

Mortality estimation for southern bluefin tuna released and discarded from Japanese longline fishery

日本はえ縄船から放流・投棄した ミナミマグロの死亡量の推定

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要約

本文書は、OMMP5 における未考慮漁獲量を含めた感度分析のための、日本はえ縄船からの放流・投棄によるミナミマグロの死亡量を推定するものである。放流投棄は IQ が導入された 2006 年から行われていると考え、2009 年からの RTMP における放流投棄報告個体数情報を集計した。死亡率は、科学オブザーバーデータ、RTMP 報告、PAT 放流実験などから仮定した。推定した年間死亡量は約 30 トンであり、日本延縄の漁獲全体に対して 1%程度であった。また、放流投棄魚の多くは 20kg 未満で 3 歳魚以下であることから CPUE 指数への影響は小さい。

Abstract

The present paper provides estimates of one of the unaccounted catch mortalities of southern bluefin tuna that release and discards from Japanese longline fishery for sensitivity analysis at the OMMP5 meeting. It was assumed that release/discard started in 2006 when IQ system was implemented for SBT fishery in Japan. The number of release/discarded reported from longline fishermen included in the RTMP data since 2009 were used. Mortality rates were estimated from the RTMP data, the scientific observer data and pop-up archival tagging experiments. The estimated annual mortality was about 30 tons in average, which was about 1% of Japanese SBT catch. Because majority of release/discard was <20kg that correspond with less than age 3, it affects little on the CPUE indices.

Introduction

The CCSBT Extended Commission (EC) requested the Extended Scientific Committee (ESC) to conduct sensitivity analyses around all sources of unaccounted catch mortality as part of the ESC's planned 2014 stock assessment at the 20th annual meeting (Anon. 2013). The present paper provides estimates of one of the unaccounted catch mortalities that release and discards from Japanese longline fishery. While we have already reported and updated for some years to CCSBT (Sakai and Itoh 2011, 2012, 2013a), we report again for some years, as well as estimate for all the years since 2006.

Materials and methods

It appears that releases and discards of southern bluefin tuna (SBT) from Japanese longline started relating to the implementation of individual quota (IQ) system for SBT in Japan. It is considered that fishermen wanted to effective use of their limited IQ so that they released and discarded some SBT individuals whose commercial value was low, e.g. small in size.

IQ system for SBT was started in 2006 in Japan. The reporting system for release and discard was not established at that time. In the RTMP reporting system, reporting for release and discard was established in 2009 to report the number of fish released or discarded by three body weight categories, <20kg, 20-40kg and >40kg, which roughly corresponding to age 1-3, age 4-6 and age7+, respectively. The body weight, assuming gilled and gutted weight which was familiar with longline fisherman, was estimated by visual measurement of fisherman in order not to prevent survival after release. In 2011, the reporting item became more in detail that live in vigorous condition and dead (including live but sluggish condition) at the time of fish were drawn to the vessel were separated in each of the weight classes. This reporting has been used even now.

The present study treated for the period between 2006 and 2013. In the period between 2009 and 2013, release/discard data in RTMP were used. In the period between 2006 and 2008, estimations after 2009 were used for calculations.

Mortality rates were applied to the number of release/discard estimated. Not only dead fish when longline retrieved but also live but sluggish condition at that time was included in mortality. In addition, post-release mortality of fish which was live in vigorous condition at the time of longline retrieved was also considered.

The total weight of mortality was calculated by the number of fish estimated to be dead and mean body weight. Since accurate body weight for fish release/discard was not collected, the mean weight of SBT retained was used from the RTMP data.

Calculation was made by year and three weight classes.

Results

In RTMP, release/discard was reported from 73% vessels in average (Table 1). Tactics of whether release/discard is conducted is relating to business strategy of each vessels or companies. Some vessels wanted to retain all SBT caught and fill their IQ as soon as possible to go for other tuna species fishing depending on price of tunas.

The numbers of retained and release/discard in the RTMP data between 2009 and 2013 are shown in Table 2. The ratio of release/discard (release and discard / retained) ranged from 6.8% to 21.0%, with a mean of 15.1%.

