life stages and/or seasons	Spawning grounds & diurnal movement
Tropical Pilchards *(cont.)*	Australia (north-east coast) *A. sirm*	Generally occurs in clear offshore waters (30-40 m deep, 40 km from shore) (Cappo 1995a; Cappo 1995b).	Seasonal formation of eddies and nutrient enrichment by coastal waters (as described previously for this location).	*A. sirm* occurred in clear, offshore waters (30-40 m deep, 40 km from shore) at all stages of its life. The offshore presence of adults, larvae and the youngest juveniles suggests spawning also occurs offshore, in an area thought to be seasonally nutrient-enriched by coastal waters. Schools of *A. sirm* juveniles occasionally moved nearshore to a rocky headland and off beaches, but only during hot, calm, clear conditions (Nov-Jan) and disappeared with onset of turbid conditions; not caught in mangroves (Cappo 1995a; Cappo 1995b).	Spawns in offshore waters (~40 km from shore, 30-40 m deep).
	Indonesia *A. sirm*	Oceanic waters near continental shelf edge around Java (Potier and Sadhotomo 1995); at depths 10-75 m (Pauly et al. 1996).	Monsoon-driven variability in environmental conditions (as described previously).	Based on assessment of length composition of fish caught by purse seiners, it has been suggested that *A. sirm* (and shortfin scad *Decapterus macrosoma*) spawn in the north-eastern Java Sea and make seasonal migrations to the Makassar Strait and Flores Sea (Sadhotomo and Potier 1995).	Spawning suggested to occur in north-eastern Java Sea (Sadhotomo and Potier 1995)
	Western Pacific Ocean *A. sirm* *A. clupeoides*	New Caledonia: deep bays & near reefs (*A. sirm*); coral-reef (*A. clupeoides*) (Conand and Kulbicki 1988). Fiji (*A. sirm*): deep lagoons with passages to open ocean; higher catches in areas of strong current (Milton and Blaber 1993). Solomon Is. (*A. sirm*): in lagoons & passages (Roeger et al. 2016).	Seasonality of environmental conditions varies by location due to large-scale oceanic and atmospheric circulation patterns – Intertropical & South Pacific convergence zones, trade-wind driven currents and counter-currents. Little variation in water temp. near equator (e.g. Kiribati); larger ranges at higher latitudes (e.g. New Caledonia). Current intensity and direction vary substantially in the western Pacific, but remain fairly constant in the south central Pacific. Interaction with local island topography modifies wind and water flow, which can lead to localised mixing and upwelling of nutrients; nutrient enrichment also occurs from terrestrial runoff (Bell et al. 2011).	Kiribati (atoll environment): generally only mature *A. sirm* adults were reported in coral reef lagoons, suggesting it spends most of its life cycle offshore (Rawlinson et al. 1992 and references therein). Solomon Islands: Fishers report that *A. sirm* occurs seasonally – it is most abundant in the lagoon and its passages from Jan-Aug, then decreases from Sep. and generally not found from Nov-Dec. During the months of absence, *A. sirm* is thought to move elsewhere out of the lagoon or to particular places, possibly to breed; some fishers suggested the species was still present but was too small to catch, and some juveniles were reported in mangroves around the edges of the lagoon. Some fishers also reported *A. sirm* schools near river mouths after rain (Roeger et al. 2016).	Kiribati: *A. sirm* probably spawns in lagoons, at night (Milton et al. 1994b; Rawlinson et al. 1992 and references therein). Solomon Is.: fishers report that *A. sirm* stays in the lagoon during the day and moves to certain passages at night (Roeger et al. 2016).
