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# Biological and economic consequences of alternative SP-ALB stock recovery trajectories

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# Background

- South Pacific albacore is a species of primary importance in the longline fishery of a number of Small Island Developing States in the Western and Central Pacific Ocean
- Despite the fact that the stock is assessed as not being subject to overfishing and not overfished, economic returns have declined significantly over the past decade and this led to calls for management intervention
- Based on biological and economic objectives, FFA members proposed an interim stock TRP to the WCPFC of 45%$SB_{F=0}$
- The purpose of this study is to examine the biological and economic consequences along the trajectories of 2 distinct longline effort reduction regimes that achieve the proposed TRP within 20 years

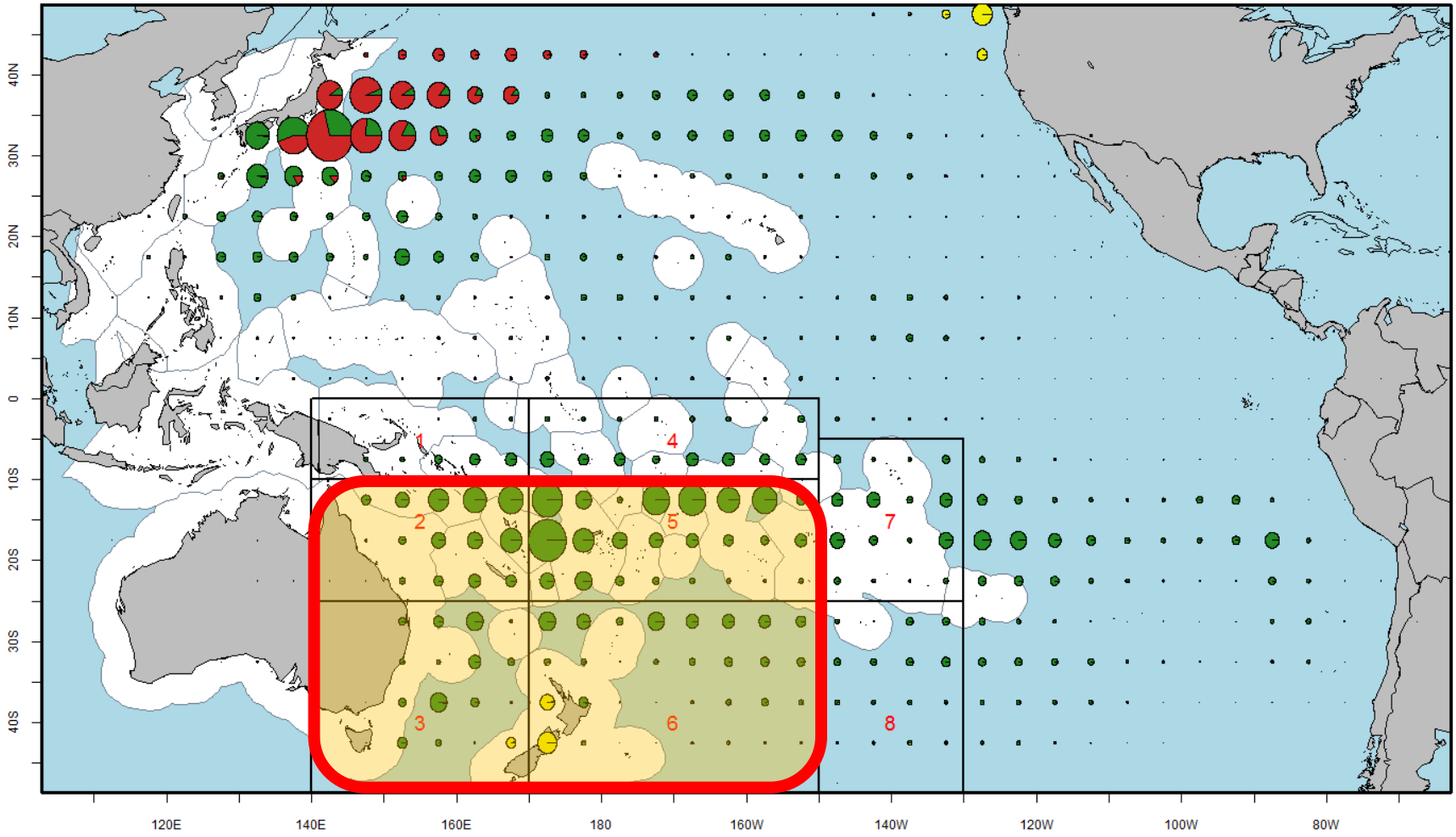
# Methodology

- The analysis was undertaken in 3 steps
  1) Identify the effort reduction required to achieve the proposed interim TRP of 45%$SB_{F=0}$ within 20 years through either a one-off reduction or a phased reduction using MULTIFAN-CL
  2) Estimate the annual catch of key species in the southern longline fishery under the identified effort reductions and also under status quo (2013) effort levels
  3) Estimate the real annual rent generated (undiscounted) and the cumulated net present value of those rents over the 20 year period
  - Annual fishery economic rents are used to illustrate the implications for fishery profitability along the path of each scenario, while NPV provides an indication of the current value of the rents generated over the future period

