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GSR REPORT

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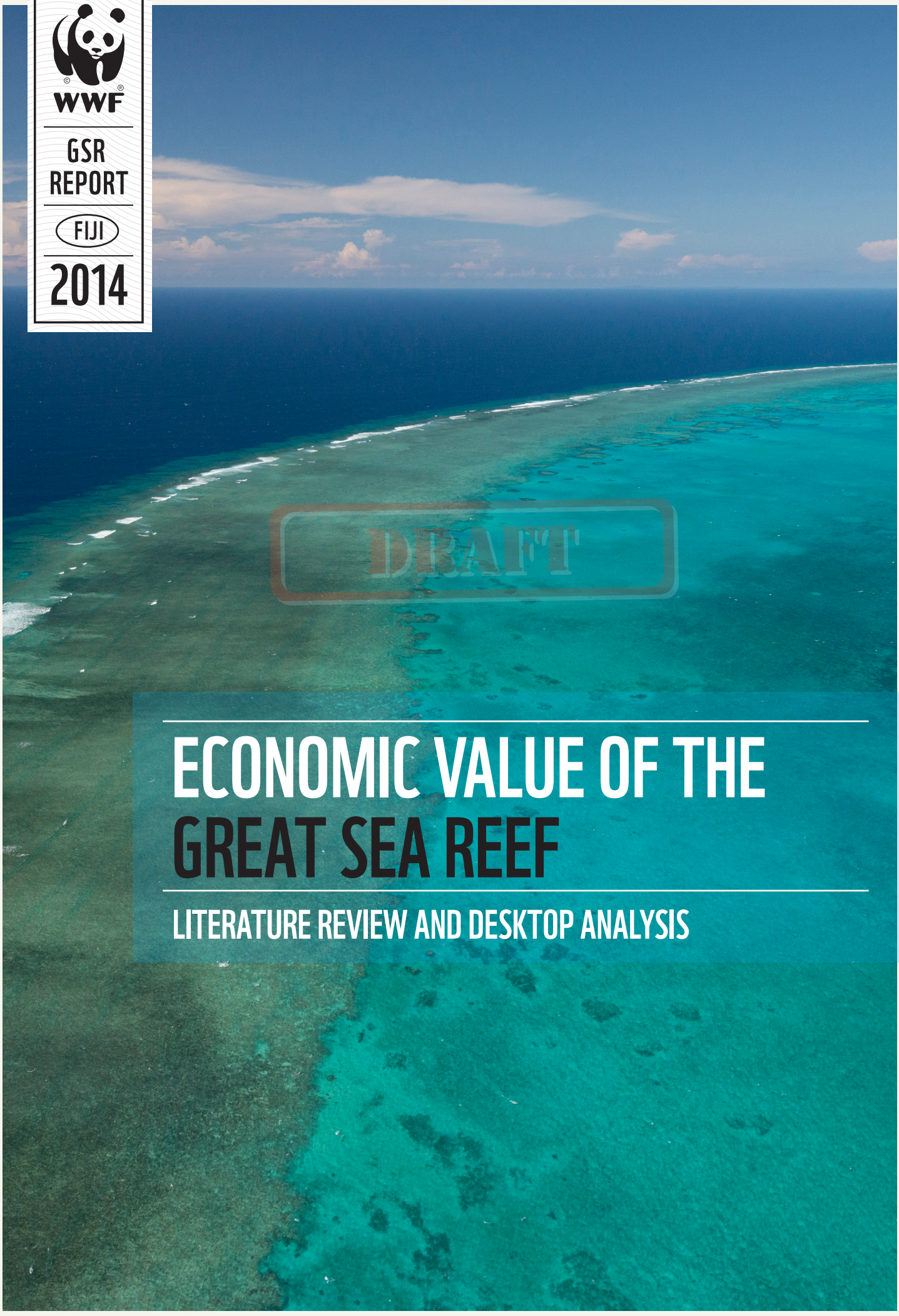

ECONOMIC VALUE OF THE GREAT SEA REEF

LITERATURE REVIEW AND DESKTOP ANALYSIS

DRAFT

Submitted by
Francis Areki

About the photos
The photos in this report depict the various important livelihood activities people derive from the GSR - food and income security and the recreational pleasures hotels along this reef system offer to tourists.

Front cover
The Great Sea Reef is the largest reef system in Fiji and a crucially important as well, a strong pillar for economic development through the fisheries and tourism sector as this report emphasises. The crucial links coastal communities along the GSR have with this reef system and indeed the livelihoods of many Fijian lives, cannot be overemphasised.

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EXECUTIVE SUMMARY

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The Great Sea Reef, despite being a globally significant reef system and an important natural asset to Fiji still remains poorly understood from an ecological standpoint and underappreciated with regard to its contribution to the socio-economic fabric of the country's economy and its inhabitants. This report provides details of some measure of the economic value of the Great Sea Reef. With the difficulty in data availability and the expense in carrying out a complete Total Economic Valuation (TEV) for the reef system, this analysis covers a portion of the economics dealing with this system, with primary focus on direct economic values, on its contribution to Fiji's inshore fisheries and tourism sector.

The report details some of the previous work undertaken in other regions of the world with regard to the valuation of corals, coral reefs and related ecosystems, highlighting the importance of reefs in general to the economies especially those in developing countries. It then focuses on work that has been done within the South Pacific region before providing an overview of the estimated contribution made by the Great Sea Reef to Fiji's national economy.

The analysis undertaken suggests and estimates that the Great Sea Reef contributes between FJD 12-16 million annually to Fiji's economy through the inshore fisheries sector. This estimate accounts for only the commercial value and recognises that the limitations in data available and the inclusion of the subsistence value of the sector would result in a much higher figure. The reef system is directly responsible for maintaining the subsistence and income livelihoods of a tenth of Fiji's population, if primary focus is placed on coastal communities located along the length of the Great Sea Reef within the provinces of Bua and Macuata.

Through previous studies carried out throughout the region and locally, proxy values determined for the Great Sea Reef include an estimate economic value of FJD 47.5 million or roughly FJD1 million for every hectare of coral reef existent on the system. Utilising a compensation mangrove study carried out in the 1990's the mangrove related fisheries production is estimated to be 3,711 tonnes annually for the entire area covered by mangrove areas within the Great Sea Reef boundary, translating into FJD 19.2 million annually.

The report recognises that due to the deficiency in detailed local data a more conclusive value for the reef system could not be ascertained. However the information gathered and presented here should provide a reasonable baseline for future analysis regarding the economics of the reef system and add on to existing knowledge regarding it.

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INTRODUCTION

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The Fiji archipelago contains' an estimated 1000 coral reef systems within its territorial waters, a representation of 6,704 sq km or 3.5% of the total coral reef area existent on the planet (Spalding et al 2001). The archipelago has the further distinction of having one of the world's longest barrier reef systems, the Great Sea Reef, ranked fifth globally and third in the southern hemisphere. The Great Sea Reef (GSR) or locally referred to as the "Cakaulevu", stretches over 260 kilometers, from the northern most tip of Fiji's second largest island, Vanua Levu tapering out to the Yasawas, the chain of islands which borders the archipelagos western edge. The GSR considered one of Fiji's natural treasures, harbours a myriad of complex coastal and marine ecosystems that sustains biologically distinct assemblages of marine flora and fauna. It has been estimated from recent biological surveys that the GSR system sustains over three quarters of all known coral and coral reef fish species found in Fiji, accounting for 40% of the archipelagos known marine species. Although there is general consensus by marine experts on the global and regional significance of the GSR, it should be highlighted that scientific studies specific to the reef system is still relatively wanting, as biological and ecological information regarding sections of the reef still remain poorly documented.

Aside from the GSR's intrinsic value as a global biodiversity hotspot, it is its provision of goods and services through the coastal and marine ecosystems it contains that makes it vitally important to Fiji's communities and economy. The GSR supports the economic and subsistence livelihoods for a significant proportion of Fiji's coastal communities. Roughly a third of Fiji's total population of over 800,000, for instance, live within close proximity of the reef system, its fisheries being the primary source of protein directly accessed by these communities for generations. Additionally anecdotes provided by Fiji's Fisheries Department suggest that over three quarters of all inshore fish supplied to urban markets within the country is primarily sourced from fishing grounds falling within the GSR boundaries. This essentially re-emphasizes the GSR's importance to revenue generated by the domestic fisheries market and its importance to Fiji's population on a larger scale, with respect to food access and security. Aside from the GSR's relevance to domestic subsistence and commercial fisheries, the reef system is a centrepiece for Fiji's largest foreign exchange earner, the tourism industry, providing natural aesthetics appreciated by dive, snorkelling, cruise, sport fishing enthusiasts and the like.