Tropical Herrings	Western Pacific Ocean *H. quadrimacul.*	Kiribati: sandy-bottom atoll lagoons and nearby seagrass beds (Milton et al. 1994a). New Caledonia: nearshore areas, deeper lagoons (Conand 1988). Solomon Is.: under wharves, and in sheltered bays (Foale 1998). Japan: mangrove estuaries (Nanjo et al. 2008). Hawaii (introduced): sand-rubble reef flats and deeper waters (Williams and Clarke 1983).		Hawaii: during the day, adults and juveniles occur in clear water over sand-rubble reef flats (1-2 m deep) or in deeper water around piers and floating docks. At night, fish move to deeper waters: juveniles remain within 100m of shore or reef, while adults can be found further offshore (including 10 km offshore, in water >100 m deep). Adults disappear from the bay for periods and reappear without obvious link to environmental changes. Seasonal changes in abundance are thought to be related partly to movements in and out of the bay, but also to its annual life-history (Williams and Clarke 1983). Kiribati: hypothesised life cycle based on observations from early biological studies – juveniles enter lagoons or shallow coastal areas where they feed and grow; mature adults leave the lagoon and spawn over the reef (then die or stay offshore); pelagic eggs and larvae are transported by ocean currents; once developed into juveniles, then enter shallow coastal or lagoon areas (Cross, 1978 cited in Rawlinson et al. 1992).	Hawaii: no eggs, larvae or spawning females were found in bay, so assumed to spawn elsewhere. Moves to deeper waters at night (Williams and Clarke 1983). Kiribati: spawn in the lagoon (Milton et al. 1994b); school in shallow water in day & disperse at night (Milton et al. 1994a). Solomon Is.: moves to deeper waters at night (Foale 1998).
	Sri Lanka Andaman Is. Western Indian Ocean *H. quadrimacul.*	Sri Lanka: shallow bays with fringing reefs, with sandy, rocky and reef flat substrate (Deepananda et al. 2016). Mozambique: recorded in catches near Zambezi River mouth (Johnsen et al. 2008).	Seasonally reversing monsoon currents cause large variations in upwelling intensity and related primary productivity around Sri Lanka, which peaks in the southwest monsoon (July/Aug) (Hood et al. 2017).	Sri Lanka: highly seasonal nearshore (stilt) fishery – fishers report that *H. quadrimaculatus* arrive in nearshore waters with the onset of stormy conditions associated with the southwest monsoon (from May/June until Feb/March). Young/small fish arrive first (Deepananda et al. 2016). Kenya, Mauritius & Madagascar: *H. quadrimaculatus* occurs in coastal fisheries. Information about seasonality is not yet documented (FAO 2019).	Sri Lanka: fish reportedly move inshore early morning & to deeper waters (10-20m) at dusk (Deepananda et al. 2016).
	Australia (north-east) *H. castelnaui* *H. koningsberg.* *H. lippa* Palau *Herklotsichthys*	Nearshore habitat including sandy and rocky habitats and mangrove estuaries; bay waters (5-10 m deep) and occasionally further offshore (varies by species) (Cappo 1995a; Cappo 1995b).	Australia: seasonal variation in estuaries & nearshore habitat is associated with the summer wet season (~Dec-March) which brings warmer water, lower salinity, higher turbidity, higher nutrient levels and higher phytoplankton biomass (Cyrus and Blaber 1992; Trott and Alongi 1999).	Australia: *H. castelnaui* adults and juveniles are common in mangrove estuaries and off the sandy spit; also occur around a wharf (rocky headland) as adults. *H. koningsbergeri* lives mainly in deeper, clearer bay waters (5-20 m deep) (rarely in turbid estuarine habitat) and forms large schools around nearshore structures such as jetties. Large mature fish are found in the bay (at 15 m depth) and off rocky headland habitat in spring (~Sept), possibly aggregating to spawn. *H. lippa* adults are common in bay waters (5-20 m deep) and occasionally further offshore (30-40 m deep, 40 km from the coast); juveniles mostly occur around the rocky headland and occasionally in other nearshore habitat (Cappo 1995b). Palau: *Herklotsichthys* spp. live in seagrass beds, sand flats and lagoon areas, then move to mangrove creeks for spawning, around the new moon (Johannes 1978).	Aust.: *H. castelnaui* aggregate in creeks to spawn (Cappo 1995b; Robertson and Duke 1990). Unknown for other species. Palau: mangrove creeks (Johannes 1978).
	India *E. thoracata*	Estuary lined with dense mangrove forest (Sreekanth et al. 2017).	Heavy rainfall and stormy conditions during southwest monsoon (June-Sept).	India (west coast): dominant species caught in an estuary habitat in all seasons (west coast), although highest abundance post-monsoon (Sreekanth et al. 2017).	
