Nominal catch of tropical tunas by artisanal and industrial fishery in the IOTC area of competence

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Abstract

Nominal catch data publicly available in the IOTC website was analysed to study the tropical tuna (yellowfin, skipjack and bigeye tuna) catch by artisanal and industrial tuna fishery of the Indian Ocean. The nominal catch during 1950-2019 indicates that, of the three species of tropical tunas, skipjack (44.14%) is caught in higher proportions, followed by yellowfin (41.75%) and bigeye (14.14%). In 2019, 66.21% of the total tropical tuna catch was by industrial fishery, whereas the contribution of artisanal fishery to the total nominal catch of Indian Ocean tropical tuna fishery was only 33.79%. The yellowfin caught by industrial fishery in 2019 was 2,55,356 t, against 1,99,533 t caught during 2014, whereas yellowfin catch (2019) by artisanal fishery was 1,90,271 t, against 2,04,022 t caught during 2014, indicating thatin the year 2019, the industrial tuna fishery increased their yellowfin catch by 28% than 2014, whereas the catch by artisanal fishery had decreased by 6.74%. More than 72% of the total Indian Ocean skipjack are caught by industrial fleet, while the remaining 28% by artisanal fleet. From the year 2014 onwards, there was a phenomenal growth in the skipjack catch by industrial fleet. This fishery increased the skipjack catch by 138.68% with reference to skipjack catch by the industrial fishery in 2014, whereas at the same period the artisanal fishery registered negative growth by 33.41%.

Introduction

Tropical tunas, including yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*), and bigeye (*Thunnus obesus*) contribute substantially to the food, employment and livelihood requirements of many coastal and distant water fishing nations of the Indian Ocean. Artisanal tropical tuna fishery, especially of skipjack has been existing in the Maldives and certain islands of Lakshadweep archipelago for centuries (Anderson and Hafiz, 1996; Vijayakumaran and Varghese, 2010). However, Indian Ocean industrial tuna fishery started comparatively recently, with the Japanese longliners fishing in the eastern Indian Ocean in the year 1952, while the industrial purse-seine fishery started in early 1980s (Miyake *et al*., 2004). The tropical tuna catch by industrial fishery developed rapidly in recent years and now this fishery contribute the lion's share of the Indian Ocean tropical tuna fishery.

Monitoring of the exploited fishery resources and the data collection are crucial for sustainable fisheries management, since the data collected therein are used to guide management decisions to avoid overfishing and eventually depletion of stocks of these commercially important species. The IOTC Secretariat receives, reviews, compiles, safe-keeps and disseminates data on catch, fishing effort, individual fish lengths, and other biological parameters and socio-economics from IOTC fisheries, as well as the species impacted by those fisheries in the IOTC area of competence, as per the standards agreed by the Commission (IOTC, 2021). Nominal catches by year, species and gear, by vessel flag and reporting country is one of the important data set disseminated by the Commission (IOTC, 2021).

The rapid development of the industrial tuna fishery is one of the major factors contributing to the overfished status of Indian Ocean yellowfin tuna stock. In this perspective, we analysed the nominal catch data of the IOTC database to study the tropical tuna (yellowfin, skipjack and bigeye tuna) catch by artisanal and industrial tuna fishery of the Indian Ocean.

Materials and methods

The IOTC data on Nominal Catch by Species and Gear, by Vessel Flag Reporting Country, available at https://www.iotc.org/data/datasets/latest/NC (IOTC-LATEST-NC-ALL-1950-2019_2021_05_21.xlsx) was accessed and used for the analyses. This dataset encompasses species-wise, gear-wise, country-wise nominal catch of IOTC species for the period 1950-2019, segregated into types of fishery, i.e., artisanal and industrial. In the context of IOTC fisheries, Industrial fishery is by the vessels over 24m LOA regardless of where they operate (i.e., within a CPC's Exclusive Economic Zone EEZ or on the high seas), as well as vessels below 24m LOA conducting fishing activities beyond their EEZ, while the artisanal fisheries are defined as those carried out by vessels below 24m LOA, and which operate exclusively within the corresponding national EEZ (MRAG, 2019).

