Pacific Community
Communauté du Pacifique

Summary of tuna stock status and national implications for the Solomon Islands

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Issue Specific National Report (Summary of tuna stock status) - SB - November 2018

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Contents

1 Introduction

Tuna stock assessments provide important information regarding the status of regional tuna stocks and the future predicted impacts of fishing on them. This information can help the Solomon Islands and other Western and Central Pacific Fisheries Commission (WCPFC) members decide how best to collectively manage these stocks. Albacore, bigeye, yellowfin and skipjack tuna are targeted by fisheries operating in the Solomon Islands. The Pacific Community (SPC) has assessed these stocks in the Western and Central Pacific Fisheries Commission Convention Area (WCPFC-CA) using a modeling tool called MULTIFAN-CL, which is reliant on accurate and comprehensive catch, effort, size and other fisheries data collected by all fishing nations. The assessments provide information on stock status at the WCPFC-CA scale and broad model Regions within that. SPC is working to develop models that can provide similar information at the Exclusive Economic Zone (EEZ) scale. However, given that tuna are migratory and may pass through many EEZs in their lifetime, it will never be feasible to assess and/or manage these species within individual EEZs in isolation from what is happening in surrounding waters. However, most countries also need to know what the status of the resource is in their immediate vicinity. Therefore we provide here some information for the broad model region that surrounds your EEZ so that you can assess your country's impact on the stock and the state of the stock in your waters. This report should be used in conjunction with the Tuna Fisheries Assessment Report published annually by the SPC (Brouwer et al., 2018). Tuna stock assessment results are described using a number of technical terms, and refer to a number of key indicators of stock status (reference points). These terms described in Table 1.

Table 1: Definitions of key terms used in describing the impact of fishing upon and the status of fish stocks.

Term	Definition
Depletion	Depletion describes the level of reduction in the fish stock since fishing first began, typically by comparing current spawning biomass to that which would occur if there was no fishing ($SB_{current}/SB_{F=0}$).
Fishing mortality rate	The proportion of the stock removed by fishing in a unit of time.
Growth overfished	Fish are harvested at an average size that is smaller than the size that would produce the maximum yield per recruit.
Maximum Sustainable Yield (MSY)	The maximum amount of catch that can be taken from the stock per year, on average, in the long-term
Overfished fishery	Occurs when there are no longer enough adults in the population to produce enough young to replace those fish removed from the population by fishing. In the WCPFC, an overfished fishery is defined as one where the current spawning biomass ($SB_{current}$) is less than 20% of the spawning biomass in the absence of fishing ($SB_{F=0}$).
Overfishing	In the WCPFC, overfishing is defined as occurring when the current fishing mortality rate exceeds the fishing mortality rate that would provide the maximum sustainable yield. Sustained overfishing leads to an overfished state.
Recruitment overfished	Occurs when the adult population is depleted to a level where it no longer has the reproductive capacity to replenish itself.

2 Summary of tuna stock status

The most recent assessments indicate that overfishing is not occurring on albacore, bigeye, skipjack and yellowfin tuna, and these stocks are not in an overfished state (Figure 1). However, catch of each of these species have increased significantly over the past 2 to 3 decades, with corresponding reductions in stock biomass relative to the biomass that would be in the water if no fishing was occurring. The following sections provide more detail regarding the status of these stocks, implications for your national fisheries and briefly reviews assessments of other relevant species. Specific details regarding catch and stock status of each species in the WCPFC and your EEZ are presented in Table 2.

