KAWAKAWA

SUPPORTING INFORMATION

(Information collated from reports of the Working Party on Neritic Tunas and other sources as cited)

CONSERVATION AND MANAGEMENT MEASURES

Kawakawa (*Euthynnus affinis*) in the Indian Ocean is currently subject to a number of Conservation and Management Measures adopted by the Commission:

- Resolution 15/01 *on the recording of catch and effort by fishing vessels in the IOTC area of competence*
- Resolution 15/02 *mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating non-Contracting Parties (CPCs)*
- Resolution 14/05 *concerning a record of licensed foreign vessels fishing for IOTC species in the IOTC area of competence and access agreement information*
- Resolution 15/11 *on the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating Non-Contracting Parties*
- Resolution 10/08 *concerning a record of active vessels fishing for tunas and swordfish in the IOTC area*

FISHERIES INDICATORS

Kawakawa: General

Kawakawa (*Euthynnus affinis*) lives in open waters close to the shoreline and prefers waters temperatures ranging from 18° to 29°C. **Table 1** outlines some key life history parameters relevant for management.

Table 1. Kawakawa: Biology of Indian Ocean kawakawa (*Euthynnus affinis*).

Parameter	Description
Range and stock structure	Lives in open waters close to the shoreline and prefers waters temperatures ranging from 18° to 29°C.Kawakawa form schools by size with other species sometimes containing over 5,000 individuals. Kawakawa are often found with yellowfin, skipjack and frigate tunas. Kawakawa are typically found in surface waters, however, they may range to depths of over 400 m (they have been reported under a fish-aggregating device employed in 400 m), possibly to feed. Kawakawa larvae are patchy but widely distributed and can generally be found close to land masses. Large changes in apparent abundance are linked to changes in ocean conditions. This species is a highly opportunistic predator feeding on small fishes, especially on clupeoids and atherinids; also squid, crustaceans and zooplankton. Fish form the dominant prey item (76.7%). *Sardinella longiceps*, *Encrasicholina devisi*, *Decapterus* spp. and *Nemipterus* spp. are the major food items. No information is available on stock structure of kawakawa in Indian Ocean.
Longevity	9 years
Maturity (50%)	**Age**: n.a; females n.a. males n.a. **Size:** females and males ~38–50 cm FL.
Spawning season	Spawning occurs mostly during summer. A 1.4 kg female (48 cm FL) may spawn approximately 0.21 million eggs per batch (corresponding to about 0.79 million eggs per season). Spawning is prolonged with peaks during June and October.
Size (length and weight)	Maximum: Females and males 100 cm FL; weight 14 kgs. Juveniles grow rapidly reaching lengths between 50–65 cm by 3 years of age.

n.a. = not available. Sources: Froese & Pauly 2009, Taghavi et al. 2010, Abdussamad et al. 2012, Kaymaram & Darvishi 2012

Kawakawa – Fisheries and catch trends

- Main fisheries: Kawakawa are caught mainly by gillnets, handlines and trolling, and coastal purse seiners, and may be also an important bycatch of the industrial purse seiners (**Table 2; Fig.1**).
- Main fleets (i.e., highest catches in recent years): Indonesia, India, I.R. Iran, and Pakistan (**Fig.2**).
- Retained catch trends:
  Annual estimates of catches for the kawakawa increased markedly from around 20,000 t in the mid-1970's to reach the 45,000 t mark in the mid-1980's and 156,000 t in 2012, the highest catches ever recorded for this species.

- Discard levels: are moderate for industrial purse seine fisheries. The EU recently reported discard levels of kawakawa for its purse seine fleet, for 2003–07, estimated using observer data.