Since the IOTC Resolutions 16/01, 17/01, 18/01 and 19/01 – On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock in the IOTC area of competence specifies catches by CPCs during the year 2014 as the base year for deciding on the quantum of proposed catch reduction, analyses were mostly concentrated on the nominal catch during the period 2014-2019.

Results and Discussion

The Indian Ocean tropical tuna catch increased gradually from 15,176.55t recorded in 1950 to 1,48,683t in 1980. There was a rapid growth in the catch thereafter, mainly attributed to the introduction of purse-seine fisheries targeting skipjack and yellowfin tunas by France and Spain in the early 1980s (Miyake et al., 2004). The catch reached a peak value of 12,17,051 t during the year 2005, thereafter showing decrease in catch until 2011, probably because of piracy prevailed in the main fishing areas. However, an increasing trend in the catches was again visible from 2012 onwards (figure 1).

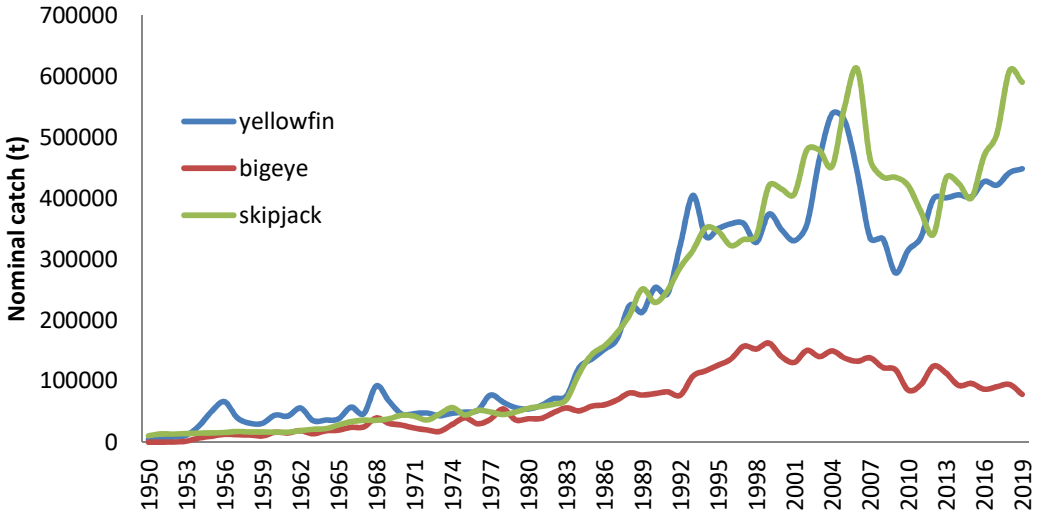


Figure 1. Nominal catch of tropical tuna (yellowfin, skipjack and bigeye) in the IOTC area during 1950-2019

Analysis of trends in the nominal catch of Indian Ocean tropical tuna with respect to catch in 2014 indicate that, there was an average increase by 9.95% during the period 2015-2019. Increase in the catch of skipjack (17.91%) and yellowfin (4.65%) was pronounced, while the average catches of bigeye reduced by 3.22% in comparison with the catch in 2014 (figure 2). In the year 2019, the latest year for which data is available, tropical tuna catch in the IOTC area increased by 21.07% with respect to the catch in 2014. Skipjack tuna catch increased by 39.25%, while the increase in catch of yellowfin was 10.51% (table 1). This increase in catch, even after adopting several management measures by the IOTC raises serious questions on the efficacy of these CMMs in arresting the overfishing of Indian Ocean yellowfin tuna.