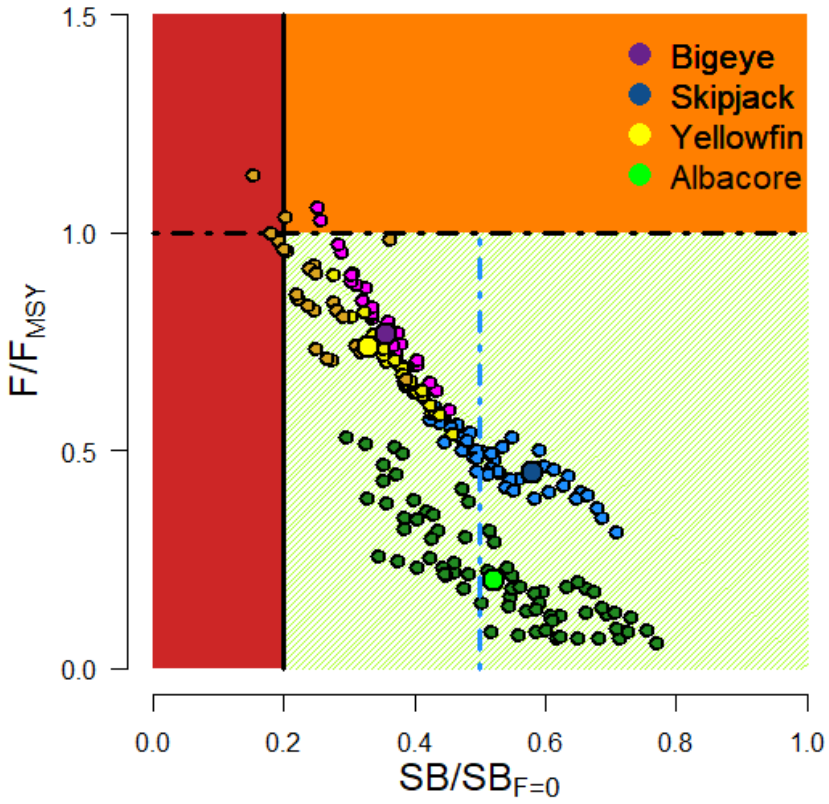

Figure 1: Majuro plot comparing the stock status of the key target tuna species caught in the WCPFC Convention Area. Where current fishing mortality rate exceeds the fishing mortality rate at MSY ($F/F_{MSY} > 1$) then overfishing is occurring. Where the current spawning biomass is less than 0.2 of spawning biomass without fishing, then the stock is overfished ($SB/SB_{F=0}$ <0.2). The small points are the estimated terminal stock status from the grid of model runs and the large points are the median values from the grid. The blue dashed line indicates the WCPFC interim target reference point for skipjack tuna.

Table 2: Key fishery statistics averaged from 2012 to 2017 for each of the four main target tunas.

Recent Average Catch (2012 - 2017)	Skipjack	Yellowfin	Bigeye	SP Albacore
WCPFC-CA catch	1,794,092	608,620	152,679	68,515
5 year WCPFC-CA catch trend	No trend	Increasing	Decreasing	Increasing
WCPFC-CA Longline catch	2,326	90,571	70,416	65,602
WCPFC-CA Purse seine catch	1,438,729	380,092	64,151	0
WCPFC-CA Pole and line catch	144,801	24,211	4,001	26
WCPFC-CA Other catch	104,118	56,873	7,056	619
Fishing impacts				
Percent reduction in spawning biomass in region	49	52	55	43
Percent reduction in spawning biomass in WCPFC-CA	48	64	62	42
Local implications				
Catch in model Region	478,187	134,320	33,059	45,560
Percent WCPFC catch from model Region	26.7	22.1	21.7	66.5
Recent average catch in SB (2012 - 2017)	76,681	40,318	4,746	8,310
Percent WCPFC-CA catch in SB	4.3	6.6	3.1	12.1
Recent average catch by SB outside EEZ	3,262	1,563	330	278
Percent WCPFC-CA catch by SB outside your EEZ	0.2	0.3	0.2	0.4

3 Skipjack tuna

The skipjack tuna assessment is based on a five Region model (McKechnie et al., 2016), your EEZ is situated in model Region 2 (Figure 2 - top). Between 2012 and 2017 skipjack catch averaged 1,794,092t in the WCPFC-CA (Figure 2 - middle). An average of 478,187t (26.7% of WCPFC-CA catch) comes from model Region 2. It is estimated that skipjack spawning biomass in the WCPFC-CA and model Region 2, have been reduced through fishing by 48% and 49% respectively (Table 2). The greatest impact on spawning biomass is from the associated - Fish Aggregating Device (FAD) - directed purse seine fisheries both in the WCPO and in model Region 2 the associated and unassociated purse seine fisheries have about the same level of impact (Figure 2 - bottom).

The 12th Scientific Committee (SC12) of the WCPFC concluded that overfishing is not occurring on the skipjack stock and the stock is not overfished (Figure 1). SC12 noted that fishing is having a significant impact on stock size, especially in the western equatorial region and can be expected to negatively affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions associated with El Niño and La Niña events, which impact on catch rates and stock size. Additional purse-seine effort will yield only modest gains in long-term skipjack catch and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas (WCPFC, 2016).

Annual catch of skipjack in the Solomon Islands has averaged 76,681t between 2012 and 2017, representing 4.3% of WCPFC-CA and 16% of model Region 2 skipjack catch. Together, skipjack catch inside the Solomon Islands and by the the Solomon Islands fleet outside your EEZ have accounted for an average 4% of the WCPFC skipjack catch. Regional catch of skipjack tuna, including those within or by the Solomon Islands, are considered sustainable at recent average levels. However, the Solomon Islands should note that the FAD component of the regional purse seine fishery (the main fishery for skipjack tuna) catches juvenile bigeye and yellowfin tuna, and that fishery is contributing to the impact on these stocks.

