Economic Analysis of Artisanal Fisheries in Fiji: Issues of Profitability and Sustainability

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Abstract

Fisheries activities are part of the culture of the Pacific island people. Furthermore, it also serves as a major source of livelihood for the millions of population in the islands. It plays an important role in their diet and is also a major source employment and income generation. However, the nature of property rights with respect to this resource could lead to unsustainable resource extraction practices. The open access nature of the resource leads to resources exploitation rather then sustainable harvesting practices. In this paper, primary data on Fiji's artisanal fisherman and their fishing operation is collected. This data is used to examine the profitability and sustainability issues of Fiji's artisanal fisheries. Results from the study suggests that artisanal fisheries in Fiji makes enough profit to earn above poverty line income. However, if the resource extraction is not carried out in a sustainable manner, then it could reduce the share of the commons over time leading to a gradual depletion of the stock.

Key words: common property, open access, sustainability, mean sustainable yield, artisanal fisheries.

Introduction

The South Pacific islands are found in an area roughly bounded by the tropics and lying between 130^0E and 125^0W. The islands within the Pacific are group into three cultural grouping, namely Melanesia, Micronesia and Polynesia. The Melanesian islands are all relatively large archipelagos and include Papua New Guinea, the Solomon Islands, Vanuatu, Fiji and New Caledonia. Polynesia includes American Samoa, the Cook Islands, French Polynesia, Niue, Pitcairn, Tokelau, Tonga, Tuvalu, Wallis and Futuna and Western Samoa while Micronesian islands lie mainly north of the equator and include the Federated States of Micronesia includes Yap, Chuuk, Pohnpei, Kosrae , Guam, the Northern Mariana Islands, Marshall Islands, Nauru, Palau, and Kiribati.

A common bonding between these groupings is the reliance of a large proportion of their populations livelihood on marine resources. The existence of a large exclusive economic zone at their disposal, approximately, 30.5 million sq. km., allows them this strategic advantage over other land lock countries. In the early days when population was small, marine resources were abundant, harvesting of this resources was carried out without any major concern for depletion of stock or the economics of such activities. However, over time, both local and international demand for marine resources has

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placed this resource and the resources users under immense pressure. This pressure has resulted in resources users to be mindful of the level of stock and also to the economics of harvesting a particular level of stock. At the global level, almost 70% of the individual fish stocks around the world are fully to heavily exploited, overexploited or depleted (GARCIA and NEWTON, 1997).

Fiji is no exception to this concern for examining the economics of resource use. Fiji is endowed with 1.29 million square kilometers exclusive economic zone which is by no means the largest in the Pacific Islands region, and far from being the richest in fish and other marine resources. The Fisheries sector alone contributes to 2.2% towards the overall Gross Domestic Product (GDP) of the country (Table 1). In terms of the export earnings, it contributes 5.8% of the total merchandise exports, the fourth largest. It also plays a very important role in providing employment and income to the rural communities in Fiji.

Table 1: Contribution of Fisheries to Gross Domestic Production of Fiji, 1985-02.

Year	Fisheries as % of GDP
1985	1.4
1986	1.2
1987	1.7
1988	1.7
1989	1.1
1990	0.9
1991	1.0
1992	1.0
1993	1.0
1994	1.2
1995	1.4
1996	1.5
1997	1.3
1998	1.4
1999	1.7
2000	1.8
2001	2.2
2002	2.2

Source: Fiji Current Economic Statistics, (Various years), Government of Fiji.

The sector also acts as a buffer during natural disasters when a large proportion of the rural population turn to this sector for a temporary source of livelihood. Given that the fisheries sector plays such an important role in the socio-economic objective of Fiji's economy, the broad objective of the government with respect to the above sector has been (Ministry of Agriculture, 1998):

- To improve production from aquatic resources thorough culture;
- To further develop fisheries of the EEZ and with special encouragement for locals to fully participate (owning);
- To improve the quality of and increase value added to exports; and,

- Encourage the implementation of sound business management methods by and in co-operation with local fisherman and to devolve Government activities to private sector as far as possible.