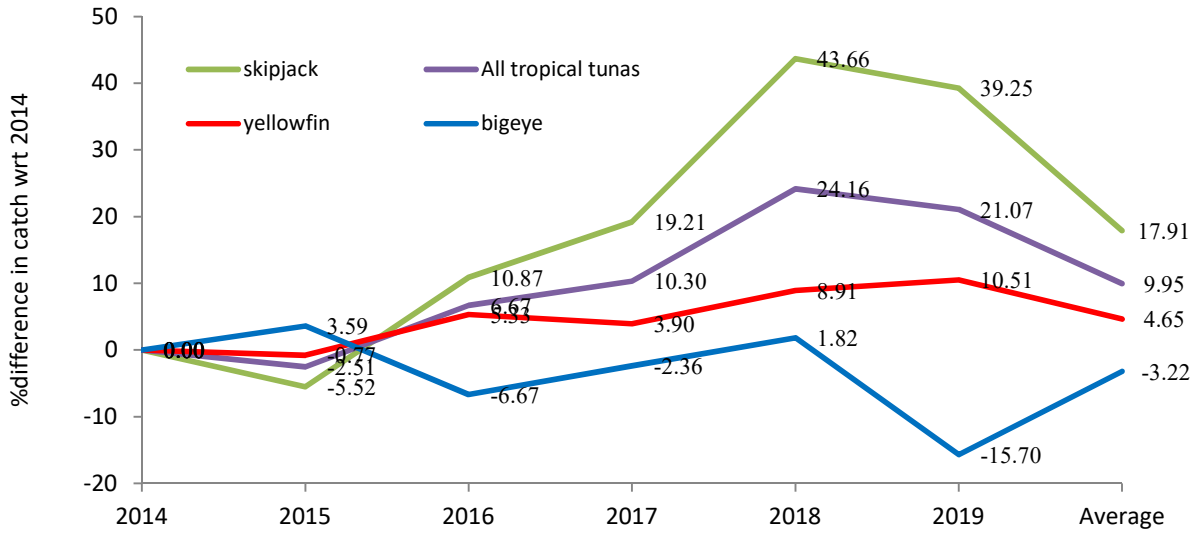


Figure 2. Percentage difference in the nominal catch of Indian Ocean tropical tunas with respect to 2014 catch

Table 1. Nominal catch of tropical tunas in the IOTC area during 2014-2019 showing percentage difference in catch compared to the year 2014

Year	Nominal catch (t)				Percentage difference compared to 2014			
	Yellowfin	Bigeye	Skipjack	All three species	Yellowfin	Bigeye	Skipjack	All three species
2014	405972.4	93055.68	424036.5	923064.6	-	-	-	-
2015	402827.4	96395.56	400642.5	899865.5	-0.77	3.59	-5.52	-2.51
2016	427619.2	86848.91	470147.7	984615.8	5.33	-6.67	10.87	6.67
2017	421817.7	90862.02	505485.7	1018165	3.90	-2.36	19.21	10.30
2018	442140.2	94750.24	609178.9	1146069	8.91	1.82	43.66	24.16
2019	448628.6	78441.61	590468.6	1117539	10.51	-15.70	39.25	21.07
Average	424834.3	90059	499993.3	1014887	4.65	-3.22	17.91	9.95

Nominal catch by principal gears: Purse seine, longline and gillnet are the principal gears employed for the fishery of tropical tuna species of the Indian Ocean. These three gears together contributed 70% of the total Indian Ocean yellowfin, 80% of bigeye and 60% of skipjack catch in 2019 (figure 3). Another

important gear used for tropical tuna catch of Indian Ocean is Pole and line, mainly targeting surface swimming skipjack tunas.