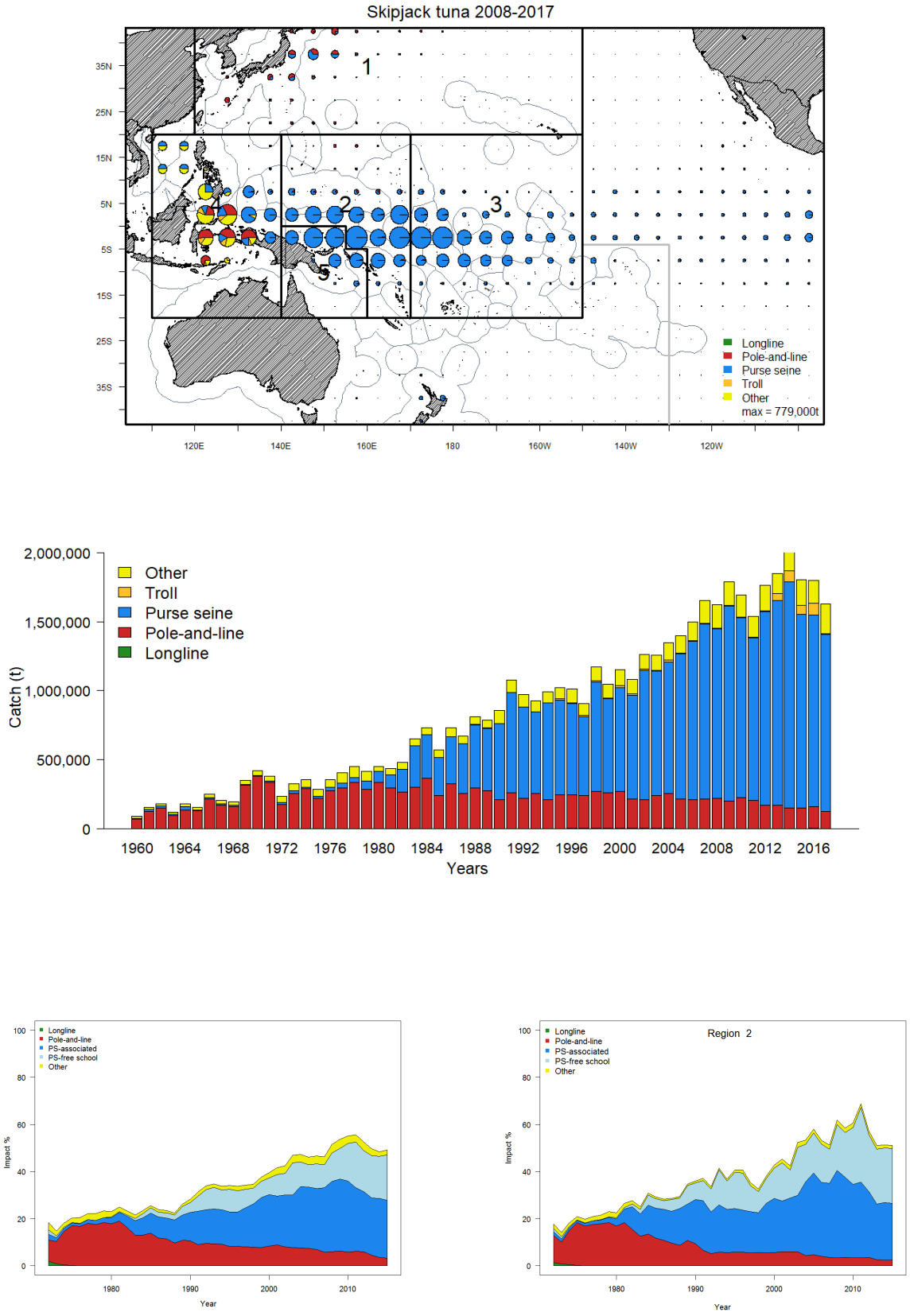

Figure 2: Distribution of total skipjack catch by fishing method 2008 - 2017 (Red, pole-and-line; Blue, purse-seine; Yellow, other) (top). Annual catch of skipjack in the WCPO by fishing method (middle). Percentage impact on spawning biomass due to fishing in the WCPO (bottom - left) and the model Region encompassing your EEZ (bottom - right).

4 Yellowfin tuna

The yellowfin tuna assessment is based on a nine Region model (Tremblay-Boyer et al., 2017), with the Solomon Islands situated in model Regions 3 and 5 (Figure 3 - top). Between 2012 and 2017 yellowfin catch averaged 608,620t in the WCPFC-CA (Figure 3 - middle). An average of 134,320t (22.1% of WCPFC-CA catch) comes from model Regions 3 and 5. It is estimated that yellowfin spawning biomass in the WCPFC-CA and model Regions 3 and 5, have declined by 64% and 52% respectively (Table 2). The greatest impact on the stock is from the fisheries of the Philippines and Indonesia, along with the FAD directed purse-seine fishery in the WCPO and model Region 3 and in model Region 5 the FAD and freeschool purse-seine fisheries have the greatest impact (Figure 3 - bottom).

The 13th Scientific Committee (SC13) concluded that overfishing is not occurring on the yellowfin stock and the stock is not overfished (Figure 1). However, fishing mortality, exploitation rates and depletion differ between regions, and exploitation rates are highest in the equatorial region (Regions 3, 4, 7 and 8), which account for 94% of the total yellowfin tuna catch. The SC13 recommended that there be no increase in yellowfin catch and that measures be implemented to maintain current spawning biomass levels (WCPFC, 2017).

