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Fisheries economics: Coastal and oceanic

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Purpose

1. The purpose of this paper is to:

   a. Update Heads of Fisheries on the work undertaken by FAME in fisheries economics.

   b. Highlight some different economic techniques and the role of economic and data analysis in the policy development process.

   c. Invite heads of fisheries to discuss the work carried out in this area and make recommendations for the future direction of the work area.

2. This paper contains detailed annexes from page 8 onwards.

Background

3. As fisheries resources get depleted, the pressure to extract greater value from them increases. Economic analysis can play a significant role in making policy and management decisions more evidence-based and in identifying the most efficient options for intervention in the fisheries sector.

4. Economic analysis is often mistaken for financial appraisal which concerns only money and the cash flows of private companies, individuals or public institutions. However, there are many forms of economic analysis that go beyond financial appraisal. Economic cost-benefit analysis, for example, tries to determine whether a policy or project is beneficial to the whole of society rather than to individuals, companies or governments in isolation. This means the non-monetary costs and benefits such as the social, health and environmental impacts are also taken into consideration as are the distributional impacts.

5. Economic analysis and advice has been utilised throughout the policy and project life cycle.

    a. ***Design*** – Economic analysis contributes to the understanding of the policy and project context. It assists in understanding of the root causes of a problem and potential solutions to address it. It can provide decision makers with an opportunity to examine the impacts of different options before taking a decision.

    b. ***Implementation*** **–** Economic analysis can help understand why a policy or project may not be achieving its expected outcomes. Economics can then be used to design interventions that will enhance the project outcomes.

    c. ***Evaluation*** **–** On completion, an economic analysis will contribute to the evaluation of and learning from a project.

6. SPC has developed a range of economic tools to assist with fisheries project or policy development such as methods for assessing aquaculture project feasibility or fishing business viability as well as a range of record keeping frameworks in support of business and policy analysis.

7. SPC has one fisheries economist based in the Nearshore Fisheries Development Section (NFDS) in the Coastal Fisheries Programme (CFP). Within the Oceanic Fisheries Programme (OFP), bioeconomic modelling work is conducted by two national Scientists, in collaboration with colleagues from other key organisations such as Forum Fisheries Agency (FFA).

8. This paper presents a number of short case studies of the economic work undertaken for member PICTs since the Heads of Fisheries Meeting in March 2015. A policy brief has also been prepared and circulated to provide a wider ranging summary of economic analysis for policy and project development and evaluation. This paper and the policy brief are designed to stimulate thinking by member representatives as to where SPC economic skills could be best deployed to benefit PICTs.

9. More detail on the case studies discussed is provided in the annex to this working paper (page 8 onwards).

Summary of Case study 1: Deep water snapper: Bioeconomic modelling

10. Bioeconomic modelling combines science, economics and fleet dynamics to understand the impact of policy decisions on the long-term sustainability of a fishery.

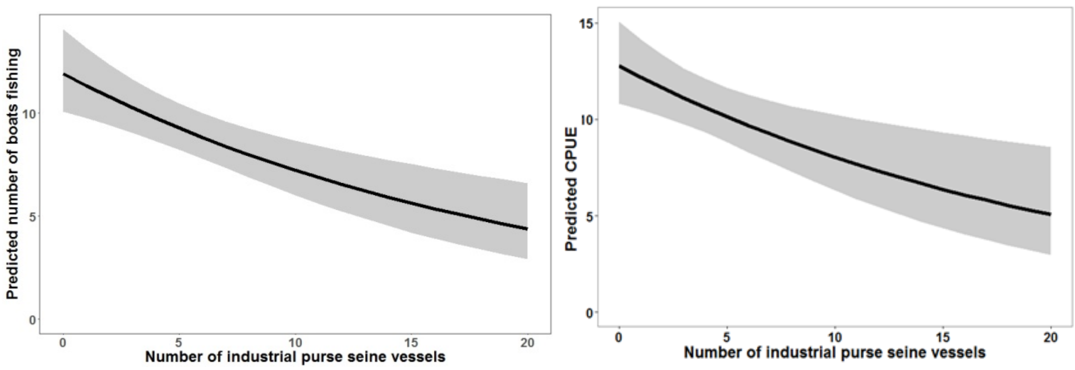
11. The impact of a simple total allowable catch (TAC) measure was estimated for the Tongan deepwater fishery. It showed that over a 10 year period[1] management of the fishery through a TAC would increase profits to the industry and the fishery would be able to support more vessels in the longer term.

12. The modelling provided Tongan fisheries with evidence to present to stakeholders of the long term impacts of decisions such as changing the total catch limits, increasing or decreasing vessel numbers and other management measures that may be effective such as day or gear limits. This data has been used to demonstrate to industry stakeholders that good management is *not* a detriment but a benefit to their businesses.

Summary of Case study 2: Interactions between artisanal fishers and industrial vessels

13. HoF 7 endorsed SPC to investigate the interactions between artisanal and industrial vessels. In order to study interactions between artisanal fishers and industrial vessels data collected through the artisanal tuna programme and Vessel Monitoring Scheme (VMS) was used. The approach was different to the traditional interaction literature that reviews direct conflicts between vessels or within the fish stocks themselves. This study examined how industrial vessels impacted the willingness of artisanal fishers to go fishing and the implications of this.

14. The results showed that the number of fishers fishing (left hand graph below) falls as more industrial vessels are present in port, suggesting that the presence of industrial vessels impacts the willingness of fishers to go fishing in the first place. The analysis also suggested CPUE declined with increasing presence of industrial vessels.



[1] The analysis can be carried out over any required time period.

15. During the time period of analysis – 4 years – we estimate that due to the presence of industrial vessels in port, more than 2,200 artisanal fishing days were lost. This resulted in a catch loss of 676 tons of fish for the local market, a loss of USD2.7m in revenue for artisanal fishers and a reduction of fish availability the equivalent of 11,500 person years[2]. Although the presence of industrial vessels also brought significant benefits to the local economy.