The issue of maintaining a sustainable fisheries stock arises out of a inherent characteristic of this resource which distinguishes it from all other natural renewable resources. This characteristic is the nature of property rights. Following BROMLEY (1991), these property rights can be defined as follows. If the resource users observe rules determined by a government or government institution, then the fishery is said to be state property. If the resource users have a right to decide on socially acceptable uses by themselves, then the resource is owned privately. If the resource use is allocated, by virtue of national constitution, to a group of individuals only, then the resource is said to be a common property. However, if any member of the society can access the resource based on a fee and harvest any amount of the resource, then the resources is said to have open access conditions. The fisheries resource can also be called Common Pool Resource (CPR) because it is difficult to exclude multiple individuals from appropriating from the resource stock, such as is the case when the resource stock is not partitioned by well defined and enforced property rights regime. It features rivalry in consumption meaning that resource units appropriated by one user reduces the amount available for the other users (this characteristics differentiates it from a pure public good). It is this common pool nature of these resources which provides an open access to all users that could lead to its demise. HARDIN (1968) states:

> The rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another.....But this is the conclusion reached by each and every rational herdsman sharing the commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his heard without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons (p. 1244).

The fisheries resources in Fiji and the world needs to ensure that harvesting is done at sustainable levels or the ruin of this common is inevitable. For this to occur, research must be done on a periodic basis to determine the stock levels and revision of MSY values. A detailed study on subsistence and artisanal fisheries was carried out in Fiji in 1993 by a group of scientists (RAWLINSON *et al.*, 1994). This study's primary objective was to estimate the volume and value of subsistence and atisanal catch in Fiji and to refine and develop a technique for documenting and estimating the catches from the subsistence fishery that could be used by the Fisheries division of Fiji in future on a regular basis. However, the study fell short of examining the issues of profitability and sustainability. Studying and developing these issues are central to developing strong and effective policies for sustainable fisheries development in Fiji.

Therefore, in this paper, the profitability and sustainability of artisanal fisheries in Fiji. The contribution of this sector to the rest of the economy is also measured by doing a partial equilibrium analysis of the factor and product market. An attempt is also made to establish a proxy for MSY which could be the basis of imposing tax on catch and

vessels to internalize the externalities arising out of these areas. Given that artisanal fisheries plays a major role on employment and income generation and is less organized and has received less attention than industrial fisheries, this study is focused on it only.

The first section of the paper provides an introduction to the subject area. The second section of the paper provides the methodology used in carrying out this study. The third section of the paper provides an overview of artisanal fisheries in Fiji. The fourth section examines the profitability and sustainability issues of artsianal fisheries in Fiji while the last section provides summary and conclusion.

Sustainability: Definitions and Conditions

Sustainable development is one of the subject area that has been received the highest scrutiny from a multi disciplinary perspective. It has been defined by many from their individual perspective. However, one of the most widely used definition is the one forwarded by WCED (1987:8) which states that sustainable development is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs". An interesting aspect of this definition is that it acknowledges equity both within a generation (across space) and between generations (over time) in terms of resource sustenance and thus its availability. Therefore, defining it more precisely, it is "a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations" (WCED, 1987:46).

While this definition has played an important role in answering a number of questions pertaining to sustainable resource use, it is still quite vague and could be subject to different interpretations, confusions and disagreements about the conceptual and operational content of "sustainability" (HEDIGER 2000). These disagreements has led rise to different paradigms that are referred to as "weak" and "strong" sustainability principles (HEDIGER 1999).

HEDIGER (2000) defines "weak sustainability" as an economic value principle which is founded within the body of neoclassical capital theory. The theory states that a level of aggregate capital along with human and natural capital must be maintained intact over time. In more narrow terms, SOLOW (1986) argues that very weak sustainability requires that the generalized production capacity of an economy is maintained intact such as to enable constant consumption per capita through time. In broader terms, PEARCE *et al.*, (1994) states that weak sustainability requires the welfare potential of the overall capital base remain intact. In contrast, very strong sustainability calls for a set of stationary-state constraints that must be imposed on the scale of the macro-economy (COSTANZA 1991, DALY 1991). Summarizing these contributions, HEDIGER (2000) states that, (i) very weak sustainability is defined with respect to economic capital; (ii) strong sustainability is defined with respect to ecological capital; and, (iii) weak sustainability is defined with respect to total capital[1].