The numbers of release/discard by weight classes are shown in Table 3. The mean compositions between 2009 and 2013 were 73.8% of <20kg, 23.6% of 20-40kg and 2.6% of >40kg.

Mortality rates by weight classes were calculated using the RTMP data between 2011 and 2013 (Table 4). The mean values were used for 2006 to 2010. The mortality rates varied with weight classes that lower in smaller size as 4.7 to 8.8% in <20kg.

Note that in the scientific observer data the mortality rates of SBT at the time of drawn to vessel was 21% for overall individuals, and similar values irrespective of age (Table 5).

However, in the scientific observer data for actual fish release/discard observed, the mortality rates varied with age and lower for smaller fish as 4.7% in <20kg including live but sluggish fish, which was similar tendency to the RTMP data (Table 6). It was suggested that longline fishermen tended to release more for fish small and in vigorous condition.

For the post-release mortality of fish caught in vigorous condition and released, 9% was used that obtained from the pop-up archival tagging experiments conducted from Japanese longline vessels (Sakai et al. 2013b). This 9% was applied for the ratio that excluded dead and sluggish fish from release/discard (Table 4). The two mortality rates were summed. It was 13% to 17% for fish <20kg.

The mean body weights by year calculated from the retained fish in the RTMP data used for release/discard fish were 14.6kg to 16.5kg for the <20kg weight class, 27kg to 31kg for the <40kg weight class and 56kg to 72kg for the >40kg weight class (Table 7). These values may be overestimated that fishermen appear to tend to release smaller fish.

Annual mortalities (a total of dead, live but sluggish and post-release mortality) were

estimated ranging from 678 fish to 1932 fish (Table 7). The weights ranged from 14.0 tons to 39.4 tons in GG and from 16.1 tons to 45.3 tons in whole weight.

CPUE abundance indices used for stock assessment and MP in CCSBT is calculated for SBT age 4 and more. The lower cut point of age 4 used in CCSBT catch-at-age estimation is 105.5 cm in January. According to the length-weight relationship used in CCSBT for fish < 130cmFL, it is calculated as 23.7 kg in whole weight and 20.6 kg in GG weight. Therefore, release/discard fish in the < 20kg weight category, which comprise majority of release/discard fish, does not affect the CPUE indices.

The numbers of release/discard fish of the weight classes in 20-40kg and > 40kg were ranged from 1.7% to 4.7%, with a mean of 3.9% to the numbers of retained fish > 20kg. Then, CPUE indices which did not considering release/discard is underestimated by a factor of $1/1.039 = 0.962$.

Discussions

Release/discard data of Japanese longline were collected for five years through RTMP. Data for life status were also collected for three years. It was confirmed the agreements on life status to the scientific observer data. Post-release mortality was estimated through the experiments of pop-up archival tagging in the same condition of releasing from longline vessels. The estimation in the present study is based on sufficient amount of data.

There would be a tendency of overestimation for mortality in the present study. For example, the mean body weights assumed seems to be overestimated. Some fish caught in sluggish condition might survive after release. Fish that pop-up tags deployed were suffered from longer handling time on deck and carrying pop-up tags in the water. Release/discard might not be done from 2006 to 2008 actually. It should be noted that we tried not to be underestimated in order to evaluate the impact of unaccounted catch on the Management Procedure precautionary.

Annual mortality was estimated to be about 30 tons. It is just about 1% of annual SBT catch by Japanese longline. In terms to evaluate the impact on MP, there is little meaning to explore further analysis for the estimation.

It is a problem that accurate length of released fish was not obtained in terms of the stock assessment of SBT. It was known that some fish were released by cutting the branch line when fish were under water so that body length was not able to measure but emphasized fish survival. These releases were motivated by a thought of fishermen to protect small size fish and attain sustainable utilization of the SBT stock, at the same

time of business strategy. It would not be appropriate to impose a duty to measure length of all fish released against to their thought.

It was estimated that release/discard affected the CPUE indices because release/discard fish included SBT of age 4+ in fish >20kg. However, it should be carefully considered because we do not know accurate length and age of fish released/discarded. Because of its small number and uncertainties, it is better to use the CPUE indices not including release/discard.

