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The future of Pacific Island fisheries



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2010

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Original text: English

Secretariat of the Pacific Community Cataloguing-in-publication data

Gillett, Robert

The future of Pacific Island fisheries / Robert Gillett and Ian Cartwright

1. Fisheries — Oceania.
2. Fishery management — Oceania.
3. Fishery resources — Oceania.

I. Robert, Gillett. II. Cartwright, Ian. III. Title IV. Secretariat of the Pacific Community.

639.20995

AACR2

ISBN: 978-982-00-0422-1

This report is a relatively short summary of the major issues related to the future of Pacific Island fisheries, and is aimed at senior decision makers in Pacific Island governments. Two additional documents have also been produced: One is a short summary of only main points (for Forum Leaders and for wider circulation); the second is a set of technical annexes (for people interested in technical aspects or justification for the conclusions reached).

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Prepared for publication at
Secretariat of the Pacific Community, Noumea, New Caledonia
2010

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Abbreviations

ADB	Asian Development Bank
DWFNs	distant-water fishing nations
EEZ	exclusive economic zone
FAD	fish aggregating device
FSM	Federated States of Micronesia
FFA	Pacific Islands Forum Fisheries Agency
GDP	gross domestic product
IUU	illegal, unreported and unregulated
MCS	monitoring, control and surveillance
MDG	Millennium Development Goal
MPA	marine protected area
NGO	non-governmental organisation
PICTs	Pacific Island countries and territories
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
SPC	Secretariat of the Pacific Community
USP	University of the South Pacific
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	western and central Pacific Oceans

No one can foresee all the opportunities and forces, or their relative importance, for the future is not a simple projection of the present. New factors keep emerging, but the more we explore the possibilities and act on the best options, the better the futures are likely to be.

Source: Crocombe 2008

1. Introduction

Fisheries are the most significant renewable resource that Pacific Island countries and territories (PICTs) have for food security, livelihoods and economic growth. As Pacific Island populations grow, the future benefits that these resources can provide will depend on how well we are able to balance the increasing demands on fisheries with the capacity of oceanic, coastal and freshwater fish stocks to sustain those harvests. Aquaculture's role in supplementing wild fisheries production is also a consideration.

This report considers the future of fisheries over a 25-year timeframe (2010–2035). It is intended to provide the basis for long-term strategic approaches to developing and managing fisheries at national and regional levels. The first part of the report provides a brief overview of the status of and trends in the region's fisheries, the major issues and challenges, and gaps that need to be addressed. The second part examines ways in which the contribution of national and regional institutions can be enhanced, and regional cooperation strengthened, to provide countries with the capacity and adaptability they need to address emerging needs and priorities.

While it is impossible to accurately predict what Pacific Island fisheries will be like in 2035, this study identifies and briefly describes the most likely significant factors driving change in fisheries, and their possible impacts. These factors were identified through discussions with Pacific Island fishery stakeholders and global specialists, and a review of the fisheries literature. Scenarios (Box 1) were developed and scrutinised to provide insight into the future of fisheries.

Box 1: What is a scenario?

Scenarios are plausible, provocative, and relevant stories about how the future might unfold. They can be told in both words and numbers. Scenarios are not forecasts, projections, predictions, or recommendations, though model projections may be used to quantify some aspects of the scenarios. The process of building scenarios is intended to widen perspectives and illuminate key issues that might otherwise be either missed or dismissed. By offering insight into uncertainties and the consequences of current and possible future actions, scenarios support more informed and rational decision-making in situations of uncertainty.

Source: Carpenter 2005

In this report:

- 'Fishing' and 'fisheries' refer to the harvesting of aquatic animals and plants, and includes aquaculture, unless otherwise stated.
- 'Fish' includes shellfish and other invertebrates such as sea cucumbers.
- The term 'Pacific Island countries and territories' and 'PICTs' refers to the region's 14 independent countries and the 8 territories.

2. Current status and general trends

2.1 Past trends: Fishery and non-fishery

It is informative to consider the likely future of fisheries in light of past experience by considering desirable and undesirable trends. Important trends in the Pacific Islands outside the fisheries sector include changes in demographics, governance, and business conditions. In general, most PICTs are experiencing declining fertility, but this reduction is lower than in most developing countries, resulting in relatively large population increases. A second significant demographic trend is increasing urbanisation. Government instability is also emerging as an important trend, especially in Melanesia. With respect to business conditions, there is increasing – but not yet full – acceptance of the private sector as an important factor in stimulating economic growth. Many PICTs have experienced improvements in their investment climate and openness to outside investment. There is also a renewed determination to secure greater tangible benefits from offshore resources (e.g. tuna) by exerting management and economic influence at a regional and sub-regional level.

The most influential trends in fishing and aquaculture (apart from resource status) include the:

- demise of government fishing companies;
- lack of success in fulfilling the development promise of offshore fisheries;
- decline of pole-and-line fishing and the rise and decline of locally based longlining effort;
- decline of the United States purse-seine fleet, steadiness in the Japanese purse-seine fleet, and the rise of the non-Japanese Asian purse-seine fleet;
- decline in bottomfish fisheries;
- emergence of new fisheries for aquarium fish and live reef food fish;
- increasing relative cost of fuel in fishing operations;
- continuing success of the fish aggregating device (FAD) as one of the few mechanisms that enable small-scale fishers to access offshore resources;
- lack of major success in government-led aquaculture development efforts; and
- success of black pearl culture.

Some important recent trends in tuna fisheries of eight independent Pacific Island countries were documented in a study by the Pacific Islands Forum Fisheries Agency (FFA), and are outlined in Table 1.

Some overall generalisations can be made about past trends in Pacific Island fisheries. While changes in fisheries were formerly driven by the initiatives put forward by national governments and donors, more recent fisheries trends have resulted from economic realities (e.g. in bottomfish, aquaculture, boatbuilding, and small-scale tuna fishing). There has been an increase in wealth in the sector, much of which is due to an increasing global scarcity of fishery resources. A shift from small-scale producers to medium-scale producers has taken place in several fisheries (longlining, bottomfish, aquaculture) in order to take advantage of economies of scale.

Table 1: The evolution of the Pacific Islands tuna industry development 2002–2008

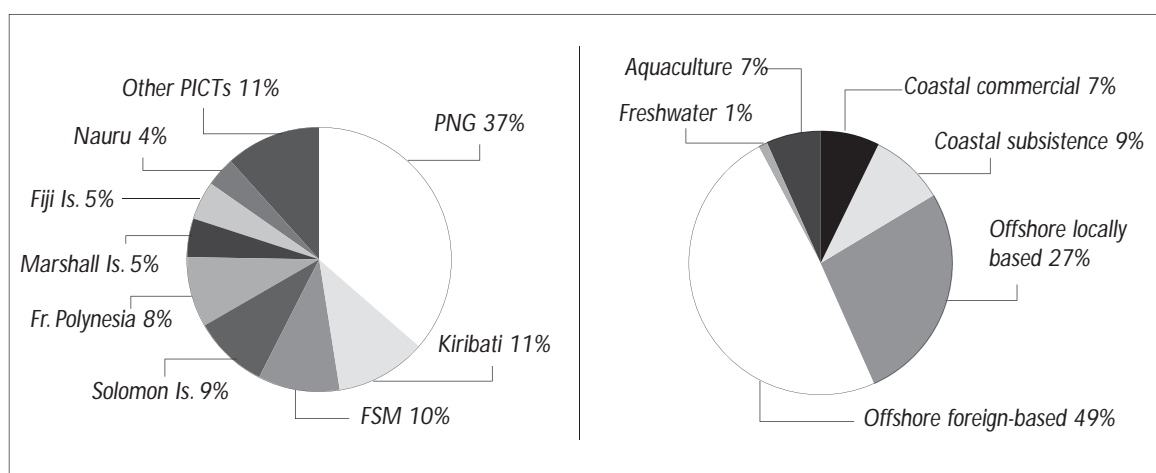
	2002	2006	2008
Purse-seine vessels (locally based)	40 vessels	55 vessels	56 vessels
Longliners (locally based)	377 vessels	316 vessels	269 vessels
Pole-and-line vessels (locally based)	14 vessels	12 vessels	2 vessels
Tuna canning and/or loining facilities	4 factories	5 factories	6 factories
Local jobs on tuna vessels	2,959 jobs	797 jobs	1,169 jobs
Local jobs in tuna canning and/or loining facilities	5,555 jobs	6,935 jobs	11,116 jobs

2.2 Fishery resources

The region's fishery resources can be divided into four categories: offshore (or oceanic), coastal (or inshore), freshwater (or inland), and aquaculture.

- **Offshore resources** include tunas, billfish and allied species. These resources are found in open-water habitats, and generally move extensively across exclusive economic zones and high seas areas. A few, well-studied species form the basis of the region's industrial tuna fisheries, which are managed through national, regional and international frameworks. Although oceanic in habit, some of the important species in this category are also found in coastal waters, where in some cases they form resident populations. In general, offshore resources are in relatively good condition, with the exception of bigeye tuna and to a lesser extent, yellowfin tuna.
- **Coastal resources** include a very diverse range of finfish and invertebrates, many species of which are poorly understood. These include demersal (bottom dwelling) species, and those that inhabit shallow water habitats, and whose individual movements are generally restricted to coastal areas. Management is undertaken on national and community levels. Because of their relative accessibility, these resources form the basis of most of the region's small-scale fisheries. In general, coastal fishery resources are heavily used, often showing signs of overfishing; These resources are targeted by both commercial and subsistence fishers.
- **Freshwater resources** include both fish and invertebrates (e.g. freshwater shrimps and clams). In the Pacific Islands region, freshwater resources are most important in the larger islands of Melanesia, but are of some significance in all areas, except atolls and tiny islands. Many of the important species are introduced, such as tilapia. Most fishing effort for freshwater resources is subsistence based. Freshwater fisheries issues and/or problems and their solutions are generally closely linked with freshwater quality.
- **Aquaculture** in the region centres on a small number of resources: black-lip pearl oyster, penaeid shrimp, tilapia, milkfish, giant clam and seaweed. In terms of value, aquaculture in the region is overwhelmingly dominated by French Polynesia (black pearl) and New Caledonia (shrimp), with 95.5% of the value of aquaculture in the region's 22 PICTs coming from these two French territories.

2.3 Production and economic contribution



(Note: Annual production by value for 2007)

Figure 1: Production from fisheries and aquaculture by country and category

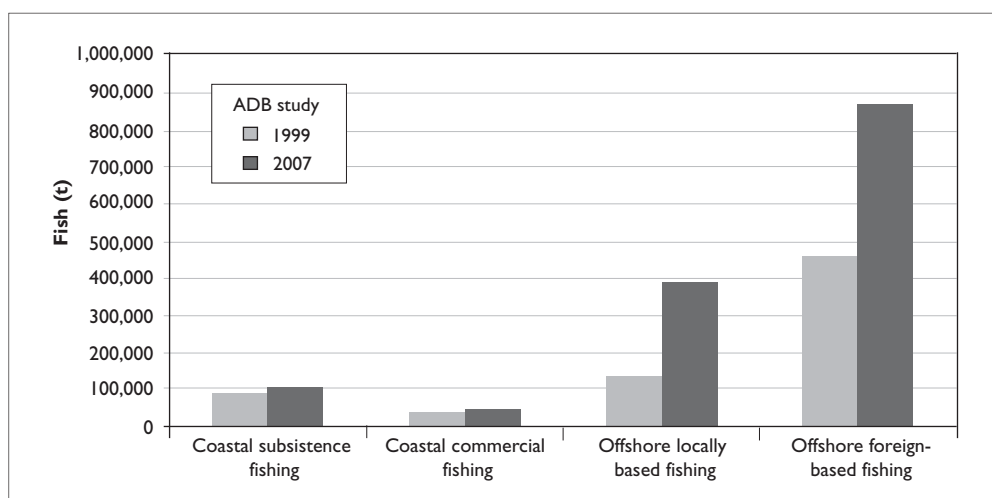
Offshore, foreign-based fishing is responsible for about half of the value of the region's fisheries, offshore locally based fishing for about one-quarter, with coastal commercial, coastal subsistence, and aquaculture together accounting for the remaining one-quarter. Papua New Guinea (PNG) – which has three canning and loining plants, three-quarters of all locally based purse-seine vessels, and vast freshwater and coastal fisheries – was responsible for about 40% of all fishery production in the region (by value) in 2007. The ranking of countries by total fisheries production is strongly influenced by the level of tuna catches, and there is a general pattern of decreasing total national catches from west to east across the region, and from equatorial to higher latitudes.

The region's fishing sector contributes up to 10% of gross domestic product (GDP), but these contributions exclude postharvest activities (as per international convention). Fishing sector GDP estimates for countries with fish processing and trans-shipment activities are likely to substantially underestimate the economic importance of the broader fisheries sector.

Exports of fisheries products are very important to PICTs, and represent a majority of the exports in about half of the countries and territories. In six PICTs, the export value of fishery products accounts for about 80% or more of all exports.

Most of the benefits from fisheries that directly affect Pacific Islanders – such as nutrition and jobs – come from coastal resources. The less tangible and more abstract benefits (e.g. contribution to GDP, exports, and government revenue) tend to come disproportionately from offshore resources.

A very important trend in recent regional fishery production is that offshore fisheries are expanding substantially, while coastal fisheries are not. Although the poor state of coastal fisheries statistics in the region normally makes it difficult to demonstrate this point, two comparable studies by the Asian Development Bank (ADB) show the trend.



(Source: Gillett and Lightfoot 2001; Gillette 2009)

Figure 2: Fishery production trends

The observation that coastal fishery production is not increasing is quite consistent with a recent policy paper by the Secretariat of the Pacific Community (SPC), which notes that coastal fisheries are ‘mature’ in fishery development terms, and that the main focus of reef fisheries should be on consolidation and protection of current benefits. It asserts that any attempt to extract additional benefits should focus on tourism and other non-extractive uses.

2.4 National, regional and multilateral fishery management arrangements

National fisheries agencies face many challenges in dealing with contemporary fisheries management issues, and numerous studies have identified these as key barriers to achieving fishery goals. Some of the main issues related to national fisheries agencies are that they:

- face increasing workloads and responsibilities with shrinking budgets and limited human capacity;
- often have limited connections with fishery stakeholders;
- have increasing regional responsibilities or activities associated with offshore fisheries, which has tended to divert attention and resources away from coastal fisheries;
- have been the focus of targeted institutional strengthening projects in recent years, the results of which are yet to be fully determined; and
- lack good planning procedures that are implemented and monitored in a structured way.

With respect to regional fishery arrangements, the Pacific Islands are served by two regional fisheries institutions, SPC and FFA. There has been an increasing focus on developing regional programmes that are implemented nationally, and heightened awareness of the need to ensure adequate in-country capacity is available to implement these regional programmes.

At the multilateral level, the Western and Central Pacific Fisheries Commission (WCPFC) has begun to address problems in managing tuna and related stocks of the western and central Pacific Ocean (WCPO) throughout their range, and particularly on the high seas. By adopting a range of conservation and management measures, WCPFC seeks to provide management arrangements for key tuna stocks, while also protecting other species caught in association with those stocks, including bycatch species. This has not been a smooth process, with strong disagreements between the FFA members and distant-water fishing nations (DWFNs) regarding the jurisdiction of WCPFC over exclusive economic zones (EEZs) and archipelagic waters. Relative to other regional tuna fisheries management organisations, coastal states can drive the WCPO process to a greater extent, because they control a greater proportion of resources in this region, and there is generally more solidarity among PICTs than among coastal states in other regions. WCPFC's effectiveness, in terms of conserving and managing fish stocks and providing 'good' outcomes for PICTs with regard to securing what they perceive as appropriate control of the resource, has been increasingly questioned by the FFA member countries

3. Key drivers of change

A list of the major factors driving change in Pacific Island fisheries are listed below, followed by a summary of the probable impacts on Pacific Island fisheries of the predicted changes arising from each of these factors.

- Population growth and urbanisation
- Patterns of economic development
- The status of fisheries resources and developments in other oceans
- Governance and political stability
- Climate change
- Limits to domestic fishery production
- Markets and trade
- Other factors (e.g. fuel costs, technology and innovation, foreign aid).

Population growth and urbanisation: The rate of overall population growth and urbanisation will remain high. Population will increase from 9.8 million in 2010 to 15.0 million in 2035, with growth especially high in Melanesia. Continuing urbanisation will result in about one-third of the population of Melanesia, one-half of that in Polynesia, and three-quarters of that in Micronesia living in urban areas by 2035.

There will be a growing gap between coastal fisheries production and the demand for fish from coastal fisheries. The amount of fishery products originating from coastal fisheries that is accessible to urban residents will decline sharply due to overexploitation and habitat destruction. A growing proportion of the population will not be able to catch sufficient fish to provide for household consumption, and purchased fish will become relatively expensive. Food security issues will grow tremendously in importance as the need increases to obtain additional sources of fish to cover shortfalls.

National economic development: PICTs appear to be falling seriously short of achieving the targets associated with the Millennium Development Goals (MDGs). Poverty in the region is on the rise, with about one-third of the people in the Pacific Islands living below national poverty lines. Governments (many with a short political horizon) have limited ability and incentives to translate MDGs into national initiatives and outcomes. Current trends suggest that the economies of most PICTs will not be in very good condition in the future.

There will be large negative impacts on coastal fisheries: greater numbers of people without jobs will be seeking income and food security from harvesting coastal resources, and will be willing to compromise future sustainability for immediate food or money. Limited public revenues will reduce the ability of governments to provide basic fisheries-related management services and infrastructure.