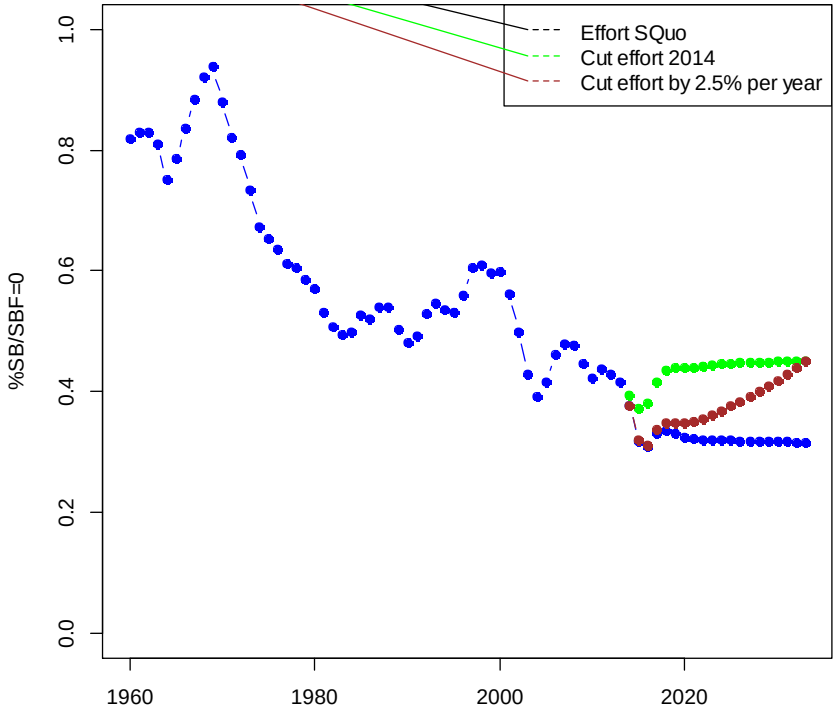
# Methodology cont.

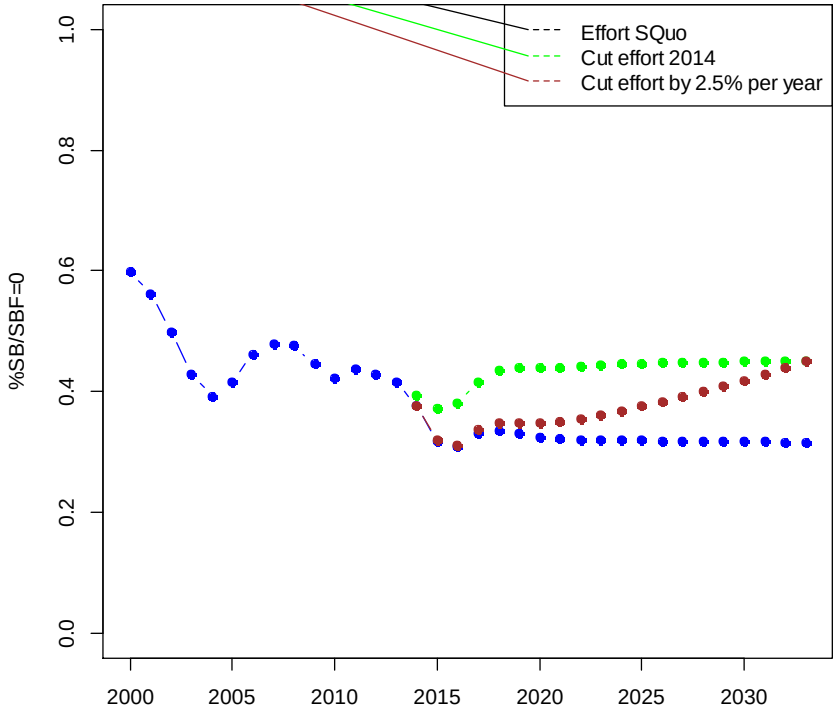
- The two types of effort regimes identified were:
  - One-off reduction of 38% in the first year
  - A phased reduction where effort is reduced by 2.5% each year from the 2nd year onwards
- The level of effort reduction required under each regime was estimated using deterministic 20 year projections based upon the 2015 assessment for south Pacific albacore.
- For yellowfin and bigeye tuna, the catch associated with the effort levels identified are estimated by applying the relative annual change from the respective stock assessments (2014) to that taken by the southern longline fleet targeting albacore
- The results of these management actions were compared to the ‘status quo’, whereby effort within the fishery was maintained at 2013 levels