References

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Table 1. Number of vessels in RTMP for all and reported SBT release and discards

Year	All Release reported		
2006			
2007			
2008			
2009	100	77	77%
2010	86	52	60%
2011	83	60	72%
2012	93	69	74%
2013	87	69	79%

Table 2. Numbers of SBT retained and released (including discards) in the RTMP data and the estimated total number of release based on logbook

Year	Retained	Release	Total	%Release	N_logbook	Estimatd Release
2006				<i>15.1%</i>	79,382	11,983
2007				<i>15.1%</i>	56,968	8,599
2008				<i>15.1%</i>	48,579	7,333
2009	52,559	9,830	62,389	18.7%	56,320	10,533
2010	46,161	4,244	50,405	9.2%	46,212	4,249
2011	58,395	3,988	62,383	6.8%	59,405	4,057
2012	51,206	10,101	61,307	19.7%	51,754	10,209
2013	49,282	10,361	59,643	21.0%	49,575	10,423
Mean				15.1%		

Italics denote that mean value of other years are used. %Release is the proportion of Release to Retained.

Table 3. Number of SBT released and discarded by weight class and life status in the RTMP data

Year	Release and Discard			Release in active			Dead or sluguish				All	
	<20kg	20-40kg	>40kg	All	<20	20-40	>40kg	All	<20	20-40		>40kg
2006				11,983								
2007				8,599								
2008				7,333								
2009	7,895	1,913	22	9,830								
2010	2,166	1,904	174	4,244								
2011	3,151	683	154	3,988	2,905	617	128	3,650	246	66	26	338
2012	7,865	1,991	245	10,101	7,175	1,833	140	9,148	690	158	105	953
2013	8,367	1,721	273	10,361	7,970	1,598	239	9,807	397	123	34	554
2006	<i>73.8%</i>	<i>23.6%</i>	<i>2.6%</i>	100.0%								
2007	<i>73.8%</i>	<i>23.6%</i>	<i>2.6%</i>	100.0%								
2008	<i>73.8%</i>	<i>23.6%</i>	<i>2.6%</i>	100.0%								
2009	80.3%	19.5%	0.2%	100.0%								
2010	51.0%	44.9%	4.1%	100.0%								
2011	79.0%	17.1%	3.9%	100.0%	79.6%	16.9%	3.5%	100.0%	72.8%	19.5%	7.7%	100.0%
2012	77.9%	19.7%	2.4%	100.0%	78.4%	20.0%	1.5%	100.0%	72.4%	16.6%	11.0%	100.0%
2013	80.8%	16.6%	2.6%	100.0%	81.3%	16.3%	2.4%	100.0%	71.7%	22.2%	6.1%	100.0%
Mean	73.8%	23.6%	2.6%									

Italics denote that mean value of other years are used.

Table 4. Ratio of the mortality applied for the release and discards for SBT caught by Japanese longline

Year	Dead and sluggish				Post release mortality				Total mortality			
	<20kg	20-40kg	>40kg	All	<20kg	20-40kg	>40kg	All	<20kg	20-40kg	>40kg	All
2006	<i>7.1%</i>	<i>8.2%</i>	<i>24.1%</i>	<i>7.8%</i>	8.4%	8.3%	6.8%	8.3%	15.5%	16.5%	30.9%	16.1%
2007	<i>7.1%</i>	<i>8.2%</i>	<i>24.1%</i>	<i>7.8%</i>	8.4%	8.3%	6.8%	8.3%	15.5%	16.5%	30.9%	16.1%
2008	<i>7.1%</i>	<i>8.2%</i>	<i>24.1%</i>	<i>7.8%</i>	8.4%	8.3%	6.8%	8.3%	15.5%	16.5%	30.9%	16.1%
2009	<i>7.1%</i>	<i>8.2%</i>	<i>24.1%</i>	<i>7.8%</i>	8.4%	8.3%	6.8%	8.3%	15.5%	16.5%	30.9%	16.1%
2010	<i>7.1%</i>	<i>8.2%</i>	<i>24.1%</i>	<i>7.8%</i>	8.4%	8.3%	6.8%	8.3%	15.5%	16.5%	30.9%	16.1%
2011	7.8%	9.7%	16.9%	8.5%	8.3%	8.1%	7.5%	8.2%	16.1%	17.8%	24.4%	16.7%
2012	8.8%	7.9%	42.9%	9.4%	8.2%	8.3%	5.1%	8.2%	17.0%	16.2%	48.0%	17.6%
2013	4.7%	7.1%	12.5%	5.3%	8.6%	8.4%	7.9%	8.5%	13.3%	15.5%	20.3%	13.9%
Mean	7.1%	8.2%	24.1%	7.8%								