16. What is clear is that there is a potential distributional issue that countries with major industrial ports may need to address. Employment may be reduced in the artisanal sector, but increased in the industrial sector; food supply may be reduced in the artisanal sector but substituted by by-catch off loads; revenues may be decreased in the artisanal sector, but local service industry revenues may increase and access fees are an important source of government revenue.

17. Further work needs to be undertaken to uncover the specific reasons behind the identified relationships and the implications of these findings, but this work is a first step and provides valuable analysis to inform policy considerations beyond that which has been provided in traditional stock interaction studies.

Summary of Case study 3: Cost benefit analysis: using underwater breathing apparatus (UBA) to harvest sea cucumber (BDM) in Fiji

18. The aim of this analysis was to provide an indication of the total costs and benefits of allowing UBA exceptions for sea cucumber fishing in Fiji and suggest whether or not exemptions should be re-examined or disallowed under new legislation.

19. The results showed that the use of UBA for the harvesting BDM has **a negative social impact**. This analysis showed that over a three year period allowing UBA exemptions for BDM harvesting provided a net present value (NPV) of –FJD 5,750,000. This means that **allowing UBA exemptions had an estimated cost to society of FJD 5.8m over three years**. This study focused only on 2012-2014 and did not project future injury or harvest rates. It is likely that as future harvest rates fall and divers have to go to more extreme lengths to harvest BDM accident frequency and impact will increase.

20. Based on this analysis policy advice was provided to Fiji Fisheries suggesting that allowing the exemptions has a detrimental cost to society as a whole. The analysis suggested that the Minister should consider banning these under new legislation, which has now been implemented.

Summary of Case study 4: Economic contribution of game fishing in New Caledonia

21. The game or sports fishing industry is a potentially important niche industry and development opportunity for many PICTs. For two years SPC has worked with Blue Caledonie Fishing in New Caledonia to collect data on trips, catch and spending by clients. This data can now be used to provide a preliminary assessment of the potential of sports fishing to the New Caledonian economy.

[2] Based on the recommended yearly intake figures of 35kg per person per year in Bell et al (2009).

22. It is estimated that New Caledonia could support approximately 10 charter fishing operators similar to the one in this case study, whilst maintaining good environmental and resource standards. This equates to a potential direct economic value to New Caledonia of AUD 1.25 million and an indirect economic value of between AUD 1.13 million and AUD 3.59 million. Further, a developed industry in New Caledonia of 10 operators could be expected to support between 32 and 41 jobs across in the economy.

23. This case study demonstrates that sports fishing can make a significant contribution to a local economy. It provides government with catch data to assist in game fishing, and wider, fisheries management and a justification for supporting legislation and policies. Further, it provides businesses with investment data that they can share with financial institutions.

Summary of Case study 5: Identification of target reference points for south Pacific albacore that provide profitability in the southern longline fishery

24. Profitability within domestic fisheries south of the equator targeting south Pacific albacore has declined in recent years as catch rates have fallen. In years where fuel and other prices are particularly high, or catch rates particularly low, this has led to vessels tying up and not fishing. These issues have led to calls for reference points for the south Pacific albacore stock, in particular a target reference point that reflects managers' and stakeholder's biological and socio-economic fishery objectives (e.g. profitability, employment, export revenue, etc.).

25. To inform discussions of candidate target reference points, SPC has worked closely with the FFA in examining alternative future albacore stock levels and the resulting average levels of fleet profitability. Those analyses show that to achieve some – but not maximum – profitability still required a reduction in effort of around one third relative to 2013 levels. In the light of falling profitability in domestic fleets, managers need to decide if and how those reductions are taken. SPC and FFA have been working to demonstrate the biological and economic consequences of alternative management approaches to achieving that reduction, to identify which approach is financially more beneficial. For example taking a large reduction in the near future may be financially better in the long run than smaller annual effort reductions over a number of years.

26. Given the regional nature of the fishery and the role of distant water fishing nations within it, the discussions on target reference point levels and how effort reductions may be achieved, are ongoing. SPC and FFA continue to provide advice and information in support of these discussions.

Summary of Case study 6: National bioeconomic analyses

27. The OFP, working together with FFA, has been providing bioeconomic analyses of the industrial longline fisheries to SPC member nations. These analyses are targeted at "rightsizing" the size of fleets given the history of catch rates and the costs associated with fishing within each country.

28. The OFP has developed a sophisticated, but user friendly spreadsheet tool (termed the "Longline Tuna Tool, or LTT) to provide guidance to member nations on setting economically, and biologically, sustainable levels of fishing.

29. Over the past 5 years, OFP have utilized early versions of this model in several countries and, in a number of cases, fleet sizes were reduced – by up to 50% - using the rationale illustrated with this tool. OFP hopes to continue presenting this work in all SPC-member nations with industrial longline fisheries both to demonstrate how bioeconomic modelling can help in their management decision making, but also to provide assurance across the entire region that all member nations are sharing in the burden of reducing effort levels to preserve the profitability and sustainability of the tuna longline fishery.

Monitoring and evaluation

30. An integral requirement to provide grounded economic analysis is data. Economists are skilled in working in data limited environments, however some data are likely to be required. As such, the fisheries economist and NFDS are centrally involved in collecting data to ensure that fisheries development activities such as sports fishing, bagan fishing, FADs, new boats and others can be effectively evaluated. More than 30 individuals were trained in data collection last year.

Capacity development

31. The SPC fisheries economist also provides capacity development across all member countries and territories through annual course for fisheries officers at the Nelson Marlbough Institute of Technology (NMIT) and the Vanuatu Maritime College (VMC). Further training is provided to women fishers, fish sellers and aquaculturists through the Pacific Fisheries Training Programme (PFTP) funded by the New Zealand Aid Programme. In 2016, SPC also trialled economic and data analysis attachments.