# Assessment area and the SLL fishery



# Deterministic stock status trajectories



# Economic assumptions

- The unit prices per mt for each species are assumed to remain constant and reflect long-term averages. Despite some short term fluctuations, long-term trends for real prices of longline caught product have been flat even with significant changes in the catch of these species
- Cost per hook was initially set at $1.10, reflecting those under status quo conditions
- NPV was calculated using a discount rate of 5%

| Species/Species group | 2014 USD |
|---|---|
| Albacore | 2,464 |
| Yellowfin | 5,313 |
| Bigeye | 7,804 |
| Billfish | 4,500 |
| Shark | 1,550 |
| Others | 2,464 |

# Forgone catch

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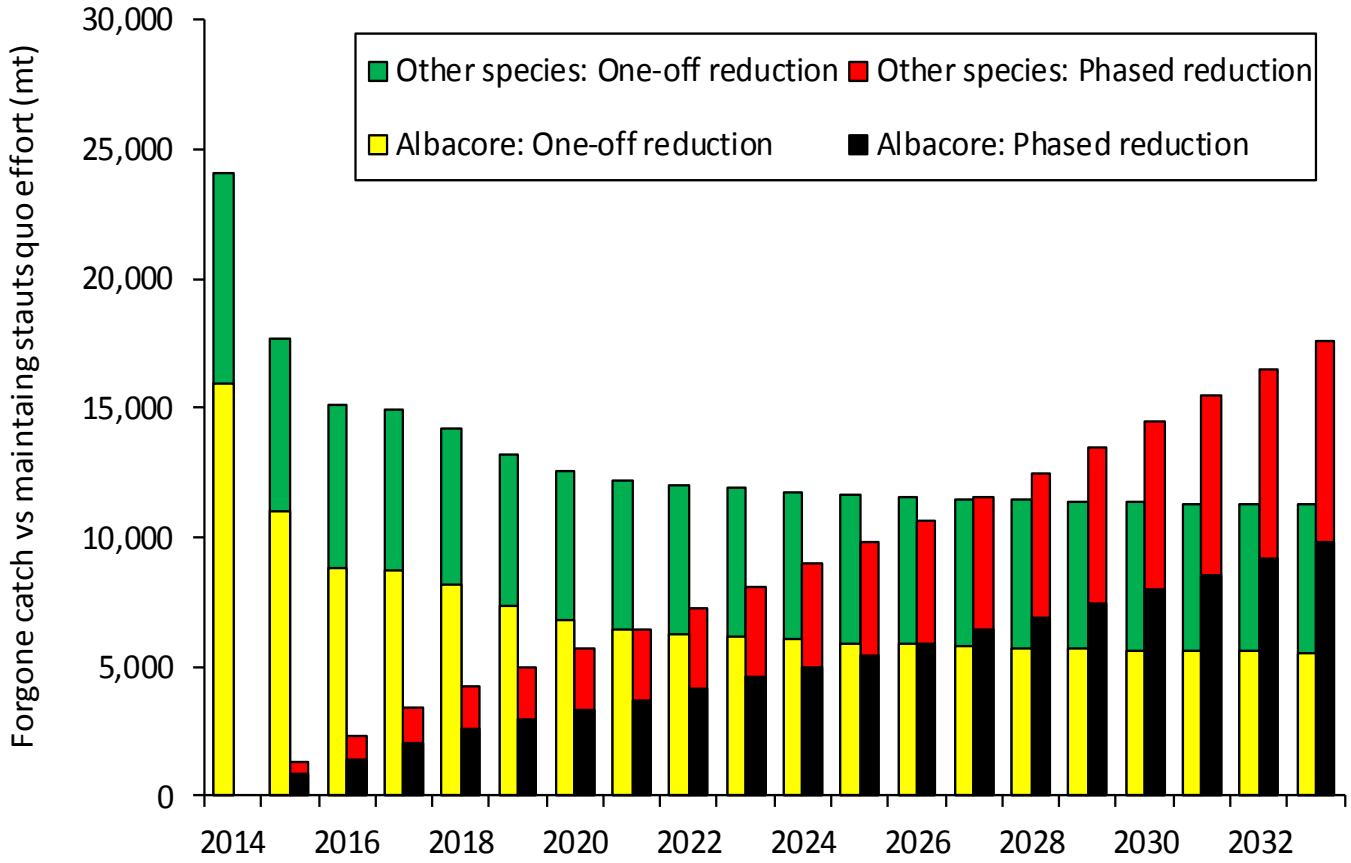
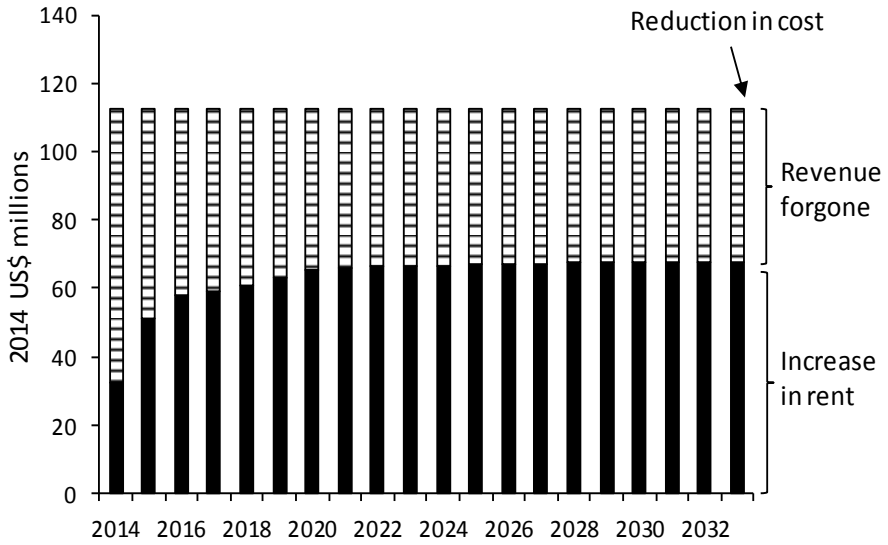
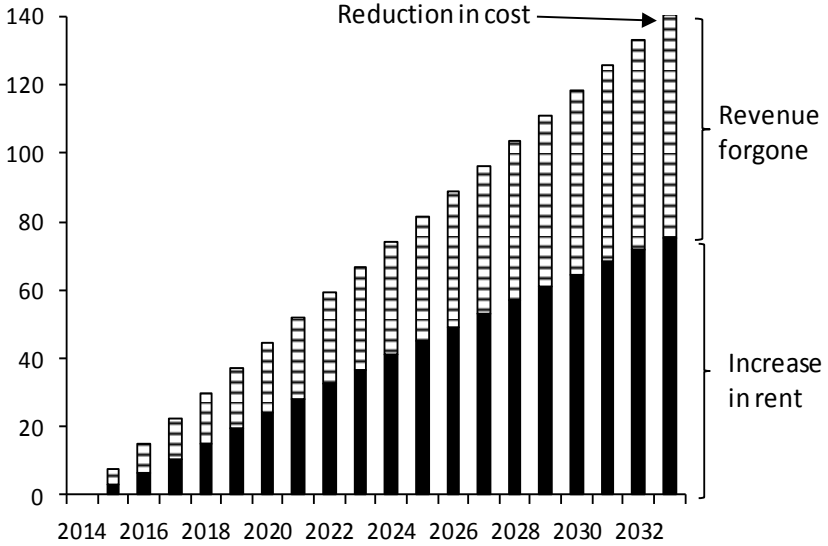