Italics denote that mean value of other years are used.

Table 5. Ratio of the number of dead and sluggish SBT at the time of caught in the database of SBT scientific observers

Age group	GG	2006	2007	2008	2009	2010	2011	2012	2013	Total
Age 1-3	<20kg	25%	28%	24%	15%	26%	19%	28%	33%	24%
Age 4-6	20-40kg	20%	22%	20%	22%	17%	18%	20%	25%	19%
Age 7plus	>40kg	21%	17%	21%	18%	21%	23%	17%	15%	19%
Total		22%	25%	22%	19%	21%	20%	20%	18%	21%

GG is the gilled and gutted weight roughly corresponded to the age range.

Table 6. Ratio of the number of dead and sluggish SBT that actually released/discarded in the database of SBT scientific observers

Age	GG	N			%		
		Dead	Sluggish	Vigorous	Dead	Sluggish	Vigorous
Age 1-3	<20kg	26	1	554	4.5%	0.2%	95.3%
Age 4-6	20-40kg	20	0	157	11.3%	0.0%	88.7%
Age 7plus	>40kg	12	3	34	24.2%	6.1%	69.7%

Data were summed up for eight years. GG is the gilled and gutted weight roughly corresponded to the age range.

Table 7. Estimated the number of release and discards, and the number and weight of dead SBT for Japanese longline catch

Year	Estimated release & discard				Mean weight			N_Death			Total
	<20kg	20-40kg	>40kg	All	<20kg	20-40kg	>40kg	<20kg	20-40kg	>40kg	
2006	8,843	2,822	317	11,983	14.6	27.3	67.6	1,368	466	98	1,932
2007	6,346	2,026	228	8,599	15.2	27.5	72.1	982	334	70	1,386
2008	5,412	1,727	194	7,333	16.4	28.2	69.7	837	285	60	1,182
2009	8,460	2,050	24	10,533	15.2	27.6	71.7	1,309	338	7	1,654
2010	2,168	1,906	174	4,249	16.5	30.6	61.6	335	315	54	704
2011	3,205	695	157	4,057	15.7	30.4	55.8	516	124	38	678
2012	7,949	2,012	248	10,209	15.8	29.8	56.0	1,350	326	119	1,795
2013	8,417	1,731	275	10,423	15.7	31.4	57.3	1,121	268	56	1,445

Year	W_Death (ton)			Whole weight		W retained	% release & discard
	<20kg	20-40kg	>40kg	Total	Total		
2006	20.0	12.7	6.6	39.4	45.3	4,207	1.1%
2007	14.9	9.2	5.1	29.2	33.5	2,840	1.2%
2008	13.7	8.0	4.2	26.0	29.8	2,950	1.0%
2009	19.9	9.3	0.5	29.8	34.3	2,659	1.3%
2010	5.5	9.6	3.3	18.5	21.3	2,223	1.0%
2011	8.1	3.8	2.1	14.0	16.1	2,519	0.6%
2012	21.3	9.7	6.7	37.7	43.4	2,528	1.7%
2013	17.6	8.4	3.2	29.2	33.6	2,695	1.2%

“W_Death” is the weight of gilled and gutted (GG) in unit of ton of estimated dead fish in release and discards. “Whole weight” is its convert to whole weight. “W_retained” is the annual total retained weight of Japanese longline in tons. “% release & discard” is the proportion of “W_Death” to “W retained”.