	Australia (north-east) *E. thoracata*	Turbid shallows along beaches; occasionally in mangrove estuary.	Seasonal variability associated with wet season (as described previously).	Both adults and juveniles occur in shallow turbid waters off beaches. Juveniles occasionally occur in mangrove estuaries (Cappo 1995b).	

[a] Species distribution revised or questioned since reference published (Hata and Motomura 2019; Stern et al. 2016).

Online Resource 5: Reported interannual fluctuations in tropical marine Indo-West Pacific clupeid fisheries & attributed drivers

Table S5.1

	Species, location & description of change	Attributed drivers
Round-bodied Sardinellas	***S. longiceps* – India (SW coast)** Large fluctuations in annual landings off the south-west coast of India have been noted since the 1800s, as well as variation in the timing of *S. longiceps* arrival and departure from inshore fishing grounds (<15 km from shore, 15-20 m deep) (Longhurst and Wooster 1990; Nair 1973; Rohit et al. 2018). Over the past 60 years (since 1961), *S. longiceps* landings off the south-west coast have fluctuated. The lowest landings occurred in 1994, after which they generally increased each year (with dips in 2001 and 2009) to a historic peak in 2012, then declined markedly in 2015 to less than 20% the 2012 volume. Catch per unit effort increased from 2007-2012 suggesting increasing abundance over this period, then decreased from 2013-2015 suggesting lower abundance (Kripa et al. 2018).	Over the past 30 years, numerous studies have compared landings and catch rates with upwelling intensity and timing, rainfall and monsoon onset, but produced mixed results, probably due to differences in time series, actual data used, complexity of analyses and complexity of the processes being investigated. Based on data from 1939-86, lower landings were correlated with early remotely-forced upwelling, indicated by lower sea level in Mar/Apr – oxygen-deficient upwelled water was hypothesised to exclude fish from productive coastal waters leading to poor spawning and recruitment (Longhurst and Wooster 1990). Higher landings occurred when wet SW monsoon onset was relatively early (May); but there was no significant correlation with rainfall (Longhurst and Wooster 1990). Lower landings from 1926-2005 were similarly generally associated with periods of high intensity upwelling, while higher landings were associated with mild upwelling; again no direct relationship with rainfall was identified (Krishnakumar et al. 2008). Madhupratap et al. (1994) however, found no correlation between landings and upwelling from 1960-90, or with monsoon onset or rainfall, and suggested drivers of fluctuations were more complex, possibly linked to timing (and mismatch in timing) of reproductive and ocean-atmospheric processes. Analysis of landings from 1950-93 (detrended to account for fishery modernisation) found that a combination of compensatory density-dependent and environmental factors (rainfall and upwelling intensity in monsoon months of the current and previous years) explained most of the variability in annual landings (Xu and Boyce 2009). Rainfall during monsoon months was associated with higher landings, while lower sea level (reflecting stronger upwelling) in monsoon months was associated with lower landings. It was hypothesised that lower recruitment to the fishery could result from spawning fish avoiding upwelled oxygen-deficient water and/or stronger advection of larval fish offshore (Xu and Boyce 2009). Other studies have investigated interannual variation in food availability, particularly phytoplankton biomass indicated by remotely-sensed chlorophyll-a concentrations. Based on data from 1998-2006, higher landings were suggested to be associated with higher chlorophyll-a in the 'bloom initiation month' (May) (George et al. 2012) however the time-series data presented do not seem to support the stated results. From a similar period (1998-2007) a significant positive correlation was found between upwelling and chlorophyll-a concentration during the monsoon period (Jun-Sep), and between monsoon upwelling and post-monsoon *S. longiceps* landings (Oct-Jan) (Manjusha et al. 2013); this period was characterised by relatively mild upwelling (Krishnakumar et al. 2008). More recent studies have also considered other life-stages (female maturation and juvenile recruitment), as well as fishing pressures. Peak landings in 2010-2012 were attributed to increased fishing capacity and effort including in previously unfished areas, supported by higher sardine biomass due to favourable conditions for maturation, spawning and recruitment. The subsequent decline (2013-2015) resulted from overfishing of mature adults and juveniles in the preceding years coupled with poor