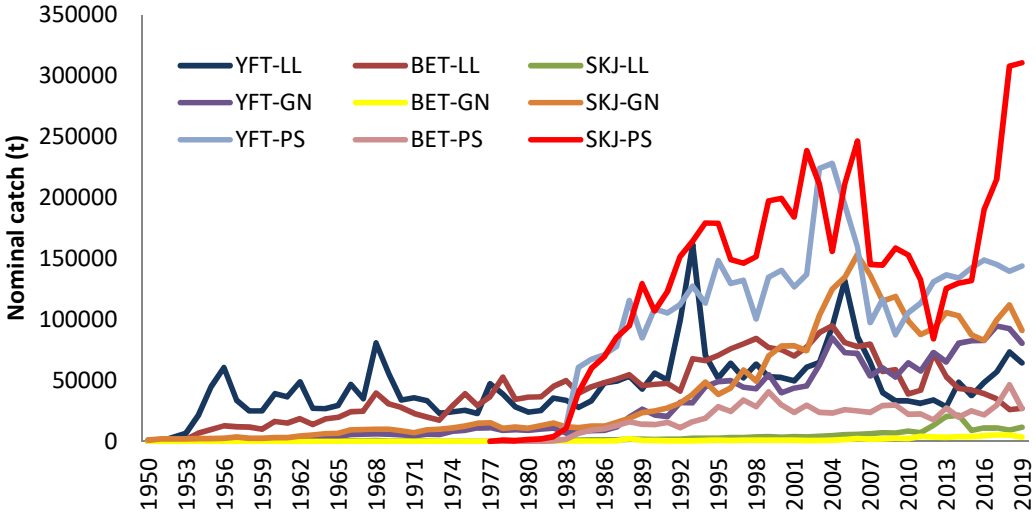


Figure 3. Nominal catch of tropical tunas by principal gears – Longline (LL), Gillnet (GN) and Purse seine (PS) in the IOTC area during 1950-2019

In the recent years, catch by the gear, industrial purse seine was substantial, and this gear alone contributed 32.1% of yellowfin, 34.32% of bigeye and 52.59% of skipjack catch originated in the IOTC area of competence in 2019 (table 2).

Table 2. Percentage contribution by principal gears – Longline (LL), Gillnet (GN) and Purse seine (PS) to the nominal catch of yellowfin, bigeye and skipjack tunas in the IOTC area during 2001-2019. The data was extracted from the nominal catch data filtering the gear codes – Longline LL,LLCO, LLF, LLEX; Gillnet – GI, GIDR, GIOF; Purse seine - PS

Year	YFT-LL	BET-LL	SKJ-LL	YFT-GN	BET-GN	SKJ-GN	YFT-PS	BET-PS	SKJ-PS
2001	14.99	53.49	0.94	13.24	0.69	19.32	38.38	18.17	45.27
2002	17.04	51.41	0.77	12.71	0.52	15.50	38.34	19.64	49.71
2003	13.88	63.51	0.84	13.49	0.62	21.65	48.04	16.98	44.07
2004	17.49	63.36	1.01	15.74	0.66	27.51	42.29	15.64	34.40
2005	25.02	58.86	1.02	13.83	1.14	24.36	36.80	18.90	38.23
2006	19.58	58.51	0.95	16.37	1.77	25.03	36.29	18.78	40.32
2007	19.36	57.72	1.39	16.00	1.34	29.44	29.07	17.20	31.31
2008	11.97	46.75	1.63	18.07	1.73	26.44	34.91	24.09	33.28
2009	11.99	49.46	1.56	18.96	2.18	27.33	31.46	25.26	36.50
2010	10.58	45.52	1.98	20.48	2.70	23.51	33.48	26.10	36.34
2011	9.25	44.38	1.90	17.22	4.24	23.18	33.67	23.96	34.90
2012	8.51	57.79	3.91	18.20	2.82	27.15	32.72	14.12	24.63
2013	7.05	47.06	4.72	16.26	2.90	24.36	34.01	24.27	28.95
2014	11.97	46.58	5.09	19.81	4.22	24.26	32.96	21.36	30.59
2015	9.30	43.62	2.24	20.50	4.07	21.81	35.34	26.12	32.90

2016	11.28	45.02	2.32	19.38	5.45	17.60	34.78	25.12	40.33
2017	13.52	38.39	2.16	22.41	5.92	19.72	34.42	32.68	42.54
2018	16.57	27.51	1.50	20.91	5.40	18.38	31.58	49.18	50.53
2019	14.38	34.47	1.96	17.94	4.49	15.41	32.08	34.32	52.59

Indian Ocean industrial and artisanal tuna fishery: Barring the short period of 2009-2011, the contribution of industrial fishery was higher than that of artisanal fishery in the IOTC area of competence. In recent years, there was tremendous increase in the catch contribution by industrial fishery (figure 4). The artisanal fishery, which was nearly totally responsible for skipjack catch in the Indian Ocean until 1980s, now contributes only about one-fourth of the catch (figure 5).