32. Since 2015:

    a. Under the PFTP program 23, largely women fishers, fish sellers and aquaculturists have been trained in small business finance skills.

    b. At the four week residential course at VMC 26 national fisheries staff members from 14 PICTs have been trained in the basic vessel finance and project management.

    c. During the wider NMIT course, 17 individuals across 10 PICTs have been trained in the basics of fishing business finance and management.

    d. A new program in 2016 was the creation of economic attachments to SPC for economists and data analysts. Three national fisheries staff, from 2 PICTs, were based at SPC for an attachment with the fisheries economist in 2016.

    e. Other ad-hoc training was also undertaken in the field, including data collection training and ad-hoc fisheries financial management training.

33. Stock Assessment Training Workshops (originated in 2006 and run annually until 2012) resumed in 2015. These workshops, which have trained more than 150 participants over the years, teach the basics of stock assessment and allow attendees to productively contribute to regional fisheries meetings. Many of the attendees now occupy high level positions in national fisheries agencies.

Future work

34. The future work plan of both coastal and oceanic fisheries economic analysis and training is driven by SPC member country requests and SPC continues to be reactive to the needs of our members.

35. Currently the work plan contains activities such as on-going FAD monitoring, refining the bioeconomic modelling of snapper, deployment and evaluation of bait fisheries, data collection and analysis of sports fishing activities and continued bioeconomic work with the Longline Tuna Tool.

36. SPC, if endorsed by HoF and additional funding successfully sourced, will continue to provide capacity development activities and examine the future options for expanding these such as more economic attachments or/and junior professional programmes.

Recommendations

37. Heads of Fisheries are invited to:

    a. Note the activities that have that have been carried out;

    b. Reaffirm interest and commitment to economic analysis for fisheries management and policy decisions acknowledging that these decisions have management, livelihood and food security implications;

    c. With b, endorse economic analysis as a priority area of work and task FAME, in collaboration with other regional agencies as appropriate, to seek additional funding to expand future work in this area in line with priority activities;

    d. Identify and prioritise upcoming national and regional needs in economic and analytical work in both coastal and oceanic fisheries;

    e. Prioritise upcoming capacity development needs in economic analysis within PICT fisheries administrations and identify the preferred options for addressing those needs.

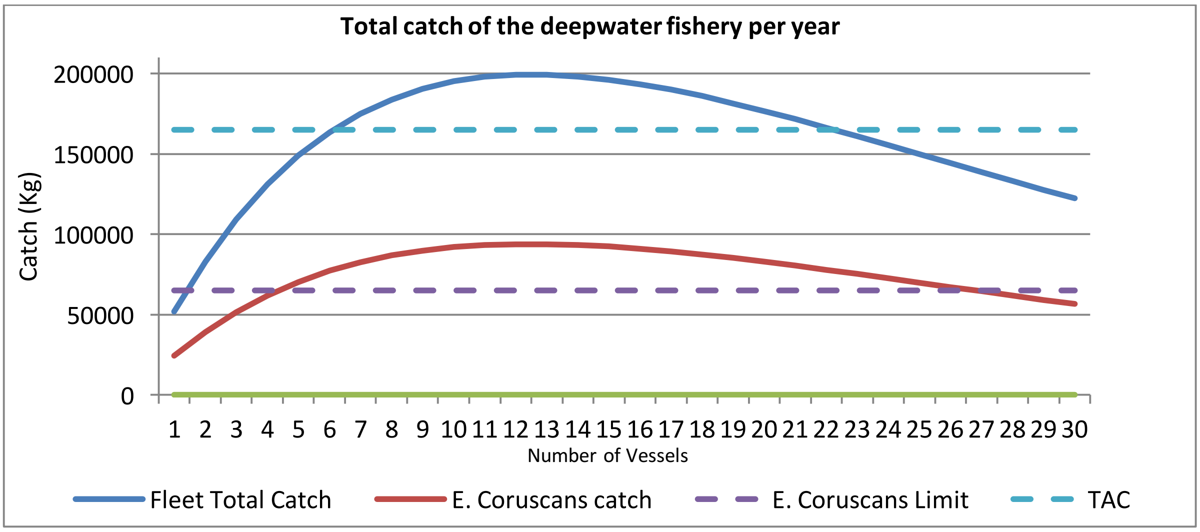
Annex: Case study details

Case study 1: Deep water snapper: Bioeconomic modelling

Bioeconomic modelling combines science, economics and fleet dynamics to understand the impact of policy decisions on the long-term sustainability of a fishery. This case study presents work carried out in Tonga on the deep water snapper industry, building on the scientific work carried out by Ashley Williams and colleagues presented at Hof9. For confidentiality reasons we do not present the actual data or advice provided to the Tongan Ministry of Fisheries.

SPC[3] produced an effort-multiplier based bioeconomic model for the deep water snapper fishery. The modelling relies on underlying relationships derived from an extensive database of catches from 1987 to 2015. Using this model SPC economists have been able to advise Tongan fisheries and other stakeholders on maximum economic fleet size, sustainability of the fishery, catch limits and the impacts of different fishery management options. The model may also be extended to assist in the design of an efficient regulatory, license and tax system that maximises government revenues whilst ensuring employment, food security and a profitable and sustainable fishing fleet.