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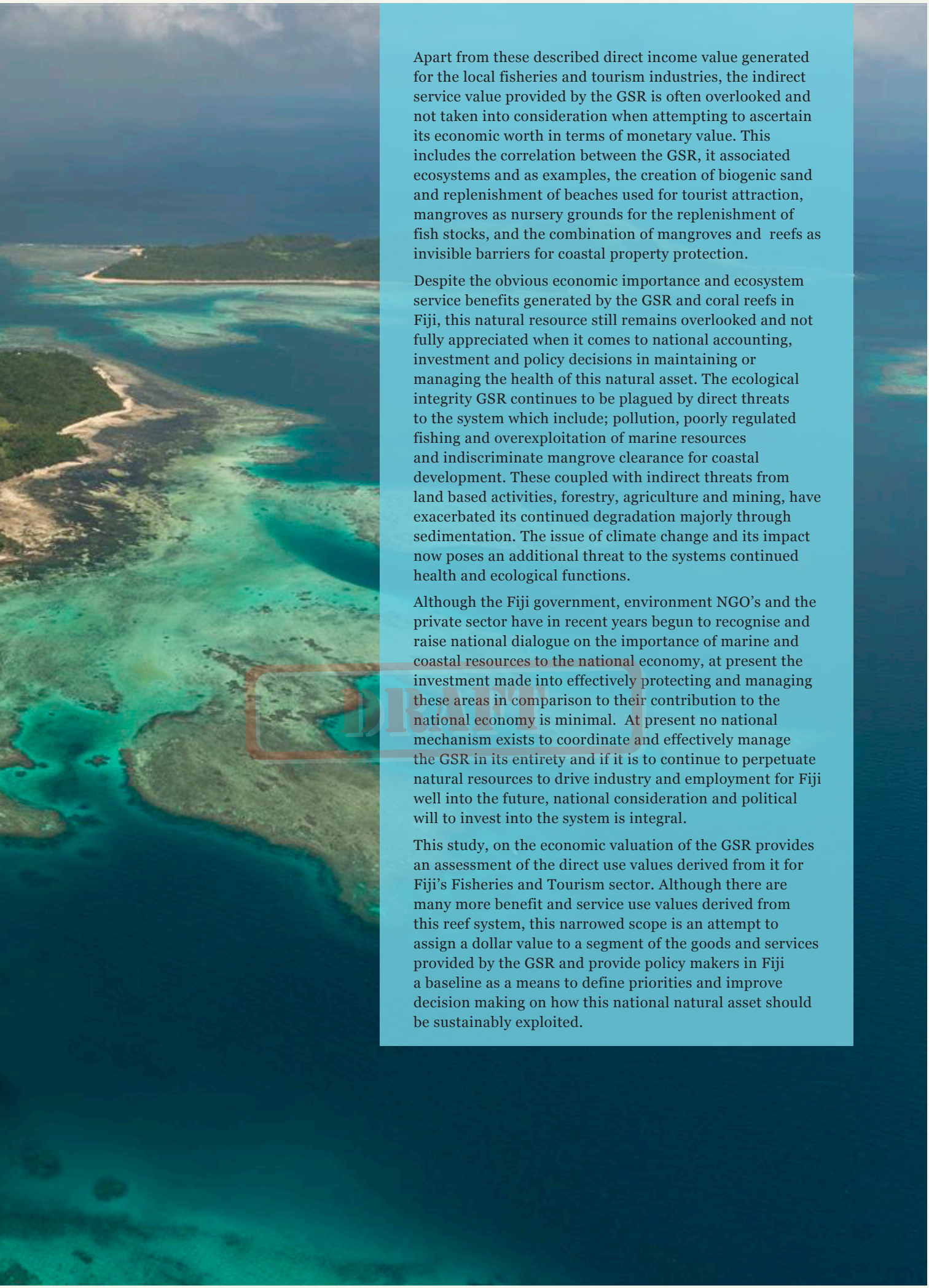

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Apart from these described direct income value generated for the local fisheries and tourism industries, the indirect service value provided by the GSR is often overlooked and not taken into consideration when attempting to ascertain its economic worth in terms of monetary value. This includes the correlation between the GSR, it associated ecosystems and as examples, the creation of biogenic sand and replenishment of beaches used for tourist attraction, mangroves as nursery grounds for the replenishment of fish stocks, and the combination of mangroves and reefs as invisible barriers for coastal property protection.

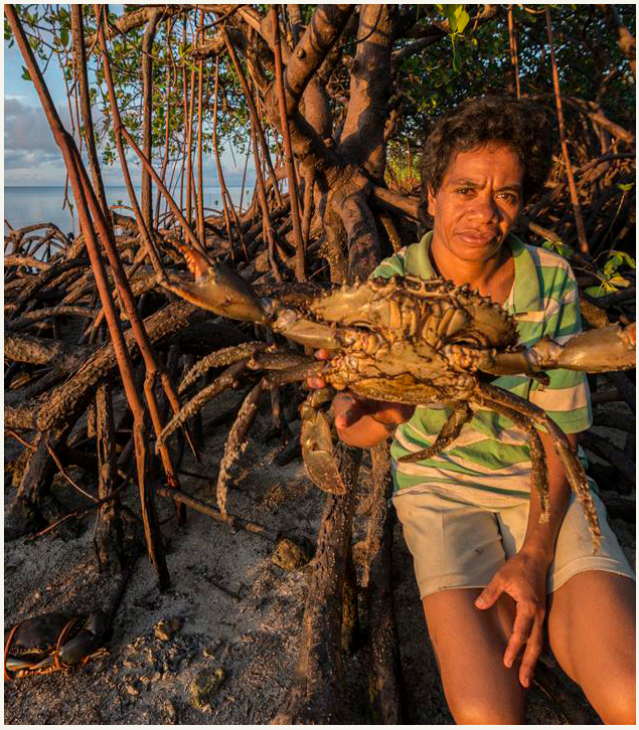
Despite the obvious economic importance and ecosystem service benefits generated by the GSR and coral reefs in Fiji, this natural resource still remains overlooked and not fully appreciated when it comes to national accounting, investment and policy decisions in maintaining or managing the health of this natural asset. The ecological integrity GSR continues to be plagued by direct threats to the system which include; pollution, poorly regulated fishing and overexploitation of marine resources and indiscriminate mangrove clearance for coastal development. These coupled with indirect threats from land based activities, forestry, agriculture and mining, have exacerbated its continued degradation majorly through sedimentation. The issue of climate change and its impact now poses an additional threat to the systems continued health and ecological functions.

Although the Fiji government, environment NGO's and the private sector have in recent years begun to recognise and raise national dialogue on the importance of marine and coastal resources to the national economy, at present the investment made into effectively protecting and managing these areas in comparison to their contribution to the national economy is minimal. At present no national mechanism exists to coordinate and effectively manage the GSR in its entirety and if it is to continue to perpetuate natural resources to drive industry and employment for Fiji well into the future, national consideration and political will to invest into the system is integral.

This study, on the economic valuation of the GSR provides an assessment of the direct use values derived from it for Fiji's Fisheries and Tourism sector. Although there are many more benefit and service use values derived from this reef system, this narrowed scope is an attempt to assign a dollar value to a segment of the goods and services provided by the GSR and provide policy makers in Fiji a baseline as a means to define priorities and improve decision making on how this national natural asset should be sustainably exploited.

STUDY OBJECTIVES

To determine the full extent of the Great Sea Reef's contribution and importance to Fiji's economy is not an easy undertaking, considering the extent of the reef system, multi facet benefits and services derived from it, and existing limitation in available data and resources needed to carry out the exercise. This study does not attempt to capture the Total Economic Value of the GSR's marine and coastal resources but instead tries to focus on a subset of goods and services provided by it to two of Fiji's economic sectors- fisheries and tourism. Although the analysis is limited to the two areas and acknowledges that study underestimates the true total value provided the GSR, what it does provide however is a temporal snapshot of the economic activity generated by it and how much the economy can likely lose in terms of monetary value should we degrade the system further or lose it altogether. This study is merely a first attempt at collating baselines which hopefully with further studies over time will build on the estimates provided for these economic sectors and other goods and services provided by the GSR.



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The specific objective of this study is to determine the

i. ***Estimated annual economic contribution of the GSR to national earnings, from the fisheries and tourism sectors.***

ii. ***Current trends observed for the two sectors in the two focal GSR divisions in Fiji- west and north***

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By providing a basic economic value for the GSR derived from the focal sectors, this study hopes to contribute to answering the policy question "What is at stake for Fiji economically if the ecological integrity GSR is allowed to continuously degrade without any sound management interventions?"