Global patterns of economic development: Global economic development trends suggest that in 25 years there will be increasing prosperity in countries that serve as markets for the region's fish, accompanied by decreasing barriers to international commerce, increasing consolidation in industries that involve international commerce, increasing relative costs of energy, and movement by labour-intensive industries to low-wage countries.

Several of these trends will contribute to higher prices for fishery products. This will bring greater benefits to those PICTs that actively pursue development objectives within the limits of sustainability, using strong fishery institutions and resilient fishery regulatory schemes. Higher prices for those countries with poor overall governance structure and weak regulatory schemes could have negative consequences, including a devastating impact on the supply of fish for domestic consumption. Higher prices for fishery products could easily be a double-edge sword for the Pacific Islands region – much like the ‘resource curse’ in some African countries that have abundant diamonds or oil, but have achieved little in the way of development. Non-fishing activities will have growing impacts, which will also need to be addressed.

The status of fisheries resources and developments in other oceans: Most of the world’s fisheries are fully- or over-exploited (FAO 2009),¹ and are increasingly subject to tight regulatory controls. This has created a ‘push/pull’ situation, in which fishers are discouraged from operating in certain regions and/or are attracted by perceptions of opportunity in other areas.

As populations and demand grow and marine resources continue to decline in Southeast Asia and China, coastal marine resources in the Pacific Islands will likely become increasingly attractive and highly valued. Overfishing of tuna in other regions will probably result in the Pacific Islands region becoming increasingly attractive to global-roaming tuna fleets, thereby increasing the value of fisheries access and/or presenting opportunities for leveraging development of domestic fisheries. On the other hand, illegal, unreported and unregulated (IUU) fishing is likely to increase, along with management costs

Governance and political stability: Common features that emerge from analyses of fisheries governance are that many national fisheries agencies have low capacity, a lack of qualified personnel at all levels, increasingly complex issues to contend with, low levels of funding, and few staff incentives for performance in support of good governance.

The future is likely to bring an increase in the scarcity of fisheries resources, and the pressure on fishery decision-makers to satisfy stakeholders with differing interests will increase, testing governance structures. However, where good governance exists, large gains in benefits should occur. Those countries that currently have poor governance structures and fisheries agencies that perform inadequately will probably suffer major or magnified negative consequences in the future. Fisheries governance can be expected to change, at least marginally, with any improvement or decline in general governance in the region.

Climate change: The build-up of carbon dioxide and other greenhouse gases in the atmosphere due to human activities is acting in two major ways that will ultimately affect fisheries: through global warming and ocean acidification.

In offshore fisheries, initial modelling indicates that the concentrations of skipjack and bigeye tunas, and the associated benefits, may be located farther to the east. Projections indicate that cyclones will become progressively more intense, which will increase the risk to shore-based facilities, fleets, and processing operations in countries located within the cyclone belt. Coastal fisheries are eventually expected to be less productive due to the degradation of coral reefs caused by the projected synergistic effects of more frequent bleaching, lower levels of carbonate, increased cyclone intensity and greater turbidity of coastal waters. Aquaculture is likely to suffer problems related to floods, increased acidification, and higher temperatures.

1 FAO (2009) states: ‘In 2007, about 28 per cent of stocks were either over-exploited (19 per cent), depleted (8 per cent) or recovering from depletion (1 per cent) and thus yielding less than their maximum potential owing to excess fishing pressure. A further 52 per cent of stocks were fully exploited and, therefore, producing catches that were at or close to their maximum sustainable limits with no room for further expansion.’

Limits to domestic fishery production: The total coastal fisheries production of many PICTs does not appear to have expanded in recent years, despite increasing effort. Many species have reached or exceeded sustainable production limits, and this trend is expected to continue across all fisheries. Coastal fisheries production is not expected to grow significantly in the future in most PICTs. In offshore fisheries, some tuna species are approaching (or surpassing) sustainable production levels, while others can support increased catches, but that potential is certainly not infinite. It is likely that most future industrial fisheries development will be based on skipjack. The nature and production of coastal and offshore fisheries in the long term will be determined, at least in part, by how fisheries managers respond when sustainable production levels are reached. Fisheries management will include economic objectives, rather than consisting simply of biological targets or limits.

Markets and trade

- **Subsidies:** Many governments in the region currently use subsidies as a fisheries development tool, while some major fishing nations continue to subsidise their fleets. The practice of subsidising domestic fisheries in the region is likely to be reduced in the future due to the a) decreasing ability for Pacific Island governments to pay for such subsidies, b) increasingly overexploited condition of coastal resources, c) shift in donor priorities toward promoting conservation efforts (donor supported many past subsidy programmes), and d) poor experience in the region with the use of subsidies as a fisheries development tool. Subsidies for distant-water fleets will most likely decline as World Trade Organization measures take effect.
- **Eco-certification:** The process of certifying that specific fishery products come from fisheries that are ‘sustainable’ is currently growing in importance. Proof of sustainability will be very important in future markets for the region’s offshore fisheries. The impact of certification schemes on Pacific Island coastal fisheries and aquaculture is less certain. The carbon inputs into fisheries production will come under increasing scrutiny.
- **Preferential access:** Many of the region’s tuna processing plants currently rely heavily on preferential market access to the European Commission. With an anticipated increase in free trade arrangements, it can be expected that these preferences will not be available in 25 years. The region must adjust to this reality and endeavour to improve the economic efficiency of processing so it can compete with suppliers in Southeast Asia. On the positive side, new markets for tuna should emerge.

Other drivers

- **Fuel costs:** Tuna longline fisheries will experience difficulty in the future, while purse-seine fisheries will have relatively fewer difficulties resulting from fuel price increases, as they are able to use increasingly effective and fuel-efficient fishing techniques. In coastal fishing, the strategy of responding to lower catch rates by extending the area fished will become less viable, while non-motorised fishing techniques will enjoy some advantages.
- **Technology improvements:** It is inevitable that Pacific Island fishers will become more efficient, which has implications for effort control and stock assessments. Changes will be both incremental and in leaps. Not all changes will be negative and improvements can be expected, including in the ways fisheries are assessed and managed, alternative fuel or energy saving technologies, fish preservation and storage, and processing methods.
- **Foreign aid:** With the budgets of many national fisheries agencies evolving to support staff costs at the expense of operations and activities, donor support will be increasingly important for any

projects or activities, but priorities may be different from those of the host government. Non-governmental organisations (NGOs) will also grow in significance, and may attract donor funding.

- **Political profile:** Where there is high-level government interest in fisheries, positive changes will be more likely to occur. A major unknown will be whether governments will be interested in and committed to approaches that consolidate current benefits and add value to existing catches, rather than seeking development through increased catches.

4. Forming an impression of the future

4.1 An exploration of challenges, threats and opportunities

Various future challenges will threaten the flow of benefits from fisheries in the Pacific Islands, and there will be opportunities to overcome these difficulties and/or produce additional benefits from the fisheries. An exhaustive listing of all challenges and opportunities would be very long and not applicable to all countries in the region. Table 2 attempts to present only those factors that are especially important or are common to many countries. Particularly serious threats are posed by excess fishing effort in both coastal and offshore fisheries, declines in bigeye and yellowfin tunas, and the direct and indirect impacts on coastal fisheries associated with a rapidly rising population.

Some of the other issues highlighted in Table 2 deserve additional attention. Many of the likely future challenges to all categories of fisheries in the region will be related to governance issues, especially the effectiveness of government fisheries agencies. Conversely, taking advantage of future fisheries opportunities will be extremely difficult if the performance of fisheries agencies does not improve.

Other important features of Table 2 are:

- Challenges facing fisheries will be considerably more complex in the future, but many may be magnifications of current challenges, and may not involve new or markedly different issues. Challenges will exist both inside the fisheries sector (where they can be addressed through fisheries management) and beyond (in which case they must be addressed through a higher level or multisectoral approach).
- For offshore fisheries, regional solidarity among PICTs will be central to mitigating most of the challenges listed, as well as for taking advantage of most of the opportunities.
- Regional approaches will need to recognise differing national circumstances, priorities and aspirations, particularly in developing fisheries management arrangements for tuna fisheries.
- Dealing with challenges will often involve the difficult act of balancing very different types of considerations, both inside and outside the fisheries sector.

In addition to the challenges and threats listed in Table 2 that are applicable to all countries, some countries and parts of countries have extra difficulties as a result of their remote locations, which reduces opportunities, especially with respect to perishable products.

Table 2: Challenges and opportunities in Pacific Island fisheries

	Main challenges	Opportunities
Offshore	<ul style="list-style-type: none"> • Overfishing: Overall levels of fishing effort are too high. Two of the four important species of tuna in the region cannot support increasing catches – biological limits are being approached and/or surpassed. Of special concern are the overfishing on bigeye and yellowfin tuna stocks and the overfished status of bigeye. Currently, catches of yellowfin/bigeye tuna are being maintained by above average recruitment; a return to long-term average recruitment (the likelihood of which is unknown) would accelerate declines in yellowfin tuna and bigeye tuna. Given the poor state of knowledge of the pelagic ecosystem, there is some concern about the irreversibility of the bigeye decline. Even the potential of skipjack, thought to be the largest fishery resource of the region, is not infinite. Indonesia and the Philippines, which share stocks with PICTs, have even more difficulty controlling overfishing. • Ineffective management processes: The pace of management interventions is likely to continue to be slower than stock declines. There may be great difficulty in balancing bigeye and yellowfin tuna management measures with development aspirations (e.g. the impact of those measures on the skipjack purse-seine fishery). There are also problems in balancing the need for regional solidarity with respect to biological and economic management objectives with widely differing country circumstances (in terms of resource endowment, time horizon, and development aspirations). Additional problems include the failure to arrive at mutually beneficial arrangements between DWFNs and PICTs, dissipation of rent through high management costs, and IUU fishing. • National fisheries governance: National fisheries agencies often have low levels of capacity, transparency and effectiveness. The lack of clear fisheries management objectives and systems of adherence and accountability to progress towards achieving those objectives is especially troublesome. Many PICTs lack a high-level government focus on fisheries. WCPFC places additional burdens on agencies. • Development challenges: Fledgling local operators are unable to compete with multi-national, vertically integrated companies in what are often difficult investment environments. It can be difficult to balance the benefits obtained by licensing foreign fishing vessels with the net benefits of having a domestic tuna industry, as these involve different types of benefits, incentives, and beneficiaries. There are large challenges associated with coastal communities deriving benefits from oceanic fisheries. PICTs are unable to compete with low-wage countries in processing. 	<ul style="list-style-type: none"> • Promote high, stable catch rates, lower fishing costs, and increased value of access by maintaining healthy tuna resources. • PICTs can control the region's tuna fisheries; WCPO is the only major tuna fishery where most of the resource lies in waters of coastal states with common interests. • Development of the domestic industry can bring increased benefits to PICTs, including revenue and employment. • There is an increased desire to fish and/or invest in PICTs, which is created by the scarcity of fishing opportunities resulting from licensing arrangements. • Quality purse-seine skipjack (at industrial prices) and bycatch or rejects can make a substantial contribution to domestic fish supplies. • There is a growing demand for innovative alternative products and traceable ecocertified products.

	Main challenges	Opportunities
	<ul style="list-style-type: none"> • Regional-level issues: In recent years, there has been some breakdown of regional solidarity due to differing interests and time-horizons, and this is likely to increase in the future. In WCPFC, the types and timing of management action are tending toward the lowest common denominator. 	
Coastal	<ul style="list-style-type: none"> • Overfishing: PICTs are unable to control fishing effort, especially on high-value species and those close to urban areas. • Population and urbanisation: With a population increase of over 5 million people in the next 25 years, there is likely to be a growing gap between what coastal fisheries can produce and the demand for production from coastal fisheries. Even coastal fisheries that are well-managed cannot keep up with the demand generated by the much larger Pacific Island population, and this will be exacerbated by ongoing urbanisation. • Other challenges, threats outside the fisheries sector: Habitat destruction, pollution, siltation, and logging and mining in some PICTs are challenges outside the fishing sector. There is increased pressure to reduce the negative impacts of fisheries on tourism, and more problems resulting from the effects of climate change will arise in the future. • Ineffective management processes: Centrally based management of most coastal resources is ineffective, while lower level management often suffers from a lack of technical knowledge and/or legal foundation. Situations where massive overfishing occurs near urban areas are often not amenable to fisheries management solutions. The demand from rapidly growing Asian economies for inshore commodities is nearly insatiable, and is often matched by the absence of a conservation ethic, leading to depletion of key species. • Fisheries governance: The challenges with respect to coastal fisheries governance are similar to those facing offshore fisheries, but are given lower priority. In general, the quality of offshore fisheries management (and recent improvements to that management) is far better than coastal fisheries management. • Development challenges: Many governments view coastal fisheries as having significant potential for economic development, whereas in reality available resources are limited. Most coastal resources are unable to support fisheries for domestic consumption and export. Development activities could lead to local area depletions and threaten the supply of marine foods to adjacent villages. 	<ul style="list-style-type: none"> • There are advantages to controlling scarce resources in what is increasingly a buyers market. • There is a potential for effective community-based initiatives with fisheries agencies providing information and support. Multiple management tools can be used at the community level, rather than relying only on marine protected areas (MPAs) or the exclusion of outsiders. • Supplies from remote areas can be matched with demand from population centres by creating transport links, possibly through linkages with agriculture transport infrastructure • Non-extractive uses for resources include tourism and ecosystem services. • The supply of fish can be increased through the use of FADs.

(Table 2 continued)

	Main challenges	Opportunities
Aqua-culture	<ul style="list-style-type: none"> • Development challenges: The viability of Pacific Island aquaculture is reduced by competition from efficient overseas producers in export markets, and by competition with capture fisheries in those domestic markets with healthy wild stocks. The government-led development model (with which the region's fisheries agencies are comfortable) has had very limited success. Subsidies are used as a catalyst, but aquaculture often declines when they are withdrawn. 	<ul style="list-style-type: none"> • Aquaculture has the potential to fill gaps in domestic fish supplies. • Increased focus in the development process on the private sector, objective economic analysis, and comparative advantages.
	<ul style="list-style-type: none"> • National fisheries governance issues: Fishery agency staff have acquired considerable capacity to culture aquatic organisms, but are lacking in skills and incentives to promote aquaculture industries. In addition, government support services required for viable aquaculture industries (e.g. hatcheries and quarantine services) often do not match the sector's needs. • Environmental concerns: The introduced species often used in aquaculture can become invasive species. 	<ul style="list-style-type: none"> • Restocking for non-extractive uses • Developing cost-effective production models
Fresh-water	<ul style="list-style-type: none"> • Environmental degradation: Environmental influences (rather than fisheries activities) are the factors resulting in change in freshwater fisheries, and climate change (and its effects on water supply) and massive ecosystem change are huge threats. • National fisheries governance: Freshwater fisheries receive insufficient management attention and attention. • Development challenges: There is a need to balance the benefits of introduced species with the negative impacts of potentially invasive species. Uses for non-preferred species need to be found to reduce their impact on valued species. 	<ul style="list-style-type: none"> • Problems/solutions of fresh water in general run in parallel with freshwater fisheries, so interventions to improve water quality are likely to improve freshwater fisheries.

The role of national administrations – and fisheries managers in particular – will gain in importance. Future managers will face daunting issues that will require experience in many disciplines, including biology, economics, political science, and organisational management. The future of fisheries will be determined in part by how well communities understand the need for – and support – various fisheries management actions, even though many of these will be unpopular and require controls on individuals and firms. Significant financial resources will be needed to support fisheries development and management, and securing this funding will require political will.

Climate change will impact fisheries, and this is discussed further in Section 3 above and in a technical annex to this report. Despite enormous recent research on climate change, there is still considerable uncertainty as to the precise fisheries-related changes, and their location and timing. Even where there is general agreement on broad changes across the region, there is considerable uncertainty regarding the effects at the island scale. Attempts to mitigate the effects of climate change at the fisheries level are likely to be futile. Adaption to changes will be the key to maintaining the flow of benefits from fisheries.

4.2 Future changes to benefits from fisheries

The previous section explored future challenges and opportunities by type of fishery. This analysis is useful, especially in terms of the changing role of government and fisheries management. Another way of looking at future changes in fisheries is by the various categories of benefits, partitioned by the types of environments or ecosystems that produce these benefits. This type of analysis deals with actual benefits, and is more oriented toward the interface between fisheries and people, than the analysis of challenges and opportunities.

To some extent the fishery categories used in this study can also be thought of as production systems, which loosely correspond to very different ecosystems, each of which is capable of producing a range of direct and indirect benefits. Table 3 examines how those production systems or ecosystems and their fishery benefits may change over the long term. It should be noted that forecasting 'likely changes' is done by the unrealistically simple process of projecting current trends.

Bearing in mind the limitations of this analysis, the information in Table 3 indicates that future benefits from fisheries in the offshore zone will probably increase greatly in many countries. Benefits in the coastal zone and freshwater systems will probably decrease, albeit for different reasons. The changes in benefits from aquaculture are more uncertain. While it is almost inevitable that there will be increases in aquaculture for domestic consumption, it is unclear how export-oriented aquaculture will fare. The future of subsidies in aquaculture (in some respects, the opposite of government revenue) is also uncertain.