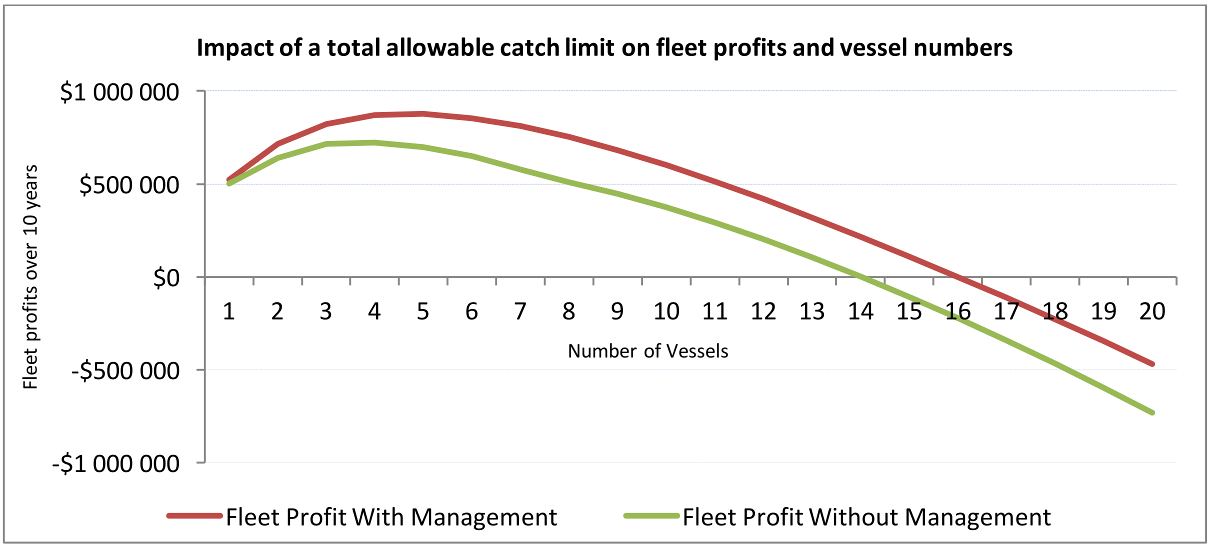
It can be seen from the diagram below that current catches from the whole fishery exceed sustainable limits as suggested by the scientific modelling (dotted lines). The management plan proposes to limit catches to sustainable levels. In this case total catch limit would be 165tons for the whole fishery.



[3] Funded by NZAid delivered through a project managed by NIWA.

The impact of a simple total allowable catch (TAC) measure can be seen in the diagram below. It shows that over a 10 year period[4] management of the fishery through a TAC will actually increase profits to the industry and the fishery will be able to support more vessels in the longer term.

The modelling provided Tongan fisheries with evidence to present to stakeholders of the long term impacts of decisions such as changing the total catch limits, increasing or decreasing vessel numbers and other management measures that may be effective such as day or gear limits. This data has been used to demonstrate to industry stakeholders that good management is not a detriment but a benefit to their businesses.



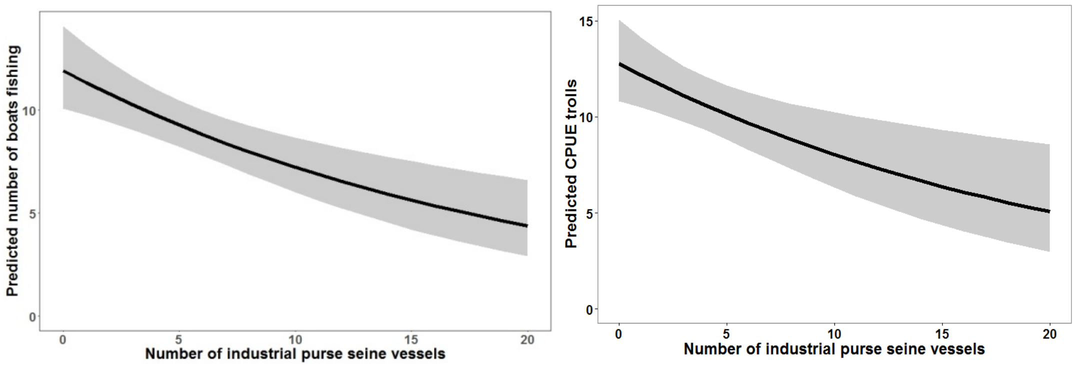
[4] The analysis can be carried out over any required time period.

Case study 2: Interactions between artisanal fishers and industrial vessels[5]

Data collectors, fisheries officers and fishers highlighted a key issue during a visit of the fisheries economist to a transhipment port; when industrial vessels were in port the fishing was poorer and fewer fishers were fishing, there was however no analysis to support this assertion. HoF 7 endorsed SPC to investigate the interactions between artisanal and industrial vessels.

In order to study interactions between artisanal fishers and industrial vessels data collected through the artisanal tuna programme and Vessel Monitoring Scheme (VMS) was used. The approach was different to the traditional interaction literature that reviews direct conflicts between boats (generally accidents or near misses) or within the fish stocks themselves. This study examined how industrial vessels impacted the willingness of artisanal fishers to go fishing and the implications of the findings.

The results show that the number of fishers fishing (left hand graph below) falls as more industrial vessels are present in port, suggesting that the presence of industrial vessels impacts the willingness of fishers to go fishing in the first place.



Previous studies have shown that industrial vessels can impact the catch of small scale vessels and it can take time for the stocks to recover after an industrial removal. This analysis supports this assertion and finds that CPUE actually decreases as the number of industrial vessels present increases. The reasons behind this finding are unclear, it may be because the industrial vessels actually decrease fish availability or that the behaviour of the artisanal fishers is changed, such that the more experienced and perhaps more effective fishers stay at home rather than go fishing and therefore there is an apparent decrease in CPUE.

The significant impact on the willingness to go fishing has important implications for food security, livelihoods and distribution policy in countries with transhipping ports.

[5] Jointly developed with Alex Tidd (Oceanic Fisheries Programme) and the article will be published as an academic paper shortly.

During the time period of analysis – 4 years – we estimate that due to the presence of industrial vessels in port, more than 2,200 artisanal fishing days were lost. This resulted in a catch loss of 676 tons of fish for the local market, a loss of USD2.7m in revenue for artisanal fishers and a reduction of fish availability the equivalent of 11,500 person years[6].