# Economic results

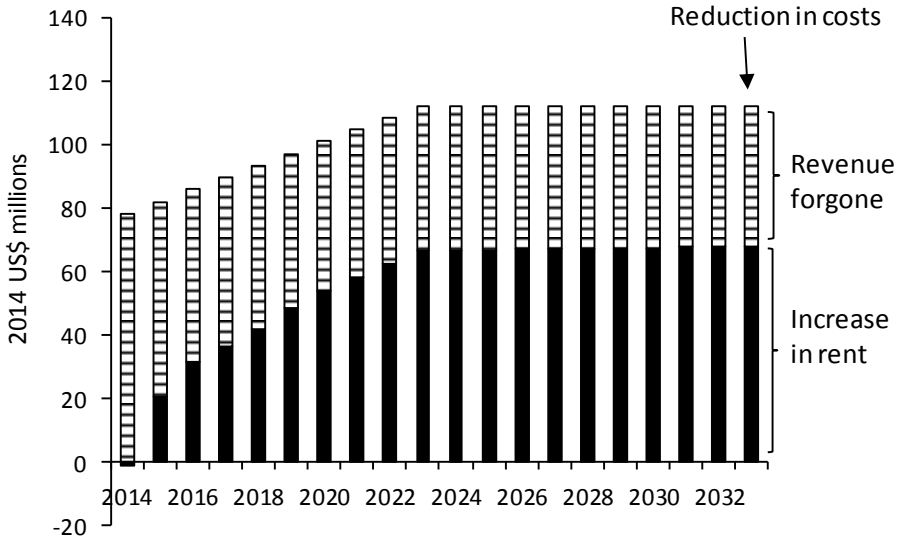



Annual reductions in economic costs, forgone revenue and changes in rent under a 38% one-off effort reduction (LHS) and a phased 2.5% effort reduction (RHS)

# Sensitivity analyses

- Vessel exit rates for one-off cut (when not proportional)
  - Scenario 1): 3.8% of original fleet size or 10% of effort cut. Average hooks set by each vessel falls by 35.6% and $/hook increase by 18.5% to $1.30 for the first year, then reduces over the next 9 years back to $1.10. NPV over 20 years is calculated to be $638 million higher than status quo
  - Scenario 2): no vessels exit. Average hooks set per vessel falls by 38% and $/hook is 20.5% higher. NPV is still estimated to be $303 million higher than status quo over 20 years.
  - For NPV to equal phased cut the exit rate for one-off cut needs to be < 0.9%



# Sensitivity analyses

- Vessel cost structure needed for one-off cut to generate no additional rent than effort status quo or phased cut
  - For NPV of rents over 20 years to equal status quo effort, economic $/hook need to be $0.75 or less. If vessels exit at just 3.8% of initial fleet size (or 10% of effort cut), this cost falls to $0.56
  - For NPV of rents over 20 years to equal that under the phased cut under the same vessel exit rate of 2.5%, an initial economic $/hook of $1.07 is required. If vessels under the one-off cut exit at double the rate of the phased cut, this cost falls to $0.80

| Scenarios | Required cost per hook |
|---|---|
| **Effort status quo** | |
| Where no vessels exit under one-off cut | $0.75 |
| Where vessels exit at 10% of effort cut | $0.56 |
| **2.5% Phased reduction** | |
| Where vessels exit at 2.5%of initial fleet size | $1.07 |
| Where vessels exit at 5% of initial fleet size | $0.80 |

# Summary and discussion

- Maintaining effort status quo (2013 levels) is estimated to reduce both the stock status and catch rate of albacore in the southern longline fishery of the WCPFC
- FFA members proposed for an interim TRP for SP-ALB of 45%$SB_{F=0}$. There are various management regimes that can recover the stock to the proposed interim TRP. The two examined in this study are a one-off 38% reduction and a 2.5% year on year phased reduction over 20 years
- While the stock rebuilds to the same TRP in 20 years for both effort cut scenarios, the economic consequences (fishery rent) are vastly different
- The forgone catch for the one-off cut is 143,000mt of albacore (or 262,000mt total catch) while the phased cut forgoes 98,000mt of albacore (or 175,000mt total catch)

# Summary and discussion

- While both effort reduction regimes yields considerably higher rent than keeping effort at 2013 levels, the NPV of rents over the period is estimated to be around $786 million higher under the one-off effort cut compared to $400 million under the phased cut, assuming proportional exit rates
- Even if no vessels exit, the one-off cut would still yield $303 million higher NPV than effort status quo. This means that if vessels are forced to exit the fishery the additional NPV of rents generated under the one-off reduction by vessels that remain in the fishery would be sufficient to cover the fixed annual costs of the exiting vessels (including a return on capital of 15%) and still earn a higher return than if status quo effort is maintained, regardless of the forced rate of exit
- And vessel exit rate for the one-off only need to be 1% or more of the initial fleet to produce higher for the same to be true when compared to the phased cut

# Summary and discussion

- These results are also robust to the likely range of initial cost levels (economic cost per hook)
- The question is then whether an effort reduction regime that results in less catch being forgone but lower levels of rent generated is preferable to one that sees higher levels of forgone catch but generates higher rents
- This will depend on the different objectives fishery stakeholders may have for the southern longline fishery
- In addition, the timescale for rebuilding has a significant impact on the level of effort cut required and the associated economic consequences. Managers may shorten or extend the rebuilding timeframes based on considerations of the level of social and economic impacts they are willing endure
- Finally, the study shows that it is important to move beyond a purely biological stock-based focus when providing management advice