maturation and low juvenile recruitment due to unfavourable conditions (weak upwelling and warm water) and/or a mismatch in timing, and high abundance of predatory jellyfish (Kripa et al. 2018). It was concluded that higher sardine biomass occurs when there is strong maturation in Apr/May (stimulated by pre-monsoon upwelling), and a normal monsoon which supports spawning (May-Jul) and fuels high food availability nearshore for juvenile growth (Kripa et al. 2018). In a separate study, monthly recruitment decreased after 2012, suggested due to spawning failure, temperature and/or poor feeding. Monthly anomalies in numbers of recruits (~3 months old) per spawning stock biomass (estimated from monthly landings and length composition data) were only partly explained by chlorophyll-a three months earlier and upwelling (Rohit et al. 2018). The El Niño Southern Oscillation (ENSO) is a key factor driving variation in interannual conditions. The multivariate ENSO index (large positive values indicate El Niño), was significantly negatively correlated with *S. longiceps* landings and catch rates from 1961-2015 (Kripa et al. 2018). No relationship was found between ENSO and landings over a longer time-frame, 1926-2005 (Krishnakumar et al. 2008), however changes in fishing effort may have confounded results. During the 2014-15 El Niño, associated with lower landings and catch rates (Kripa et al. 2018), large fish with immature gonads and poor spawning were reported and some stock appeared to move to deeper waters and adjacent areas (Rohit et al. 2018). In contrast, during the 2010-13 La Niña, *S. longiceps* grew and matured normally and had high resilience to fishing pressure (Rohit et al. 2018). Rainfall was higher in La Niña (Krishnakumar et al. 2008); and months with higher rainfall have been associated with higher proportions of mature, partially spent and spent females (Kripa et al. 2018). The Indian Ocean Dipole also drives interannual variation in environmental conditions in the Indian Ocean (Saji et al. 1999) and has also been hypothesised to impact food availability and sardine movement (Rohit et al. 2018 and references therein) and interannual variation in landings (Vivekanandan and Krishnakumar 2010). *S. longiceps* abundance has also been suggested to be inversely related to abundance of Indian mackerel *Rastrelliger kanagurta*, with periods of dominance by each species (comparable to sardine and anchovy in temperate regions) (George et al. 2012; Nair 1959), possibly based on 5-year intervals (Devaraj et al. 1997). However other studies have found no correlation between seasonal landings (or lagged landings) of the two species suggesting no density-dependent relationship (1926-2005, Krishnakumar et al. 2008; 1939-86, Longhurst and Wooster 1990; 1960-90, Madhupratap et al. 1994). *S. longiceps* landings appear to fluctuate more widely than mackerel landings, and the two species appear to respond differently to environmental variability (Longhurst and Wooster 1990; Manjusha et al. 2013). The 1997-98 El Niño adversely affected mackerel reproduction causing collapse of this fishery in 1999-2000, which in turn may have reduced predation on sardine eggs and larvae, resulting in increased sardine abundance and landings (Krishnakumar and Bhat 2008); although transfer of fishing effort between the two fisheries did not appear to be considered.
	***S. longiceps* – India (E coast)** East coast *S. longiceps* landings were rare and sporadic pre-1980s, but have increased and now contribute substantially to total catch (Jayaprakash and Pillai 2000; Rohit et al. 2018; Vivekanandan et al. 2009).	Increased *S. longiceps* landings on the south-east and north-east coasts have been attributed to an extension of the species' range northward (poleward) in response to climate change and rising sea surface temperature (Vivekanandan et al. 2009). Fishing pressure on predatory species may also be a contributing factor (Funge-Smith et al. 2012). Consumer preference for *S. longiceps* is also reportedly low on the east coast (Rohit et al. 2018) and exploitation increased after the 1980s to meet increasing demand from processing plants interstate (Jayaprakash and Pillai 2000).
	***S. longiceps* – Oman** Annual *S. longiceps* landings declined from 2001-2011 off the coast of Oman (north-west Arabian Sea) (Piontkovski et al. 2014).	Decline was hypothesised to be due to rising sea temperature and water column stratification. Basin-wide migration was also suggested given a concurrent increase in landings off the west Indian coast (east Arabian Sea) (Piontkovski et al. 2014); however significant genetic and morphological differences have been found between *S. longiceps* caught in Indian and Omani waters (Rohit et al. 2018; Sebastian et al. 2017).