Table 2. Kawakawa: Best scientific estimates of the catches of kawakawa by type of fishery for the period 1950–2016 (in metric tonnes).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Purse seine	110	385	2,616	12,070	21,396	28,613	32,586	32,441	37,051	35,064	44,892	42,700	42,124	38,878	40,684	38,288
Gillnet	2,568	4,488	9,691	17,958	30,709	53,547	59,138	70,971	69,772	64,713	74,762	75,602	85,919	84,304	75,643	86,176
Line	1,711	3,260	6,642	9,865	15,673	19,874	22,299	22,524	23,804	23,356	25,785	32,656	29,050	25,086	30,045	25,378
Other	295	719	1,357	2,690	5,127	7,819	9,629	9,015	10,129	9,994	10,007	9,976	10,255	8,108	7,088	6,990
Total	**4,684**	**8,852**	**20,306**	**42,583**	**72,905**	**109,853**	**123,652**	**134,952**	**140,756**	**133,127**	**155,446**	**160,934**	**167,348**	**156,377**	**153,460**	**156,831**

The catches provided in **Table 2** are based on the information available at the IOTC Secretariat. Annual estimates of catches for kawakawa have been increasing over time, reaching a peak of almost 170,000t in 2013 followed by lower catches between 2014 and 2016.

In recent years nearly three quarters of the total catches of kawakawa are attributed to four countries: Indonesia (27%), India (23%), Iran (18%), and Pakistan (8%) (**Fig. 2**).

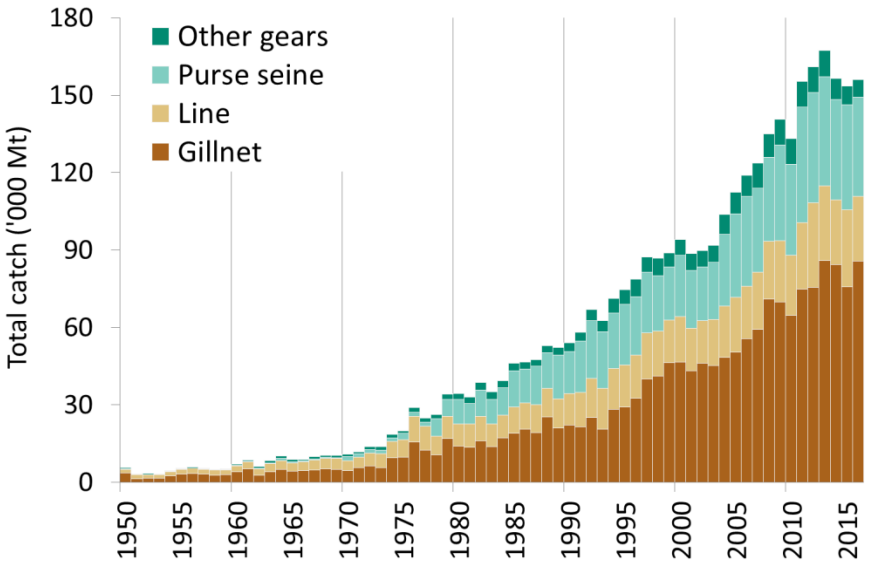


Fig. 1. Kawakawa: Annual catches of kawakawa by gear recorded in the IOTC database (1950–2016)[1].

[1] **Definition of fishery:** Gillnet: gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; Purse seine: coastal purse seine, purse seine, ring net; Other gears: baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