[1] Economic capital is defined as an economy's generalized productive capacity (which includes, machines, natural resources and social capital). Ecological capital consists of the total renewable resource stock and its carrying capacity..all those factors that determine the overall quality of the ecosystem. Natural capital is the natural resources base of a geographical area. (Hediger, 2000).

Given that sustainability implies welfare of the society, the sustainability principles can be illustrated using the social welfare function. Following HEDIGER (2000), the social welfare function can be represented as follows:

$$U = U(Y, M, S, Q)$$

with $U_Y, U_M, U_S, U_Q > 0$, and $U_{YY}, U_{MM}, U_{SS}, U_{QQ} \leq 0$ (1)

Where U = Social welfare function;
Y = Aggregate income;
M = Macroeconomic stability;
S = Social capital; and
Q = Ecological capital.

Based on the above welfare function, the weak sustainability requires keeping aggregate value U at least constant over time.

$$\dot{U} = U_Y \dot{Y} + U_M \dot{M} + U_S \dot{S} + U_Q \dot{Q} \geq 0 \qquad (2)$$

However, strong sustainability is defined in terms of economic , social and ecological sustainability:

* economic sustainability: $U_Y \dot{Y} + U_M \dot{M} \geq 0$; (3)

* social sustainability: $\dot{S} \geq 0$ (4)

* ecological sustainability: $\dot{Q} \geq 0$ (5)

Economic sustainability requires that both income and macroeconomic sustainability not decrease over time. Social sustainability requires that the social capital should not decrease over time while ecological sustainability requires that the stock of ecological capital should not decrease over time. In summary, sustainability requires a balance in all these four types of resources in order to have inter and intergenerational equity.

Methodology

This study utilizes secondary and primary data to examine the micro and macro economics of artisanal fisheries in Fiji. The data on fisherman's and their activity was obtained through interviews using structured questionnaires. Primary data was collected in Western, Central and Northern division of Fiji. The Eastern division represents a very small proportion of artisanal fisheries activities and given resources constraints, it was left out. The other three regions are well represented as stated in Table 2.

Table 2: Sample vs Population.

Division	% in Population	% in Sample
Central	28.1	29.7
Western	32.1	40.2
Northern	33.8	30.1
Eastern	6.0	0
N (n)	1596	(480)
Sample as a proportion of population		30.1

Source: Data obtained from primary survey.

The survey was administered over a 7 –month period, from June 2003-January 2004. An attempt was made to interview the fisherman's in a random manner. Coastal village names were listed for each of the districts and a quota was established for each village. In each village every second fisherman was attempted for interviewing until the quota was exhausted. Those who refused to be interviewed were left out and the fisherman was interviewed. The interview was also done at wharf and roadside stall in which case, the corresponding village quota was reduced. Most of the interviews were conducted at their home during evenings thus prolonging data collection work. The survey was carried out with the support of Undergraduate University students.

Out of the total 550 operators interviewed, only 480 questionnaires were usable due to missing data. A summary profile of the fishermen's are provided in Table 3 below.

Table 3: Summary Profile of Fishermen (n= 480).

Variable	Sample Observation
Mean Age (years)	43.8
Mean Formal Education (years)	7.1
Ethnicity (%) Fijian	41.7
Indo Fijian	48.3
Mean Household Size	5
Gender (%): Male	95.6
Female	4.4
Fishing Experience (years)	25

Source: Data obtained from primary survey.

Data from the table above reveal that fisherman's were of quite old with very low levels of formal education. Their mean family sizes were 5 indicating an average of three children. The low level of education indicates that they have very little alternative skills other then fishing. However, in fishing, they have very long period of experience, with mean experience level of 25 years.