The results suggest that interventions in the offshore zone will be oriented toward increasing benefits, whereas management actions in coastal and freshwater zones will increasingly focus on preventing benefit declines. This has implications for the approach used (promotion of development vs placing controls on fisheries or habitats), political will (attractive incentives vs. unpopular restrictions), and the skills required for these very different tasks.

Table 3: Changes in direct fishery-related benefits by production system

Production system →	Offshore	Coastal	Aquaculture	Freshwater
Contribution to GDP	Will increase greatly in countries where domestic industry development occurs.	Likely to decrease somewhat with overexploitation and habitat destruction.	Likely to increase due to aquaculture for domestic markets.	Likely to decrease if main threats occur.
Contribution to exports	Will increase greatly in countries where domestic industry development occurs.	Will decrease in countries that restrict food-fish exports; some increase in value of non-food exports.	Degree to which aquaculture can compete internationally is uncertain.	Very little now, and not likely to increase.
Contribution to direct govt revenue	Fees for foreign fleet will decrease; revenue from licensing domestic vessels and various processing taxes could compensate.	Very little	Very little, negative if subsidies are considered.	Very little now, and not likely to increase.

(Table 3 continued)

Production system →	Offshore	Coastal	Aquaculture	Freshwater
Contribution to employment	Will increase greatly in countries particularly where domestic industry development occurs (especially processing) and where there are large observer programs.	Likely to decrease with overexploitation, population growth, habitat destruction and urbanisation.	Likely to increase due to aquaculture for domestic markets.	Likely to decrease should the main threats eventuate.
Contribution to food security	Could increase greatly in countries that have purse-seine activity. Some increase in other countries (longlining & FADs).	Likely to decrease with overexploitation, habitat destruction, population growth, and urbanisation.	Likely to increase	Likely to decrease should the main threats eventuate.
Non-extractive	Little benefits at present and no increase foreseen.	Likely to increase with increasing tourism.	Some increase conceivable.	Some increase conceivable.

4.3 The condition of offshore fishery resources in the future

In the purse-seine fishery, there will be continued pressure to admit additional vessels to the region to fish as foreign, locally based or domestic vessels, and older vessels will be gradually replaced by new, more efficient and generally larger vessels. These developments will result in increased and more efficient purse-seine effort. Skipjack tuna are likely to be able to accommodate such increases, although the standing stock will probably be decreased, thus reducing catch rates. Impacts of the purse-seine fishery on yellowfin and bigeye tuna stocks will depend on the management of how, when and where the purse-seine fishery operates. There will be pressure for the increased use of FADs to counter rising fuel prices, and, in the absence of technical or logistical solutions to manage the associated juvenile yellowfin and bigeye tuna catches, pressure on these species will continue to increase. Such an increase would be expected to have negative impacts on the longline and non-FAD purse-seine fisheries that target them at a larger size and may negatively impact the overall status of stocks. As capacity expands and if efforts to limit catches or fishing are effective, the scarcity of fishing opportunities will drive the incentive for both foreign and domestic fleets to fish illegally. Effective and well coordinated monitoring, control and surveillance (MCS) measures, including data sharing will be necessary to ensure the integrity of management arrangements.

Higher exploitation pressure by purse seiners on juvenile yellowfin and bigeye tuna combined with longline fishing impacts at current levels will further reduce the abundance of adult fish. In the absence of measures to address these and other impacts, such as rising fuel costs, the longline fishery targeting these species will likely become unprofitable. There will also be negative impacts on the profitability of the locally based longline fisheries targeting albacore tuna in the South Pacific, as yellowfin and bigeye tuna are important secondary targets of this fishery. In the absence of significantly increased prices for longline-caught albacore, effort in this fishery is unlikely to increase, and may in fact contract. The status of albacore stocks is therefore not likely to become a concern, unless there is an unforeseen rise in the efficiency of longlining, or a dramatic increase in the catch of juvenile albacore tuna.

Swordfish in the South Pacific are increasingly being fished by Spanish and some locally based Pacific Island longline vessels. This may represent a development opportunity for some PICTs, but the current status of the stock in the south-central Pacific is unknown. Without careful management, this resource could be quickly depleted if experience elsewhere is a guide.

It is likely that bycatch in the tuna fisheries will come under increasing scrutiny. At least initially, this will come about by pressure from developed country import requirements.

4.4 The condition of coastal fishery resources in the future

In the future, these resources will be subject to increased fishing pressure and stress from other sources. Many of the factors driving change in Pacific Island fisheries (presented in Section 3) will cause the condition of coastal resources to change. Factors that are likely to be particularly important in the next 25 years in determining the condition of coastal resources are population increases, urbanisation, governance, and especially, reaching the limits to fisheries production.

It is likely that current coastal resource condition trends will continue into the future, but there will be great differences between individual PICTs. Although such projections are quite speculative, some insight may be obtained by projecting three of the major current trends into the future: 1) overexploitation near urban areas, 2) overexploitation of export invertebrates, and 3) reduction in abundance of resources due to degradation of coastal habitat.

The degree of exploitation of coastal finfish and edible invertebrates is generally related to the distance to urban areas, or more precisely the range of vessels that feed into urban markets. Coastal areas around cities where coastal fishery resources for domestic consumption are in a degraded condition will expand, both as a result of a) the evolution of small towns into urban areas, and b) because higher prices and improved technology will allow fishing vessels to range farther. Such areas will be characterised by:

- Falling catch per unit of effort, and smaller individual fish as biological limits for target species are approached. As biological limits are surpassed, total production will fall.
- Larger and more sought-after species will decline to the point of local extinction (this has already occurred with some species, such as the humphead wrasse and some giant clam species). The impending disappearance of some of the larger iconic species has implications for recreational dive tourism.
- While coastal commercial fisheries can range farther afield, the fisheries resources available to the relatively sedentary urban subsistence fishers will fall remarkably in terms of catches and desirability of species. Catches are increasingly likely to be dominated by herbivorous species as coral reefs are degraded by more intense land use and climate change.
- The decline in the condition of species used for domestic purposes will be exacerbated where exports of those same species occur.

Much of the commercial invertebrate fishery harvest consists of non-perishable exports (e.g. beche-de-mer, trochus). The non-perishable nature of the products dictates that not even remote areas are insulated from overfishing. Extensive field research by SPC shows that most sites surveyed in the Pacific Islands are currently 'seriously depleted of commercial invertebrate resources' (SPC 2008). There are indications that this trend will continue and the abundance of these resources will decline further, with some local extinctions possible.

- Many of the invertebrate exports are in high demand from Asia, especially China. In normal circumstances economics compel fishermen to switch gear or locations before the resource population nears local extinction. In the future, an increasingly high export value will be placed on many coastal resources by Asian economies, which will encourage fishing effort, often after the targeted species is too rare to sustain a viable reproductive population (Birkeland 1997).
- Given the probable declining state of the economies of many countries of the region, in the future there will be greater numbers of people without jobs or access to remittances who will be seeking income and food security from harvesting coastal resources. Unlike the situation for coastal finfish, increasing pressure on non-perishable resources and subsequent declines will occur throughout the country or territory.

A third major trend affecting the condition of coastal fishery resources is the reduction of their abundance due to degradation of coastal habitats. This occurs as a result of destructive fishing practices, pollution, siltation from mining, logging and agriculture, and competing uses of the coastal zone. The resulting problems will be exacerbated by climate change, particularly where coastal fisheries depend heavily on coral reefs.

Present indications are that major trends affecting the condition of coastal resources will continue, with the likely scenario for most PICTs that in 25 years there will be very low abundance of edible resources in the vicinity of urban areas and low abundance of export invertebrates throughout the country or territory.

Trends in freshwater fishery resources will probably mirror that of coastal resources, especially overexploitation near urban areas and reduction in abundance due to habitat degradation.

4.5 Three scenarios for 2035

What will fisheries in the Pacific Islands be like in 25 years? Projecting current patterns of change into the future are inevitably highly uncertain, and it is to be expected that many unforeseen events will occur. Nevertheless, there is considerable value in speculating on what may occur in the future and then using this exercise to inform planning for, and adaptations to, those changes that are especially likely. In addition, outlining even crude scenarios may encourage others to formulate a more refined picture of the future, and to update these predictions over time.

Three broad scenarios are developed below. These have been formulated by taking into consideration current trends, factors that are expected to be drivers of future change in the fisheries sector, and challenges and opportunities that are considered likely to arise.

The three scenarios focus on changes in the tangible benefits from fisheries, especially the impacts on food, employment, government revenue and exports. Portraying the forecast changes to benefits rather than to processes is likely to have a stronger impression on public awareness and political commitment to change.

Box 2: The best case – Securing the future

Offshore fisheries: Cost-effective WCPFC action results in stable stocks at levels that maximise benefits to PICTs. Control by PICTs of the tuna fisheries achieved, including through regional cooperation, asserting sovereign rights, advantageous allocation arrangements and negotiating significantly more beneficial arrangements with DWFNs, including substantial onshore investment. Strong rights-based systems are established at national and sub-regional levels. The WCPFC-associated workload for national fishery officers is reduced significantly. Substantial increase in onshore processing and increase in exports of value-added tuna products leveraged through EEZ control. Catch volume/value increase; biological/economic/social optimisation in favour of PICTs between gear/species agreed upon and implemented. MCS measures are effective and compliance with management measures by all fleets is high. Bycatch interaction problems solved. Domestic fleets and processing plants expand and become internationally competitive. New, profitable markets for alternative tuna products are supplied. Products from PICTs recognised as being fully 'green' and achieve preferential prices. Through domestic industry development in fishing/processing, and other economic opportunities – including monitoring services, FAD ownership, etc. – a substantial increase in employment occurs in many PICTs. Continued demand for traditional and innovative, new, tuna products that require large labour input, which the region supplies on a competitive basis. Offshore fisheries close the gap between the supply and demand for affordable fish for domestic markets and are managed so that coastal pelagic fisheries remain healthy. Bans on discards creates major source of affordable fish. Trade-offs between domestic industry development and license fees for countries with licensed foreign fleets. Domestic license fees generated from resource rent.

Coastal fisheries: Total fisheries production slightly above 2010 level due to areas near cities maintaining production and rural areas increasing production to higher but sustainable levels due to judicious use of transport links. Widespread adoption of effective community-based management initiatives. Climate change impacts are manageable and reefs and associated fisheries adapt to gradual climate change. The value of exported non-food items increases, while the volume is stable; there are some highly controlled exports of valuable coastal food fish. Level of employment rises from that in 2010 due to transport links to remote locations, value-adding, and links to tourism industry (supplying hotels, sport-fishing, diving), and assists in deterring urban drift. Flow of total fish volume to urban areas steady (but declining on a per capita basis). Food supply for coastal communities secured. Selective restrictions on exports of food fish result in virtually all coastal fish used for domestic nutrition while exports for some key marine products increase. Use made of fish from fisheries on previously unexploited resources. Many fishery management activities paid for by the steady revenue from licensing domestic fishing operations and by taxing some types of fishery exports and marine tourism. System of FADs becomes part of national infrastructure and is maintained. Non-fishing impacts, including pollution, habitat degradation and poorly designed development, are managed effectively.

Aquaculture: Real comparative advantages are identified and associated marketing arrangements developed, targeting a small number of key species. Development assistance has been focused on the private sector. Government fishery agencies refrain from 'growing things' but rather focus on mitigating constraints and facilitating investment in the most promising species. Aquaculture production makes a substantial contribution to filling the fish supply gap and producing income opportunities. Employment and exports surge because (for export aquaculture) the comparative advantages cause private sector investment to pour in, and (for domestic aquaculture) capture fish shortages, healthy economies, and growing tourism combine to create strong demand for the products. Increased attention has been paid to environmental sustainability and disease considerations.

Freshwater fisheries: Extensive improvements to water catchment management improve water quality, resulting in rehabilitation of many freshwater fisheries. Production in 2035 is considerably greater than in 2010. Subsistence activities increase; some commercial activity (e.g. barramundi) recommences after rehabilitation of some major rivers. Total freshwater fisheries production is considerably greater in 2035 than in 2010 (but per capita supply does not increase). Biosecurity measures are improved and invasive species impacts lessened through productive use. Stocking of impoundments successful.

Box 3: The worst case – collapse

Offshore fisheries: WCPFC is ineffective and there is failure to agree on effective allocation and management measures between FFA and Parties to the Nauru Agreement members, resulting in inadequate fisheries management. Regional organisations fail to provide adequate support or deliver relevant programmes. DWFNs continue to dictate terms and continue and expand ‘divide and conquer’ tactics. Yellowfin and bigeye tuna stocks decline dramatically with major economic losses. Purse-seine impacts on yellowfin and bigeye and rising fuel and other costs result in longline fisheries targeting these fish to be non-viable, even for low-cost fleets. Range contraction and/or stock declines of yellowfin and bigeye tuna make most domestic longline fisheries uneconomic. Skipjack fisheries decline in value due to falling catch per unit of effort and smaller fish, with an increasing risk of recruitment failure that jeopardises future of skipjack fisheries. Fishing and processing affected by progressively more intense cyclones in some countries. Catch rates of albacore decline – yellowfin and bigeye tuna portion of catch declines, impacting domestic fisheries. MCS measures are ineffective and extensive IUU fishing undermines management measures and stock assessments. Domestic processing sector fails to become competitive after preferential market access removed. The region’s cost and productivity disadvantages equate to few opportunities to promote domestic industry development. Population growth is such that employment gains made in any domestic industry development are dissipated. Profits, wages and conditions are all low and are unattractive to nationals of many PICTs, requiring import of labour, creating social problems. Increasing automation and new tuna products developed that do not require large labour inputs in processing. Substantial food for domestic consumption is not generated from offshore fisheries. Although license fees are foregone to promote domestic industry development, it does not come close to generating the expected indirect government income. DWFN fleets continue to dominate the tuna fishery. Failure of PICTs to adequately present a united front with respect to license fees allows DWFNs solidarity and forces access fees down. Ecocertification and similar schemes do not curb demand for non-sustainable products.

Coastal fisheries: Community-based management arrangements collapse after donor interventions cease, and poverty and commercialisation destroys conservation ethic. Massive overfishing, particularly in urban areas due to domestic and export demand and failure of management systems; resource abundance driven so low that production of important species drops remarkably below the 2010 level. Declines in employment, and over-reliance on MPAs as a panacea diverts attention from more comprehensive management arrangements, including of non-fishing impacts. Many high-value species are wiped out due to the failure of even simple management. Coral bleaching and other effects of climate change alter species composition and reduce fishery production from reefs. Uncontrolled pollution and poorly designed development degrade habitats. Exports after 2010 surge but subsequent overfishing causes resource and export volume to crash leading to a large decrease in employment in some countries. Tourists repelled by barren reefs. Flows of fish to urban areas crash due to low catch rates in nearby areas, and poor logistics of transporting fish to urban areas. Failed ‘development’ schemes and habitat destruction have resulted declines in flow of fish to villages. Some food fish exported at the expense of domestic food supplies. Collapsed coastal fisheries accelerate urban drift.

Aquaculture: Aquaculture for export unable to compete with countries that are relatively efficient producers. Energy and feed prices become prohibitive. Subsidised inputs into aquaculture result in no net benefits and detract from other aquatic production initiatives. Aquaculture for domestic use declines due to inability to compete with capture fish, tuna bycatch, imports or alternative sources of food (e.g. chicken). Aquaculture facilities affected by progressively more intense cyclones. Any exports decline with the phasing out of subsidies and government aquaculture operations. With the decrease in production due to problems with export and domestic aquaculture, employment related to aquaculture falls. Demand in inland areas of large islands is not met due to failed models of production. Disease and habitat degradation reduce total aquaculture production.

Freshwater fisheries: Substantially increased logging, mining, agriculture, and other human activities result in significant habitat damage and the fishery production crashes. Changed rainfall patterns have negative impacts in some countries. Spread of invasive species impact native fisheries and degrade habitat.

Box 4: Most likely scenario – missed opportunities

Offshore fisheries: Effectiveness of regional fisheries agencies is mixed. Some improvement in agreements with DWFNs, including provisions for onshore investment or development. The volume of skipjack catches rises substantially but value fails to rise proportionately, at least in the short term. Yellowfin and bigeye tuna stocks stabilise or continue to decline slowly, and higher fuel costs result in unprofitable domestic longline fisheries. For tuna processing, preferential market access removed, resulting in less export value due to competition with efficient producing nations, mitigated somewhat by growing demand and improved technology. MCS measures reduce IUU activities by the DWFN fleet, but there is poor compliance by domestic fleets and on the high seas. There will be a greater volume of high-value purse-seine-caught yellowfin and bigeyetuna. For locally based longlining, production moves to low-cost fleets, reducing exports in PICTs. Domestic industry development continues in two or three countries but is unsuccessful in countries with low infrastructure and/or high production costs. Some growth in jobs related to tuna (observers, crew, officers) continues. Offshore fisheries do not fully close the gap between the supply and demand for affordable fish. Cheap tinned fish becomes less affordable to Pacific Islanders, but supply is augmented by bycatch. Many countries continue to obtain access fees alone. Some success of domestic industry development to compensate for foregone access fees. Domestic industry development fails to deliver expected benefits.