STUDY SITE

The scope of this valuation is delimited to the boundaries currently recognised as being part the Great Sea Reef (marked A and B on the map). The reef system traverses four provincial marine boundaries of the northern (Macuata and Bua) and western (Ba and Ra) administrative divisions. Data specific to the fisheries and tourism activities occurring within these focal provinces in each division was collated as a means to estimate GSR related economic values covered in the study.

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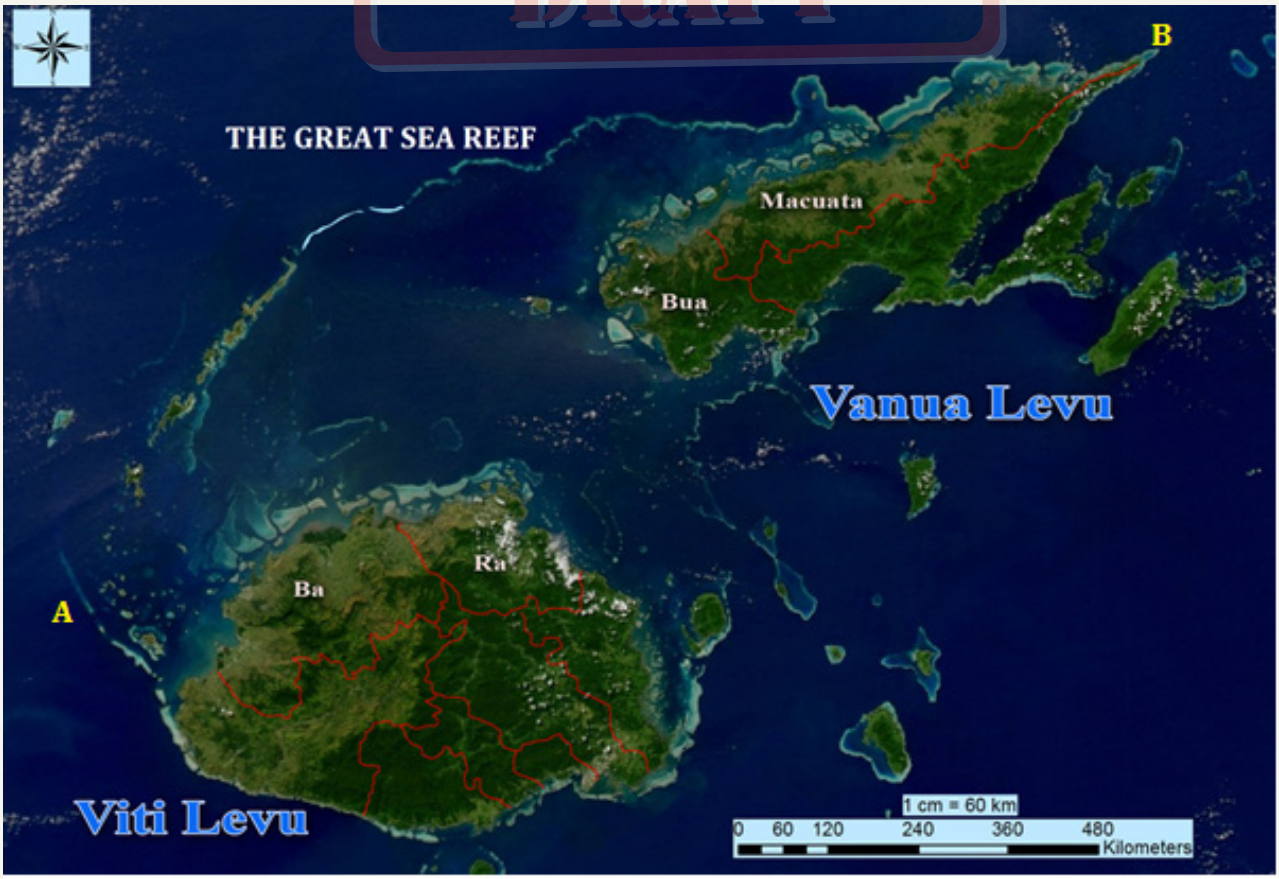
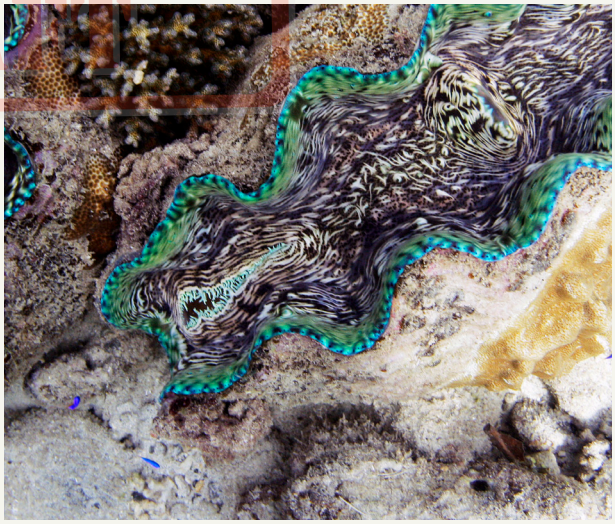


OVERVIEW-GLOBAL

Coral reefs although occupying less than 0.1% of the earth's surface, remain one of the most biologically diverse and economically valuable ecosystems on the planet. Of the 34 recognised animal phyla, 32 are found on coral reefs as compared to 9 in rainforests (Wilkinson 2002). Over 25% of all known marine species and between 9-12% of fisheries worldwide are associated with coral reefs. Scientists estimate that, in total, more than one million species of plants and animals are associated with coral reef ecosystems (Spalding et al 2001). The various goods and services provided by coral reef systems are critical to global human populations, which include food, income, building materials and coastal protection. It is estimated that 500 million people worldwide have some level of dependence on coral reefs, whilst about 30 million are totally dependent on the ecosystem for their livelihoods or dwelling, as in the case of atolls (Wilkinson 2008). The World Meteorological Organisation estimates the value of goods and services coral reefs provide annually on a global scale to be on average about USD 130,000 per hectare or USD 30 billion (WMO 2010). Other studies indicate a much higher value suggesting coral reefs provide economic goods and ecosystem services an estimated worth of about $375 billion each year (Constanza et al 1997).

The global distribution of coral reefs is predominately within the Indo-Pacific region, which include the Red Sea, Indian Ocean, Southeast Asia and Oceania. Of the total 284,803 sq km of coral reefs globally, South East Asia accounts for 32.3% and Oceania (Pacific and Australia) 40.8%. Within the two regions is the area referred to as the Coral Triangle, located along the equator where the western portion of the Pacific Ocean meets the Indian Ocean and includes all or part of the exclusive economic zones of the following countries; Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands, and Timor-Leste. This area is recognised by scientific experts to be the most biodiverse coral reef region in the world and accounts for one third of the world's remaining reefs. The area harbours 75% of all known coral species and almost 3,000 species of fish, the total annual economic value of the regions coral reef ecosystems being estimated at USD 2.3 billion and supporting the livelihoods of 126 million within the region (Wilkinson 2008).

The demonstration of economic value of coral reefs to a given countries economy provides a means to make a case for national authorities to make informed decisions and take appropriate actions protect and manage their marine and coastal resources. Much of the literature regarding coral reef ecosystem valuation has focused on direct use marketed ecosystem services, primarily around fisheries and tourism. Many countries with coral reefs generate significant portions of their income through the two sectors. Studies show that on average, countries with coral reef industries derive a significant and in some cases more than half of their gross national product from them. The table below highlights derived values of corals reefs to these two particular economic sectors based on recent country specific economic valuation reports.