Annual catch of yellowfin in the Solomon Islands have averaged 40,318t between 2012 and 2017, representing 6.6% of WCPFC-CA and 30% of model Regions 3 and 5 yellowfin catch. Together, yellowfin catch inside the Solomon Islands and by the the Solomon Islands fleet outside your EEZ have accounted for an average 7% of the WCPFC yellowfin catch. As such, the the Solomon Islands fishery contributes moderately to overall regional impacts on the stock. The yellowfin stock in model Regions 3 and 5 has low levels of depletion, but the the Solomon Islands EEZ lies inside the equatorial area where fishing impacts are highest.

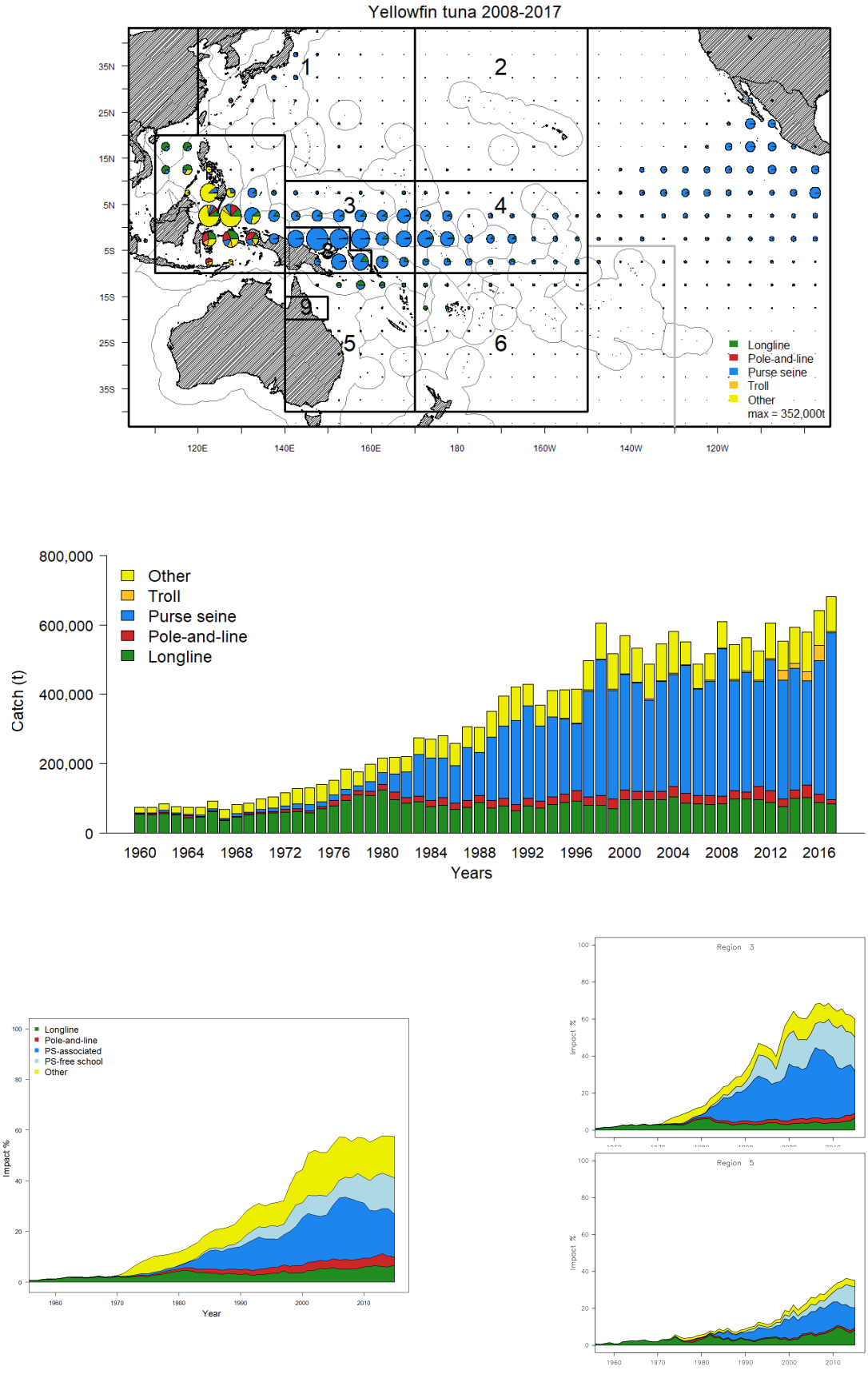

Figure 3: Distribution of total yellowfin catch by fishing method 2008 - 2017 (Red, pole-and-line; Blue, purse-seine; Yellow, other) (top). Annual catch of yellowfin in the WCPO by fishing method (middle). Percentage impact on spawning biomass due to fishing in the WCPO (bottom - left) and the model Regions encompassing your EEZ (bottom - right).