If this was true across the five major transhipment ports in the Pacific; Majuro, Tarawa, Pohnpei, Rabaul and Honiara, then this could lead to catch losses from artisanal fishers that are close to or surpass the bycatch, undersized or damaged fish unloaded from industrial vessels on to local markets.

There are also employment implications in the 2,200 lost fishing days, however transhipping also brings local employment benefits. Transhipping often employs local staff to assist in the operation. As such, transhipping can provide significant opportunities for local employment. Preliminary estimates suggest that in the port of study this could be upwards of ten to twenty thousand person days over the study period, far greater than the estimated five thousand person days lost in the artisanal fishery.

Industrial fisheries make significant contributions to the economies of the Pacific Islands. Revenue from license fees in Solomon Islands was USD27m, Tuvalu received more than 85% of its government revenue from license fees and the Marshall Islands earned USD17m for access rights in 2014 (Gillett et al 2016). This far out strips the USD2.7m loss to artisanal fishers suggested by this analysis.

What is clear is that there is a potential distributional issue that countries with major industrial ports may need to address. Employment is reduced in the artisanal sector, but increased in the industrial sector; food supply may be reduced in the artisanal sector but substituted by-catch off loads; revenues may be decreased in the artisanal sector but local service industry revenues may increase and fees are an important source of government revenue.

The analysis shows that despite very large access revenues, the presence of industrial vessels near local landing sites is likely to impact the supply of fish from the artisanal boats. More work needs to be done to uncover the specific reasons behind this relationship, but this work is a first step in this process and provides valuable analysis to inform policy considerations beyond that which has been provided in traditional stock interaction studies.

[6] Based on the recommended yearly intake figures of 35kg per person per year in Bell et al (2009).

Case study 3: Cost benefit analysis: Using underwater breathing apparatus (UBA) to harvest sea cucumber (BDM) in Fiji

The aim of this analysis was to provide an indication of the total costs and benefits of allowing UBA exceptions for sea cucumber fishing in Fiji and suggest whether or not exemptions should be re-examined or disallowed under new legislation.

This analysis covered both the direct financial costs incurred as a result of UBA accidents, such as hospital visits, and the social impact costs such as the impact of an accident on an individual's quality of life. The ecological cost of harvesting BDM was excluded. The value of the BDM harvest using UBA exemptions has been included as a benefit to society and to Fiji.

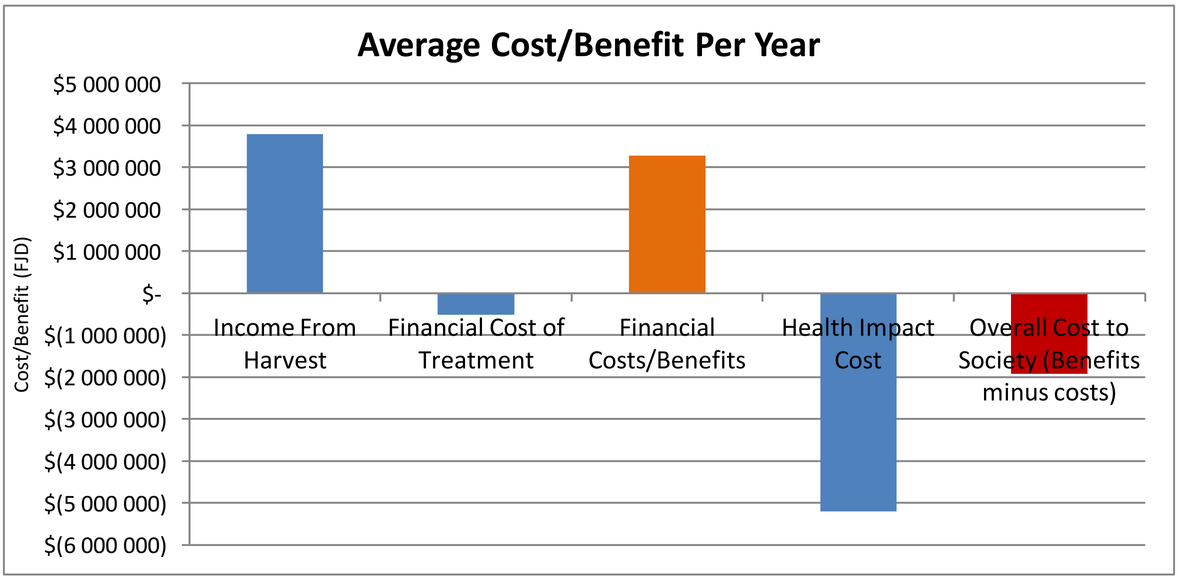
Benefits of UBA

The value of the catch of the sea cucumber fishery using UBA is not known. A range of sources suggested an average income from BDM per day is between $100 and $300, we took the mid-point of these estimates and assumed that each diver earns $200 per day. As a result, we estimated that the income from harvesting BDM under the exemptions was approximately FJD 3.9m.

Financial costs

The analysis used hospital data to model the direct financial costs of providing hospital treatment to those involved in UBA accidents. The modelling showed that the average cost of hospitalisation was FJD 515, 000 per year.

Modelling therefore suggested that income from harvesting BDM is greater than the cost of treating the accidents. However, this is where economics differs from financial analysis; it takes account of the social and on-going impacts of the activity.



Social impacts

To undertake a social cost benefit analysis economists place a monetary valuation on life. Valuing life is an emotive subject, however economists and health professionals have developed a number of methods to 'value life'. The total value of a statistical life using this technique is calculated and injuries suffered have a disability weighting which reduces this value for each year that the injury is suffered.