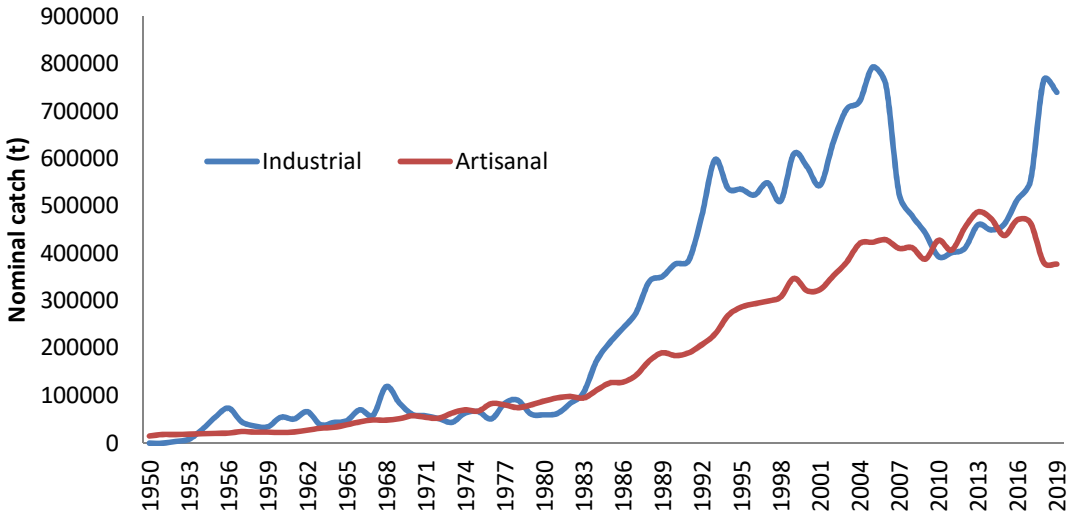


Figure 4. Nominal catch of tropical tunas by industrial and artisanal fishery in the IOTC area during 1950-2019

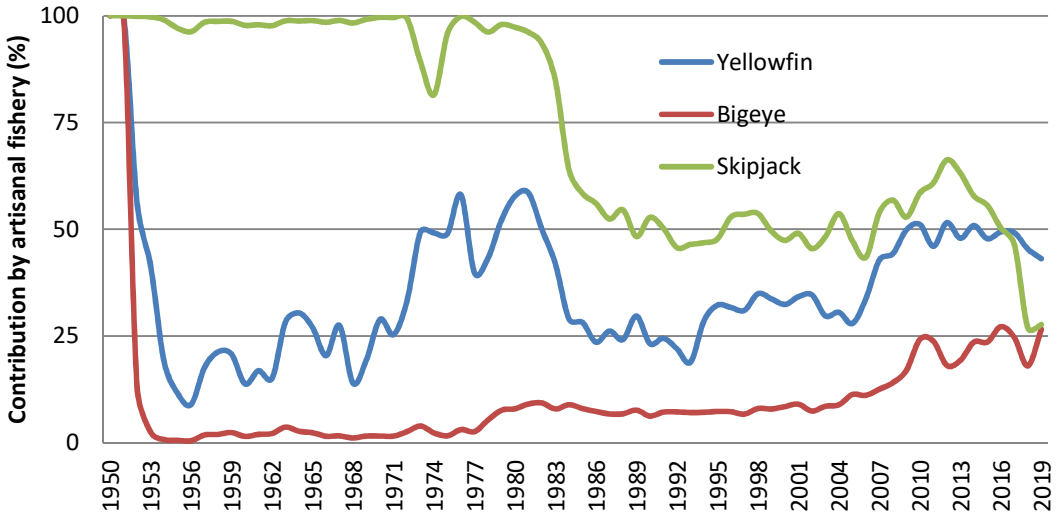


Figure 5. Percentage contribution of artisanal fishery to the Indian Ocean tropical tuna nominal catch (1950-2019)

When the catch contribution by artisanal and industrial fishery of recent years were compared with that of 2014 - the base year for deciding on the quantum of proposed catch reduction by IOTC CMMs, it is evident that the artisanal fishery had negative growth in catch (table 3), and the average growths in catch were -2.22% (yellowfin), -2.34% (bigeye), -13.95% (skipjack), whereas the industrial fishery recorded phenomenal growth during the period, the growth rates recorded being 11.75% (yellowfin), -3.49% (bigeye), 61.56% (skipjack). During the latest year for which the data is available, i.e., 2019, average catch growth recorded for artisanl fishery were -6.35% (yellowfin), -5.02% (bigeye), -33.31% (skipjack), while that of industrial fishery was 27.93% (yellowfin), -19.00% (bigeye) and 138.67% (skipjack) (figure 6).