Artisanal Fisheries: an Overview

Artsanal communities tends to engage the most vulnerable of the society who generally have no other alternative source of livelihood. Approximately 200 million artisanal fisherman around the globe are engaged in this sector for their livelihood (SQUIRES *et al.* 1998). They use generally very low amount of technology and are labour intensive. The technology use has not changed much over the years while in

some countries, notable change has been noticed with respect to the use of a high powered engine. In these countries, this change has a strong correlation in the overall income growth (DALZELL *et al.* 1994). Fiji's fisheries sector can be divided into five primary sub sectors:

- Industrial fisher: operates on a large scale and is primarily export oriented;
- Artisanal fishery: includes most small-scale commercial production for domestic sale;
- Semi-subsistence: includes small-scale commercial production for domestic sale while small portion of it is retained for home consumption;
- Subsistence fishery: involves catches for home consumption, with the occasional sale of surplus catch;
- Aquaculture: inland fish farming which is done on a very small scale in Fiji.

The industrial fisheries are geared mostly for export purposes. It uses fairly advanced technology and has much less local multiplier effect. However the subsistence and artisanal fisheries plays a very important role in sustaining the rural communities livelihood. Subsistence fishing activity mostly takes place from the shore or in shallow waters without the use of fishing vessels. Where fishing vessels are used, these are generally small, either non-powered canoes or canoes and dinghies powered by outboard motors and, to a lesser extent, by sail. Artisanal fisheries involve larger vessels between 8-20 m in length, powered by outboard or inboard[2] diesel engines. Inboard engine boats are mostly used for commercial fishing for demersal species beyond the reef slope and for catching tunas on the open ocean.

Common gears include hooks-and-lines, traps (fixed and moveable), seine and gill-nets, and spears. Hooks-and-lines can be deployed in a variety of ways, as simple drop lines to catch demersal fish, as bottom and surface long-lines to catch demersal and pelagic fishes respectively, and towed with baits and lures to troll for pelagic fishes.

The artisanal fishery is spread over the Fiji with majority of the vessels operating in Central, Western and Northeren division. The eastern division has mostly subsistence fishery within the demarcated area (customary fishing right or QoliQoli). The major fish families that consist of the Artisanal fisheries basket are those listed in Table 4 below. The most common ones come from the Scombridae, Lethrinidae, Mugilidae and Serranidae families.

Fisherman arriving from their trip have various options to sell their fish. This includes selling it to (a) consumers at the wharf, (b) Middleman at the wharf, (c) Consumers and Middleman; (d) consumers from road side stalls; (e) consumers at Municipal market; and (f) Hotels and restaurants or shops.

Results from the survey reveal that most of the fisherman (38%) sell 100% of their catch at the wharf to middleman. 16% sell all their catch to middleman or consumers directly at the wharf and approximately 10% sell all their catch at Road side stalls (Table 5). Fisherman's normally have regular and stable clients to whom they normally sell all their catch to. The catch consists of various quality of fish fetching different prices. However, when the fish is sold to the middleman, it's sold by weight for a given

[2] Outboard vessels include vessels propelled by outboard engines while inboard vessels include vessels propelled by inbuilt engines in the hull of the boat.

unit price. Generally, at least 40% mark-up is added by the middleman when the fish is sold to the consumers.

Table 4: Local Artisanal Fish Production (mt) by major Fish Families

Families	Year						
	1995	1996	1997	1998	1999	2000	2001
Scombridae	1229	892	659	1189	1320	1201.76	1273.86
Lethrinidae	509	616	546	481	545	496.33	526.10
Carangidae	294	500	243	167	230	174.57	185.04
Mugilidae	345	341	360	486	550	486.58	501.17
Serranidae	504	570	528	491	555	498.62	523.55
Sphyraenidae	335	315	233	276	340	270.00	280.80
Lutjanidae	317	420	270	296	360	332.42	339.06
Sub total of 7 species	3537	3654	2838	3387	3801	3460.28	3629.58
Total of all families	4691	4782	3485	4182	4303	4086.74	4274.83
Percent of Major Families	75.5	76	81	81	88	84.67	84.90

Source: Data obtained from Fiji Fisheries Division, Annual Reports (various years).

Table 5: Mode of Fish Disposal.