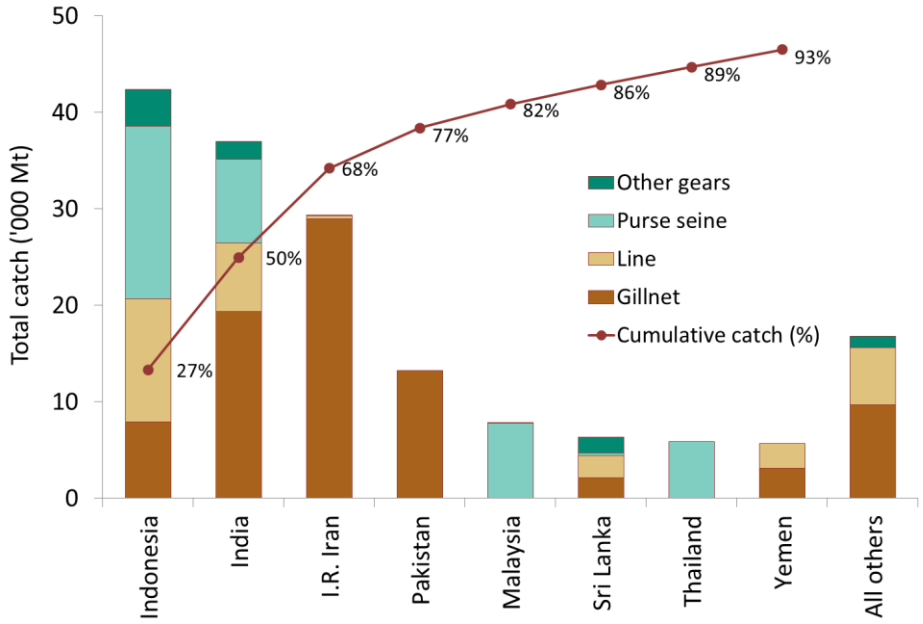


Fig. 2. Kawakawa: Average catches in the Indian Ocean over the period 2012–16, by country. Countries are ordered from left to right, according to the importance of catches of kawakawa reported. The red line indicates the (cumulative) proportion of catches of kawakawa for the countries concerned, over the total combined catches of this species reported from all countries and fisheries.

Kawakawa – Uncertainty of catches

Retained catches for kawakawa were derived from incomplete information, and are therefore uncertain[2] (**Fig.4**), notably for the following fisheries:

- Artisanal fisheries of Indonesia: Indonesia did not report catches of kawakawa by species or by gear for 1950–2004; catches of kawakawa, longtail tuna and, to a lesser extent, other species were reported aggregated for this period. In the past, the IOTC Secretariat used the catches reported since 2005 to break the aggregates for 1950–2004, by gear and species. However, a review by the IOTC Secretariat conducted by an independent consultant in 2012 indicated that the catches of kawakawa had been overestimated by Indonesia. While the new catches estimated for kawakawa in Indonesia remain uncertain, the new figures are considered more reliable than those previously recorded in the IOTC database.
- Artisanal fisheries of India: Although India reports catches of kawakawa they are not always reported by gear. The catches of kawakawa in India were also reviewed by the IOTC Secretariat in 2012 and assigned by gear on the basis of official reports and information from various other alternative sources.
- Artisanal fisheries of Myanmar and Somalia: None of these countries have ever reported catches to the IOTC Secretariat. Catch levels are unknown.
- Other artisanal fisheries: The catches of kawakawa are usually not reported by species, being combined with catches of other small tuna species like skipjack tuna and frigate tuna (e.g., coastal purse seiners of Thailand, and until recently Malaysia).
- Industrial fisheries: The catches of kawakawa recorded for industrial purse seiners are thought to be a fraction of those retained on board. Due to this species being a bycatch, its catches are seldom recorded in the logbooks, nor are they monitored in port. The EU recently reported catch levels of kawakawa for its purse seine fleet, for 2003–07, estimated using observer data.

[2] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches had to be estimated.