Table 3. Nominal catch (t) and percentage differences in nominal catch of Indian Ocean tropical tunas with reference to 2014

Year	**Nominal catch (t)**							
	Artisanal fishery				Industrial fishery			
	Yellowfin	Bigeye	Skipjack	All three species	Yellowfin	Bigeye	Skipjack	All three species
2014	206371.36	21929.74	245129.30	473430.40	199601.02	71125.93	178907.24	449634.19
2015	192398.10	22734.79	222700.63	437833.52	210429.32	73660.77	177941.85	462031.94
2016	211009.41	23604.77	236355.46	470969.63	216609.83	63244.14	233792.22	513646.19
2017	207270.05	22358.19	234436.93	464065.17	214547.66	68503.83	271048.77	554100.26
2018	200414.80	17048.41	163576.71	381039.92	241725.36	77701.83	445602.22	765029.41
2019	193269.59	20828.87	163469.35	377567.82	255359.00	57612.74	426999.26	739971.01
Average	201788.89	21417.46	210944.73	434151.08	223045.37	68641.54	289048.59	580735.50
Percentage difference with reference to 2014								
Year	**Artisanal fishery**				**Industrial fishery**			
	Yellowfin	Bigeye	Skipjack	All three species	Yellowfin	Bigeye	Skipjack	All three species
2014	0	0	0	0	0	0	0	0
2015	-6.77	3.67	-9.15	-7.52	5.42	3.56	-0.54	2.76
2016	2.25	7.64	-3.58	-0.52	8.52	-11.08	30.68	14.24
2017	0.44	1.95	-4.36	-1.98	7.49	-3.69	51.50	23.23
2018	-2.89	-22.26	-33.27	-19.52	21.10	9.25	149.07	70.14
2019	-6.35	-5.02	-33.31	-20.25	27.93	-19.00	138.67	64.57
Average	**-2.22**	**-2.34**	**-13.95**	**-8.30**	**11.75**	**-3.49**	**61.56**	**29.16**