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STUDY SITE

Region	Country	Year of Economic Valuation	Fisheries	Tourism	Coastal Protection
Americas	Belize	2009	14.4-15.9	150-196	231-347
Caribbean	St Maarten	2010	1.84	55.7	-
	Bermuda	2010	4.9	405.9	265.9
	St Vincent & Grenadines	2010	0.95	22	-
	Trinidad and Tobago	2007	0.8-1.3	100-130	18-33
	Jamaica	2011	34.3	315	65
	US Virgin Islands	2007	3	96	6
	Puerto Rico	2007	1	192	1
Middle East	Egypt	2003	14.2	470	-
Oceania	Guam	2007	3.96	94.6	8.4
	Northern Mariana Islands	2007	1	45	9
	American Samoa	2007	0.83	0.08	0.49
	Hawaii	2007	3	356	-
	Australia	2012	160	5100	-

(All values in the table are in USD millions/yr)

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Coral reef economic valuation contributions to national economies vary from country to country, for instance Australia with the world's largest reef system, the Great Barrier Reef (GBR), registered USD 5.7 billion as its reef catchment value added economic contribution for 2012. Of this contribution, over 90% was derived from coral reef tourism related activities, commercial fisheries contributing USD 160 million and domestic recreation contributing just over USD 240 million (DAE 2013). The Australian government in recognition of the economic and biological importance of the reef system and in order to reduce increasing anthropogenic threats to the system, declared 33% of the GBR World Heritage Area as highly protected or no take zones in 2004. Having economic valuations undertaken has its merit in helping define appropriate mitigative actions against current and projected threats. The declaration by the Australian government in regard to the GBR was also in response to the increasing fishing pressure and reduction of populations of commercial target fish species, rapid decline of nesting population of resident marine megafauna, four-fold increase in annual sediment and nutrient outflow into the system, infestation through marine invasives and coral bleaching. One study carried out to value the effect of bleaching on the GBR indicated the system as a whole, equated to roughly 4.7% of Australia's annual GDP for the period 2007-2008, while the corresponding bleaching cost was equivalent to 3.5% of annual GDP. In other words the bleaching cost for the whole GBR is roughly equivalent to a constant of USD $1.08 billion per annum over the course of a century (OE 2009). In retrospect the Australian governments declaration for an area increase in 33% from an original 5%, in protected areas within the GBR is farsighted ensuring safeguards are in place to ensure sustained reef health and associated economic returns in a changing climate.

Contrasting Australia to developing countries such as in the Caribbean, economic valuations in the region have similarly demonstrated strong linkages between coral reef health and national economic returns. Majority of Caribbean countries depend heavily on tourism as their major foreign exchange earner. The average annual value of coral reef ecosystems for Bermuda for instance amounts to USD $722 million, 12% of the country's GDP for 2007, 56% of which, was sourced from coral reef related tourism (Sarkis et al 2010). In Tobago, coral reef-associated tourism and recreation in 2006 was estimated to contribute between US$100 and $130 million to the national economy, accounting for over 35% of its GDP (Burke et al 2008). It should be noted that the variation in values for countries is highly dependent on the socio-economic and geographical context in which the assessments is undertaken and is has limitations when using market prices to determine economic values. This is clearly seen when comparing say for instance a Caribbean country with a smaller, isolated territory such as American Samoa with less developed high value activities such as tourism. In Southeast Asia, a major global tourism hub, areas with tourism potential it has been estimated that each square kilometer of healthy reef, has a potential net benefit of USD $23,100 to $270,000 (Burke et al 2002)

Economic valuation also provides insight for the need to have precautionary preventative policies to safeguard national economies. The cost of policy inaction have been demonstrated in various studies such as in the case of Jamaica, where the lack of proper management regimes for its local fisheries cost the country's economy USD 1.6 billion in lost revenues over a 25 year period (Sary et al 2003). Aside from fisheries other valuation studies on Jamaica's reefs that if its reef system is allowed to continually degrade, beach erosion will cause an annual loss in value of USD 19 million, reduction in tourist visitors costing between USD9-19 million in annual loss to the local tourism industry and losses of between USD 11 to 23 million per year to its national economy (Kushner et al 2011). For Caribbean countries such as Jamaica, tourism is central to their economies and where beaches are the conduit to attracting tourists. A 2010 study carried out in the Dominican Republic estimated that for each meter of beach a resort loses the average per person hotel room rate drops by about a US dollar per night. If the country's tourist related beaches continued to erode at this current value rate, its economy would likely face a loss in revenue between US 52 to 100 million by 2020 (Wielgus et al 2010). It was also estimated through the economic valuation, that the income generated from reef or mangrove dependent fisheries for the period 2000-2010 reduced by 60%, from US 41 to US17 million, due to pollution and overfishing. The merit in better managing coral reefs can be summarised through the economic valuation of coral reefs on the Caribbean island of Bonaire. Coral reef activities contribute USD $23 million annually to Bonaire's economy, yet managing its marine park costs less than USD $1 million per year (Schep et al 2012).

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Although numerous coral reef economic valuation studies have been carried out over the last decade, much of them have been delimited to South East Asia, developed countries with overseas territories such as France and the United States and the Caribbean. Aside from Australia, and overseas territories in the Pacific, very few have been undertaken in South Pacific countries. For economic valuations conducted in South Pacific countries, resulting coral reef values have registered much lower values as compared other regions in South East Asia and the Caribbean. For instance the annual coral reef service values per hectare of coral cover calculated for Fiji (USD$972), New Caledonia (USD$609) and Vanuatu (USD$658) were a far lower magnitude as compared to US territories Hawaii (USD$3148) and Northern Mariana Islands (USD$17,873) (Laurens et al 2013; Brander & Beukering 2013). The stark difference in the studies have been attributed to the scale of tourist access, population density, scale of fisheries exploitation and in the case of coastal protection values the modest development of infrastructural assets on coastal areas within the region. It has been suggested in a study of economic valuations applied in the South Pacific that the application itself has to consider the regions cultural context on value. Whereas in South East Asia and the Caribbean where assigning monetary value to coral reefs maybe a simple straightforward exercise, the same does not resonate in the Pacific where community's often assign value to things that cannot be priced. The same study indicated that most of the economic valuation studies in the South Pacific to date has been used for awareness and that there is an aggressive need to engage regional economists and decision-makers in productive dialogue to utilise economic valuations to improve both the protection and management of coral reefs throughout the region. The 2011 Reefs at Risk Revisited Report identified slightly less than 50% of Pacific reefs as being threatened by local activities, of which only 20% being at high or very high threat (Burke et al 2011). Although the report further indicates that Pacific reefs as being amongst the healthiest in the world, it also emphasizes that this does not give reason for the region to be complacent with climate change being an issue of concern for coral reefs across the globe.

NATIONAL-OVERVIEW

Fiji has the largest and most developed economy in the South Pacific, but remains a developing country with a large subsistence agriculture sector. Its relatively undiversified economy also makes it vulnerable to internal (natural disasters, political instability) and external (fluctuating world market prices) shocks, such as the financial crisis in 2008. The tourism industry is the leading source of foreign exchange earnings, generating FJD$ 1.074 billion in 2011 and accounts for more than 25% of national GDP (FBS 2012). Direct employment for this sector in 2011 was recorded 39,500 or 11.7% of the total employed workforce. The fisheries industry classified Fiji's third largest primary sector on average contributes 2.8% towards Fiji's GDP and generates 9% of total domestic exports. In 2010, fisheries accounted for 3% of national GDP, with real export earnings of FJD$ 205 million. The bulk of contribution from this sector is attributed to offshore fisheries, specifically tuna. The industry with the inclusion of the subsistence sector employs an estimated 50,000 people.

The coastal inshore areas in Fiji are a vital component of Fiji's economy as it is the primary source for income for many of its coastal communities. Domestic fish and invertebrate catch landings recorded in 2012 was 7,150 tonnes and was estimated to have a value of FJ$ 37 million. Reef fin fish is primarily supplied to the domestic market while other marine products such as aquarium ornamentals, seaweed and increasingly beache-de-mer are targeted for overseas export markets. Fiji's Department of Fisheries estimates that around 18,800 tonnes was harvested in 2004 through subsistence fishing. However this value and the values given for previous years is suspect, as the estimates was based on a 1979 small scale fishing survey conducted on the main island Viti Levu. The department uses this value from the study as a baseline and has continuously added 200 tonnes annually over the years to the baseline figure determined through the survey.

For the purpose of this study only national data specific to inshore fisheries was extracted to ascertain rough correlations between the fisheries itself and by proxy with coral reefs and mangroves. Table 1 below indicates the breakdown of national inshore fisheries by artisanal or commercial production and value for the years 2001 to 2012. The average annual tonnage for inshore fisheries domestic production for the twelve year period was 7,312 tonnes and average annual value of marine resources derived from inshore areas across the country for the same period was FJ$ 33.78 million.