%	Consumers at Wharf	Middleman	Consumers and Middleman	Road Side Stall	Municipal Market	Hotels/Restaurants/Retail Shops
			%			
100	16	185	77	47	17	10
90	0	1	0	1	1	0
80	0	0	2	5	2	0
70	2	0	0	4	3	0
60	6	6	1	0	0	1
50	2	7	34	5	4	0
40	0	7	11	9	2	0
30	0	0	2	6	2	0
20	2	3	7	3	2	0
10	1	32	1	34	38	26

Source: Data obtained from primary survey.

While most of the artisanal fish harvested are sold in the local market, a significant proportion is also exported thus, along with the industrial fish harvested, it brings in a major source of foreign exchange (Table 6).

In 2002, the Fish industry in Fiji brought in F$68m of foreign exchange. By examining the production trend, one may note that there is sharp increase in production after the 1997[3] period. This could be attributed to the expiry of land leases which has pushed some of the cane farmers into this industry. Fishing does not require major skills and could be easily done with little supervision. The land issue, if not resolved soon, may push more farmers into this industry leading to crowding externality and unsustainable harvesting practices.

Table 6: Fish Production and Export, 1985-02.

Year	Production (tones)	Export (F$,000)	
		Canned	Fresh
1985	10,202	10,885	800
1986	9,834	16,680	1,486
1987	12,324	20,782	4,285
1988	13,900	39,757	8,458
1989	14,354	39,435	5,109
1990	13,394	39,228	10,043
1991	13,796	35,739	10,895
1992	13,520	28,726	10,581
1993	13,979	31,425	13,400
1994	16,772	39,134	20,900
1995	17,375	34,153	28,000
1996	13,847	29,300	23,500
1997	13,230	24,000	21,000
1998	13,920	22,200	21,100
1999	20,515	22,900	10,200
2000	21,078	1,600	45,800
2001	14,979	7,700	51,700
2002	19,304	5,100	62,700

Source: Data obtained from various issues of Fiji Current Economic Statistics Bulletin, Government of Fiji.

Note: The production value refers to the estimated value of Fish caught inside Fiji waters (excluding subsistence fishing).

Economic and Sustainability Analysis

Profitability Analysis

Artisanal fisheries includes fishing trips out in the open sea. These trips could be short one (1 or 2 days) or longer ones (3-5 days). The following analysis takes into account these two durations. As expected, the average catch per trip varies with the length of stay in the sea with shorter trip providing an average catch of 133kg while the longer trip with around 4days at sea providing a catch of 175kg/trip (Table 7).

The fishing trips with two different duration have different profit levels. The shorter 1-2 day trip brings in a net profit of $112.70 while the longer 4-5 day trip brings in $261.55 net profit. However, it can be noted that even if two trips of 2 days duration are made in a week, it will still earn less profit relative to the longer duration trip. The reason is that in the two tips, the costs are much higher then a single longer duration trip. Switching from a shorter duration trip to a longer one results in an increase in cost by 62% while the catch increases by 78% thus increasing the profit by more than 100%. The way to increase profit, apart from increasing the duration at sea, is to control costs as it puts a major squeeze on the profit. The major cost component is labor and fuel with bait cost being the third highest. With net profit of an average trip being at $152.05, any effort to raise the profit per trip would require reduction in the specific cost components

[3] He first set of leases expired on 31st of December, 1997. However they were granted a years grace period thus, effectively, those leases that were not renewed, they vacated the farm by 31st of December, 1998.

stated in the table above, or increase in the catch size, or selling in high demand areas at a higher price or attempting to do all three together. A large proportion of the Fisherman who uses family labor or uses less hired labor are able to internalize the labor cost which is the highest cost component. Fish boat owners who provide fixed wages to the laborers do not provide any real incentive to the labors to maximize the output subject to the input constraints. However, an alternative to fixed wages is to give the fisherman's a proportion of the total harvest. In this survey, there were 25% cases where output was shared between the boat owner and the fisherman. The boat owner's share ranged from 60% to 40%. In case where owner took 60% of the harvest the owner provided fuel, ice and bait. In case where the owner chose to take 40% of the harvest, the owner only provided boat, engine and fishing gear.