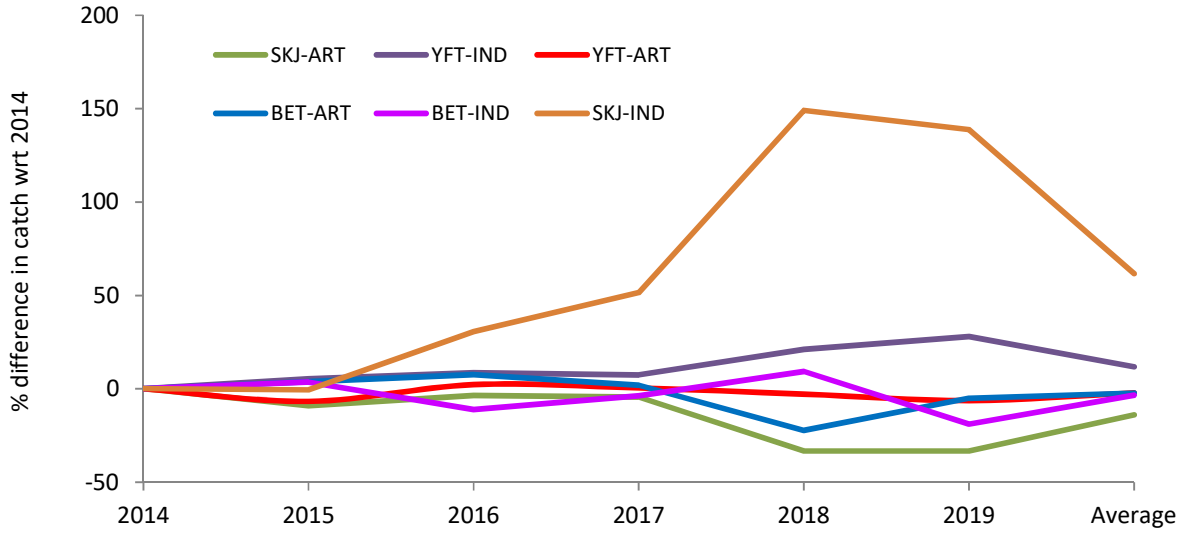
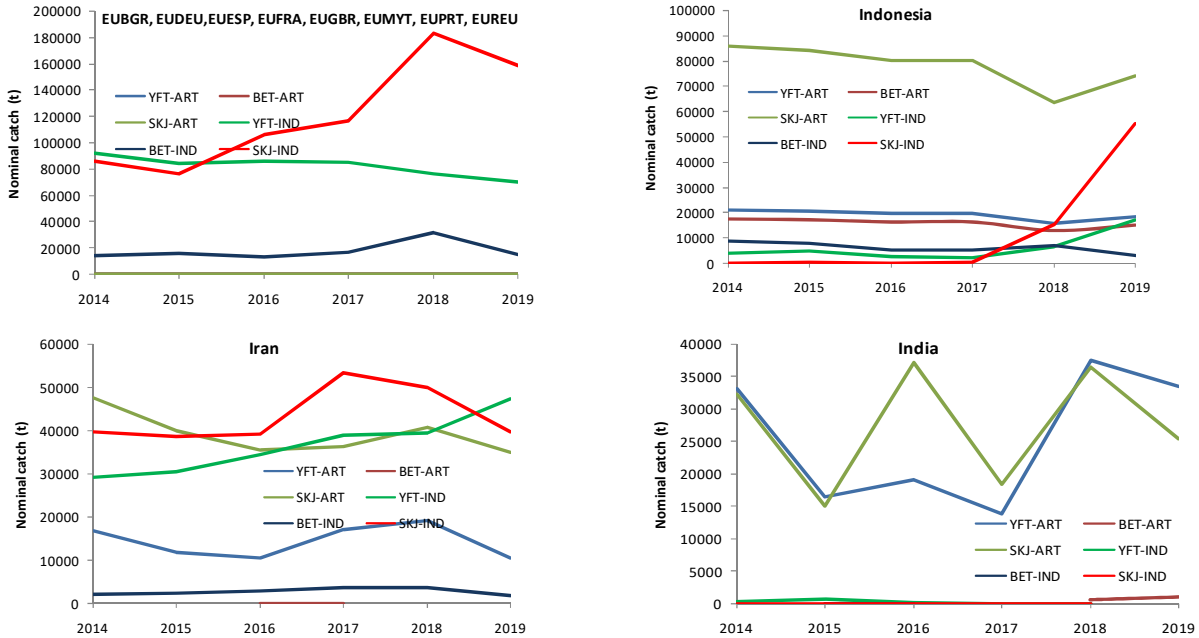


Figure 6. Percentage difference in the nominal catch ofthree tropical tunaspecies by industrial and artisanal fishery in the IOTC area with respect to 2014 catch (ART- artisanal; IND- industrial.

Figure 7 is the graphical representation of the nominal catch of tropical tunas by the artisanal and industrial fishery by different fleets during the period 2014-2019. The fleets were selected randomly and it is observed that the obligations of the CPCs as per the provisions in different CMMs for reducing the catch of yellowfin tunas, mainly by the industrial fishery, with reference to the catch of 2014, were not achieved by many of the CPCs.