Table 1- National Inshore Fisheries Production and Earnings (2001- 2012)

Year	Total Inshore Fisheries Domestic Production (tn)	Total Reef Fish in Domestic Production (tn)	% in Inshore Domestic Production	Total Inverts in Domestic Production (tn)	% in Inshore Domestic Production	Total Estimated Value (FJ$ mil)	Total Value Reef Fish (FJ$ mil)	Total Value Inverts (FJ$ mil)
2001	7,085	4329	61	2756	39	23.89	18.52	5.37
2002	6,871	4039	59	2831	41	26.60	13.88	12.74
2003	6,665	4439	67	2226	33	27.90	18.98	8.92
2004	10,969	6241	57	4728	43	44.80	27.00	17.80
2005	5,994	4015	67	1978	33	27.00	-	-
2006	7,452	4922	66	2530	34	46.60	28.60	18.00
2007	6,675	4148	62	2527	38	29.00	19.00	10.00
2008	7,610	4886	64	2724	36	34.10	24.80	9.30
2009	6,445	4200	65	2245	35	33.00	24.00	9.00
2010	7,530	4750	63	2780	37	36.00	26.00	11.00
2011	7,295	4675	64	2620	36	39.50	28.00	11.50
2012	7,150	4650	65	2500	35	37.00	26.00	11.00

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DIVISIONAL GSR FOCUSED-OVERVIEW

In attempting to determine an estimate of how much of this annual average production from the commercial inshore fisheries is contributed to by the Great Sea Reef, one has to break the national data down to the divisional level. For this estimation and due to data gaps in divisional data, the following assumptions are made: 1) the geographical location of the reef system and the proportion of catch landings recorded for the northern division, in which it is located, contributing to the overall annual national values, 2) observed trends and assumed projections in comparison to other national divisions as indicative of its national worth and 3) based on previous valuation studies carried out in Fiji, proxy estimates of its economic value.

Although data from the Fiji Department of Fisheries and Bureau of Statistics provide adequate data regarding the commercial inshore fisheries sector at the national level, detailed data presented for the four administrative divisions, central, western, northern and eastern in annual fisheries reports are often minimal or altogether missing. Data in these annual reports are often presented as cumulative values for the divisions, reporting focused on a more national overview of the sector. Attempting to retrace data back to divisional offices is again problematic, staff turnover and lost databases are often cited as reasons behind the inability to provide historical data for the divisions. It appears that once data from a divisional office has been officially submitted to it's the head office in the capital, usually quarterly, there is no internal mechanism at the divisional level to guarantee its retention for future reference. The head office itself upon requesting such divisional level data will most likely refer the inquirer to the annual reports or provide national level statistics.

The divisional data available and utilised for generating a rough estimate for the GSR's contribution to national inshore fisheries catch data in this discussion was extracted from the Departments Annual Reports for the years 2001-2005. The change in the Department's reporting format from 2006- 2011, did not provide details previously provided in the Inshore Fisheries section or breakdown in division market records found in previous annual report annexes to make complete, a more detailed presentation and analysis. As of June 2014, the Department was still yet to release its annual reports for the years 2012 and 2013.

For the purpose of this discussion, the context of the GSR in relation to the division catch data needs to be explained. Referring to the map below the northern division encompasses the whole of Fiji's second largest island Vanua Levu and includes the three provinces of Macuata, Bua and Cakaudrove. The western division includes Ba, Ra and Nadroga-Navosa. Both Cakaudrove and Nadroga-Navosa are not included on the map as they are not adjacent or in close proximity to the GSR, therefore catch landings from these areas have been discounted. When referring to the GSR, it is often taken to mean the reef areas running from the eastern end of the Macuata coast (green) towards western the end of the fishing boundaries of the Bua Province (dark brown). The inclusion of areas beyond this, into the maritime districts of the Ba Province on the western extreme is based on the argument that the geological and ecological nature and extent of the reef system extends beyond what is currently referenced as the Great Sea Reef.

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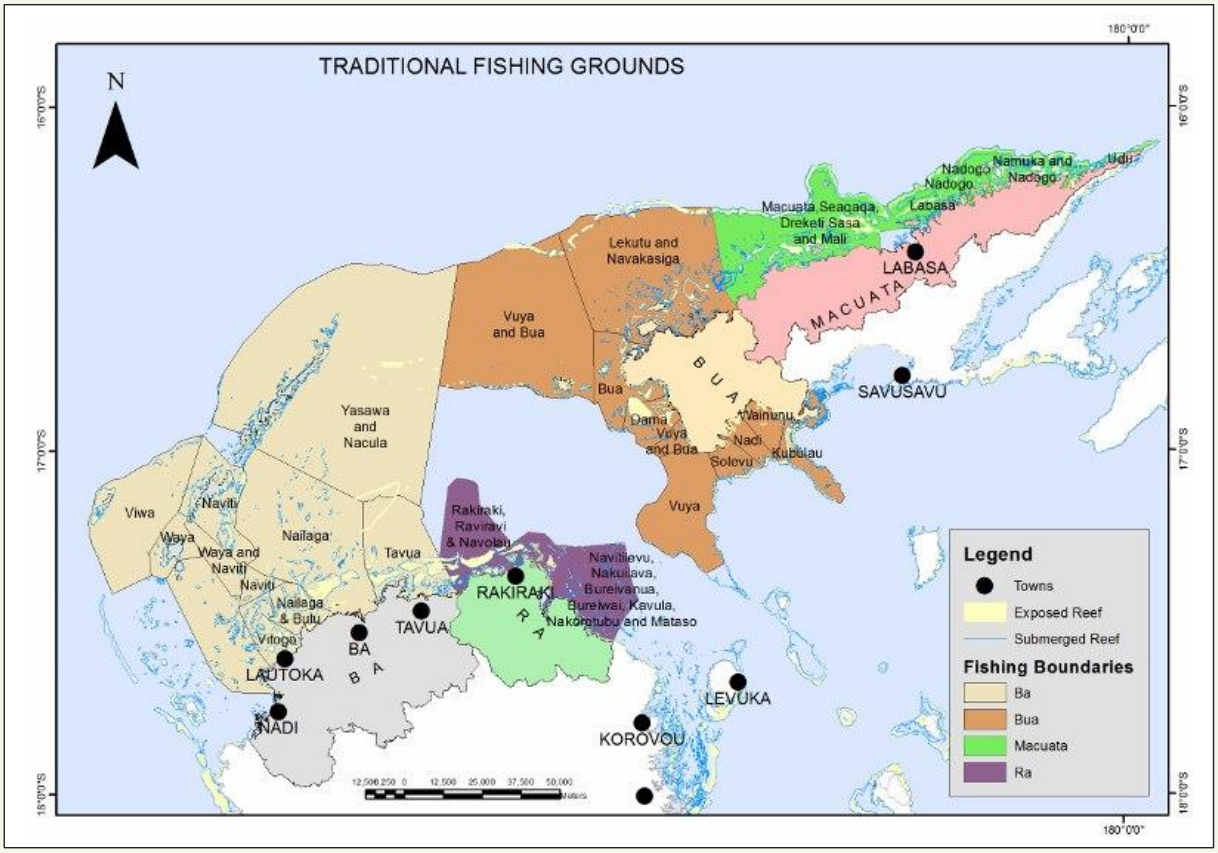

Presented in Table 2 below is the breakdown in inshore fisheries catch landings by division and contribution to the national total for the years 2001 to 2005. As no record for catch landings were made for the eastern division aside from licenses issued, this division is not included as it also did not register any contribution to the annual national total for the given period.

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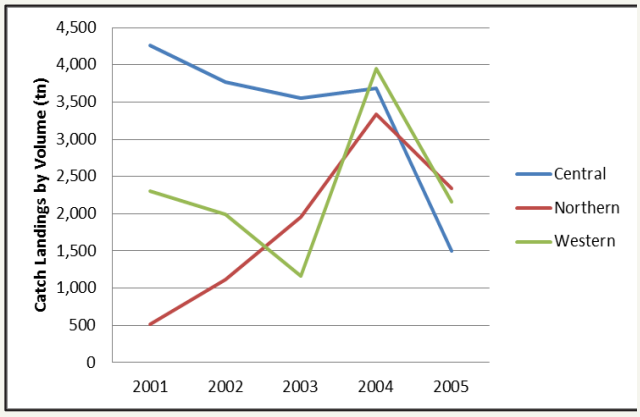
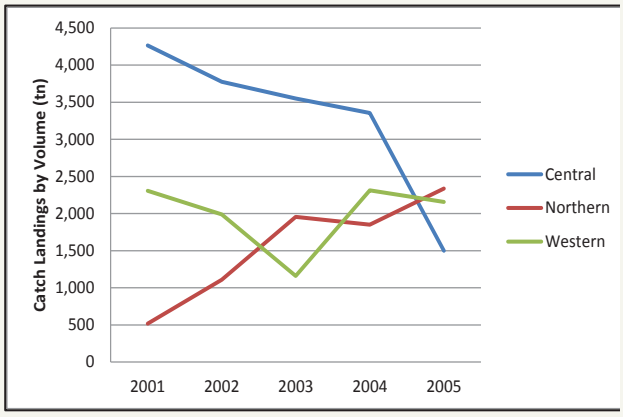
Table 2- Inshore Fisheries Catch Landings by Division (2001-2005)