	***S. lemuru* – Indonesia (Bali Strait)** Annual *S. lemuru* landings are characterised by large fluctuations. From 1950-74, landings were relatively low due to low fishing effort. From 1975-2007, landings increased but with wide fluctuations: major peaks occurred in 1983, 1991, 1997-98 and 2007; very low landings occurred in 1986, 1996, 1999-2000 and 2005 (Buchary et al. 2011; Ghofar and Mathews 1996; Merta et al. 2000; Wudianto et al. 2013). Fishing effort (engine power) increased 1975-91, then plateaued 1992-99 (Ghofar et al. 2000).	Several studies have found that *S. lemuru* landings and CPUE in the Bali Strait fluctuate closely with ENSO (Southern Oscillation Index). During El Niño periods total sardine catch and CPUE are an order of magnitude higher than in La Niña (1974-99, Ghofar et al. 2000; 1990-2004, Purwanto 2011). High discards and high grading are also common during El Niño due to very large catches (Buchary et al. 2011). The mechanisms behind this close association are less well understood. For the period 2003-07, monthly CPUE were significantly correlated with remotely-sensed chlorophyll-a concentrations (3-month moving average), which seasonally peaks during the SE monsoon. Very high landings in 2006-07 occurred several months after unusually high chlorophyll-a levels late-2006. This resulted from a strong El Niño and a strong positive IOD which both intensified and prolonged upwelling (indicated by unusually low water temperature), fuelling high primary productivity and peak landings around three months later (Sartimbul et al. 2010). In a separate study (2007-17), higher monthly *S. lemuru* landings were correlated with cooler water and with higher chlorophyll-a concentrations five months earlier (Puspasari et al. 2019). Two periods of very low landings (2011, 2017) coincided with temperatures around 2-3°C warmer than usual. Unlike chlorophyll-a levels, water temperature

	Species, location & description of change	Attributed drivers
Round-bodied Sardinellas *(cont.)*	Landings and catch per unit effort (CPUE) dropped in 2010 (from a peak in 2007) and reached very low levels in 2011; there was a slight increase from 2012-16 (to approx. half 2007 peak), then dropped to very low levels again in 2017 (Puspasari et al. 2019).	had a fairly immediate influence on *S. lemuru* landings (i.e. no lag period). The processes driving this change were not identified, but hypothesised to have resulted from sardine migration horizontally or vertically out of usual fishing grounds (fishers reportedly did not change fishing grounds during these low-catch periods) or other causes (Puspasari et al. 2019). While environmental variability driven by changes in ENSO and IOD evidently strongly influence *S. lemuru* landings in the Bali Strait (as described above), high fishing effort is also thought to have affected stock levels and possibly their ability to recover after unfavourable conditions (Ghofar and Mathews 1996).
	***S. lemuru* – Philippines** Fish landings off Zamboanga Peninsula (dominated by *S. lemuru*) during the NE monsoon (Dec-Mar) exhibited wide fluctuations (1998-2009). Landings were very high in 2005 and 2007, and very low in 2000-01 and 2008-09. Anecdotal reports from fishers also noted large sardine catches in 2007, which dropped steeply in 2008-09 (Villanoy et al. 2011). Monthly sardine catch rates from commercial ring-nets (2008-2016) also show monthly, seasonal and interannual fluctuations (2008-2016) (Naguit 2016).	Large landings in 2007 and 2009-10 coincided with highest chlorophyll-a levels in the NE monsoon upwelling season. Monthly data (2009-10) showed peak chlorophyll-a (Dec-Feb), immediately followed by peak landings (Jan-Feb). Conversely, low landings in 2008-09 coincided with lowest chlorophyll-a concentrations (Villanoy et al. 2011). Landings from 2003-2015 were negatively correlated with chlorophyll-a, possibly due to a lag period (Naguit 2016 and de Guzman et al. cited within), but further analysis was not presented. Monsoon-driven upwelling varies interannually with ENSO. From 1985-2010, cooler sea surface temperature and higher chlorophyll levels (stronger upwelling) occurred in El Niño years; and warmer temperatures and lower chlorophyll (weaker upwelling) during La Niña. Higher rainfall in La Niña was thought to increase water column stratification hence reduce nutrient upwelling. From 1998-2009, higher landings (2005, 2007) tended to occur in El Niño periods, and lower landings (2000-01, 2008) coincided with La Niña (Villanoy et al. 2011). A subsequent study found a significant correlation between Zamboanga Peninsula sardine landings (2003-15) and ENSO (3.4 Index) (Naguit 2016). In Butuan Bay, where primary production is fuelled mainly by river discharge, chlorophyll-a concentrations were also lowest in 2007-08 (La Niña) although did not drop as low as in the upwelling region; high peaks during El Niño years were less prominent (Villanoy et al. 2011).