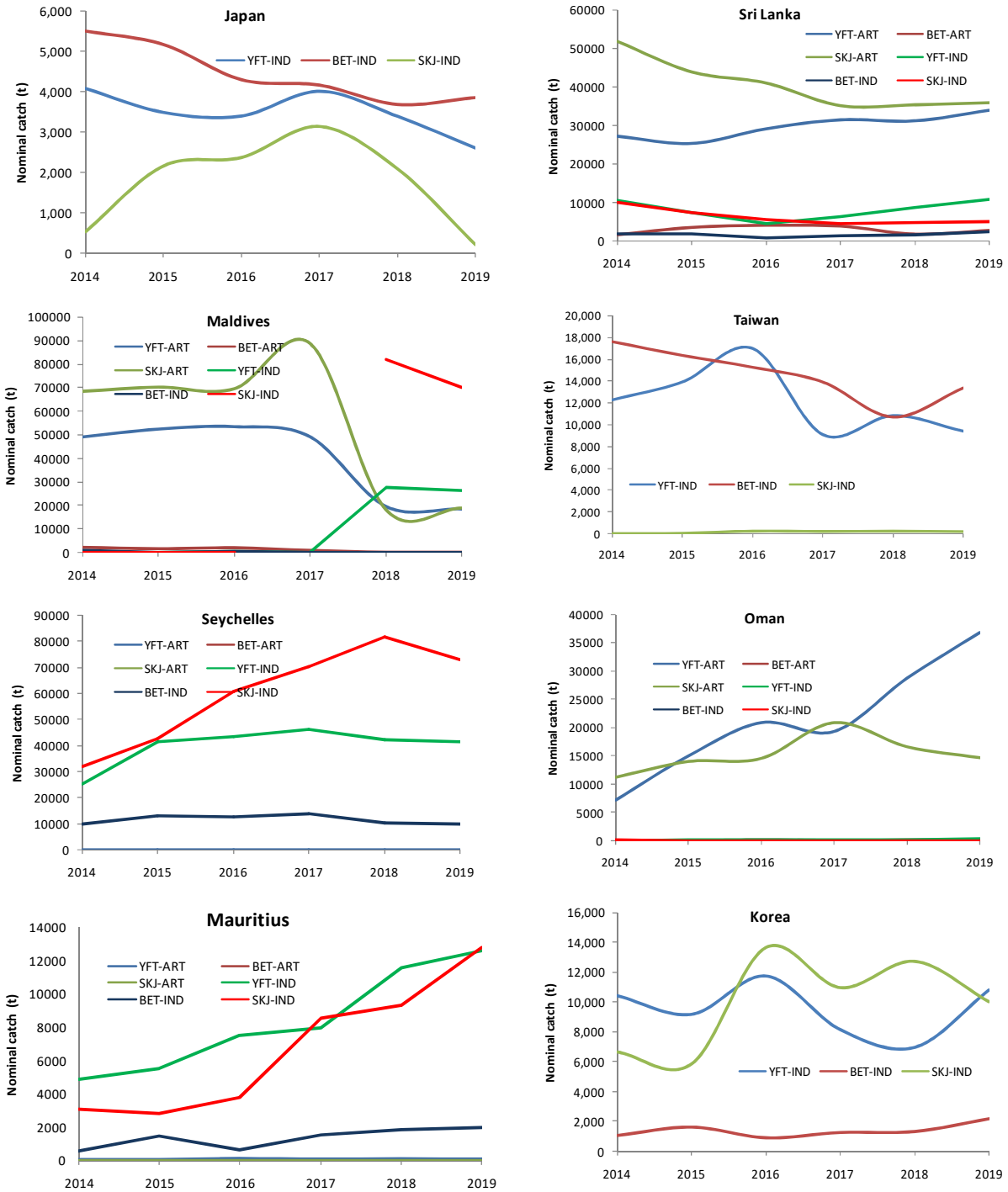


Figure 7. Trends in the nominal catch of tropical tunas by the artisanal and industrial fleet of selected CPCs of IOTC.

Conclusion

Results of this preliminary analysis indicate that the industrial tuna fishery had increased the catch of Indian Ocean tropical tunas substantially, in spite of catch reductions advocated by various IOTC CMMs, whereas the catch by the artisanal fishery had been decreasing in recent years. There should be

concerted effort by all the CPCs, especially by those with large industrial fleet to reduce the catch to meet the management targets of the tropical tuna species of the Indian Ocean to ensure the food, employment and livelihood requirements of coastal communities and development aspirations of the Indian Ocean coastal States.

References

Anderson RC and Hafiz A (1996). Status of tuna research and data collection in the Maldives. Pp. 361-367. *In*: A.A. Anganuzzi, K.A. Stobberup and N.J. Webb (Eds.) Proceedings of the Expert Consultation on Indian Ocean Tunas, 6th Session, Colombo, Sri Lanka, 25-29 September 1995. IPTP, Colombo.

IOTC (2021). Available data sets. https://www.iotc.org/data/datasets

Miyake MP, Miyabe N and Nakano H (2004). Historical trends of tuna catches in the world. FAO Fisheries Technical Paper 467.

MRAG (2019). Final Report – Monitoring of Artisanal Fishing in the Indian Ocean. IOTC-2019-WPDCS15-INF01.

Vijayakumaran K and Varghese SP (2010). Update on the status of tuna fisheries in India. IOTC-2010-SC-Inf12.