Table 7: Profitability Analysis of Artisanal Fisheries

Revenue/Cost	1-2 Day Trip	4-5 Day Trip	Average/Trip	Cost Composition (%)
Revenue				
Total Catch (Kg)	133	238	174.9	
Price $\kg	3.50	3.50	3.50	
Total Revenue ($)	465.50	833.0	612.15	
Cost ($)				
Bait	48.8	61.25	53.80	11.7
Fuel	141.0	185.31	158.60	34.4
Labor	110.40	233.40	159.30	34.6
Food	25.10	24.26	24.8	5.4
Ice	10.8	11.49	11.1	2.4
Battery	5.1	7.73	6.5	1.4
Kerosene	2.0	8.43	6.0	1.3
Other cost	9.6	39.58	40.00	8.7
Total Cost	352.8	571.45	460.1	100
Net Profit ($)	112.70	261.55	152.05	

Source: Data obtained from primary survey.

Artisanal Fisheries and the Economy

Artisanal fisheries provides a significant boost to local economy in terms of the backward and forward linkages. The artisanal fisherman buying of inputs will raise demand in the factor market which induces supply thus leading to overall economic growth and rise in income. Furthermore, the sales of catch will raise the incomes of the fisherman who will now engage in savings, consumption and investment decisions as depicted in Fig. 1. All these activities will raise aggregate demand in the economy thus leading to increased economic activity, increased employment and a general rise in the standard of living of the general population.

Using the data presented in table 8, we could illustrate the potential impact in dollar terms on the overall economy.

The royalty payment was formalised in 1991 when cabinet approved a fixed royalty payment of $10/night in a customary fishing rights area. However, over the years, all artisanal fisherman (except the indigenous fisherman) who fishes outside the

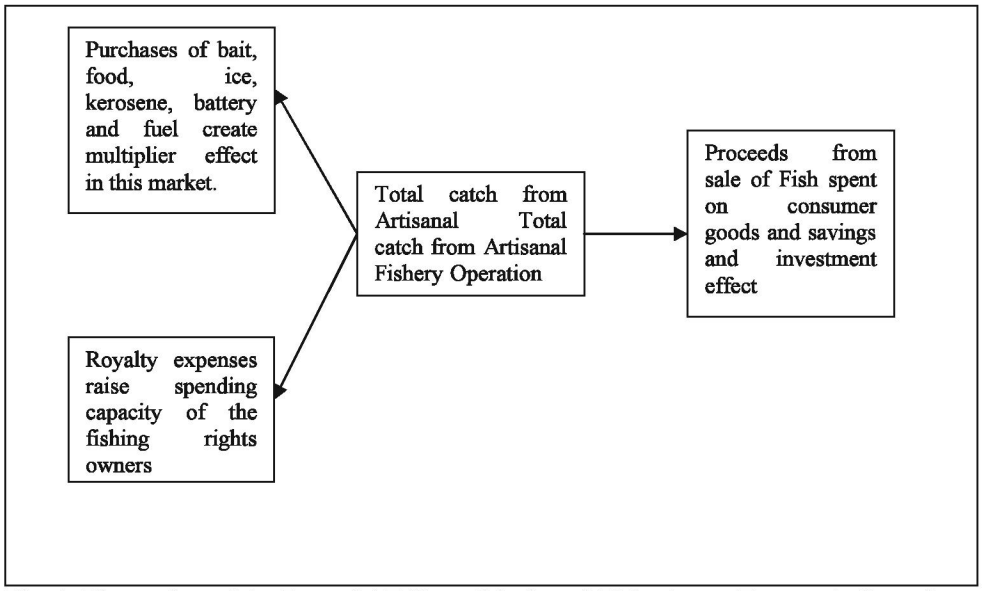

Fig. 1: Illustration of the Potential Effect of Artisanal Fisheries on Economic Growth.