Year	Total National Inshore Fisheries Catch Landings (tn)	Central Division		Northern Division		Western Division	
		Total Recorded Catch Landings (tn)	% Contribution to National Total	Total Recorded Catch Landings (tn)	% Contribution to National Total	Total Recorded Catch Landings (tn)	% Contribution to National Total
2001	7,085	4,263	60	516	7	2,306	33
2002	6,870	3,774	55	1,109	16	1,988	29
2003	6,665	3,550	54	1,954	29	1,160	17
2004	10,969	3,688	34	3,334	30	3,947	36
2005	5,994	1,498	25	2,338	36	2,158	39

Graph 1



Graph 2



Although a five year period does not provide for definite conclusions regarding the current contributions made by each division, to actually generate a rough estimation of the actual value made the northern inshore fisheries sector, reasonable assumptions can be made instead. One clear trend shown is that, initially the commercial inshore fisheries sector was dominated by the central and western divisions, and this is expected, as both are located on the main island Viti Levu and would have dominated previous decades prior to 2000 in terms of production due to more developed urban centres, better access to markets and larger urban populations. (XXXXX- Add reference) What is interesting to note is that although this status quo by division may have been maintained into the early 2000's this has likely changed, for instance in 2001 the central division still registered 60% of the total national catch landing volume, what is apparent is that by 2005, this had steadily declined by over half of its original contribution. In comparison, the northern division has steadily increased in its catch landing volume contribution by year, offsetting the decline in the central division. The western division although similarly indicating an initial decline it has however continued to maintain its catch landing volume output at an annual average of just over 2,000 tonnes for same period. The abrupt spike shown for 2004 is recorded in the Fisheries Departments annual report as being due to the implementation of an enhanced data collection system. By 2005, it appears this data collection system was not maintained as the data record for the year shows a sharp decline suggestive of perhaps a reversion to the older data collection system. To generate a clear indication of trend and account for the 2004 anomaly, the second graph uses the average annual divisional catch landing volume for the period as a substitute.

The main assumptions drawn and perhaps questions posed from the table and graph for the period is the change in trends shown for the divisions. The decline in inshore fisheries volume output for the central division may be of some concern as it could possibly be indicative of declining health of fisheries in the area and which has been suggested in various literature (XXXX-Add reference). The increase in catch landing volume output shown for the northern division indicates the opposite, suggesting inshore fishing grounds and fisheries within the division becoming more important in maintaining the national volume generated by the sector annually. If indeed fisheries in the central division has continued to decline, which is inconclusive until more recent data for the division is can made available, then there is a serious risk to the economic viability of not only the sector, as pressure shifts to the two divisions, but also highlights an issue that will likely in time affect supply to the domestic market and compromising local food security for the country's growing population. If the northern division continues to offset the decline in the central division, then this suggests the increased pressure in the areas fisheries will directly affect the Great Sea Reef, where the bulk of the divisional catch landings recorded is sourced from.

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The 2004 data record for the three divisions makes for an interesting commentary, suggesting that the data registered by the divisions are an underestimate almost by half, if we take ratios of the 2004 value against the annual catch landing values from 2001-2012 . As the data collected is itself a sample of catch landings derived from municipal and non-municipal market outlets, what is eventually registered at the national level is again an underestimate, a truer conservative value being a quarter more of the catch landing volume recorded. If that is the case then the monetary value of the inshore fisheries sector presented in the annual reports is also an underestimate.

In attempting to determine the value of fisheries generated from the northern division and using the available 5 years data, the annual growth rate for catch landings for the division is about 35% or 445.5 tonnes per year. Upon comparison with the national catch landing total up to 2012, it is unlikely the northern division output continued at this rate for the successive seven years, noting the annual national average limit of just over 7,000 tonnes. Assuming the northern division maintained a positive gradient over the successive years, a range of its present contribution to the current national total would be between 40%, assuming growth stabilised after 2005 and 75%, assuming the division sustained its annual increment indicated from the previous 5 years. Using this as a plausible upper and lower limit for the northern division catch landing volume and against the average national catch landing volume of 7312 tonnes, the current northern division catch landing volume would be between 2,925 to 5,484 tonnes. As such the current inshore fisheries value derived and generated from the northern division based on the 2012 market price value (FJD 5.18 per kg) would be between FJD 15 and FJD 28 million. This upper limit of FJD 28 million may be an overestimation as it would indicate total dominance of the sector by the northern division a more likely scenario would be at around 50% or 60% of the total national annual volume output. In that instance the estimated value for this upper limit would be FJD 19-22 million.

Graph 3- National and Divisional Catch Landings by Volume (2001-2012)

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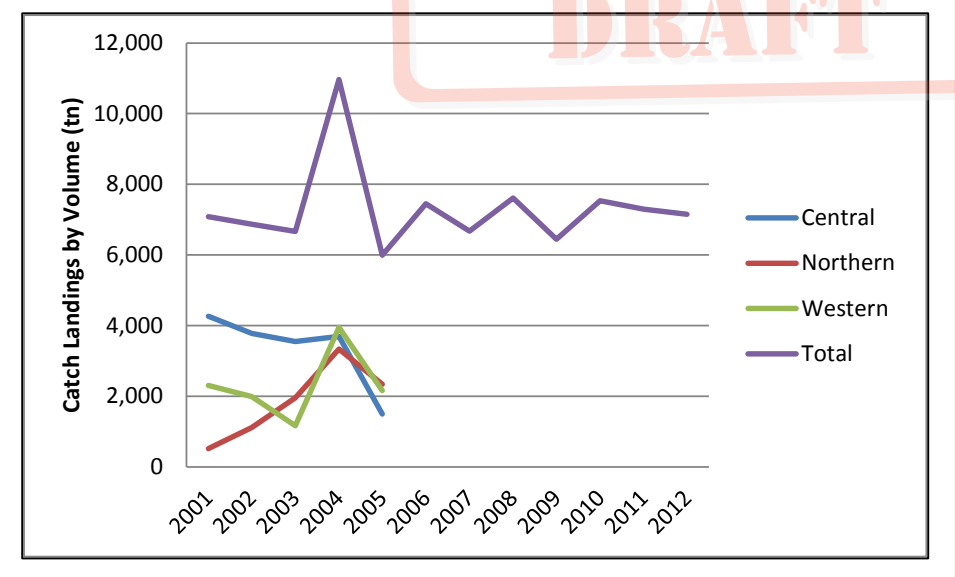
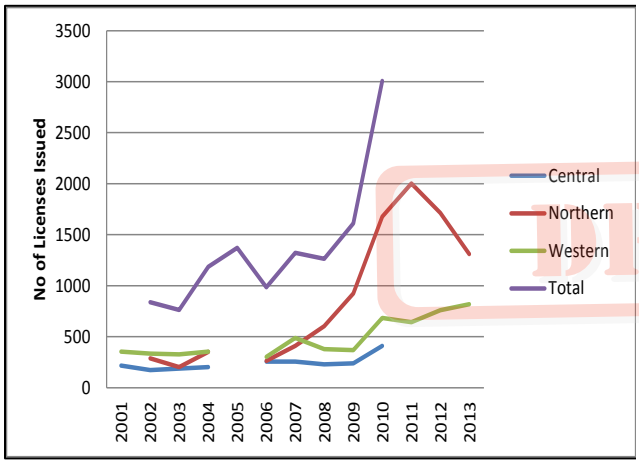


The other proxy data available which infers that the catch data landing for the northern division and its proportion of the total national volume has been increasing is the number of licenses issued by division. Divisional data regarding licenses issued although not entirely complete is more readily available and provides some insight with regard to the divisional trends previously discussed. Table 3 details the breakdown of licenses by division which was extracted from annual reports and raw data provided by both the divisional northern and western offices. Depending on the format of annual reports, some years provided complete divisional data, whilst other years simply the national total or with some divisions missing.