Coastal fisheries: Production of valuable species (in economic and food security terms) falls significantly below 2010 level due to uncontrollable fishing effort, pollution, siltation, landfill, and habitat destruction, especially near urban areas. Coastal production fails to meet the food gap. Community-based management is effective in some areas. Some transport of fish from rural to urban areas, and some depletion of fish in those rural areas, especially by government-subsidised transport of catches. Coral bleaching and other effects of climate change have some negative effects on reef fishery production. Volume of exported items falls, but rising prices allow trade to continue. Some countries have banned exports of food fish, which helps reduce some fishing pressure, but many bans are 'leaky' due to exemptions and illegal exports. Fishing employment near urban areas tapers off gradually, with decreasing catch rates and profitability, mitigated somewhat by higher prices and technology improvements. Fishers from urban areas range farther, but are constrained by high fuel prices. Benefits from fishing in remote areas tapers off with decline in abundance of non-perishable items. Tourism employment related to the marine environment grows in some countries. Interaction between inshore and offshore fisheries increases. Few countries are able to institutionalise and maintain FAD programmes. Continued reliance on donor support.

Aquaculture: Production for domestic purposes continues to be associated with subsidies, domestic tourist markets, and government or donor projects. Private sector production expands considerably for the fast-growing domestic urban markets with fish shortages. Export aquaculture production declines, except in special cases of exceptional entrepreneurial skill or comparative advantages. Employment oriented at culturing fish for rapidly expanding urban areas increases. Growth of aquaculture in inland areas of large islands varies greatly between countries, depending on subsidies, development models used, and the availability or desirability of alternatives. Substantial amounts of food are produced for fast-growing urban markets that have fish shortages, with variable increases in food production in the inland areas of large islands.

Freshwater fisheries: Some increase in logging, mining, agriculture, and other human activities results in habitat damage and fishery production declines between 2010 and 2035. This results in a decline in total fish production and a sharper decline in per capita supply.

The above scenarios are generally applicable across the Pacific Islands region. Differences can be expected to occur between sub-regions and groups of countries. Some of the more significant geographic variations are:

- Most of the tuna purse-seine catch comes from the EEZs of Pacific Island countries that are Parties to the Nauru Agreement (known as PNA, and including FSM, Kiribati, Marshall Islands, Nauru, Palau, PNG, Solomon Islands and Tuvalu). Therefore, any change in the huge purse-seine fishery (which accounted for 74% of the region's total tuna catch in 2008) will occur largely in the waters of PNA countries. The major change that can be foreseen concerns efforts to exert control over the purse-seine fishery by PNA to secure increased benefits, and – once that control has been achieved – the extent to which effective management by PNA in their own waters can be achieved. Skipjack, which are targeted by purse seining, is one of the largest underexploited fishery resources in the world, and consequently total fishery production will probably expand considerably in those countries that are PNA, but not so in the rest of the region. While more challenging than controlling the purse-seine fishery, PNA will also seek to increase control of the longline fisheries.
- There will also be east-west and north-south differences in impacts. Should any contraction of the range of yellowfin and bigeye tunas be experienced, those countries in the extreme northeast and south of the Pacific Islands region will be the most affected. Should the expected longitudinal shift in areas of skipjack and bigeye concentration occur due to climate change, countries in the west (e.g. PNG, FSM) will be the losers and those in the east (e.g. Tokelau) will be winners.
- The large islands of western Melanesia (e.g. PNG, Solomon Islands) will be subjected to different changes than those affecting the rest of the region, especially the small islands and atolls of Micronesia and Polynesia. The large islands and their major freshwater fisheries are likely to be greatly affected by habitat degradation, alterations in rainfall patterns, and burgeoning inland populations.
- The small islands have a much greater dependence on coral reef fisheries, and are more certain to be affected by climate change. Domestic development opportunities in small islands are more limited.
- The relatively rich territories with their support from metropolitan countries and emigration opportunities are less vulnerable than many of the independent countries of the region.

Another important aspect of all three scenarios is that the evolution of fisheries over the next 25 years will likely have different impacts on men, women, children, youth and the elderly. They are also likely to affect gender and other social relations. For example, as women gain access to education and communication technologies through gender-equity policies in other sectors, their roles in market chains, contributions to household incomes, and decision-making on household investment and expenditure may change.

5. Moving to the best-case scenario: Addressing the challenges and realising opportunities

5.1 Some general observations on attaining the best-case scenario

Two topics, the best-case scenario (Box 2) and the opportunities for the future presented in Table 2, deserve some additional attention. To some degree, the positive features in these two areas represent ambitious goals in the fisheries sector that countries in the region should aspire to. Rather than attempting to predict specific development opportunities, we have addressed the issue conceptually by outlining the general things that must be done to take advantage of opportunities.

Cooperation between PICTs and control over key management decisions, including allocation, at WCPFC is required to secure long-term economic benefits from oceanic fisheries. WCPFC has a widely disparate membership that holds quite different perspectives, and the best-case scenarios for PICTs will not simply develop as a matter of course. Strong regional and sub-regional campaigns will be required. The newly invigorated PNA group has been established with the objective of providing the leadership necessary to substantially increase economic benefits. Robust rights-based management systems, strengthened by national allocations agreed at WCPFC, will substantially increase the economic power and value arising from access to fishing resources. Transparent allocation of these rights between and within PICTs will offer the opportunity to leverage viable investment in domestic tuna fishing and processing operations, and/or increase the value of fishing opportunities granted to DWFNs.

An examination of the best-case scenario and the opportunities shows that the brightest future for fisheries involves dealing with a much wider range of disciplines and subjects than is currently addressed by regional fisheries agencies. Many of the favourable future fisheries outcomes listed in the previous section bridge the boundaries between fisheries and several other sectors: agriculture, environment, legal affairs, health and nutrition, and (especially) tourism.

The government interventions required to achieve the best-case scenario are extremely ambitious. A very large amount of work, delivered consistently over time, is required to achieve almost every favourable outcome. Strong political commitment and support will also be essential in providing the overarching impetus and recurrent funding. Governments will require considerable external assistance, including the long-term input of donors, NGOs and other supporting agencies to realise best scenario outcomes.

Large-scale fisheries development will be capital intensive and few PICTs will have the resources to finance the necessary investment to build domestic industries. Consequently, most development aspirations will require foreign investment if they are to get off the ground. Build confidence among investors and addressing the risk associated with fisheries investments will require the creation of an environment of effective governance and political stability. International financial institutions, regional initiatives to promote trade and investment through the Pacific Islands Forum Secretariat and other sources of assistance will be necessary to promote appropriate, long-term investment.

An even more important issue is the question of who will be directing the necessary changes. Over the past 25 years most of the changes in the fisheries sector were driven by forces external to PICTs; there are few cases in which countries of the region, acting alone, were able to seize opportunities and generate significant positive outcomes. The favourable outcomes in the best-case scenario will require immense proactive effort on the part of both governments and development partners. Ensuring this work is well coordinated and delivered and aligns with national goals and aspirations will be key challenges.

The best-case scenario requires unusually skilled and dedicated people to lead the process. Individuals are needed who are knowledgeable in many disciplines and are as energetic/motivated as the ‘captains of industry’ with whom they will need to work (and in some circumstances, manage). In addition to fisheries skills, those people will need to have considerable empathy for the non-government sector, knowledge of business principles, insight into the fishing industry, sharp analytical expertise, considerable international savvy, sensitivity to community issues, and a host of other attributes.

Other key conclusions regarding the best-case scenarios and the future opportunities include:

- Many favourable outcomes involve the private sector successfully pursuing opportunities in areas where governments generally do not excel (e.g. development of markets and/or products).
- Other opportunities require fishery agency involvement in areas that where PICTs have not previously been involved (e.g. industry promotion, trade policy formulation, and objective economic analysis).
- Many favourable outcomes flow from fisheries agencies and other agencies successfully devising a ‘big picture’ strategy (e.g. figuring out how offshore fisheries can close the gap between the supply and demand for affordable fish for domestic markets), and then implementing it and measuring progress.
- Governments, faced with short-term political realities, will need to create policies and make decisions that are conducive to long-term outcomes with national and regional benefits.
- There is considerable diversity between countries, so that what will work in one country may not work in another.

In examining some of the requirements for attaining favourable outcomes in specific fishery categories, some general concepts emerge.

- **Offshore fisheries:** Regional cooperation among Pacific Island countries is necessary for almost all of the positive outcomes and effective control over and use of the resource. To achieve the best-case scenario, a high degree of cooperation with, and support for, the private sector will also be required.
- **Coastal fisheries:** The best-case scenario requires that more emphasis be placed on preserving existing benefits (especially relating to food security), rather than on generating additional benefits. It is also evident that fisheries agencies need to acquire greater desire and ability to work with private sector, communities and NGOs.
- **Aquaculture:** Many of the favourable outcomes appear to require a shift in emphasis of government interventions. The identified opportunities suggest that this would involve government fisheries agencies identifying and building comparative advantages and promoting a favourable business and policy environment for aquaculture, with less emphasis on ‘growing things’. Additional attention should be paid to biosecurity issues, especially formulating and implementing policies and procedures to reduce risks and safeguard biodiversity.

Despite Forum Leaders having made numerous political statements (e.g. Pacific Plan), the current capability of most fisheries agencies in Pacific Islands countries is far from what is required to provide the support and direction necessary to attain the best-case scenario. This has implications for current staffing and institutional arrangements, including staff incentives, training of future fisheries managers,

development models used, and institutional orientation, responsiveness, and accountability. It also affects the type of assistance that the regional organisations should provide in the future.

Many of the issues highlighted above extend well beyond the fisheries sector. In many cases it is unrealistic to assume that fisheries-focussed interventions can be effective, as progress depends on national policies across all sectors.

The challenges identified above may appear immense or even insurmountable. On the other hand, the value of the fisheries resources of the region is huge (the 2007 fisheries and aquaculture production was worth USD 2 billion) and will grow much larger in the next 25 years. Although the challenges are enormous, PICTs simply cannot afford to miss out on the tremendous opportunity they have to maximise fishery benefits.

The territories in the Pacific face some different considerations in attaining the best-case scenarios outlined above. Due to the support and opportunities provided by their associated metropolitan countries, the impacts of population growth, food scarcity and similar pressures are not likely to be as great. On the other hand, some territories have little control over policies and activities in their EEZs. In general, greater attention needs to be placed on assuring that the various fisheries programs (often conceived, formulated and implemented from afar) are relevant to the needs of the territories. In this context, there could be considerable value for territorial fisheries agencies in taking a 25-year view of the future, and articulating a long-term vision, with the intention that any various fisheries programs be relevant to and consistent with that vision.

5.2 National fisheries agencies

5.2.1 Challenges

Pressure has increased on fisheries administrations, both to address the increasing level of overfishing of inshore fisheries, including key invertebrate species, and to handle the increasingly complex and time-consuming nature of offshore fisheries management. These and other challenges need to be effectively addressed by PICT fisheries agencies so that best-case scenario outcomes can be achieved.

Although these challenges are not uniform across the region, the following are common, priority challenges:

- The lack of highly competent and appropriately skilled fisheries managers.
- Inadequate communication with, and real input from, stakeholders – particularly from the private sector.
- A lack of clear policy directions and planning in all fisheries; continued optimism (or inertia) that somehow ‘it will all be fine’ with respect to the resource.
- Lack of incentives for fisheries agency achievements outside the fisheries sector; insufficient financial resources.
- A weak legislative base in many countries.

5.2.2 Addressing the challenges facing fisheries agencies

A fundamental improvement in the quality of governance within government fisheries agencies is required.

Institutional arrangements for government fisheries agencies should be modified so that there is increased orientation to proactively take advantage of opportunities, greater motivation to working with the private sector, improved inclination to work with other economic sectors, and enhanced sensitivity to community issues. In addition, the working conditions within agencies should attract and retain motivated younger staff, and include a high degree of accountability for attaining established objectives.

Some arrangements exist that represent an improvement on the traditional bureaucrat-driven governance model currently used in most PICTs (i.e. a fisheries division or department responsible to a permanent secretary who is responsible to a minister, with the two overseers often having no experience in the fisheries sector). The essential component of the improved model is making the fisheries agency responsible to a group of fisheries stakeholders, rather than a single public servant. In PICTs where public and private sector stakeholders have some degree of real control over the fisheries agency (such as PNG and FSM), the quality of national fisheries governance is relatively high. Such changes to the institutional character of national fisheries agencies should be considered a priority in moving towards the best-case scenario..

There would be considerable value in formulating national best-case scenarios, or using some other process that generates an appreciation of the opportunities and what needs to be done to achieve them. Identifying the priority actions that can and cannot be undertaken by national agencies in this regard will be fundamental to success .

Some priority initiatives that deserve consideration include:

- Build on successful past interventions to improve governance, including through the use of fishery management plans, empowering communities to manage adjacent marine resources, and enhancement of fishery associations.
- Create a new cadre of highly competent fisheries managers, and institutional environments that will attract and retain them.
- A change in the emphasis of government fisheries agencies from regulation to management services, in which they provide services to stakeholders.
- Identify new funding models and sources.
- Place greater emphasis on management actions that take account of the value of ecosystem services and non-extractive uses.
- Actively communicate development opportunities (especially the results of objective economic analysis) to potential investors.
- Implement planning processes that include ways of measuring progress against nationally agreed fisheries development and management objectives, including those relating to subsistence fisheries, participation by gender and benefits to the country (e.g. fish consumption and job creation).

- Better integrate fisheries into the development agenda at a whole-of-government and economy level, instead of focussing only on the fisheries sector.

5.3 Regional fisheries agencies

FFA and SPC provide essential fisheries management and development advisory services to their members, many of which are not within the capacity of most national fisheries agencies to deliver. These services include: offshore and coastal stock monitoring and assessment, fisheries management and development advice, legal services, and capacity building. FFA also provides administrative services for fisheries treaties and a range of monitoring, control and surveillance (of foreign fishing vessels) services. Additionally, regional agencies will continue to offer a useful avenue for donor funds to be applied in a way that benefits many countries and promotes harmonisation and coordination. While generally well regarded, FFA and SPC need to address a wide range of challenges if they are to support achievement of the best-case scenario.

5.3.1 Challenges

Regional fisheries agencies in the Pacific face a range of common challenges:

- Ensuring that staff and regional programmes are updated as fisheries and their priorities change and evolve, and that they deliver results that meet country-specific needs and outcomes;
- Balancing headquarter staff and administration costs with funding for in-country work, including short-term specialist consultancy services;
- Balancing the work needed to support WCPFC activities with domestic fishery priorities;
- Managing the large number of regional and international meetings and workshops each year (71 are listed in the 2007 FFA annual report), which detract from the ability of nationals to undertake domestic fisheries management tasks;
- Ensuring adequate oversight of organisational direction and policy setting by member countries, including through meetings of governing bodies;
- Working out how best to deal with the private sector;
- Ensuring the comprehension of, use and benefit from the volume of technical material and advice produced;
- Maintaining substantial funding for core fisheries management activities, given the reality of donor fatigue, which requires the acceleration of cost-recovery approaches;
- Maintaining regional solidarity in the face of differing levels of national resource endowments, interests and demands for services;
- Understanding the basic principles of economic ‘overfishing’ and overexploitation that represents a need for biological conservation and relating these to sound sustainable development; and
- In the case of FFA, attracting and retaining quality staff.

5.3.2 Addressing the challenges facing regional fisheries agencies

Major changes will inevitably occur in fisheries over the next 25 years, and these will require a shift in the focus of regional agencies to ensure they address emerging priorities and remain relevant to their membership. Around 70 professional fisheries staff work at SPC and FFA, and these organisations will need to regularly review and alter the skills composition of their staff to meet the changing needs of PICTs.

In the past, regional agencies have tended to be measured by their regional outputs and achievements, both in terms of science (e.g. regional stock assessments and advances in the knowledge of tuna biology) and management (e.g. negotiation of the WCPF Convention). However, there is a growing demand and need to substantially increase the focus on in-country activities, including those that encourage long-term capacity building in areas such as fisheries data and stock assessment analysis, and fisheries legislation, trade, and management. Assistance provided by regional organisations will need to change in emphasis, from the current approach based on ad-hoc requests towards a programme-based strategy aimed at assisting countries achieve best-case scenarios. This shift will require a reduction in the size of regional agency headquarters staff, and a greater use of in-country or regional expertise to build support for new initiatives.

An emerging feature that is considered likely to increase in the future is the need for regional agencies to adapt programmes to national circumstances, and address the growth in sub-regional arrangements based on common interests (e.g. the PNA office and the Te Vaka Moana initiative). These have emerged from the view that there is a need for more dynamic action on a range of issues, and that Forum Fisheries Committee and the full FFA membership is unable to agree or react at the speed necessary, or in the best interests of sub-groups. It is uncertain to what degree these arrangements will meet with more success than would be possible by PICTs acting individually, or through a model in which sub-regions are serviced through regional agencies. Costs, duplication, and dilution of funding sources will all need to be considered.

The current pace at which PICTs have been expected to absorb and implement WCPFC and regionally driven initiatives is neither sustainable nor desirable. In the future, FFA and SPC will have to ensure that the high level of resources devoted to work for WCPFC under the scientific services agreement and in preparing countries for the annual rounds of meetings will not dominate work programmes at the expense of national work programmes and capacity building.

More needs to be done if the gap between the 'centres of excellence' at FFA and SPC and in-country capacity is not to widen. The University of the South Pacific (USP) has an opportunity to make a substantial contribution towards building high-calibre fisheries managers, but this will take major investments in staff and changes in curriculum. Building formal links between USP, SPC and FFA is necessary in areas such as training and applied research to ensure that training programmes are relevant to country needs. USP staff should directly contribute to SPC and FFA programmes and vice versa.