5 Bigeye tuna

The bigeye tuna assessment is based on a nine Region model (McKechnie et al. 2017 and Vincent et al. 2018), your EEZ is situated in model Regions 3 and 5 (Figure 4 - top). Between 2012 and 2017 bigeye catch averaged 152,679t in the WCPFC-CA (Figure 4 - middle). An average of 33,059t (21.7% of WCPFC-CA catch) comes from model Regions 3 and 5. It is estimated that bigeye spawning biomass in the WCPFC-CA and model Regions 3 and 5, have declined by 62% and 55% respectively (Table 2). The greatest impact on spawning biomass is coming from the longline and associated - FAD - purse seine fisheries in the WCPO and model Region 3, but in Region 5 longlining has the greatest impact (Figure 4 - bottom).

The 14th Scientific Committee (SC14) concluded that overfishing is not occurring on the bigeye stock and the stock is not overfished (Figure 1). However, the increase in juvenile bigeye catch has resulted in a considerable reduction in the potential yield of the WCPO bigeye stock. The loss in yield per recruit due to excess harvest of juvenile fish is substantial.

Annual catch of bigeye in the Solomon Islands have averaged 4,746t between 2012 and 2017, representing 3.1% of WCPFC-CA and 14% of model Regions 3 and 5 bigeye catch. Together, bigeye catch inside the Solomon Islands and by the the Solomon Islands fleet outside your EEZ have accounted for an average 3% of the WCPFC bigeye catch. Regional catch of bigeye tuna, including those within or by the Solomon Islands, are not considered to be sustainable at recent average levels. In addition, the Solomon Islands should note that the FAD component of the regional purse seine fishery (the main fishery for skipjack tuna) catches juvenile bigeye and yellowfin tuna, and that fishery is contributing to the impact on these stocks.

Bigeye tuna is one of two species targeted in the longline fishery operating in the Solomon Islands (recent average 53,374t) and bigeye are also taken in the purse seine fishery in the Solomon Islands. The viability of the local and regional purse seine fishery is not dependent on bigeye tuna abundance. However, the prospects for long-term viability (and/or further expansion) of a longline fishery for bigeye in the Solomon Islands will be dependant, in part, on trends in both national and regional fishing mortality on the bigeye stock (and economic and other factors not discussed here).