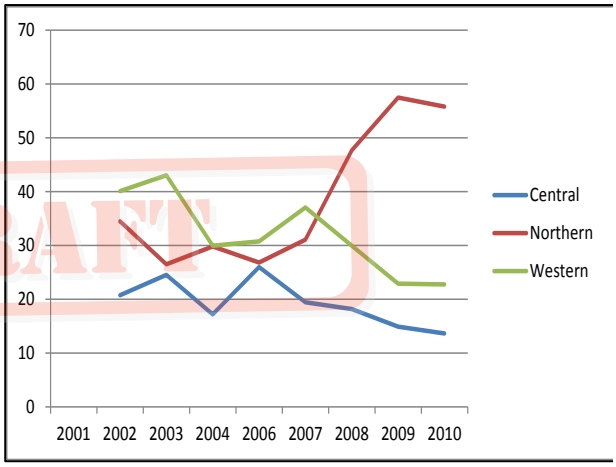
Table 3- National and Divisional Inshore Fisheries Licenses Issued (2001-2013)

Year	Total National No of Licenses Issued	Total No of Licenses Issued for Eastern Division	% of National Total	Total No of Licenses Issued for Central Division	% of National Total	Total No of Licenses Issued for Northern Division	% of National Total	Total No of Licenses Issued for Western Division	% of National Total
2001	-	44	-	217	-	-	-	355	-
2002	838	39	*5*	174	*21*	289	*34*	336	*40*
2003	762	45	*6*	187	*25*	202	*27*	328	*43*
2004	1185	273	*23*	204	*17*	353	*30*	355	*30*
2005	1372	-	-	-	-	-	-	-	-
2006	985	162	*16*	256	*26*	264	*27*	303	*31*
2007	1323	165	*12*	257	*19*	411	*31*	490	*37*
2008	1265	53	*4*	230	*18*	603	*48*	379	*30*
2009	1610	76	*5*	240	*15*	925	*57*	369	*23*
2010	3008	235	*8*	410	*14*	1678	*56*	685	*23*
2011	-	-	-	-	-	2003	-	644	-
2012	-	-	-	-	-	1714	-	760	-
2013	-	-	-	-	-	1310	-	818	-

Graph 4-



Graph 5-



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What the data suggests that the total no of commercial inshore fisheries licenses issued annually in Fiji has been steadily increasing and similarly this trend is experienced across the central, western and northern divisions. The northern division by comparison is the most pronounced in terms of the number issued from 289 in 2002 to 1310 in 2013, a 75% annual growth rate. Although the three divisions all show an increase by number of licenses issued as indicated in the first graph, upon conversion to a percentage of the overall national total what is demonstrated is that only the northern division registers an increase over the 12 year period, peaking at over 50% of the national total. What this again suggests is what has been previously highlighted, the increasing importance of this division fisheries economic contribution to the national inshore fisheries sector, the role of the Great Sea Reef in sustaining the northern divisions fisheries and need for precautionary and effective management of this system.

PROVINCIAL GSR FOCUSED- OVERVIEW

Now that a rough estimation of the range of the northern divisions contribution to the national commercial inshore fisheries sector has been inferred, the question remains, is how much of this divisional total is actually derived from fishing areas within the boundaries of what is defined the Great Sea Reef. In order to do this, one has to break this divisional level data down to what is captured at the provincial level. As the northern division comprises catch data from the three provinces of Macuata, Bua and Cakaudrove, data in reference to the latter province, as it covers the southern portion of Vanua Levu and outliers needs to be removed from the divisional total. Also certain fishing areas along the southern sections of the Bua Province also need to be removed as it does not lie directly within boundaries of the GSR. For the estimation of the Great Sea Reef contribution to the divisional total, the following fishing grounds or i qoliqoli's are considered. All qoliqoli's falling within the boundaries of the Macuata province excluding Cikobia an outlying maritime district and the three qoliqoli's of Lekutu-Navakasiga, Bua-Vuya and Bua for the Bua Province as they encompass or directly face the western sections of the GSR. Again it must be highlighted the difficulty in obtaining provincial level data to undertake this exercise. Include site level examples. Due to the difficulty of even securing divisional catch landing data, much of what that is discussed in this section is inferred from the licensing data issued within the division.

The table below provides the most recent breakdown in licenses for the northern division. In data indicates that by average proportion for the four years, Macuata registered the highest with 40%, followed by Cakaudove 34% and Bua with 26%. Although it might be a simple formula to allocate the given percentages as a proxy estimation of the total volume registered for the division, caution needs to be applied. Communication with the Northern Fisheries Department indicate that much of the catch data landing recorded for the northern division is captured from Labasa within Macuata. Records from Nabouwalu (Bua) and Savusavu (Cakudrove) have not been consistent to give a better picture of landings made for the entire northern division. As much as 80% of the data for the northern division is indicated to be collected from Labasa. Also it should be highlighted that using the licenses alone as an indication of catch landing proportions is not altogether correct if one considers variables such as effort, for example 1 license registering greater catch due to higher effort as say compared to 3 licenses issues but with lower catch effort.

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Table 4- Licenses Issued By Province for Northern Division (2010- 2013)

Year	Macuata	Bua	Cakaudrove	Total
2010	754	509	413	1676
2011	661	455	887	2003
2012	847	415	452	1714
2013	476	327	507	1310

Two possible scenarios have been presented below; the first is that one accepts the distribution indicated from the licenses as a proxy indicator of effort and thus catch landing. In this case one considers the total 40% registered from Macuata and includes half of the 26% for Bua. Only half of the latter is considered as licenses would also have been issued for non GSR areas. Also it has been communicated from the northern Fisheries Department that generally bulk of the Bua Licenses were issued for those fishing highlighted previously as falling under the GSR boundaries such as Lekutu-Navakasiga and Bua-Vuya I qoliqoli's.

Table 5- Scenario Estimation of GSR inshore fisheries catch landings and monetary worth

Annual National Catch Landing Average- 2001-2012 (tn)	7312				
Estimated Divisional Contribution by Percentage- Upper- Lower Limits	*40%*	*50%*	*60%*	*70%*	*75%*
Estimated Assumed Northern Division Catch Landings Based on Limits (tn)	2925	3656	4387	5118	5484
Macuata-GSR- Estimation based on portion of licenses- 40% (tn)	1170	1462.4	1754.8	2047.2	2193.6
Bua-GSR- Estimation based on half of portion of licenses- 13% (tn)	380.25	475.28	570.31	665.34	712.92
1.Total Estimated Assumed Catch Landings derived from GSR- Bua & Macuata (tn)	1550.25	1937.68	2325.11	2712.54	2906.52
2. Estimation based on assumption 80% of recorded catch Landings from Macuata (tn)	2340	2924.8	3509.6	4094.4	4387.2

For this first scenario the estimated range for GSR related catch landings , using the conservative limit of 40%-60% of the northern divisions national contribution would fall within 1550 to 2325 tonnes per year, valued at FJD 8 to 12 million per year. The second scenario assuming 80% of the catch landing data is sourced from Macuata, the estimated range for GSR catch landing would fall within 2340 to 3510 tonnes per year, translating into FJD 12 to 16 million annually.

The data available suggests the importance of the Macuata Province fishing grounds as the main source of catch landings registered for the northern division and in turn the Great Sea Reef. Another interesting layer is to determine the contribution of catch landings from the seven fishing grounds or i qoliqoli's within the province itself. The table and graph below shows the breakdown of licenses issued per qoliqoli for the province of Macuata for the period 2009-2013 as extracted from raw data provided the Northern Fisheries Department.

Table 6: District Level Licenses issued for Macuata Province (2009-2013)

	2009	2010	2011	2012	2013
Cikobia		1	6	25	11
Labasa- Macuata		26	2	10	25
Udu	32	90	39	82	23
Qoliqoli Cokovata	130	259	283	252	119
Nadogo	10	32	18	33	8
Namuka-Dogotuki	38	152	155	207	91
Wailevu-Macuata		2	1	1	3


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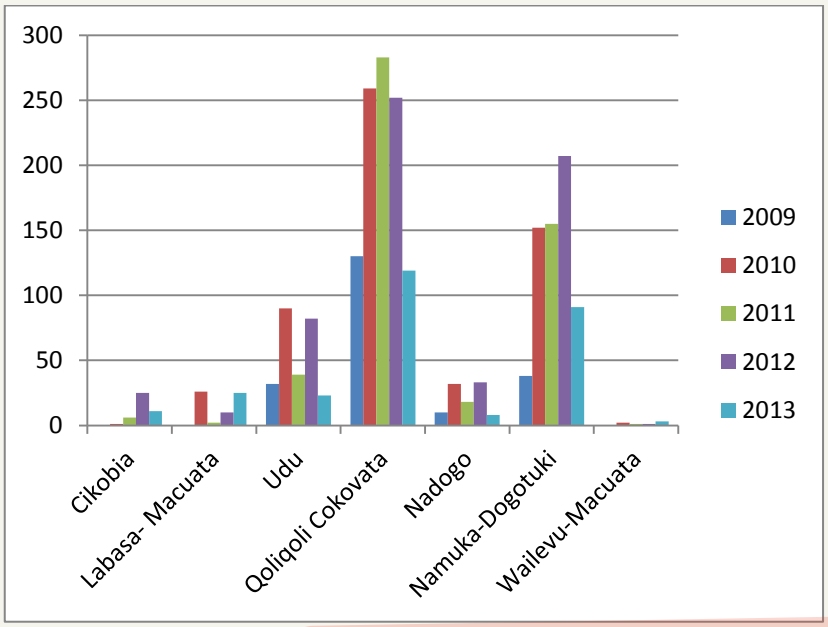
Graph 6-