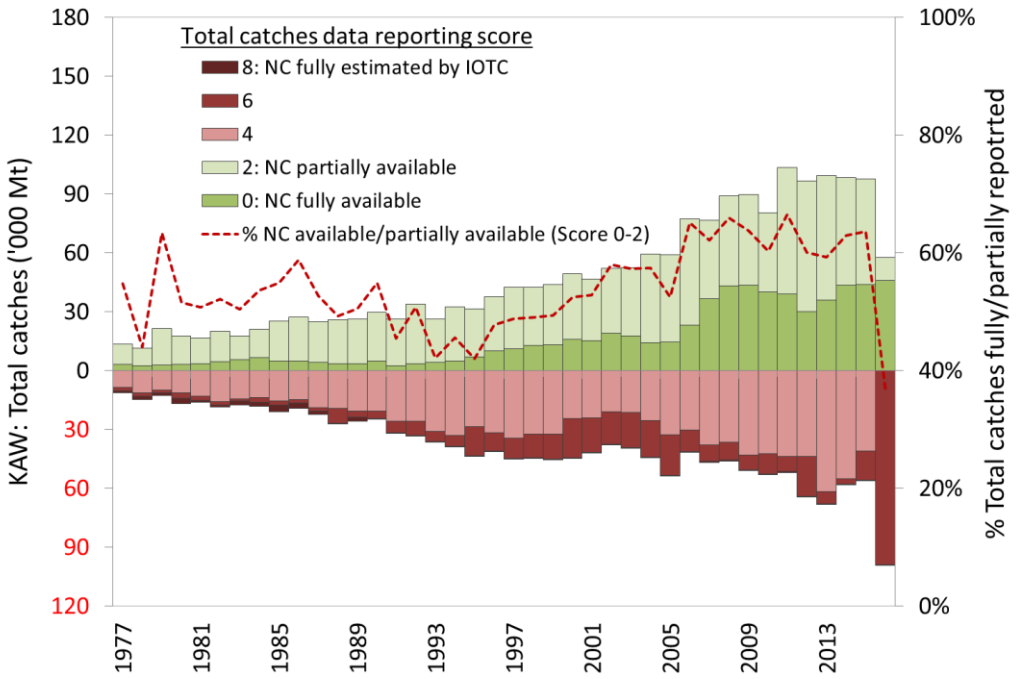


Fig. 3. Kawakawa: nominal catch; uncertainty of annual catch estimates (1977–2016).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (e.g., partially adjusted by gear and species by the IOTC Secretariat; catches with a score of 8 refer to fleets that do not report catch data to the IOTC and are fully estimated by the IOTC Secretariat. The red dotted line indicates the proportion of total catches fully or partially reported to the IOTC Secretariat.

Kawakawa tuna – Effort trends

- Availability: Effort trends are unknown for longtail tuna in the Indian Ocean.

Kawakawa tuna – Catch-per-unit-effort (CPUE) trends

- Availability: highly incomplete, with data available for only short periods of time and selected fisheries (**Table 3**).
- Main CPUE series available: Maldives (baitboats and troll lines) (**Fig.5**), and Sri Lanka (gillnets). However the catch-and-effort data recorded for Sri Lankan gillnets are thought to be unreliable, due to the dramatic changes in CPUE recorded between consecutive years.