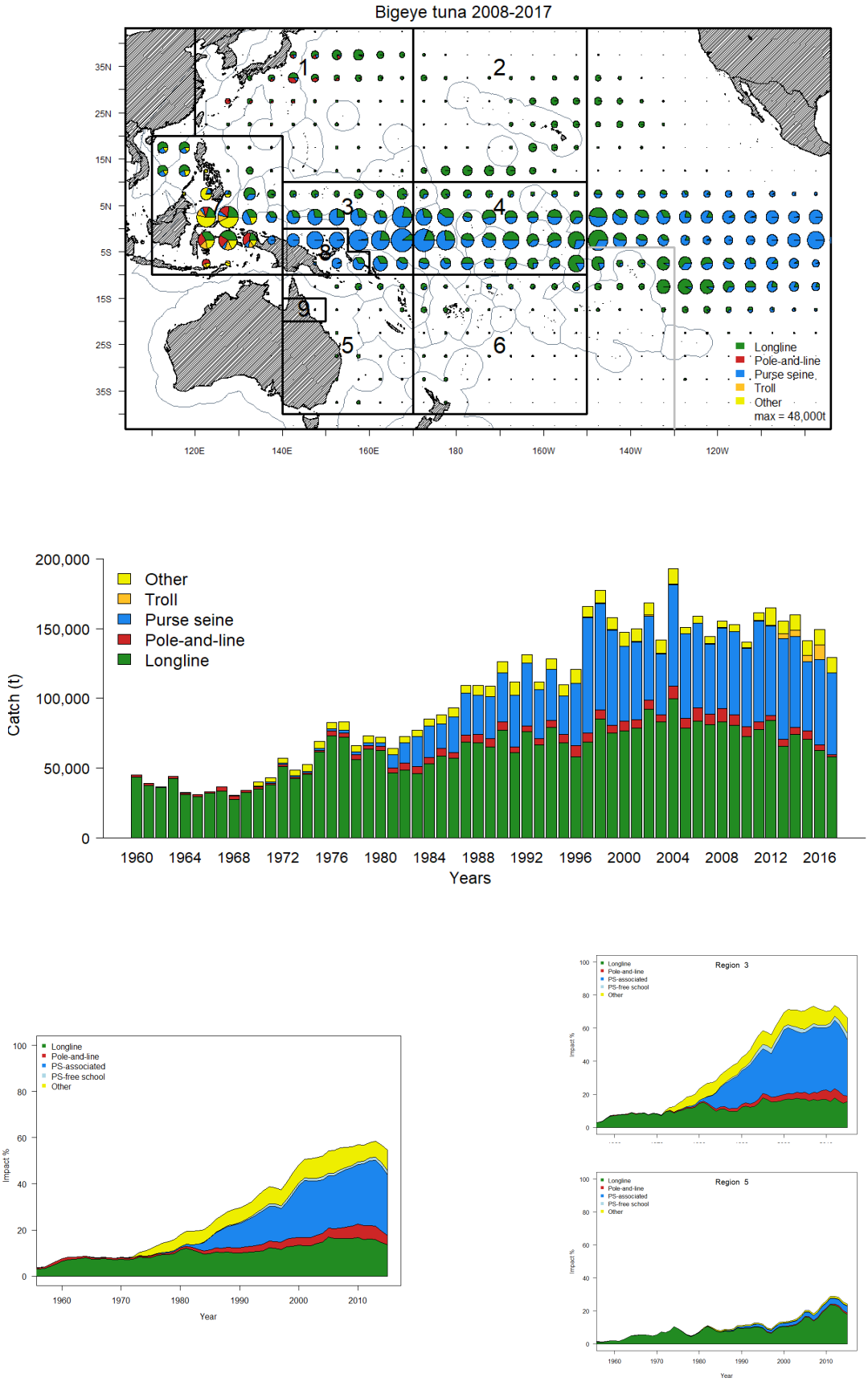

Figure 4: Distribution of total bigeye catch by fishing method 2008 - 2017 (Red, pole-and-line; Blue, purse-seine; Yellow, other) (top). Annual catch of bigeye in the WCPO by fishing method (middle). Percentage impact on spawning biomass due to fishing in the WCPO (bottom - left) and the model Regions encompassing your EEZ (bottom - right).

6 South Pacific albacore tuna

The South Pacific albacore assessment is based on a five Region model (Tremblay-Boyer et al., 2018), your EEZ is situated in model Regions 1 and 2 (Figure 5 - top). Between 2012 and 2017 albacore catch averaged 68,515t in the WCPFC-CA (Figure 5 - middle). An average of 45,560t (66.5% of WCPFC-CA catch) comes from model Regions 1 and 2. It is estimated that albacore spawning biomass in the WCPFC-CA and model Regions 1 and 2, have declined by 42% and 43% respectively (Table 2). The greatest impact on spawning biomass is from the sub-tropical longline fisheries in the WCPO and model Region 2 but the tropical longline fishery is having the greatest impact in model Region 1 (Figure 5 - bottom).

The WCPFC SC14 concluded that South Pacific albacore spawning stock is currently above both the level that will support the MSY and the adopted spawning biomass limit reference point, and overfishing is not occurring (Figure 1). But SC14 also noted that while overfishing is not occurring, further increases in effort will yield little or no increase in long-term catch and result in further reduced catch rates. SC14 also noted that any increases in catch or effort in sub-tropical longline fisheries are likely to lead to declines in longline catch rates between 10^{o}S-30^{o}S, which will impact vessel profitability (WCPFC, 2018).

Annual catch of albacore in the Solomon Islands has averaged 8,310t between 2012 and 2017, representing 12.1% of WCPFC-CA and 18% of model Regions 1 and 2 albacore catch. Together, albacore catch inside the Solomon Islands and by the the Solomon Islands fleet outside your EEZ have accounted for an average 13% of the WCPFC albacore catch. Regional catch of albacore tuna, including those within or by the Solomon Islands vessels fishing outside your EEZ, are considered sustainable at recent average levels. But the Solomon Islands should note that, deterministic projections[1] (Pilling, 2018) estimate that there is a 24% chance of the overall stock falling below the Limit Reference Point (LRP) by 2045 at recent (status quo) catch and effort levels. While the stock remains in a biologically healthy state, the prospects for any future albacore targeted fishery in the Solomon Islands will depend on local abundance, catch rates and economics.

[1]Estimates of risk using deterministic projections are likely to be underestimated as they do not include future uncertainties such as fluctuations in recruitment.