	***S. lemuru* – Western Australia** *S. lemuru* catch rates over a three-year period were higher in 1995-6 and lower in 1997, suggesting possible changes in sardine abundance in fishing grounds (mid-west coast) over a short time-frame (Gaughan and Mitchell 2000).	Variation in catch rates were hypothesised to be due to variation in recruitment or shifts in distribution, rather than adverse effects of fishing. Variation in the timing, strength and location of the Leeuwin current and eddies between years may influence recruitment success (Gaughan and Mitchell 2000). Variability in the Leeuwin current is linked to ENSO: flow is stronger in La Niña and weaker in El Niño (Hood et al. 2017). Lower catch rates could also have resulted from part of the population moving out of fishing grounds. During this period, *S. lemuru* were reportedly prevalent 400 km south, possibly indicating a shift or extension in distribution, which may occur when the water south is sufficiently warm (Gaughan and Mitchell 2000).
Flat-bodied Sardinellas, Tropical Pilchards & Tropical Herrings	***Sardinella* & *Amblygaster* spp. – India** Landings and catch rates of 'lesser sardines' fluctuate between years (Bennet et al. 1992). While they have also been noted as relatively consistent (1967-2007) (Manjusha et al. 2013) this may be from comparison with *S. longiceps* landings (an order of magnitude higher) on the same scale.	Mixed-species post-monsoon landings (*S. gibbosa*, *S. fimbriata*, *S. albella* and *A. sirm*; Oct-Jan; 1998-2007, south-west coast) were significantly negatively correlated with monsoon upwelling intensity and chlorophyll-a concentrations (and post-monsoon *S. longiceps* landings). This was a different response to these environmental variables than Round-bodied Sardinella *S. longiceps* and mackerel *Rastrelliger kanagurta*. It was hypothesised this could be due to differences in prey: *S. longiceps*, a phytoplankton feeder, may out-compete the Flat-bodied Sardinellas and Tropical Pilchards which feed on zooplankton (Manjusha et al. 2013).
	***Sardinella* spp. – India (E coast)** Mixed-species landings (*S. gibbosa*- and *S. fimbriata*-dominated) off mid-east coast declined from 1960-92 (Luther 2001). From 2005-10, annual gillnet landings (~75% of total) off mid-east and NE coasts increased [slightly], with small fluctuations between years. The dominant species shifted from *S. gibbosa* (2005-08, 78.5%) to *S. fimbriata* (2009-10, 77.5%) (Ghosh et al. 2013).	Declining landings off the mid-east coast (1960-92) were hypothesised to be due to use of small-mesh gillnets (particularly ≤23 mm) netting younger juveniles early in the fishing season which prevented these fish from growing and contributing to higher landings (in terms of weight) later in the same season (Luther 2001). Increasing landings (2005-10) off the north-east coast were hypothesised to be due to gradual expansion of fishing grounds from nearshore to offshore, and favourable environmental conditions. Annual *S. gibbosa* landings were significantly correlated with chlorophyll-a in the previous year, while fluctuations in annual mixed-species Flat-bodied Sardinella landings were influenced by a combination of sea surface temperature, rainfall and chlorophyll-a concentration in the previous year (Ghosh et al. 2013), however the directions of these relationships were not reported.
	***S. gibbosa* – Australia (NE coast)** Large schools of juveniles (incl. *S. gibbosa*) were observed in nearshore shallows in 1990; over 90% near river mouths. Fewer schools were observed during four years of drought (Cappo 1995a; Cappo 1995b).	Drivers were not investigated but hypothesised to be due to interannual variation in nutrient enrichment – due to variation in intensity and frequency of events such as rainfall, cyclones and localised upwelling – and subsequent differences in phytoplankton and zooplankton abundances between years. Short lifespans (estimated to be ~1-2 years in this region) mean that high mortality (or survival) of one generation/year-class of larvae or juveniles can result in very different abundances in consecutive years (Cappo 1995b).