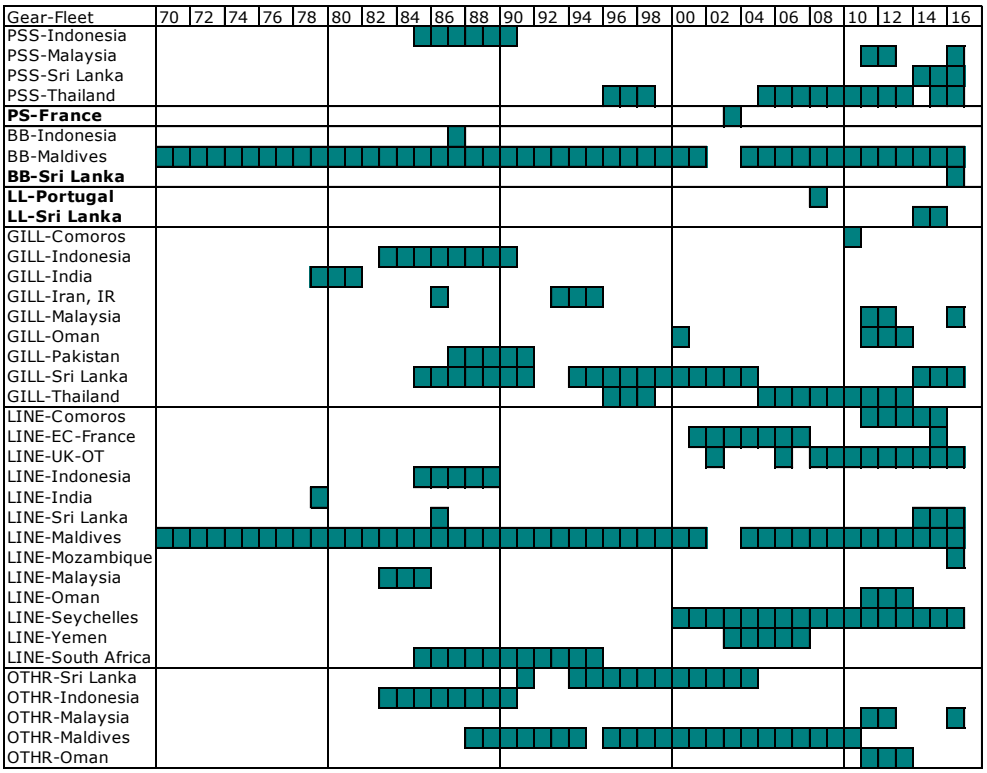


Table 3. Kawakawa: Availability of catches and effort series, by fishery and year (1970–2016). Note that no catches and effort are available at all for 1950–69[3].

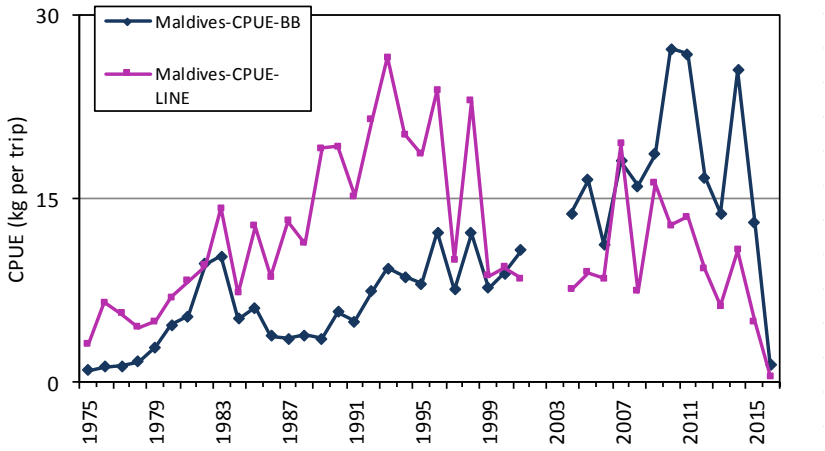


Fig. 4. Kawakawa: Nominal CPUE series for the baitboat (BB) and troll line (TROL) fisheries of Maldives (1975–2016) derived from the available catches and effort data.

Kawakawa tuna – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

- Sizes: the size of kawakawa taken by the Indian Ocean fisheries typically ranges between 20 and 60 cm depending on the type of gear used, season and location (**Fig.5a**). The coastal purse seine fisheries operating in the Andaman Sea tend to catch kawakawa of small size (15–30 cm) while the gillnet, baitboat and other fisheries operating in the Indian Ocean catch usually larger specimens (25–55 cm).
- Size frequency data: overall highly incomplete, with data only available for selected years and/or fisheries (Table 4).

[3] Note that the above list is not exhaustive, showing only the fisheries for which catch-and-effort are available in the IOTC database. In addition, catch-and-effort may not be available for all months for years shown in the table for each fishery.