Developments in fisheries in the next 25 years will be largely based on economically viable, private sector operations, and SPC and FFA will need to seek new and effective ways of increasing links with and delivering direct and indirect assistance to the private sector. The current need to provide a range of advice on economic issues (particularly by SPC) will need to be addressed to ensure there is rigorous and objective economic analysis of fisheries management and development initiatives. A new analytical framework to assess the overall economic benefits of development of domestic tuna fisheries as compared with access fees will be necessary to inform future policy development and decision making. Such a framework will need to consider the economic circumstances of PICTs, including the lack of opportunity cost for labour. Other considerations will be the form of any benefits (direct government revenues vs economic growth, e.g. employment and investment), who the beneficiaries are, and the relative attractiveness of such options to individual governments. The approaches taken are likely to vary between PICTs.

6. Implementation roadmap

This report identifies key strategies and activities. These are expressed at a relatively high level, and it is expected that once Forum Leaders have considered and commented on the report, regional agencies will commence developing more detailed implementation plans. Some of the strategies and activities suggested are already included in, or will be added to, existing regional fisheries strategies to ensure consistency and avoid duplication. The tables below consolidate the main issues and the associated strategies and actions for dealing with the issues, in order to achieve the best-case future scenario. The table is organised in a manner that reflects the current trend in focusing on national priorities in fisheries, with support provided by regional agencies (addressed in the last column). Some observations can be made:

- The strategies and actions required to achieve the best results for the long-term future are not remarkably different from that required at present.
- Some items are repeated in several places and thus given additional emphasis: the need for incentives for agency staff, for stakeholder input into fisheries agencies, for support to the private sector, and for economic analysis of development and management initiatives.
- An example of an ‘incentive for fisheries agency staff’ is to have a representative of a fisheries industry association on board that has a role overseeing the fisheries agency, thereby creating an incentive to cater to the needs of the private sector.
- Some of the strategies and actions in Table 4 address new and/or unique situations and effective implementation will require some creativity. Other suggested strategies and actions address well-known situations, for which there is considerable knowledge in terms of effective ways they can be addressed. In the latter case, use should be made of past experience and international best practices.

The roles and responsibilities of SPC and FFA in supporting implementation of the roadmap need not be altered greatly in the future. The present basic arrangements – with FFA responsible for providing assistance related to managing and developing offshore fisheries, and SPC focusing on coastal fisheries, aquaculture, and scientific studies related to offshore fisheries – remains appropriate. Changes in these institutional arrangements will, however, be required in three main areas. First, more attention needs to be given to using regional programmes to achieve measurable and sustainable benefits at the national level (i.e. an increased focus on obtaining specific benefits), especially in the areas of food security and employment. Secondly, a greater degree of joint FFA and SPC cooperation and coordination will be required in areas that transcend the coastal/offshore boundary, including fisheries governance, measurement of change, support to the private sector, and fisheries legislation. Cooperation with the Pacific Islands Forum Secretariat and use of Forum Leaders’ meetings to promote fisheries issues and gain high-level political support for future management and other actions should also be pursued. Finally, extended and coordinated efforts by FFA, SPC and USP to build adequate capacity and capability within national fisheries agencies will be essential.

Table 4: The roadmap

Objective with some comments	Strategy	Action	Regional agency involvement
1. Reform and build fisheries agencies for better services <i>Most aspects of the favourable long-term scenario depend on improvements to the performance of the national fisheries agencies.</i>	<ul style="list-style-type: none"> Assess the scenarios that will result in maximised long-term benefits for PICTs. Use more efficient and effective models of fisheries administration. Increase real input and influence by fishery stakeholders into policies/operations of fishery agencies. Create incentives for fisheries agencies to work with private sector and other economic sectors (e.g. trade, environment tourism, health). Shift away from attempting government micromanagement of coastal fisheries to empowering local communities. Ensure expenditure on fisheries management is proportional to value. Improve the capacity of tertiary educational institutions in the region to produce people who have the multi-disciplinary skills to manage fisheries. Improve the economic scrutiny of fisheries management and development activities. Structure fisheries agencies as coordinators and facilitators rather than total service providers. 	<ul style="list-style-type: none"> Undertake a 25-year 'look to the future' exercise in each country, focusing on structured pathways to achieve long-term tangible outcomes and benefits rather than short-term administrative requirements. Create public awareness of the results. Consider using alternative models for fisheries agencies, especially those that enhance stakeholder input, improve attractiveness to future staff, and that have secure income streams. Creation of incentives for staff of fisheries agencies to work with the private sector and across sectoral boundaries. Generate high-level interest in fisheries. Promote community empowerment and legislative and other support for coastal fisheries. Promote the use of fishery management plans for offshore and coastal fisheries, with the latter receiving the same substantial support as did the offshore plans. Strengthen and empower stakeholder associations. Carry out objective economic appraisal of costs/benefits arising from management systems at regional and national levels. Encourage NGOs to broaden their activities beyond the current focus on biodiversity conservation and MPAs to a larger array of interventions that encourage maximising long-term sustainable benefits from fishery resources. 	<ul style="list-style-type: none"> FFA to focus on institutional governance and economic aspects. SPC to focus on relationships with communities and long-term future. USP to focus on modifying fisheries-related curriculum to meet the region's evolving needs.

	<ul style="list-style-type: none"> • Establish merit-based pay and conditions. 	<ul style="list-style-type: none"> • Increase the relevancy and attractiveness of the fisheries-related curriculum of tertiary educational institutions. 	
<p>2. Maximise long-term national benefits from offshore resources</p> <p><i>Most of the future increases in benefits from fisheries in PICTs will be associated with offshore fisheries.</i></p>	<ul style="list-style-type: none"> • Gain effective control over management of fishery resources. • Use regional cooperation and solidarity to leverage management objectives, uphold sovereign rights, and derive favourable WCPFC outcomes. • Develop rights-based systems where appropriate. • Develop, negotiate and implement a mixture of harvesting strategies and targets that achieve maximum benefits, while maintaining vulnerable species (bigeye, yellowfin) at acceptable levels. • Clearly articulate national aspirations, objectives and positions for offshore fisheries. • Promote effective sub-regional arrangements and cooperation, building on common interests. • Achieve overall catch levels that optimise benefits to all PICTs in an equitable manner. 	<ul style="list-style-type: none"> • Jointly decide who will access the resources. • Move towards rights-based management and recovery of resource rent, including from domestic vessels. • Build on the successes of the tuna management plans. • Regulate effort/catch at levels that create scarcity, influence world market prices and return maximum benefits. • Resist displaced fleets seeking unsustainable fishing opportunities. • Balance foreign licensing benefits against domestic industry development, basing decisions on appropriate analytical frameworks. • Compare economic impacts of alternative fisheries management measures on PICTs, including the trade-offs between purse-seine and longline fisheries. • Develop strategies to attract offshore investment, using International Finance Corporation and other appropriate financial institutions. • Encourage the concept of accountability in regional agreements, including pre-agreed mechanisms to improve compliance. • Develop national implementation plans supported by the MCS regional strategy. 	<ul style="list-style-type: none"> • Largely supported by FFA with science input from SPC.

(Table 4 continued)

(Table 4 continued)

Objective with some comments	Strategy	Action	Regional agency involvement
3. Sustain coastal communities <i>Inshore fisheries produce most of the food and employment for Pacific Islanders. Resilient inshore fisheries will absorb shocks and continue to deliver these benefits to coastal communities.</i>	<ul style="list-style-type: none"> • To achieve the goal of ensuring the optimal and sustainable use of coastal fisheries and their ecosystems by Pacific Island communities, attention should be given to the six guiding principles of the Apia Policy. • Clearly articulate management objectives, processes, accountability, and ways of measuring progress. • Encourage long-term relationships between fishery resources and their exploiters. • Selectively devolve management responsibility to communities, with support from fisheries agencies for technical issues and issues beyond the community level. • Encourage the transition from government-led development of what are often non-existent opportunities to the concept that fisheries agencies, their officers, and communities are guardians of marine resources. • Work across sectoral boundaries to promote non-extractive use of coastal resources. • Formulate, review and update climate change adaptation strategies as impacts evolve and become clearer. 	<ul style="list-style-type: none"> • Develop national coastal fisheries management plans, with substantial support from regional agencies (as was the case for offshore management plans). • Promote and establish policies that recognise the benefits of community-based approaches. • Provide information, assistance, and encouragement to communities for them to address issues within their power. • Create incentives for fisheries officers to be more active and responsive in inshore fisheries management, and to work across sectoral boundaries. • Create an awareness that no single management measure is likely to be effective in addressing all the present and future concerns at a particular site. Avoid dependence on a single type of management measure (i.e. MPAs). • Give special attention to preventing irreversible depletions (e.g. destroying spawning aggregations) and high-risk species. • Take advantage of 'choke points' at the point of export to facilitate the management of export fisheries. • Undertake economic assessments of the national costs of poor coastal fisheries management and failed development projects. • Refine a parallel national regulatory scheme for community-based management (i.e. what to do when it fails) . • Establish a legal basis for community-based management. 	<ul style="list-style-type: none"> • Largely supported by SPC, with involvement of FFA in legal aspects.

<p>4. Feed our growing populations</p> <p><i>The Pacific Island population will increase by over 5 million people in the next 25 years; there is likely to be a growing gap between what fisheries can produce and the demand for fisheries products.</i></p>	<ul style="list-style-type: none"> • Nationally, carry out an assessment of future food needs including protein from fisheries and other sources. • Devise a 'big picture' strategy to ensure that the supply of fish from all sources (imports, offshore, inshore, aquaculture and freshwater) is sufficient to meet future estimated demand for affordable fish protein. • Where shortfalls in supply occur, identify possible interventions to mitigate shortages, particularly for growing urban populations. • Consider establishing a national policy stating that in the context of coastal fisheries, managing and developing the flow of fish to villages is of paramount importance. 	<ul style="list-style-type: none"> • Consider various schemes to mitigate fish shortages, including restrictions on the export of coastal food fish, facilitating rural–urban transport of fish, piggybacking on future agriculture transport infrastructure, the use of FADs, schemes to encourage the landing of fish from offshore industrial fisheries, and small pond aquaculture. • Carry out assessments of the long-term economic and practical viability of these interventions. • Work across sectoral boundaries (agriculture, health, and customs) to carry out the above action. • Monitor food security over time, noting that exchange rates, the supply of imported fish and substitute products will have major effects. • Establish national environmental assessment and planning frameworks for aquaculture developments. • Consider the gender implications of the above action. 	<ul style="list-style-type: none"> • Largely supported by SPC. • FFA involvement in the schemes dealing with the offshore industrial fisheries.
<p>5. Support private sector 'winners'</p> <p><i>To achieve the best case scenario for fisheries in the future, a high degree of cooperation with, and support for, the private sector will be required.</i></p>	<ul style="list-style-type: none"> • Where applicable, transform the fisheries sector so that government serves people and businesses, rather a situation in which people and businesses serve a government administration. • Define the role of government intervention and subsidies in fisheries. • Conduct an appraisal of domestic industry ventures involving foreign investment, including determination of net benefits accruing to PICTs. 	<ul style="list-style-type: none"> • Increase input of the private sector and other stakeholders into the policies and operations of the fisheries agency. • Enhance private sector organisations. • Create incentives for fisheries agency staff to embrace/support the private sector. • Identify constraints to operating fishery businesses and move to reduce and remove them. • Assume that any subsidies used in fisheries development are subjected to economic scrutiny, are transparent, and have an exit strategy. • Enhance the capacity for economic analysis within fisheries agencies. 	<ul style="list-style-type: none"> • FFA to focus on institutional, governance and economic aspects, with SPC providing support as per staff experience.

(Table 4 continued)

Objective with some comments	Strategy	Action	Regional agency involvement
6. Support from the top <i>Many favourable outcomes flow from political commitment and support</i>	<ul style="list-style-type: none"> Gain political support by clearly articulating a national vision for the future of fisheries. Create a vision for the region's offshore fisheries that sees the balance of power shift in a structured manner from DWFNs to PICTs. Promote activities that focus attention on fisheries – keep fisheries in the headlines. 	<ul style="list-style-type: none"> Bring to the attention of national leaders the results of a country specific 25-year 'look to the future' exercise that focuses on long-term tangible outcomes and benefits from fisheries. Identify, quantify and publicise the tangible benefits from the fisheries sector and changes to those benefits. Highlight positive changes in fisheries governance. Emphasise the potential benefits of cooperation influencing the structure and profitability of offshore fisheries. 	<ul style="list-style-type: none"> An SPC/FFA co-operative exercise.
7. Measure the change <i>In the context of fisheries, 'what gets measured gets managed', with the converse being especially true</i>	<ul style="list-style-type: none"> Promote the importance of quantifying fishery production, its changes, and the impacts of management and development interventions. Collect gender-disaggregated data and carry out gender analysis and incorporate results into policies. Create an evidence-based approach to assessing and adapting management and development initiatives, thereby generating political will and support for action when needed. Maintain an understanding of the status and impact of key factors driving fisheries. 	<ul style="list-style-type: none"> Develop and use simple and clear reporting structures that give information relevant to identifying trends in benefits and impacts of management and development. Monitor the impacts of climate change. Work with other agencies to obtain non-fisheries data in areas relevant to fisheries (e.g. household income and expenditure surveys, censuses). Develop and use indicators for fisheries management success in community-based fisheries. Provide incentives for data provision. 	<ul style="list-style-type: none"> An SPC/FFA co-operative exercise.

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Acronyms and abbreviations used in this report

ADB	Asian Development Bank
ASEAN	Association of South East Asian Nations
AusAID	Australian Agency for International Development
BE	bigeye tuna
CBM	community-based management
CFP	Coastal Fisheries Programme (SPC)
CITES	Convention on the International Trade of Endangered Species
CPUE	catch per unit of effort
CR	catch retention
DevFish	Development of Tuna Fisheries in the Pacific ACP Countries
DWFN	distant-water fishing nation
EAFM	ecosystem approach to fisheries management
EEZ	exclusive economic zone
EU	European Union
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FFA	Pacific Island Forum Fisheries Agency
FSM	Federated States of Micronesia
GDP	gross domestic product
GNI	gross national income
HSP	high-seas pocket
IATTC	Inter-American Tropical Tuna Commission
IUCN	World Conservation Union
IUU	illegal, unregulated and unreported
kg	Kilogram
km	Kilometre
LIFDCs	low income food deficit countries
LMMA	locally-managed marine area
MDGs	Millennium Development Goals
MA	millennium ecosystem assesement
MCS	monitoring, control and surveillance
MPA	marine protected area
MRAG	Marine Resources and Fisheries Consultants
MRD	Marine Resources Division (SPC)

MSY	maximum sustainable yield
NFA	National Fisheries Authority (of PNG)
NGO	non-governmental organisation
OFP	Oceanic Fisheries Programme (SPC)
PICTs	Pacific Island countries and territories
PNA	The Pacific Island countries that are party to the Nauru Agreement: FSM, PNG, Kiribati, Marshall Islands, Nauru, Palau, Solomon Islands and Tuvalu
PNG	Papua New Guinea
RFMO	Regional fisheries management organization
SJ	skipjack tuna
SPC	Secretariat of the Pacific Community (formerly, South Pacific Commission)
TMP	tuna management plan
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFSA	Fish Stocks Agreement
US	United States
USP	University of the South Pacific
VMS	vessel monitoring system
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	western and central Pacific Ocean
WTO	World Trade Organization
YF	yellowfin tuna

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- Kieran Kelleher, *Fisheries Specialist, World Bank*
- Manuel Barange, *Director Globec*
- Meryl Williams, *Chair ACIAR*
- Nick Dulvy, *Canada Chair of Marine Biodiversity*
- Ray Hillborn, *Professor of Fisheries University of Washington*
- Robert Kearney, *Emeritus professor*
- Ron Duncan, *Professor of Economics and Government, Australian National University*
- Sena de Silva, *President, NACA*
- Steven Hall, *Director General, Worldfish*

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- Jeff Kinch, *Coastal Management Adviser, SPREP*
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- Len Rodwell, *FFA*
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- Eddie Route, *fisherman*
- Nick Solomon, *National Fisheries Corporation*
- Andrew Wright, *WCPFC*
- Andy Richards, *WCPFC*
- Karl Staisch, *WCPFC*

Fiji Islands

- Stacey Jupiter, *WCS*
- *IUCN Oceania Programme group discussion:* Taholo Kami, Padma Lal, Bernard O'Callaghan, Kelvin Passfield
- Sanaila Naqali, *Fisheries Department*
- Malakai Tuiloa and Anare Raiwalui, *Fisheries Department*
- Dave Lucas, *Solander Fisheries*
- Bill Aalbersberg, *USP*
- Randy Thaman, *USP*
- *WWF South Pacific Programme group discussion:* Kesaia Tabunakawai, Penina Solomona, and Jackie Thomas
- X.J. Du General Manager, *Golden Ocean Fish Limited*
- Charles Hufflet, *Solander Fisheries*
- Graham Southwick, *Fiji Fish Co.*

Tonga

- Sione Vailala Matoto, *head of Fisheries Division*
- Pau Lililik, *Fisheries Management Section, Fisheries Division*
- *Others at Fisheries Division:* Vilimo Fakalolo, Siliveinusi Manavahetau Ha'unga, Hau Halafihi, Tala'ofa Lotoi'afea
- Tricia Emberson, *'Alatini Fisheries*