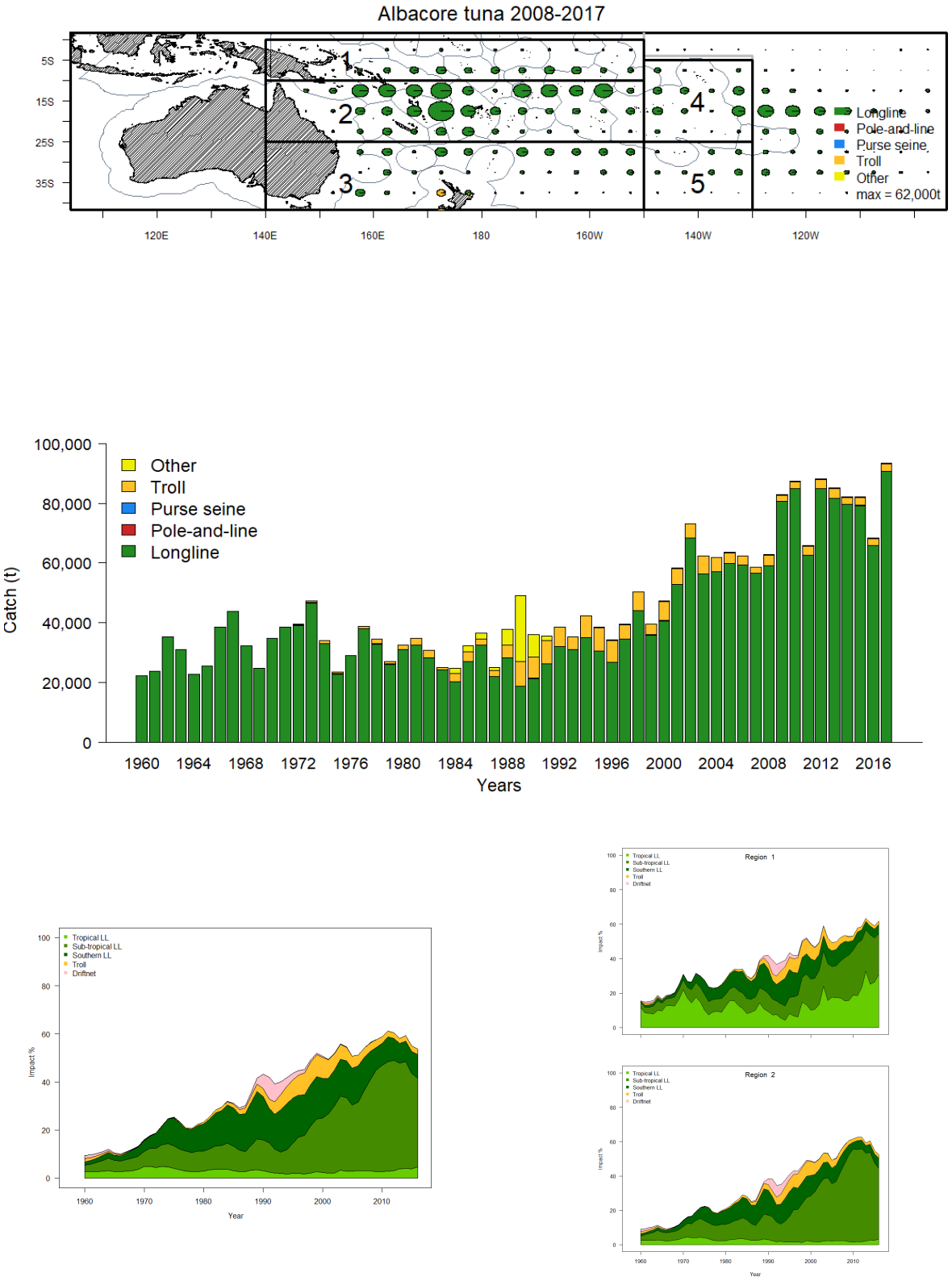

Figure 5: Distribution of total South Pacific albacore catch by fishing method 2008-2017 (Red, pole-and-line; Blue, purse-seine; Yellow, other) (top). Annual catch of South Pacific albacore in the WCPO by fishing method (middle). Percentage impact on spawning biomass due to fishing in the WCPO (bottom - left) and the model Region encompassing your EEZ (bottom - right).

7 Other species

Stock assessments are available for some other species which may interact with the fisheries in the Solomon Islands (Table 3). These include three shark and three billfish species (Figure 6). Both north and south Pacific swordfish and blue marlin are not overfished and no overfishing was taking place. The Scientific Committee (SC), has recommended that there should be no increase in fishing mortality for blue marlin and swordfish. The southwest Pacific striped marlin assessment results indicate that the stock is fully exploited, is not experiencing overfishing, but may be overfished (Table 3) (WCPFC, 2012, 2013). For the sharks that have been assessed to date, blue sharks in the north Pacific are not considered to be overfished and no overfishing is taking place; silky sharks are overfished and overfishing is taking place; and for oceanic whitetip sharks the stock is overfished and overfishing is occuring (WCPFC, 2012, 2013, 2014). It should also be noted that due to concerns expressed by the Scientific Committee regarding the steep declines in biomass of silky and oceanic whitetip shark, the Commission has adopted CMMs for these species prohibiting their retention, transshipment, storage or landing (WCPFC, 2011, 2013). In addition, in an attempt to reduce incidental catch of these species CMM2014-05 prohibits the use of either wire trace branchlines or shark lines on longline sets.