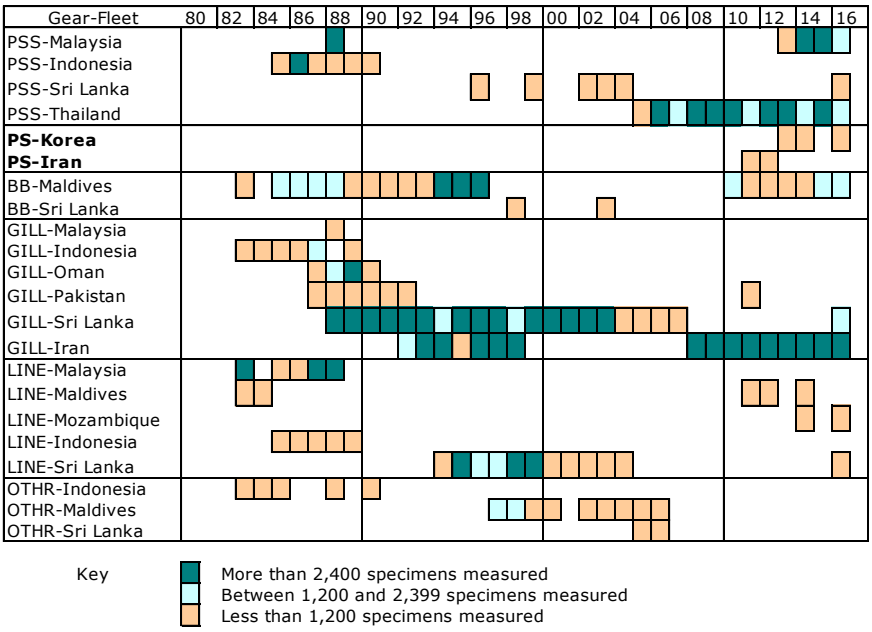
Main sources for size samples: Sri Lanka (gillnet), and I.R. Iran (gillnets).

Trends in average weight can be assessed for Sri Lankan gillnets from the mid-1980s to early-1990s, but the number of specimens measured has been very low in recent years (**Fig. 5b**). Since 1998 there has also been some sampling of lengths from Iranian gillnets – although average lengths are significantly larger than specimens reported by other fleets which reflect differences in the selectivity of offshore gillnets operating in the Arabian Sea, rather than an actual change in average sizes in the underlying population.

Length distributions derived from the data available for gillnet fisheries are shown in **Fig. 5a**. No data are available in sufficient numbers for other fisheries.

- Catch-at-Size (Age) table: Not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates.
- Sex ratio data: have not been provided to the Secretariat by CPCs.

Table 4. Kawakawa: Availability of length frequency data, by fishery and year (1980–2016). Note that no length frequency data are available at all for 1950–82[4].



[4] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. In addition, size data may not be available for all months for years shown in the table for each fishery.

a) Kawakawa (Gillnet): size (in cm)

b) Kawakawa (Gillnet): no. of samples ('000)