- George Nakao, **former Secretary of Finance, former manager Sea Star Fishing Company**
- Semisi Fakahau, **FFA consultant**
- Iliesa Fefita, **Secretary, Tonga National Fishing Association**
- Halevalu Palu, **Quality Fishing Company**
- David Edwards, **Export Culture Fishing Company**
- Tuifui Faletau, **Planning Division, Ministry of Finance and Planning**
- Paul Mead, **Vava'u based fisher and former SPC masterfisherman**
- Natilima Tupou, **Fishing Industry Association of Tonga**
- **Absent:** 'Ulunga Fa'anunu, Eddie Palu

Solomon Islands

- **Ministry of Fisheries and Marine Resources:** Chris Ramofafia, Sylvester Diake
- **FFA:**
Dan Sua, Transform Aqorau, Len Rodwell, Barbara Hanchard, Peter Philipson, David Rupokets, Kaburoro Rauaia, Moses Amos, Wez Norris, Apolosi Turaginivalu, Manu Tupou-Roosen, Pio Manoa, Lara Manarangi-Trott
- William Atu, **The Nature Conservancy**
- Adrian Wickham, **National Fishery Development**

New Caledonia

- **SPC:**
Jimmy Rodgers, Richard Mann, Mike Batty, Lindsay Chapman, Michel Blanc, Ben Ponia, Steve Pickering, Beeing Yeeting, Eric Clua, Beeing Yeeting, Shelton Harley, Simon Nicol,

David Kirby, Valerie Allain, Aymeric Desurmont, Mecki Kronen, Tim Pickering, Antoine Teitelbaum, Johann Bell

- Tomas Requillart, **Département Aquaculture et Pêches, Province Sud**
- Bernard Fao, **Responsable du Bureau des Pêches, Province Sud**
- Richard Farman, **Aquarium de Nouméa**
- Régis Etaix-Bonnin, **Service de la Marine Marchande et des Pêches Maritimes**

Others

- Bill Holden, **Marine Stewardship Council**
- Gerald Haberkorn, **SPC**
- Andreas Demmke, **SPC**
- Margaret Chung **[demography]**
- Bernd Cordes, **Packard Foundation**
- David Coates, **freshwater fisheries**
- Tiare Holm, **Palau Conservation Society**
- Ray Clarke, **NMFS**
- Dale Squires, **NMFS**
- David Itano, **University of Hawaii**
- Professor Keith Sainsbury, **Consultant**
- Duncan Leadbitter, **formerly Marine Stewardship Council**
- Steve Battaglione
- Walt Smith, **Walt Smith International**
- Yvonne Sadovy, **University of Hong Kong**
- Tim Adams, **Nauru Fisheries Adviser**
- Paul Roger de Villers, **development economist based in French Polynesia**
- Liam Campling, **fishery trade specialist**

Major changes that have occurred in the Pacific Islands from 1985 to 2010

C1. Outside fisheries sector:

- Population
 - « Declining fertility, but lower reduction than in most developing countries, resulting in relatively large population increase
 - « Increased urban concentration
- General governance
 - « “Arc of instability” emerging in Melanesia
 - « Decreasing involvement of governments in commercial activities
- Other
 - « Increasing acceptance of the private sector as an engine of economic growth
 - « Improvement in investment climate and openness to outside investment
 - « Increasing involvement of Asian countries in the region
 - « Decreasing viability of some PICTs economies (spectres of failed states)

C2. Inside fisheries sector:

- National fisheries agencies
 - « Decreasing resources against an increasing need to manage/regulate inshore and offshore fisheries (noting limits to the latter)
 - « Localization of head of fishery agencies
 - « Phasing out of funding for expatriate line positions and long-term advisors
 - « Shrinking of funding for fishery agency activities, with a maintaining of staffing levels – resulting in scarce funds for operations leading to greater dependence on donors.
 - « General decrease in output and effectiveness
 - « Increasing travel created by regional initiatives reducing effort on national fisheries issues
- Fisheries management
 - « Growing recognition of the futility of management of coastal fisheries by central government agencies
 - « Increasing involvement of environment community and NGOs in coastal fisheries management
 - « Evolution from fisheries development to fisheries management in coastal fisheries
 - « Coastal fisheries management moving away from being driven by stock assessment to be more oriented to community objectives.
 - « Increasing attention to offshore fisheries

- « Growing importance of regional initiatives for management of offshore fisheries: FFA, PNA Palau Arrangement, the Multilateral High Level Conference (MHLC) Convention and Commission (also below).
- « The formulation and entry into force of the US Tuna Treaty.
- Fishery resources
 - « Experiencing several boom/bust cycles of beche-de-mer
 - « Wiping out of the larger species of giant clam
 - « Increasing awareness of the limitations of deep bottom fish potential recognised
 - « Status of tuna resources (skipjack tuna(SJ), yellowfin tuna(YE), bigeye tuna (BE)) going from largely unknown to light/moderate exploitation to a situation of approaching limit, at the limit, and past the limit, respectively.
- Fishing
 - « The fall of government fishing companies
 - « The fall of pole/line fishing
 - « The rise and decline of locally based longlining
 - « The rise of fishing for aquarium fish
 - « For purse seining, the fall of the US fleet, steadiness in the Japanese fleet, and the rise of non-Japanese Asian fleet
 - « Decline in bottomfish fishing
 - « Emergence of new fisheries: aquarium fish, live reef food fish
 - « Increasing relative cost of fuel in fishing operations
 - « The FAD remaining one of the few successful mechanisms to enable small-scale fishers to have access to offshore resources – despite considerable effort to develop other mechanisms.
- Aquaculture
 - « Lack of major success in government-led aquaculture development
 - « Increasing awareness of the limitations of Pacific Islands aquaculture
 - « Success of culture of black pearls
- Post-harvest
 - « Introduction of fish sanitary requirements
 - « Increase in canning/loining
 - « Opening of the EU market
 - « Increasing demand for those products marketed in Asia: sharkfin beche-de-mer, live reef food fish
 - « Lack of success of government-led small-scale value adding
 - « Decrease in quality of canned tuna
- Regional/international agencies involved in fisheries
 - « Expansion of staff of FFA and fisheries staff of SPC
 - « Increased use of consultants by SPC and FFA
 - « Creation of an RFMO

- « Oscillation in perceived effectiveness/relevance/utility of SPC and FFA
- « Increased participation in FAO
- « The rise and fall of hope for WCPFC
- Other
 - « Continued dominance of locally based offshore fishing by Caucasians/Asians with very few successful indigenous Pacific Islanders.
 - « Phasing out of most boatbuilding activities associated with national fishery agencies
 - « Donor funding has become more oriented to institutional improvements and management, and less oriented to increasing fisheries production
 - « Donor funding has become less oriented to national level staff/programmes/activities, and more towards that at the regional level
 - « Increasing interest by major international NGOs in Pacific fisheries issues
 - « Increasing role of fishing associations in improving governance of the sector
 - « Increasing dissatisfaction at levels of return from tuna fisheries (access agreements) and increasing aspirations for domestic industries.

C3. Some patterns that could be projected into the future:

- « General gravitation of fishing to low-cost producing nations
- « The rise and fall of several fisheries and participants in fishing
- « The driver of much change in many fisheries has shifted from national governments and donors to economic realities (e.g. bottomfish, aquaculture, boatbuilding, small-scale tuna fishing)
- « A growth of wealth in the sector, much of which is due to an increasing global scarcity of fishery resources.
- « A gravitation from small-scale producers to medium scale producers in several fisheries to take advantage of economies of scale: longlining, bottomfish, aquaculture
- « The changes that have occurred in the last 25 years have been largely as a result of external drivers forces, or in a few cases, reacting to external drivers. There are few cases when changes were actually driven by PICTs. One of the few situations of being “in the driver’s seat” was pushing for the US Tuna Treaty.

C4. The evolution of tuna industry development 2002–2008 in independent Pacific Island countries

	Active locally based industrial tuna vessels (PS, LL, PL)			Tuna canneries & loining facilities			Export packing & value adding facilities			Local jobs on vessels			Local jobs in shore facilities		
	Gillett 2002	DEVFish 2006	Gillett 2008	Gillett 2002	DEVFish 2006	Gillett 2008	Gillett 2002	DEVFish 2006	Gillett 2008	Gillett 2002	DEVFish 2006	Gillett 2008	Gillett 2002	DEVFish 2006	Gillett 2008
Cook Is.	10 L/L	8 L/L	7 L/L	0	0	0	3	3	2	50	15	12	15	15	10
Fiji Islands	96 L/L 1 P/L	60 L/L	29 LL	1	1	1	6	4	6	893	330	150	1496	2200	1250
FSM	34 L/L 8 P/S	3 P/S	31 LL 3 P/S	0	0	0	4	0	1	89	36	25	131	24	140
Kiribati	2 L/L 1 P/S	1 P/S	1 P/S	0	0	0	2	1	1	39	15	15	47	80	70
Marshall	54 L/L 5 P/S	40 L/L 6 P/S	36 L/L 5 P/S	1	0	1	2	1	1	5	0	25	457	100	116
Nauru	1 L/L	0	0	0	0	0	0	0	0	5	0	0	10	2	0
Niue	0	0	0	0	0	0	0	1	1	5	0	0	0	14	18
Palau	71 L/L 1 P/L	139 L/L 1 P/L	115 L/L 1 P/L	0	0	0	2	3	3	1	0	0	11	5	20
PNG	40 L/L 24 P/S	25 L/L 43 P/S	27 L/L 43 P/S	1	3	3	7	4	7	460	110	440	2707	4000	8550
Samoa	35 L/L	29 L/L	15 L/L	0	0	0	4	3	2	674	110	255	108	90	40
Solo-mon Is.	8 L/L 2 P/S 12 P/L	2 P/S 11 P/L	4 P/S 1 P/L	1	1	1	1	0	0	464	66	107	422	330	827
Tokelau	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonga	26 L/L	15 L/L	9 LL	0	0	0	4	3	3	161	75	45	85	35	35
Tuvalu	0	0	0	0	0	0	1	0	0	59	20	65	36	10	10
Vanuatu	0	0	0	0	0	0	0	0	0	54	20	30	30	30	30
TOTAL	377 L/L 40 P/S 14 P/L	316 L/L 55 P/S 12 P/L	269 L/L 56 P/S 2 P/L	4	5	6	36	23	27	2,959	797	1,169	5,555	6,935	11,116

Note: PS = purse seine; LL = longline; PL = pole-and-line

Source: Gillett R. 2008. A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

National, regional and multilateral management

D1. National fisheries management

National fisheries agencies in the region are facing increasing pressures, both to address the increasing level of overfishing of inshore fisheries, including key invertebrate species, as well as to handle the increasingly complex nature of offshore fisheries management, including the key priority of facilitating increased economic returns. Activities associated with the offshore fisheries have placed very substantial loads on fisheries agency staff requiring many weeks of travel per annum, as well as considerable time preparing briefs and positions for the Commission meetings. Regionally-adopted measures requiring incorporation into national legislation and implementation have further increased workloads of agencies. This pressure, combined with inadequate institutional arrangements, governance problems and a lack of transparency has reduced the ability of the agencies to deal with contemporary fisheries management challenges.

In the last decade, there has been increasing assistance to fisheries agencies in the form of targeted capacity building to improve performance, with major projects having been completed in Marshall Islands, FSM, Cook Islands and PNG. A capacity building project in Solomon Islands is currently being implemented.

Prior to the adoption of the UN Straddling Stocks Treaty in 1995, the bulk of offshore fisheries management activity was undertaken primarily by the countries that are party to the Nauru Agreement. Since the commencement of the negotiations for WCFPC, the emphasis on offshore fisheries has spread to all PICTs, with a tendency towards lower levels of resources being directed to coastal fisheries. This bias seems to have been more as a result of workloads, particularly in terms of travel to regional meetings, than an intent to prioritise one sector over another. The result has been, however, a slowing of initiatives to address coastal fisheries management issues, including community fisheries management approaches, a number of which were built on Fiji Islands and Samoa models and showed considerable promise.

On the positive side, many national fisheries agencies have built considerable capacity in regional/multilateral fisheries issues. As discussed in following sections, these agencies have been at the forefront of the negotiation of a number of key fisheries management measures and other agreements at the Commission, and at regional and sub-regional levels. Fisheries agencies in PNA countries, with their extensive offshore resources, have been particularly active in this regard. The focus of national agencies is now increasingly turning to securing greater benefits from offshore resources. While it has been accepted that the private sector will be the driver to increasing wealth from fisheries, the role government can, and should play in facilitating such development remains unclear.

Many fisheries agencies rely on recurrent funding from Government and have been faced with budgetary cuts applied to all departments, against the increasing workload outlined above. Since staffing numbers have remained relatively static, pressure on budgets (and the need to maintain employment) has severely constrained project/operational funding and activities, particularly where travel to remote islands is required.

For some fisheries agencies (including Niue and Cook Islands), the US Treaty Project Development Funds remain crucial to budgetary performance. Others remain almost totally reliant on aid funding for project-based activities, which creates difficulties when trying to establish the continuity of funding necessary to implement a proper fisheries management regime.

Tuna management plans (TMPs) have provided some focus for a more structured approach to fisheries management and development (see Box D1). However, their implementation has highlighted shortfalls in stakeholder consultation, annual review and periodic plan review. Many of these plans, which have been externally driven, have tended to decay over time due to a lack of commitment and/or resources in national administrations. The practice of annual performance reporting by national fisheries agencies has ceased in many PICTs.

Box D1: TMPs – Lessons learned

Experience gained in studying the formulation and implementation of tuna management plans in the region indicates that TMPs have had their successes and disappointments. On a different level, these plans have had a major positive effect on many of the countries of the region. Although the process has not always been smooth, there have been substantial benefits. The first experience of some countries at formally establishing fisheries policies and articulating management goals has been during the process of formulating these plans. The plans have brought a degree of transparency to the fisheries management process, which was somewhat nebulous in several countries. The stable/reliable set of policy measures promoted by the plans are crucially important for attracting domestic and foreign investors into the fisheries sector. In some countries the first government/industry consultative mechanisms in the fisheries sector are those established by the plans. The tuna planning process has resulted in a movement in some countries to develop management plans for the inshore fisheries.

A major lesson learned in this study is that a tuna management plan, even an initial attempt with all sorts of problems, can make a remarkable improvement in fisheries governance. Furthermore, a TMP can be of value even though not adopted; some of the consultative mechanisms, awareness and networks created by the attempt to produce some of the plans are quite evident a half decade after work on the plan ceased.

(Source: Gillett 2009)

A fundamental problem of many fisheries agencies is insulation from fishery stakeholders. For maximum effectiveness, these stakeholders need some degree of real input into the planning and operations of fisheries agencies. The lack of such input may contribute to many other governance difficulties.

There are a wide range of models fishery administration models in the Pacific, ranging from fully autonomous fisheries statutory authorities (e.g. the National Fisheries Authority of PNG) and fully integrated (with government) fisheries departments. The distinction between an authority and a department in Pacific fisheries is often blurred. It is considered that any model can be satisfactory and that considerations are national priorities in fisheries, funding and how best to resource the institution (Ferraris 2008).

Some national agencies have adopted an authority model that enables the management agency to retain all or a portion of fisheries-derived revenue for ongoing budgetary support. This allows for a degree of independence to set priorities for the provision of services. The governing body of an authority offers the significant advantage of allowing external oversight and input, with the potential for improved governance and transparency. Authorities also have the ability place greater focus on core business and providing services, and are able pay more attractive salaries and provide an identity and incentive for performance that is not always present in government departments. However, some authorities may lose financial autonomy, as well as their focus on core business in attempting to meet a mandate to service multiple stakeholders and government development priorities. This is particularly likely to occur where authorities are created primarily for political reasons.

Updating Fisheries legislation continues to be a major burden for fisheries agencies. Fisheries Acts, subordinate legislation and promulgation of regulations require regular updating to accommodate developments that include giving effect to Commission measures and legislation associated with the move towards community-based management initiatives. It is not uncommon for maximum effort by fisheries agencies to be put into development of a new Fishery Act, only to have the implementing regulations fall by the wayside until external assistance is forthcoming.

There is an increasing amount of interest on the part of PICTs in the use of “rights-based fisheries management”. Conceptually, this frequently consists of the government granting a restricted number of fishers the long-term right to participate in a fishery, allowing them to transfer the right to fish to others. This effectively creates a property right that assumes tradeable value. Because that value can increase should the profitability of the fishery increase, the participants have an interest in the effective management of the fishery. The use of such property rights are becoming increasingly common in the management of fisheries worldwide. Box D2 gives some of the key features of a national rights-based fisheries management system. In order to effectively use rights-based management as a tool for domestic tuna industry development in the Pacific Islands region, two key conditions are important:

- as the licensing of a limited number of vessels is the basic mechanism for creating the required scarcity, countries need to pay increased attention to the integrity of licensing systems; and
- because the system depends on investor confidence that the scheme will be in place for the long-term future, positive perceptions of stability and continuity of government policies are essential.

Box D2: Key features of a rights-based fisheries management

The key features of a rights-based fisheries management system are:

- The use of rights as the primary management instrument: This entails shifting the emphasis of control to managing businesses rather than boats.
- The granting of rights to nationals: This entails allocating rights to nationals whether they are individuals or locally registered companies with whatever level of foreign shareholding is agreed upon by the State concerned.
- Limited number of rights: This entails restricting the number of rights available to make the rights valuable.
- Imposition of standards on right holders: This entails imposing stringent terms of investment and job creation or otherwise they lose their rights.
- Payment of fees by right holders: This entails imposition of fees on right holders.
- Reduced role for access agreements: This entails requiring foreign vessels to operate only under charter to right holders

Putting a rights based system for the Pacific Island States will require some careful planning and consideration. As explained above, the Pacific Island States have become accustomed to a certain way of conducting business. Thus, reorienting their approach will require careful planning. In order to put a rights based system in place, the Pacific Island States need to undertake a number of steps. These include defining the application of rights, developing criteria for the identification of right holders, characterising the nature of the rights, and the form of the limits.