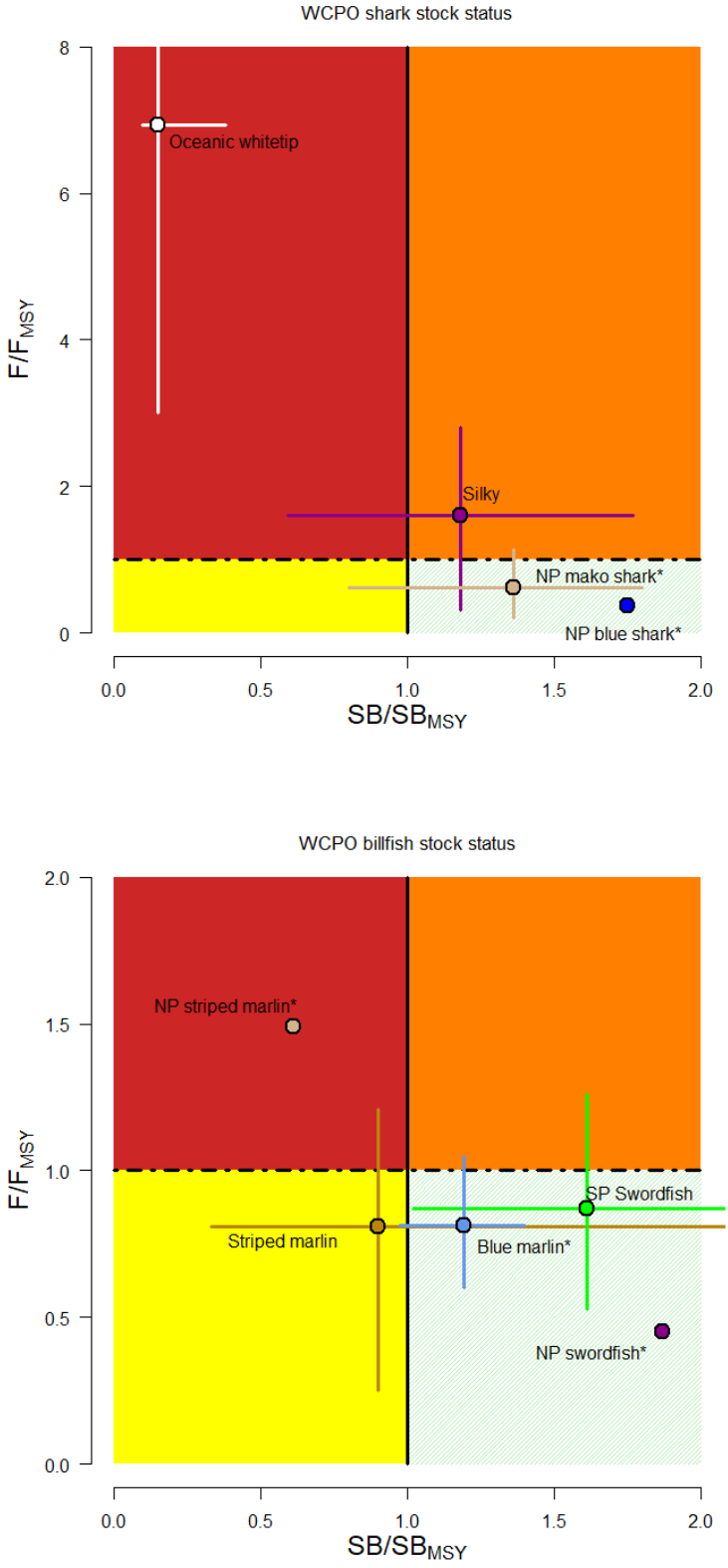

Figure 6: Kobe plot comparing the stock status of the key bycatch species caught in the WCPFC Convention Area. Where current fishing mortality rate exceeds the fishing mortality rate at MSY ($F/F_{MSY} > 1$) then overfishing is occurring. Where the current spawning biomass is less than the spawning biomass that would produce MSY, then the stock is overfished (SB/SB_{MSY} <1).

Table 3: Stock status and WCPFC Scientific Committee (SC) recommendations for other species stocks caught in the Solomon Islands. NP = North Pacific; SWPO = Southwest Pacific Ocean; SPO = South Pacific Ocean; SEPO=Southeast Pacific Ocean.

Species/Stock	Status	SC recommendation	Reference
Blue marlin	No overfishing, not overfished	Fishing mortality rate should not be increased from the 2009-2011 level	ISC (2013)
Striped marlin (SWPO)	The stock is fully exploited, is not experiencing overfishing but may be overfished	Reduce overall catch of this stock, through the expansion of the geographical scope of CMM 2006-04 to cover the entire distribution range	Davies *et al.* (2012)
Swordfish (SPO)	SWPO stock - No overfishing, not overfished; SEPO stock- uncertain	No increase in fishing mortality over 2007-2010 levels	Takeuchi *et al.* (2017)
Blue shark (NP)	No overfishing, not overfished	Catch and fishing effort on blue shark should be carefully monitored	Rice *et al.* (2014)
Oceanic whitetip shark	Overfishing, overfished	Management measures to reduce fishing mortality and to rebuild spawning biomass required and mitigation to avoid capture is recommended.	Rice and Harley (2012)
Silky shark	Overfishing, overfished	Develop mitigation as well as measures control targeted catch.	Rice *et al.* (2013)

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Acromyms

EEZ Exclusive Economic Zone

FAD Fish Aggregating Device

LRP Limit Reference Point

SC Scientific Committee

SC12 12th Scientific Committee

SC13 13th Scientific Committee

SC14 14th Scientific Committee

SPC Pacific Community

WCPFC Western and Central Pacific Fisheries Commission

WCPFC-CA Western and Central Pacific Fisheries Commission Convention Area