The total reduction in the value of a life as a result of the injuries suffered from reported hospital cases is over FJD 5m. The analysis only includes those cases that reported to hospital, it is like the cost is actually far greater as many cases will go unreported.

Conclusions

The results showed that the use of UBA for the harvesting BDM has **a negative social impact**. This analysis showed that over a three-year period allowing UBA exemptions for BDM harvesting provided a net present value (NPV) of –FJD 5,750,000. This means that **allowing UBA exemptions had an estimated cost to society of FJD 5.8m over three years**. This study focused only on 2012-2014 and did not project future injury or harvest rates. It is likely that as future harvest rates fall and divers have to go to more extreme lengths to harvest BDM accident frequency and impact will increase.

Based on this analysis policy advice was provided to Fiji Fisheries suggesting that allowing the exemptions has a detrimental cost to society as a whole. This analysis suggested the Minister should consider banning these under new legislation, which has now been implemented.

Case study 4: Economic contribution of game fishing in New Caledonia

The game or sports fishing industry is a potentially important niche industry and development opportunity for many PICTs. For two years SPC has worked with Blue Caledonie Fishing in New Caledonia to collect data on trips, catch and spending by clients. This data can now be used to provide a preliminary assessment of the potential of sports fishing to the New Caledonian economy.

Data were collected from sports fishing trips during the 2014–2015 period. These trips involved 59 fishers catching a total of 452 fish. The clients spent a total of 348 person nights in New Caledonia, with an average trip duration of just under 6 nights. In 87% of the cases fishing was believed to be the primary purpose of visiting New Caledonia.

Data showed that clients spent a total of AUD 250,000 in New Caledonia, equating to an average outlay per person per night of AUD850. Client spending broke down as 53% on charter costs, 14% on accommodation and 22% on food and drink. Local transport and souvenir spending made up a small amount of spending. International transport was necessarily excluded from calculations.

Tourist spending allows businesses and employees to make expenditures in other branches of the economy. For example, business will pay for other goods and services in support of their businesses such as suppliers, mechanics, accountants, outfitters, advertising and others. Individuals who are employed in the business will also spend their income on items such as food, housing, transport, entertainment and others. These indirect economic benefits can also be assessed. In the absence of better information, multipliers were used to calculate the indirect economic value of sports fishing to the New Caledonian economy.

It is estimated that New Caledonia could support approximately 10 charter fishing operators similar to the one in this case study, whilst maintaining good environmental and resource standards. This equates to a potential direct economic value to New Caledonia of AUD 1.25 million and an indirect economic value of between AUD 1.13 million and AUD 3.59 million. Further, a developed industry in New Caledonia of 10 operators could be expected to support between 32 and 41 jobs across in the economy.

This case study demonstrates that sports fishing can make a significant contribution to a local economy. It provides government with catch data to assist in game fishing, and wider, fisheries management and a justification for supporting legislation and policies. Further, it provides businesses with investment data that they can share with financial institutions.

Further extensive economic-based studies on sport fishing initiatives for economic development in PICTs need to be undertaken to fully understand the cost-benefit of investment in the industry and how to ensure that local individuals and organisations benefit from the advantages that this brings.

Case study 5: Identification of target reference points for south Pacific albacore that provide profitability in the southern longline fishery

Profitability within domestic fisheries south of the equator targeting south Pacific albacore has declined in recent years as catch rates have fallen. In years where fuel and other prices are particularly high, or catch rates particularly low, this has led to vessels tying up and not fishing. This has knock-on effects for the support and processing sectors in some member countries.

This has led to calls for defined reference points for the south Pacific albacore stock. Reference points are an important component of fisheries management, and relate to levels of the fish stock that provide desirable outcomes for the fishery. A target reference point reflect managers' and stakeholder's biological and socio-economic fishery management objectives (e.g. profitability, employment, export revenue, etc.).

SPC analyses have shown that at recent levels of southern longline fishing effort, there is an increasing risk that the stock may fall below the limit reference point level. This has the potential to lead to biological concerns for the stock. In addition, those reduced stock sizes are estimated to lead to further declines in catch rates of up to 15%, and hence further concerns for future fishery profitability.

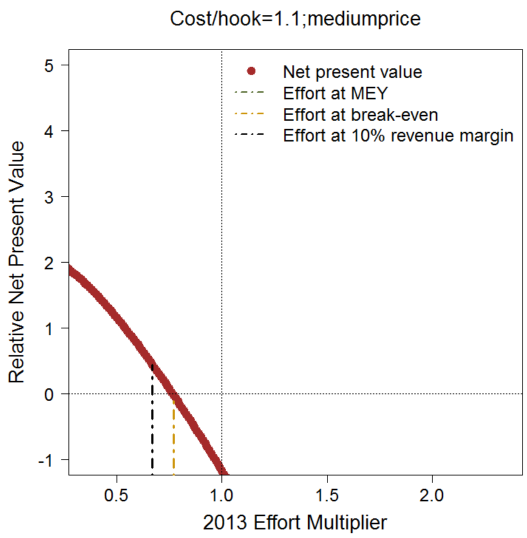
To inform discussions of candidate target reference points, SPC has worked closely with the Forum Fisheries Agency (FFA) in examining alternative future albacore stock levels and the resulting average levels of fleet profitability.

Notably, the 'default' target level used within the WCPFC of maximum sustainable yield (MSY) implies further reductions in albacore stock size, considerable risk of the stock falling below the limit reference point, very low catch rates, and would result in the majority of fleets making a financial loss.

Maximising profitability across fleets implied very significant reductions in fishing effort, and is unlikely to be palatable for fishery managers. Smaller effort reductions that achieve some – but not maximum – profitability still required a reduction of around one third relative to 2013 levels, however.