(Source: Cartwright 2002)

In summary, national fisheries agencies currently:

- face workloads and responsibilities with shrinking budgets and limited human capacity;
- are often insulated from fishery stakeholders;
- have increasing regional responsibilities/activities associated with offshore fisheries which have tended to divert attention and resources away from coastal fisheries;
- have been the focus of targeted institutional strengthening projects in recent years, the results of which are yet to be fully determined;
- are recognizing the value of rights-based fisheries management;
- lack good planning procedures that are implemented and monitored in a structured way; and
- have experienced some success with the authority model which has increased efficiency and strengthened the connection between fisheries benefits and investment in management services.

D2. Regional institutional arrangements

The Pacific Islands are served by two key fisheries institutions, SPC and FFA. Both have achieved international standing outside the region, and enjoy generally strong support among their members. SPC provides a range of scientific, development and other advice relating to Pacific fisheries. The FFA Secretariat, in addition to providing advice, is also concerned with the development and implementation of specific fisheries management and related arrangements.

There has tended to be an oscillation in the perceived effectiveness and relevance of SPC and FFA programmes over the last two decades, as influenced by staffing, institutional policies and programme content and delivery. Generally, there has been an increasing focus towards developing regional programmes that are implemented nationally, and heightened awareness of the need to ensure adequate capacity is available in country to implement these regional programmes.

D2.1 The Secretariat of the Pacific Community

SPC has maintained coastal and oceanic streams of activity under for more than three decades. Currently these are the coastal and oceanic fisheries programmes (CFP/OFP), which together comprise the Marine Resources Division (MRD).

The Coastal Fisheries Programme (CFP)

CFP of SPC has undergone a number of changes in response to resource status and changing priorities in fisheries management and development. Initially, the emphasis was very much on development, although as the extent of the demersal fishery resource and its relatively low yields were recognised, interest switched towards tuna and the pelagic sector, including FADs and small-scale tuna fishing. As several PICTs geared up for domestic tuna longline operations, SPC changed its assistance to suit this change in focus, hiring people with tuna longlining experience.

With increasing pressure on coastal marine resources, CFP has grown and diversified its programmes from those based on development to reflect an emphasis on management, as reflected in the work of the current Coastal Fisheries Management Section. Coastal fisheries resource science followed

and expanded into the Reef Fisheries Section. Programmes are currently evolving to meet emerging challenges include food security and global climate change.

A recent review (MRAG 2009) found that MRD is generally effective in its mission to optimise the value of small-scale fisheries and aquatic resource use in Pacific Island waters. Some key observations relating to the work of CFP drawn from this report and SPC reports include:

- The high proportion of the total budget of CFP committed to staff costs, while OFP has more operational funds and a broader funding base;
- An urgent need to develop some simple monitoring methods and effective management measures for key inshore fisheries and provide effective support to, and communication with, coastal fisheries enterprises, including post-harvest and export market requirements;
- A continuing problem with the capacity of some member fisheries administrations, and the need for a strategy to address human resource constraints that goes beyond short-term training courses; and
- Limited capacity in the programme in to deal with work in the legal and economic areas.

The Oceanic Fisheries Programme (OFP)

OFP has run a more stable (in terms of focus) programme over the last 25 years. The Programme supports the sustainable management and optimal economic use of oceanic fisheries resources by providing scientific information required for management. OFP is considered a world leader in fisheries science and has also been repeatedly favourably reviewed, including in the Mid-Term Review of the GEF-funded Pacific Islands Oceanic Fisheries Management Programme (Zann and Vuki 2008), and through independent reviews by MRAG (2009).

Recognising the need to make the most effective use of existing capacity with the region (OFP), WCPFC has a formal arrangement with SPC for OFP to provide the majority of the Commission's science services, under contract. These cover a wide range of administrative and technical services for target and non-target species, including data administration, biological research, stock assessment and website administration. This arrangement was reviewed in 2009 as part of an independent Review of the Commission's Science Structure and Function was generally supported under the findings of that review. While the existing arrangement provides support for the effective implementation, by all Commission Members, of the WCPF Convention, the arrangement is also considered to generate additional benefits for SPC members in relation to understanding, and responding to, Commission-related obligations and developments.

OFP's role as a science provider is in contrast to that of CFP which also engages in providing direct management advice. In recent years, OFP has played an active role in the analysis and development of management measures to combat sustainability threats, including to yellowfin and bigeye tuna, working with the Commission, FFA, PNA and at the national level.

OFP continues to increase its capacity-building role, and has worked closely with FFA on initiatives such as the development of EAFM-based fishery management plans and a range of regional and sub-regional fishery management workshops. The demands for this type of support have increased as WCPFC and FFA develop their respective fishery management initiatives.

A key issue relates to attracting donor interest in what are essential core fisheries monitoring and assessment projects which are more usually considered the responsibility of fishing entities under cost recovery frameworks. This work is likely to continue for many years to come.

Some key observations relating to the work of OFP drawn from the Marine Resources and Fisheries Consultants (MRAG) report and SPC reports include:

- Increasing workload in support for FFA member countries both in the development of national management arrangements under the EAFM approach and measures at the regional and sub-regional levels;
- Increasing training, quality control and data processing requirements to cover increases in observer coverage;
- The requirement to balance the high level of resources devoted to work for WCPFC under the scientific services agreement with regional and national work programmes;
- Maintaining donor funding streams for research in support of fisheries that generate in excess of USD 2 billion per annum;
- Increasing emphasis on capacity building and assistance to members
- MRD is currently committed to greater decentralisation to ensure that costs are managed and assistance is available nearer to where it is needed – a range of activities are under consideration to achieve this including nationally recruited staff and relocating positions. In addition, a greater emphasis is to be placed on programmed in-country activities.
- Creating a balance between maintaining experienced staff within regional organisations, with the attendant high overhead (accommodation, leave, family support costs) and using short term consultants.

D2.2 The Pacific Islands Forum Fisheries Agency (FFA)

FFA comprises a technical secretariat that provides a range of technical and administrative services in fisheries management and development, overseen by the Forum Fisheries Committee, which has representation at Ministerial and officials level, from each member country. The fisheries management achievements of the FFA members, as supported by the Secretariat, have been recognised internationally, particularly in two areas: monitoring, control and surveillance (MCS) of fishing operations; and coordinated actions to negotiate beneficial regional treaties and agreements on fisheries management, including access for foreign vessels to fish in the FFA waters. There has been considerable recent criticism, however, that the FFA Secretariat has not been sufficiently successful in initiating and supporting initiatives to gain greater economic benefits from the resource, given the degree to which the FFA members are able to exert control of certain offshore fisheries, and in particular the tuna purse seine fishery. This has, in part, led to the formation of a PNA office (see next paragraph) and an increased focus by FFA in this area of endeavour.

A sub-regional grouping of FFA, the Parties to PNA was established in 1982 between those countries with a particular interest in the purse seine fishery operating between 20°N and 20°S. PNA has driven a wide range of regional fisheries arrangements, a number of which have been taken up by the full FFA membership.

Most recently, the PNA group agreed to establish a regional PNA Office in Majuro, Marshall Islands, which will become operational early in January 2010. The decision was based on PNA's desire to assert

greater control of, and secure greater rights to the region's tuna fishery, and the perceived restrictions on the ability of the FFA Secretariat to deliver against certain commercial objectives of the PNA Parties. This decision is likely to have significant ramifications for both FFA and the FFA Secretariat.

The technical services delivered by the Secretariat are associated with three main areas; fisheries management, fisheries development and fisheries operations, including MCS. The Agency also provides administrative services for regional agreements on fisheries access agreements.

Fisheries management

The fisheries management activity of FFA has grown with the development of national and regional management arrangements for tuna. Both of these types of arrangements increased dramatically in the late 1990s, with the process that established WCPFC and the assertion of sovereign rights and sovereignty over tuna resources in the waters of FFA members. The latter activity found expression at the national level through the development of national tuna management plans, in which PICTs have laid out a range of management objectives for the sustainable development of their tuna resources. FFA also provides legal services by reviewing and updating and harmonising national fisheries legislation, including assistance to give effect to the Commission measures.

Fisheries management activities fall under three key areas:

- **National:** development of national TMPs and the establishment of the ecosystem approach to fisheries management (EAFM), and assistance with national fisheries legislation.
- **Sub-regional:** support to management initiatives of PNA, including arrangements for preferential access to the waters of PNA (the FSM Arrangement) and limits to purse seine fishing effort (the Palau Arrangement and Vessel Days Scheme) and support to southern and longline states, most recently via the Sub-committee on South Pacific Tuna and Billfish.
- **Multilateral:** support to the FFA members, both nationally and regionally, on a range of issues relating to the development and implementation of the WCPF Convention, and particularly through participation at the Commission and associated meetings.

Some key observations relating to the delivery of fisheries management services by FFA are:

- Despite progress at WCPFC, many issues remain unresolved, including the effective management of yellowfin tuna and bigeye tuna, protection of the Pacific Island country interests and aspirations and management of Commission-associated workload;
- The importance of integrated and balanced national fisheries management, taking into account economic, biological and social objectives and a focus on implementing national fisheries management plans; and
- The need to achieve best possible management arrangements across gear types and species, such that fishery-wide FFA benefits are maximised, while maintaining equity between members.

Fisheries development

Domestic industry development has been a long sought after objective of Pacific Island countries. The FFA secretariat has sought to support this activity through a wide range of programmes ranging from support for access agreement negotiations and national tuna management and development plans

through to targeted assistance to assess individual development projects. Increased attention has been turned to assistance with the implementation of development policy initiatives at national level through locally based national consultants. A range of economic and marketing data is also collected and supplied to members. It has been recognised that the form of domestic industry development will vary greatly between countries, according to key factors that include infrastructure, resource endowment, communications and logistics, and macroeconomic environment.

As management and development have become more closely linked, FFA has supported the development of arrangements that restrict fishing access and thereby increase the value of that access, as well as leveraging investment in domestic industries. This work is likely to increase in the future, although the degree to which the formation of the PNA office will influence this activity has yet to be determined.

Some key observations relating to the delivery of fisheries development services by FFA are:

- Expectations/aspirations of FFA members with respect to increasing value from tuna have increased substantially and will continue to place considerable demands on the Secretariat to deliver development outcomes at national level;
- Economic indicators of the national benefits from tuna fisheries are necessary to measure the success of development initiatives; and
- The development/economic aspects of management measures at the Commission and sub-regional levels have increased in importance and profile, particularly in relation to creating scarcity and value.

Fisheries operations

FFA fisheries operations consist of treaty and monitoring, control and surveillance (MCS) services. The former is primarily an administrative process based on the operation, review and distribution of financial benefits arising regional fisheries treaties and arrangements, including the US Tuna Treaty.

MCS services are perhaps FFA's most extensive and well known activities and based on the fact that members have only limited personnel and financial resources to apply effective fleet monitoring and regulatory procedures. In recognition of these constraints, procedures that have been developed combine legal and technical elements that are applied at either the national level, or regionally in cooperation with other island States. These procedures include the Minimum Terms and Condition of Fisheries Access incorporating vessel registration and tracking through a vessel monitoring system (VMS), catch and position reporting, tuna transshipment restrictions and a regional observer programme for the US tuna fleet. FFA also administers the Niue Treaty, which provides flexible arrangements for cooperation in fisheries surveillance through bilateral or subsidiary agreements that facilitate closer cooperation between the parties.

MCS arrangements in support of the Commission management measures are driving, and will continue to drive, the work for the FFA operations. Key activities are the provision of VMS services to the Commission and the training of observers in support of the agreement to implement 100 per cent observer coverage of the purse seine fleet.

Some key observations relating to the delivery of fisheries operations services by FFA are:

- The development of the PNA office and the likely transfer of responsibilities will heavily influence the future income and activities of FFA;

- There is an increasing need for effective MCS, given its role in fisheries management and the current the status of stocks and increasing fishing pressures;
- Efforts to improve effectiveness will include implementation of a regional MCS strategy, and a broader MCS focus beyond 'boats and planes' towards monitoring in support of fisheries management decision making;
- An increased focus on improving compliance amongst licensed, including domestic, vessels.

D3. The Commission

The overall need for regional fisheries management organisations (RFMOs) to manage shared and highly migratory stocks is well understood and provided for under international law through the provisions of the Law of the Sea (UNCLOS) and the Fish Stocks Agreement (UNFSA). Despite the growth of RFMOs in recent years, they are considered to have been generally ineffective in preventing overfishing, stock/ecosystem declines and the erosion of the potential economic benefits (Willock and Lack 2006; Lodge et al. 2007)

The formation of the Commission was driven by PICTs, recognising the need to exert effective control over the high seas, as well as to ensure effective management for the highly migratory stocks of the region throughout their range. This was not possible under the FFA convention structure, given the membership limitations.

the Commission was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the western and central Pacific Ocean (WCPF Convention) which entered into force in 2004. The Convention was concluded after 6 years of negotiation which commenced in 1994.

The WCPF Convention generally reflects international fisheries law, while, at the same time, reflecting the special political, socio-economic, geographical and environmental characteristics of the western and central Pacific Ocean (WCPO) region. The WCPF Convention seeks to address problems in the management of the tuna and related stocks of WCPO throughout their range, and particularly on the high seas. These problems include unregulated fishing, over-capitalization, excessive fleet capacity, and vessel re-flagging to escape controls. Relative to other tuna RFMOs, coastal states can drive the process to a greater extent, since coastal states control a greater proportion of resources in this region, and generally, there is more solidarity among PICTs than among coastal states in other regions.

The Commission supports three subsidiary bodies, of which two are directly relevant to, and are attended by, PICTs – the Scientific Committee and the Technical and Compliance Committee. The Committees meet once a year, as does the full Commission. In addition there are a number of adhoc task and working groups. Preparation, attendance and participation in these meetings has considerably stretched PICT resources.

By adopting a range of conservation and management measures, the Commission seeks to provide management arrangements for key tuna stocks, while also protecting other species caught in association with those stocks, including bycatch species. Such measures now include:

- Limiting effort the capacity of vessels operating in the WCPO purse seine fishery and the effort they can expend, and the catch by the longline fleet;
- Limiting effort and/or capacity in the South Pacific albacore fishery

- Management measures for seabirds, sea turtles and sharks; and
- Limiting vessel numbers operating in the WCPO swordfish and striped marlin fisheries.

Additionally, the Commission has undertaken a substantial amount of work to implement the WCPF Convention provisions relating to monitoring, control and surveillance. Outcomes include:

- implementation of a high seas boarding and inspection regime;
- implementation (initial stage) of a centralised vessel monitoring system;
- establishment of a WCPFC vessel record and requirements relating to authorisations to fish;
- establishment of a list of vessels that have engaged in illegal, unreported and unregulated fishing within the convention area;
- elaboration of procedures for participation by cooperating non-members in WCPO tuna fisheries and the work of the Commission;
- implementation (initial stage) of a WCPFC observer scheme;
- elaboration of provisions regulating transshipment activities;
- elaboration of requirements relating to the use of charter vessels; and
- commitments to further develop processes to monitor CCM's submission of data and compliance with Commission conservation and measures.

The effectiveness of the Commission, in terms of conserving and managing fish stocks and providing 'good' outcomes for PICTs in terms of securing what they perceive as appropriate control of the resource, has been increasingly questioned by the FFA membership. This is largely due to the failure of the commission to adequately resolve five key challenges:

First, the Commission is yet to resolve key disagreements between DWFN and Pacific Island States over how the WCPF Convention should be interpreted regarding the implementation of management measures in EEZs and their application to archipelagic waters.

FFA members argue that the main purpose for WCPFC is to regulate the high seas and ensure that stocks are not over-fished on the high seas. Pacific Island States accept that WCPFC can establish 'global' catch, effort and/or capacity limits across the entire Convention area, but that it is the sovereign right of coastal States to determine catches within their EEZs. Furthermore, FFA members refer to PNA VDS and argue that management measures already exist within their EEZs. They note provisions within both WCPFC and UNFSA which require measures be compatible across the high seas and EEZ, taking into account existing measures already in practice.

DWFNs argue that WCPFC, as the primary management authority for tuna across WCPO, should establish management and conservation measures across the entire range of the stocks, both inside EEZs and on the high seas. These States refer to Article 10 of the WCPF Convention which provides that WCPFC can determine the quantity of catches, levels of effort, limitations on fishing capacity and other necessary management measures throughout the Convention area.

Tensions also exist continue in regard to the application of WCPFC to the archipelagic waters of coastal states. These waters, particularly in the case of PNG and Solomon Islands, support substantial offshore

fisheries. It is the FFA view that the WCPF Convention only has application to the high seas and EEZs, and not the internal waters, archipelagic waters and territorial seas. This position is not accepted by some DWFNs including the US and remains a strong focus of discussion at the Commission. While the FFA membership remains staunchly protective of their sovereignty, and their sovereign rights in terms of making fisheries management decisions in archipelagic waters, so too does Indonesia and the Philippines. While this creates some mutual interests, it also creates some tension as ultimately it is in the interests of FFA that Indonesia and the Philippines conserve tuna stocks and effectively manage fishing activities within their archipelagic waters.