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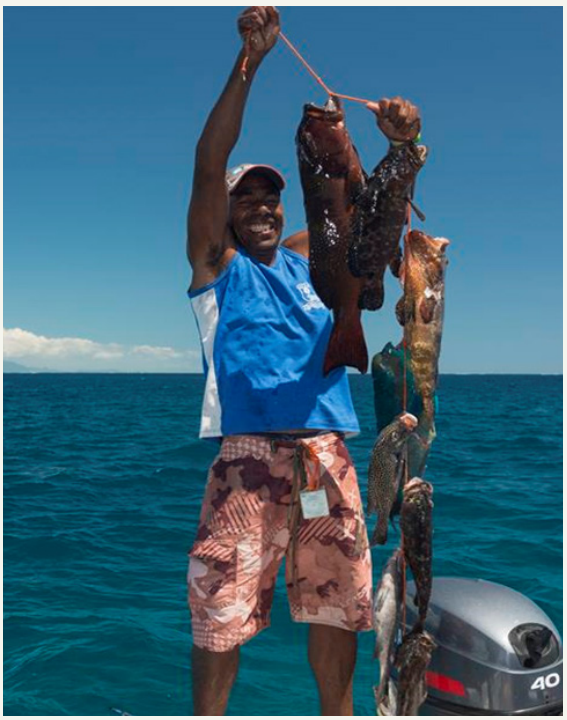
The general trend indicated from the dataset demonstrates for the given 5 year period the largest proportion of licenses was issued for the Qoliqoli Cokovata, out of the seven qoliqoli's within the province. This was closely followed by licenses issued for the Namuka Dogotuki and Udu qoliqoli areas respectively. Whereas in the other qoliqoli's license issued appears fairly consistent over the period, for the Qoliqoli Cokovata and Namuka- Dogotuki there was a sudden spike in licenses issued from 2009 to 2010 peaking around 2012 and a general decline by 2013. The increase in licenses issued may be indicative of the improvement in fisheries within the areas as the licensing numbers were maintained at this peak period ((2010-2012). The decline by 2013 may be due possibly to both lower catch and thus lesser applications for licenses during the 2013 or resulting from greater enforcement by the Fisheries Department noting higher fishing intensity in the areas. This however needs to be corroborated further with Fisheries northern officials.



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OTHER GSR RELATED VALUES-OVERVIEW

In order to consider other economic values contributed by the Great Sea Reef, one needs to break down in detail the types of habitats or ecosystems present within its boundaries. The total area considered part of the Great Sea Reef for the Macuata and Bua provinces is 6,302 sqkm. The breakdown by fishing grounds or I qoliqoli and extent of coral reef and mangrove habitat is provided below-

Table 7: Area of GSR Related I Qoliqoli's

Province	Qoliqoli Name	Area (sq km)
Macuata	Udu	73
	Namuka and Nadogo	232
	Nadogo	264
	Qoliqoli Cokovata	1349
	Labasa	67
	Wailevu	41
	Total	**2026**
Bua	Lekutu & Navakasiga	1827
	Vuya and Bua	2065
	Bua	384
	Total	**4276**

Table 8- Area of GSR Related Habitats by Type

Province	Fringing Reef (sq km)	Non Fringing Reefs (sq km)	Mangroves (sq km)
Macuata	89.7	258.1	78.2
Bua	28.5	112.5	33.9
Total	118.2	370.6	112.1

As discussed earlier the economic value of services provided by coral reefs in the South Pacific region was determined to be $972 per hectare in Fiji. If one considers this value then considering the total area of reefs (488.8 sq km) for the demarcated areas of the GSR this would amount to $47.5 million or roughly $1 million for every hectare of coral reef on the Great Sea Reef.

Similarly a mangrove direct use valuation study conducted in Fiji comparing the net benefits of converting mangrove lands to agricultural production by estimating the benefits lost after conversion, calculated the economic value for reclamation compensation for the three divisions to be FJD 2,939 per hectare for the central division, FJD 217 per hectare in the western division and FJD 209 per hectare in the northern division. Using the calculation presented in this study, the compensation value for the GSR related mangrove areas would be FJD 2.3 million. The study also registered calculations for on-site fisheries with a total production of commercial (147 kg) and subsistence (184 kg) harvest in mangrove-ecosystems collectively being 331 kg per hectare per year. If we again use this estimation as a proxy measurement for mangrove fisheries production, then this would amount to 3,711 tonnes annually for all mangrove areas within the GSR boundary, translating into FJD 19.2 million using current market price. Other mangrove related services such as nutrient filtering was included in the study and was been calculated as $5 820 per hectare through an alternative cost approach using a conventional treatment plant. In this instance the filtering value of the GSR mangroves would be FJD 65.2 million. It should be noted however that this study was conducted in 1990 and only direct use values were used in the calculation. The values presented here utilises the values generated in 1990 and is more likely much higher in today's money.

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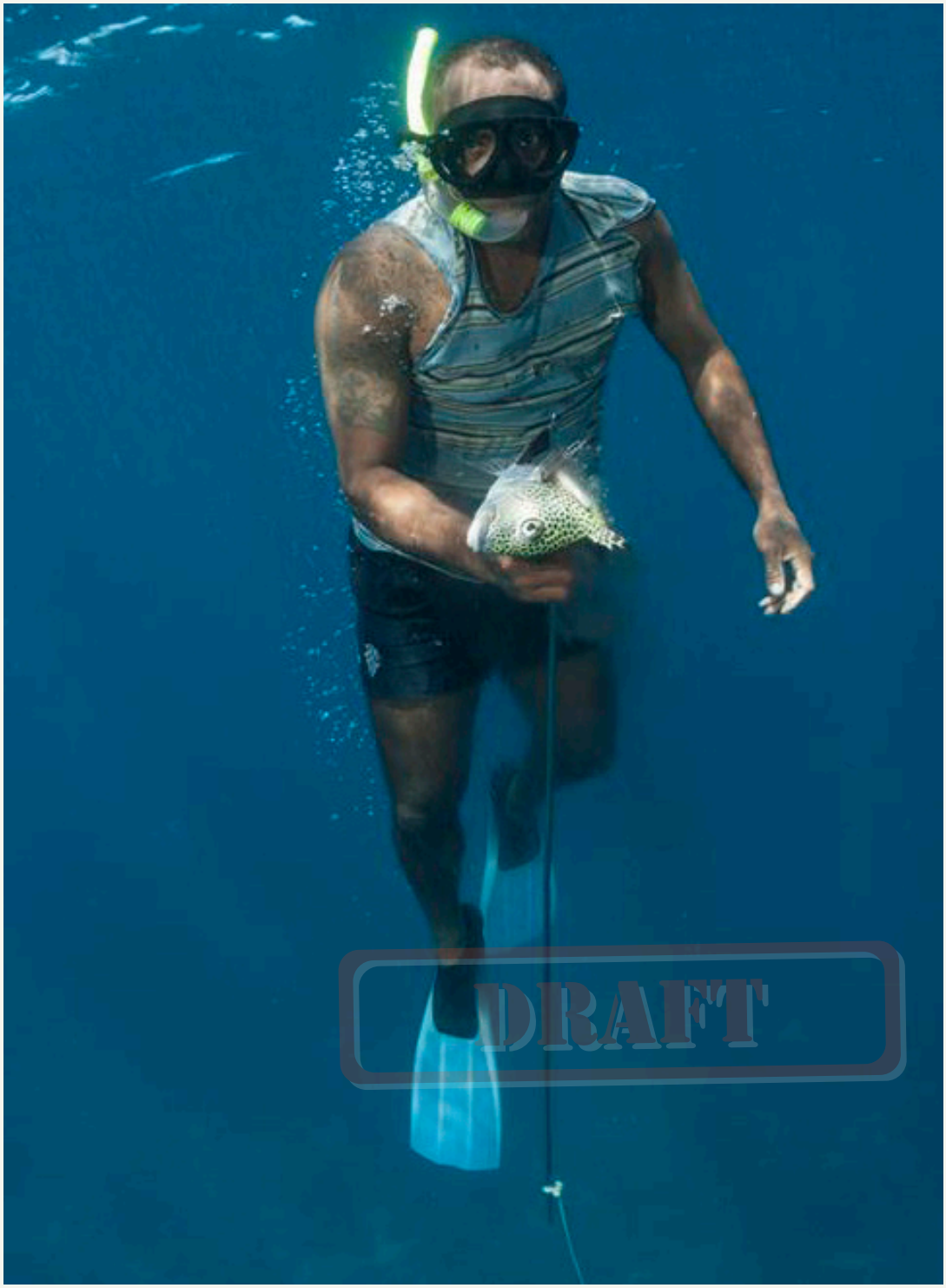

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