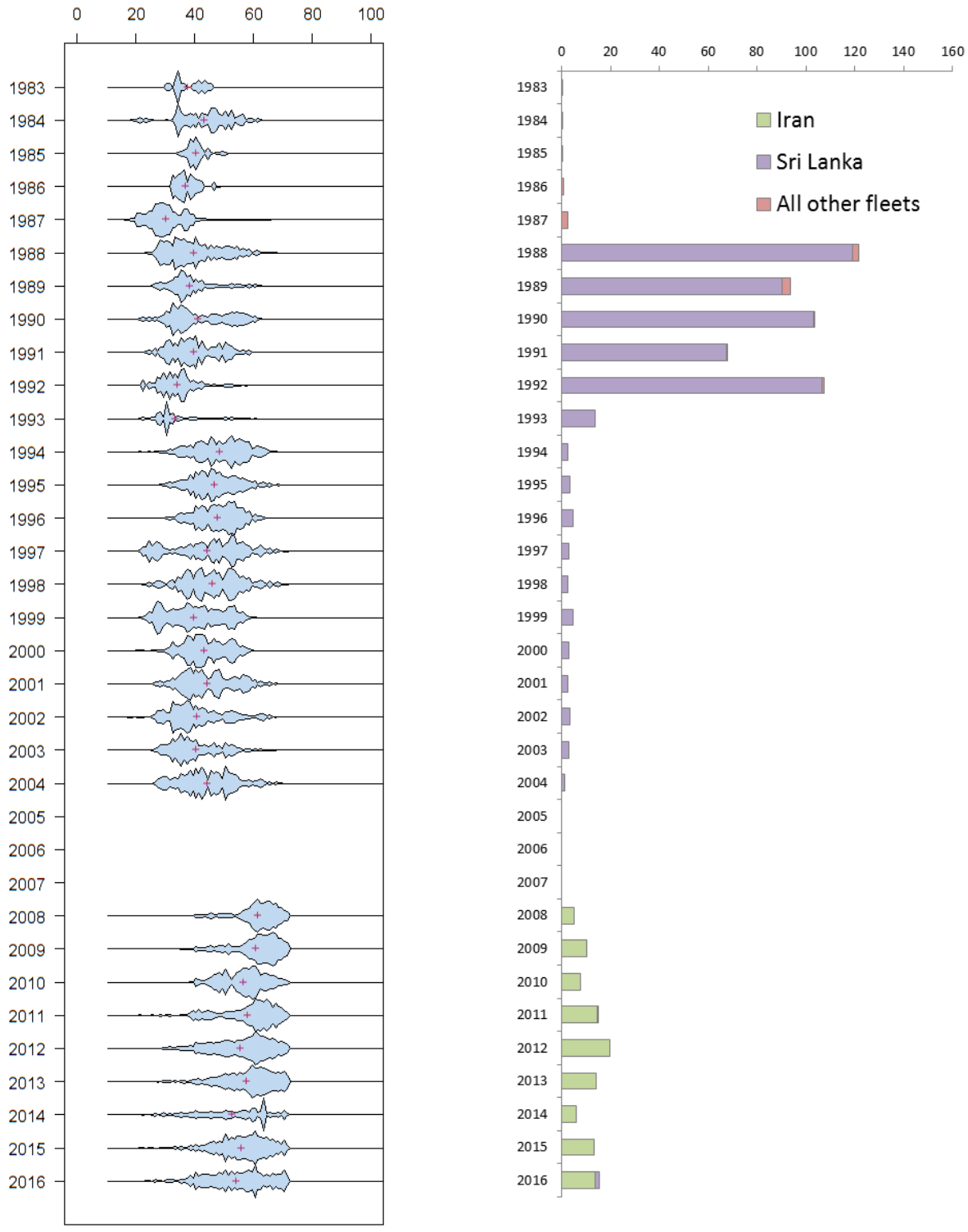


Fig. 5. Kawakawa: Left - Length frequency distributions for gillnet fisheries (total amount of fish measured by 1cm length class) derived from data available at the IOTC Secretariat. Right - number of kawakawa specimens sampled for lengths, by fleet (gillnet only).

STOCK ASSESSMENT

Three modelling methods, Optimised Catch-Only Method (OCOM), Catch-MSY and SS3 (Stock Synthesis) were used to assess the status of kawakawa in 2015. There was a divergence in the results from the three assessments and it was decided that the OCOM method was the most robust and so should be used for providing stock status advice. Results from the SS3 model were highly dependent on the pole and line CPUE series from the Maldives which forms only a small component of total Indian Ocean catches, so more CPUE series and better length data are needed to improve this approach. The Catch-MSY method was designed to estimate MSY rather than stock status and makes assumptions about the final depletion level, so the OCOM model, which makes fewer assumptions about final depletion, was considered more appropriate for generating management advice.

Table 5. Kawakawa (*Euthynnus affinis*) key management quantities from the OCOM used in 2015.

Management Quantity	Indian Ocean
Most recent catch estimate (2014)	162,687 t
Mean catch from 2010–2014	155,764 t
MSY (1000 t) [*]	152 [125 –188]
Data period used in assessment	1950–2015
F_{MSY} [*]	0.56 [0.42–0.69]
B_{MSY} (1000 t) [*]	202 [151–315]
F_{2013}/F_{MSY} [*]	0.98 [0.85–1.11]
B_{2013}/B_{MSY} [*]	1.15 [0.97–1.38]
SB_{2013}/SB_{MSY} (80% CI)	n.a.
B_{2013}/B_0 [*]	0.58 [0.33–0.86]
SB_{2013}/SB_0 (80% CI)	n.a.
$B_{2013}/B_{0,\ F=0}$ (80% CI)	n.a.
$SB_{2013}/SB_{0,\ F=0}$ (80% CI)	n.a.

n.a. not available; plausible range: results from a combination of a specific catch only method assumed prior information, as well as catch data.

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