Table 8: Partial Equilibrium Analysis of Annual Contribution to the Factor Market and Product Market

Cost	Per Trip/Vessel	Expenditure: 52 Trips/1500
Bait	53.80	4.19
Fuel	158.60	12.37
Labor	159.30	12.42
Food	24.8	1.93
Ice	11.1	0.87
Battery	6.5	0.51
Kerosene	6.0	0.47
Other cost	40.00	3.12
Total Cost	460.1	35.88
Royalty to Customary Rights Owners (50% of vessels @$430)		0.32
Approx. Fisheries department revenue (Fishing gear sales, Fishing license and registration)		0.02
Product Market		
Total Annual Volume and Value of Artisanal Production	175 kg/Trip * 1500 vessels * 52 weeks = 13,650 t	$47.8m

Source: Data obtained from primary survey.

demarcated area, also has to pay the royalty. The computations in the table above reveal that approximately $36m is spent in the factor market while $48m is spent in the product market. This magnitude of spending with raise aggregate demand and spiral up economic thus expanding the economy activity and raising the general level of income. There will also be expansion in investment both directly and indirectly which will increase the overall economic activity. The expanded economy will further increase the absorptive capacity of the resources and thus continue to increase income in the longer run.

Maintaining Sustainability of the Stock

The long run survival of the vulnerable rural and coastal communities engaged in artisanal fisheries depend to a large extent on the ability of the fisherman's to maintain sustainable stock levels. Under the current property rights system, the stock depletion arises from stock and crowding externalities. Therefore, in order to ensure that stock is not depleted beyond the Mean Sustainable Yield (MSY), then both of these externalities should be internalised.

In order to impose a tax on the catch and on boat, we need to first determine the MSY. This is the job of biologists and in the absence of this figure, an alternative approach would be to establish a proxy MSY which could be computes as follows:

$$\text{Proxy } MSY_{TW} = \text{Mean catch volume} + 1 \text{ Stdev of the Catch}$$

Using the data from this study, the weekly mean harvest rate is 238kg plus 83 (1 standard deviation) = 321 kg. Therefore the proxy MSY is equal to 321kg.

The number of vessels could be regulated and the current number (1500) could be maintained. To internalise the catch externality, a tax on catch beyond the MSY_{TW} should be imposed. This tax could be equal to the marginal revenue. For example, for a price of $3.50, the tax on catch could $3.50/kg on all catch beyond the MSY_{TW}. Some fisherman may find that the optimal output is not at MSY_{TW} but before that. Therefore, they may choose an optimal harvest before MSY_{TW}. In this case, they should be allowed to transfer or sell their quota to other licence holders. In this case, the economy would benefit in terms of the maximising the returns while individual resource users will optimise their output. However, concerted effort should be made to determine the MSY for the three types of fisheries, the subsistence, artisanal and industrial. This MSY should then be used instead of the above proxy. Currently, the existing number of vessels in artisanal fisheries has not risen any major alarm bells with respect to stock levels so it seems that the current level of harvest is around or below the MSY.

Conclusion

Artisanal fisheries provides a major source of income and employment for the coastal and rural population of Fiji. These groups of population are the vulnerable lot with very little formal education and no other skills. Artisanal fisheries also provides a major stimulus to the overall economy via its factor and product market.

The long term sustainability of this industry depends a lot on the ability of the regulation system to maintain the stock at sustainable levels. At the moment, the

property rights system, that of open access, is not conducive to sustainable harvesting of the resource. The number of vessels operating in the waters is also not based on any particular limits set by the authorities. An estimate of the Fish stock in the fisheries grounds should be made and based on this, the harvesting catch rates are to be established.

While government's annual budget does focus on this area, much more resources should be diverted to ensure that not only proper administration is done for the management of the resource, but also research is done to back up extension work. Government may have the funds to do the research, but it may not have other resources and skills to successfully conduct this research. Therefore it needs to collaborate with other regional and multinational institutions to ensure that its resources are fully utilised and results are effectively used for sustainable management of Fiji and the regions marine resources.

The strong sustainability conditions require a balance over time in the stock of economic, social and ecological capital. Therefore, the broader framework with which the government should operate must ensure these conditions are satisfied.

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