	***A. sirm* & *H. quadrimaculat.* – Kiribati** Landings and catch rates (tuna baitfish fisheries) varied widely between years (1982-1990). The relative proportions of three main species (*H. quadrimaculatus*, *A. sirm* and sprat *Spratelloides delicatulus*) also varied between years (Rawlinson et al. 1992 and references therein). It was noted that *H. quadrimaculatus* could vary from dominant to near absent over a 1-2 year period; while *A. sirm*, in the 1980s, increased from near absent to a dominant species over a 4-5 year period then declined again (Ianelli 1988; Rawlinson et al. 1992 and references therein).	Interannual variation was suggested to be due to a combination of factors including previous fishing effort, weather conditions (turbidity reducing effectiveness of underwater lights) and recruitment (Rawlinson et al. 1992). A detailed study on recruitment found that *H. quadrimaculatus* spawned frequently throughout the year with little temporal or spatial variability in fecundity, egg weight or spawning interval. Back-calculation of birth dates indicated fish were born in all months but the proportion born each month varied between years and was not related to monthly egg production (Milton et al. 1994b). *A. sirm* spawned most months (but not all) and had significantly higher recruitment some months. The two species differed in distributions of back-dated birth dates, suggesting differing influence of environmental conditions (Milton et al. 1994b). Apparent changes in abundance (catch rates) were hypothesised to be due to environmental conditions being more favourable to recruitment of one species than the other (i.e. different recruitment strengths). Analysis was limited to monthly rainfall, which was not significantly correlated with catch rates of either species, possibly due to a lag period (not tested) (Ianelli 1988). However catch rates from fishing using underwater lights may not reliably reflect species abundance or relative abundance: *H. quadrimaculatus* are less attracted to underwater light (or disperse at night); and large *A. sirm* schools swim actively near light which can scare away other fish, resulting in *A. sirm*-dominated catches (Rawlinson et al. 1992).
	***A. sirm* & *H. quadrimaculatus* – Fiji** Landings, catch rates and relative species importance in mixed-species landings varied between years (e.g. 1976-80, Ellway and Kearney 1981; 1982-92, Rawlinson and Sharma 1993). A poor season occurred in 1979/80 (Ellway and Kearney 1981). The importance of *H. quadrimaculatus* declined from mid-1980 to 1992; *Encrasicholina* sp. (anchovy) increased; other species showed no clear trends (Rawlinson and Sharma 1993).	The poor 1979-80 season was concluded to be the result of a late (and possibly poor) spawning season resulting in lower than usual abundance (across species). However the scale of decline/natural fluctuation was exaggerated by a decline in fishing effort (as fisher incentives for extra effort were minimal) and underreporting when good catches did occur (due to competition between vessels). Lower catch rates were widespread in both heavily and lightly fished areas suggesting overfishing was an unlikely cause. While there was a seasonal relationship between catches and water temperature and rainfall, there was no evidence of unusual interannual variability in these factors (Ellway and Kearney 1981). Declining catch rates of *H. quadrimaculatus* were hypothesised to be due to overfishing (catch rates over the years had declined with increased fishing pressure) and/or movement of fishing away from areas dominated by *H. quadrimaculatus* (fishing grounds had shifted but it was unknown if this was in response to declining landings or other reasons), and/or a natural decrease in abundance due to poor recruitment (since the declining trend occurred across a wide geographic area) (Rawlinson and Sharma 1993).
	***E. thoracata* – India** Annual *E. thoracata* landings fluctuated from 2007-16. Peak landings were fairly consistent; lowest landings were in 2010 and 2015. Distribution of landings has shifted: in 2007, over 90% came from the east coast; in 2016 ~80% came from the west coast (Abdussamad et al. 2018).	*(Description of change cont.):* SW coast landings from 1971-2005 showed repeated 'depletion' of the fishery (e.g. 1991, 1997, 2004) and subsequent recovery to abundant levels after four years each time (Mohamed and Veena 2016). Drivers for fluctuations were not investigated but supposed to be due to heavy fishing pressure (Abdussamad et al. 2018).

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