Levels of effort reduction are significant, therefore. In the light of falling profitability in domestic fleets managers need to decide if and how those reductions are taken. SPC and FFA have been working to demonstrate the biological and economic consequences of alternative management approaches to achieving that reduction, to identify which approach is financially more beneficial. For example, taking a large reduction in the near future may be financially better in the long run than smaller annual effort reductions over a number of years.

Given the regional nature of the fishery and the role of distant water fishing nations within it, the discussions on target reference point levels and how effort reductions may be achieved, are ongoing. SPC and FFA continue to provide advice and information in support.



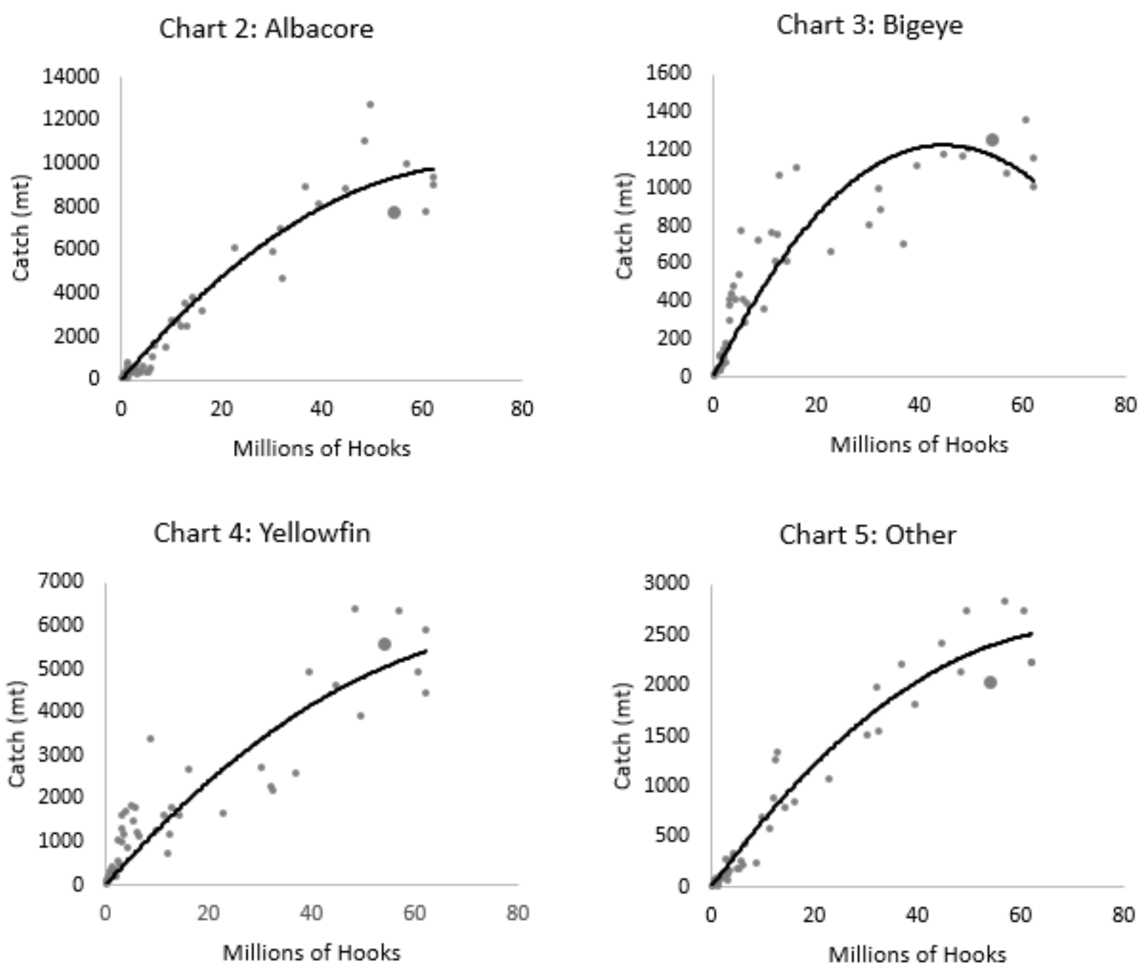
Relative profitability (net present value) of the southern longline fishery at effort levels relative to those seen in 2013, where the fishery is assumed to have a cost per hook of $1.10, and the price of albacore and associated species is comparable to recent level ('medium price'). The red curve represents the profit levels – at 2013 effort (multiplier = 1), the fishery is – on average – unprofitable. Reductions in effort (multipliers less than 1) allow profitability to recover to a level of 'break even' (where vessels being to make a basic return on their investment; gold vertical line) or a 10% additional profit (black vertical line). Maximum economic yield (MEY) is achieved where the curve reaches a peak, and is outside the range of effort levels examined here.

Case study 6: National bioeconomic analyses

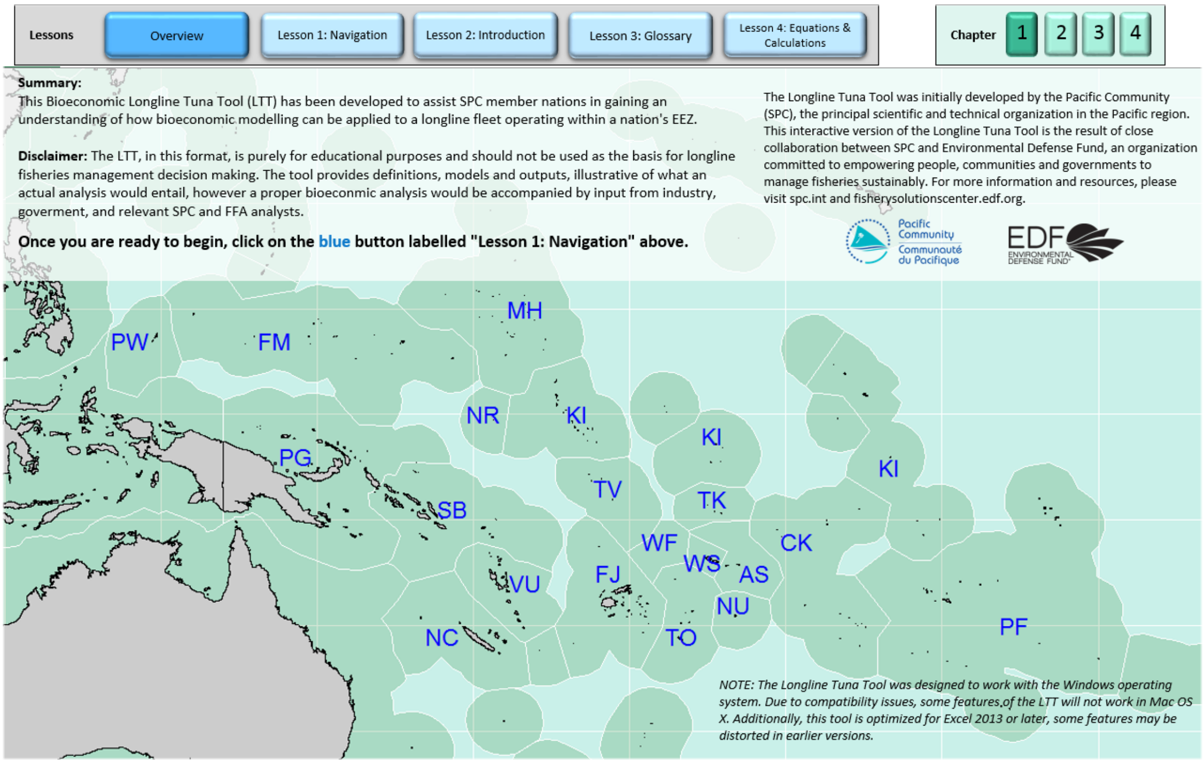
While work proceeds to develop target reference points for albacore as well as to establish regional limits on catch and/or effort levels via multi-national arrangements such as the PNA Longline Vessel Day Scheme and the Tokelau arrangement, there remains the immediate need for individual nations to set national effort levels, with economic profitability being a major concern.

The OFP has been providing bioeconomic analyses of the industrial longline fisheries to SPC member nations for several years. These analyses are targeted at "rightsizing" the size of fleets given the history of catch rates and the costs associated with fishing within each country.

At the heart of the analyses is the basic relationship between increasing effort and the general decline in catch rates. The figure below, assembled as a composite from several countries, illustrates the ubiquitous pattern of the decreasing rate in catch as effort increases seen in industrial longline fisheries.

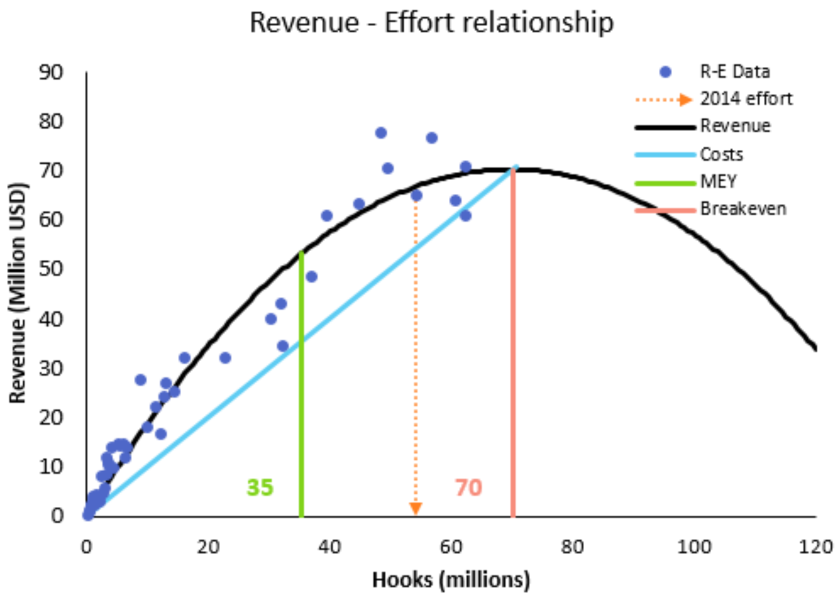


The OFP has developed a sophisticated, but user friendly spreadsheet tool (termed the "Longline Tuna Tool, or LTT) to provide guidance to member nations on setting economically, and biologically, sustainable levels of fishing. The introductory page of the tool is shown below.



With the assistance of FFA and the Environmental Defense Fund, two versions of the LTT have been developed. One is a self-guided training tool that develops and illustrates the theory behind bioeconomic modelling and permits the user to adjust input (in the form of costs and prices) and identify economically sound fishing effort levels. The second version of the tool is country specific – 17 country-ready tools complete with actual catch and effort data that can be used in country by SPC and FFA analysts to work with country fisheries managers.

The figure below provides an illustration of the advice that results from the analysis – determination of two important levels of fishing effort, termed MEY (Maximum Economic Yield) and BE (Breakeven). This figure provides results in terms of millions of hooks fished, the outputs can then be translated to either fishing days or number of vessels to license each year.



With the input of local managers and the involvement of stakeholders, the parameters that affect the shape of each of the curves can be determined and choices then made between such desired outcomes as maximized profit or maximized employment. The effect of subsidies, differing sized vessels and so on can also be explored.

Over the past 5 years, OFP have utilized early versions of this model in several countries and, in a number of cases, fleet sizes were reduced – by up to 50% - using the rationale illustrated with this tool. OFP hopes to continue presenting this work in all SPC-member nations with industrial longline fisheries both to demonstrate how bioeconomic modelling can help in their management decision making but also to provide assurance across the entire region that all member nations are sharing in the burden of reducing effort levels to preserve the profitability and sustainability of the tuna longline fishery.