Second, tensions between PICTs and DWFN continue to be exacerbated by the perceived failure of the Commission to recognise the special requirements of developing small island States to a degree that satisfies the development aspirations of PICTs. Ultimately, this requires some form of benefit transfer from historically active DWFNs to PICTs. In this absence, the FFA members have become increasingly wary of conservation measures that may, in any way, limit their fisheries development opportunities.

Third, despite three attempts (2005-01, 2006-01 and 2008-1) the Commission is yet to adopt a conservation measure that meets the advice of its own scientific committee on the conservation and management of bigeye and yellowfin fisheries.

Fourth, the Commission continues to suffer from weak compliance by many of its DWFN CCMs with the Commission's data submission requirements (particularly operational level). This directly undermines the accuracy of fisheries assessments and continues to exacerbate tensions between DWFN and PICTs.

Fifth, the capacity of the Commission to support its increasing workload is significantly undermined by its limited budget and lack of an equitable cost-recovery formula.

Some substantial progress has been made by the FFA members at the Commission. The FFA members have effectively won arguments regarding compatibility across the high seas and EEZ and in some cases have used the Commission to expand their national management into the immediately adjacent high seas. In 2006, such compatibility arguments were partly resolved in practice through the incorporation of PNA VDS into a Commission-wide conservation and management measure for yellowfin tuna and bigeye tuna. Then in 2008, the Commission endorsed the closure of the high seas pockets as agreed by PNA members and its inclusion within the same measure. These decisions indirectly recognised the primacy of coastal states over management of fisheries within their EEZs and framed conservation and management for high seas fisheries in the context of existing management practised in EEZs. It is highly unlikely that DWFN members of WCPFC would have agreed to close these high seas areas without their hand being previously forced by the PNA 3IA.

While some members of FFA and PNA have become increasingly sceptical of the Commission, their limited regional memberships and the migratory nature of the tuna stocks, ultimately mean that they require broader cooperation beyond their direct neighbours. This is less true of the purse seine fishery, although as noted previously, the cooperation of Indonesia and Philippines and within-PNA agreement of catch levels that represent some form of best possible economic outcome, will be essential if development aspirations are to be realised. In the longer term, there will need to agree and implement binding allocation and compensatory strategies in lieu of allocation, and harvest strategies including reference points. However, given the diverse membership of the Commission and the different stages of development nationally and as fishing nations, it would seem extremely optimistic that some form of economically optimal (for PICTs) outcome will emerge from the Commission in the short term. This again emphasises the key role that FFA members, and chiefly the PNA will have to take in cooperatively driving and implementing fisheries management and development arrangements.

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Key drivers of fisheries in the next 25 years

It is not possible to predict the long-term future of Pacific Island fisheries. The approach taken in this study is to identify and briefly describe several factors that are likely to be important drivers of change and then for each factor, explore the types of changes likely to be induced. In this way some insight into the future is provided.

To identify important drivers of change in fisheries, discussions were held with Pacific Island fishery stakeholders and global specialists. This was combined with experience of the consulting team and the fisheries literature. The major drivers thus identified are:

- Population growth and urbanisation
- Patterns of economic development
- The status of fisheries resources and developments in other oceans
- Governance and political stability
- Climate change
- Limits to fishery production
- Other drivers: fuel costs, subsidies/protectionism, technology creep and innovation, foreign aid, and eco-certification.

In the following sections these categories of drivers are discussed. Some general considerations are given, followed by some thoughts on how the drivers are likely to have an impact on the long-term futures of fisheries in the Pacific Islands.

E1. Population growth and urbanisation

With respect to the future, two of the most important features of Pacific Island populations are (1) Sustained high levels of natural increase throughout most of the Pacific; and (2) urbanisation becoming more prominent. Both of these features have important implications for fisheries.

Unless otherwise indicated, the population information in the section comes from two papers by the head of the Statistics and Demography Program at SPC: Haberkorn (2006, 2007)

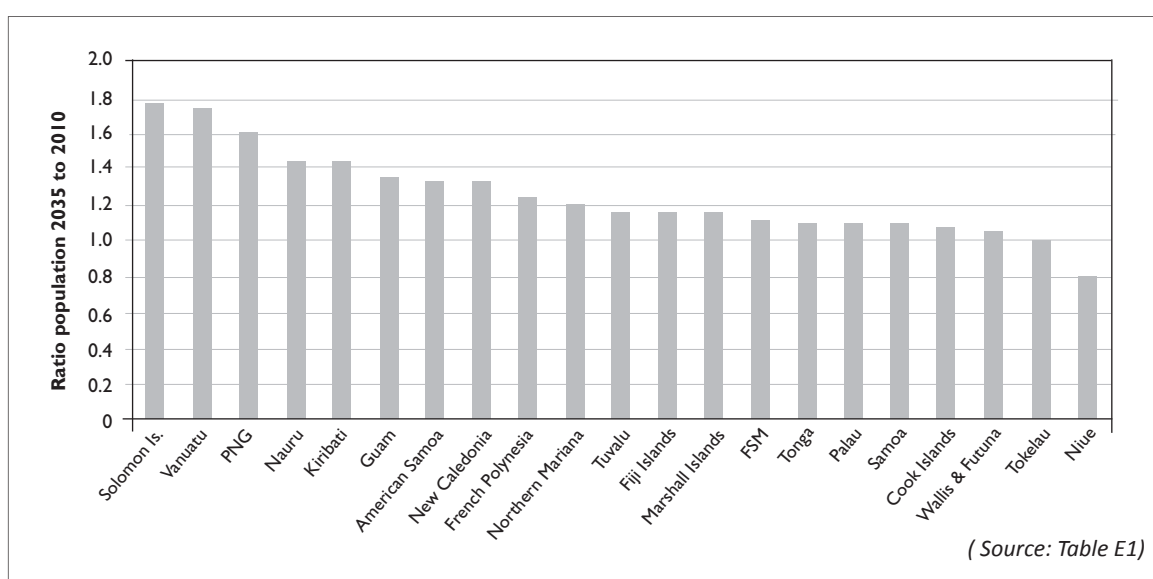
E1.1 Number of Pacific Islanders

SPC has made population projections for each country of the region. The current levels and the projections for the year 2035 are given in Table E1. The relative increases for each country for the 25-year period are shown in Figure E1.

Table E1: Current and projected Pacific Island country populations

		2010	2035
MELANESIA	Fiji Islands	847,800	977,600
	New Caledonia	254,500	335,600
	PNG	6,752,700	10,822,300
	Solomon Islands	549,600	969,900
	Vanuatu	245,000	424,100
MICRONESIA	FSM	111,400	124,100
	Guam	187,100	250,400
	Kiribati	100,800	144,600
	Marshall Islands	54,400	62,700
	Nauru	10,000	14,400
	Northern Marianas	63,100	76,200
	Palau	20,500	22,700
POLYNESIA	American Samoa	65,900	87,300
	Cook Islands	15,700	16,900
	French Polynesia	268,800	330,800
	Niue	1,500	1,200
	Samoa	183,100	202,000
	Tokelau	1,200	1,200
	Tonga	103,400	115,000
	Tuvalu	11,100	12,800
	Wallis & Futuna	14,100	14,800
TOTAL		9,861,700	15,006,600

(Source: Unpublished data, SPC Statistics and Demography Program)



(Source: Table E1)

Some important features of the changes in population levels are:

- Sustained high levels of natural increase are determined by two obvious developments – moderately high fertility rates and declining mortality. Although fertility rates are high by world standards, they have declined throughout the region over the past decade, with only Tuvalu and Tokelau showing a modest trend reversal.
- Mortality has a much smaller impact on population structure, distribution and dynamics relative to fertility, but with non-communicable (or life-style) diseases on the rise throughout the region, and the prospect of increased viral outbreaks such as HIV/AIDS, mortality may assume a much greater prominence in the future, in impacting on population structure, distribution and growth.

E1.2 Urbanisation

Around half of the countries in the Pacific Island region presently have more people living in cities than in rural areas. This is shown in Figure E2.

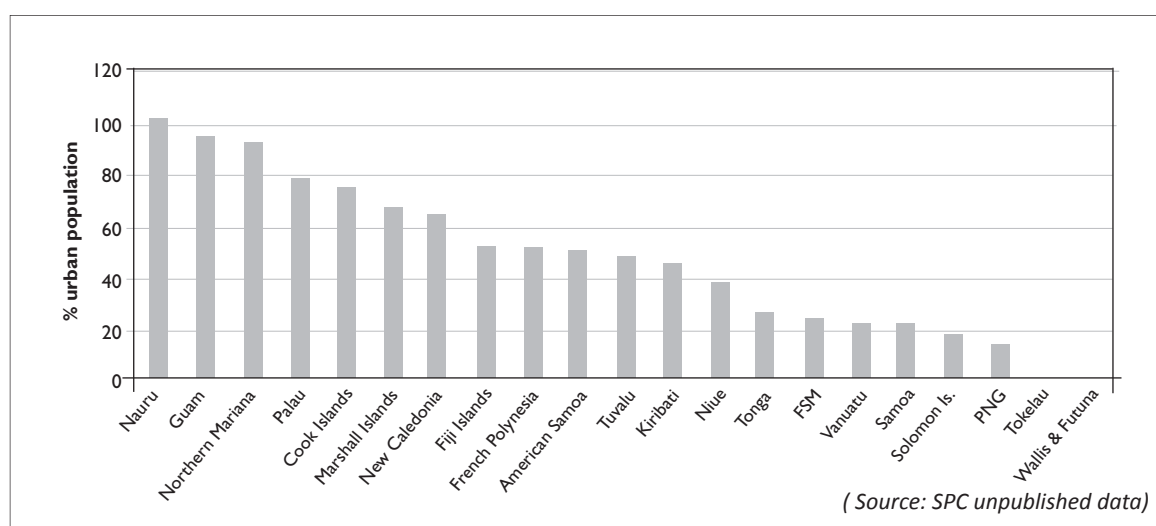


Figure E2: Urbanisation in PICTs, 2006

This high degree of urbanisation is somewhat surprising. There is widespread view that Pacific Islanders are largely not urban residents (Box E1).

Box E1: Rural vs urban realities

The continued perception of Pacific people as primarily rural dwellers is factually correct, but in wider political and development terms a myth, lulling national policy-makers and their international development partners into a false sense of security that traditional village social structures and support networks are able to handle sustained high population growth and associated developments. Most observers seem unaware that the perpetuation of this “rural myth” is largely the result of three predominantly rural societies — PNG (87%), Solomon Islands (84%) and Vanuatu (79%) dominating the Pacific demographic landscape and accounting for 74 per cent of the region’s overall population.

(Source: Haberkorn 2006)

The World Bank (2000) comments on the reasons for this high degree of urbanisation: “Throughout the Pacific, high population growth has led to migration from smaller islands to larger islands and from rural areas to towns, especially national capitals. Key drivers of these trends include push factors, such as declining agriculture commodity prices and livelihood opportunities and insufficient rural land to confer social standing, as well as pull factors, such as the prospect of cash employment, perhaps with the government, the availability of public services in towns and the intrinsic excitement of urban areas”.

With a high degree of urbanisation already a reality in most PICTs, what is likely in the future?

- Urbanisation is a demographic double-whammy: once an urban population base has been established, having largely attracted a young population, subsequent urban growth is fuelled by the dual process of (a) natural growth (higher birth rates due to a greater number of women, who are often reflected in a much younger urban than rural age structure), and (b) ongoing urban-bound migration, again of a largely younger (and often, single) population.
- Urban growth rates over the past 25 to 30 years have outpaced rural population growth everywhere in the Pacific. At these rates, urban populations throughout Melanesia are expected to double in one generation (25 years), with Solomon Islands and Vanuatu likely to achieve this in 16 and 17 years respectively, with American Samoa, Kiribati and Northern Mariana Islands not far behind in 20 years (SPC 2007).
- The picture looks serious when considers changes in specific towns or cities. Honiara and Port Vila could double their respective populations by 2015–2016, reaching populations of around 98,000 and 60,000 respectively based on recent trends (SPC 2007)

World Bank (2000) summarises the future of urbanisation in the region: “The young age structure and high fertility rates of many Pacific towns virtually ensure that towns will continue to grow rapidly, even where urban conditions and the quality of life are deteriorating”.

Projections of future urbanisation in individual PICTs are given in the figure below. In 25 years, about one-third of the population of Melanesia, one-half of Polynesia, and three quarters of Micronesia will live in cities. These features, together with high overall rates of population increase equate to a very large increase in the number of people living in cities of the region.

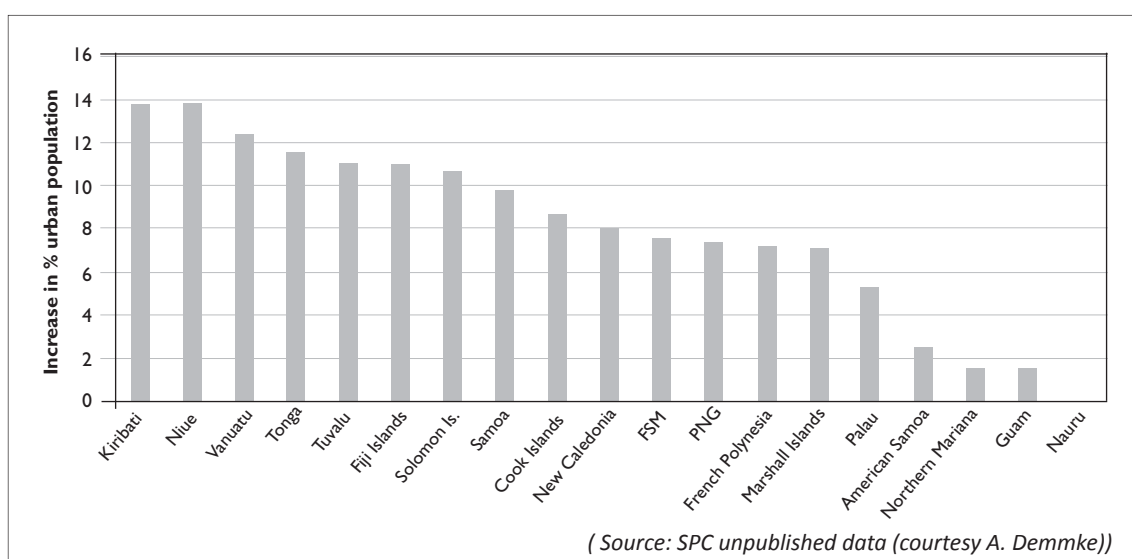


Figure E3: Percentage increase in urban population during period 2010 to 2030

E1.3 Some fisheries implications

Some of the fisheries implications of population increases and urbanisation:

- Given that the Pacific Island population will increase by over 5 million people in the next 25 years, there is likely to be a growing gap between what coastal fisheries can produce and the demand for production from coastal fisheries.
- The production from coastal fisheries that are accessible to urban residents will probably decline to over-exploitation and habitat destruction.
- There will be an increase overfishing conditions due to expanding urban populations fishing intensively close to those populations.
- A growing number of people in the cities will result in a higher proportion of the population not being able to catch sufficient fish to provide for household consumption. It is clear that much more of the fish consumed by Pacific Islanders will be purchased and shipped in from less populous areas.
- Many of the above points will contribute to more expensive fish.

E2. Patterns of economic development

E2.1 National economic development

National economic development is battling strong headwinds. Past attempts at reform have been generally disappointing, leading to the belief by many that economic development will not attain established goals or fulfil general expectations.

The Pacific appears to be seriously off track to achieve the Millenium Development Goals by 2015 (AusAID 2009; Chhibber 2009). The real buying power of Pacific Islanders has been static for years, but in terms of the true economy, it has probably declined everywhere due to the depletion of the economic base (Crocombe 2001). The growth of employment has not kept pace with population growth (Hess 2006). The countries of the Pacific region have gone through an extended period of low or zero economic growth, despite levels of foreign aid that have been among the highest in the world (Holden 2005). Poverty in the region is on the rise, with about a third of the people in the Pacific Islands living below their “basic needs” poverty lines (AusAID 2009).

The gloomy features of past economic progress cited above are not likely to continue in the future in all PICTs. Some specific national reforms could result in remarkable improvements. In general, however, past trends suggest that the economies of PICTs will not be in very good shape in the future.

What are the fisheries implications of poorly performing economies?

- There will be large negative impacts on coastal fisheries: greater numbers of people without jobs will be seeking income and food security from harvesting coastal resources – and willing to compromise tomorrow’s sustainability for today’s food/money
- Limited tax base and subsequent public revenues will equate to less ability of the government to provide basic services in regulating and promoting fisheries and in the provision of infrastructure related to fisheries.

- A degeneration of government-supplied infrastructure, transport and communications, combined with jobs concentrated in urban areas (even if the private sector grows) will exacerbate the imbalance of supply and demand of fish between urban and rural areas.
- Governments of the region are likely to have less ability to provide subsidies to encourage what they perceive as favourable developments in fisheries and aquaculture: boatbuilding, transporting catches, rural fisheries centers, and specific fishing/aquaculture activities.
- Donors (bilateral, multilateral, and NGOs) will, at least partially, move into the vacuum for management/development services, albeit with priorities that may be different from those of the host government.
- Governments will need to prioritize the available funding for essential fisheries management and development interventions rather than fund the multitude of activities that historically fishery department have carried out.

E2.2 Global patterns of economic development

Predicting global economic development in 2035 is far beyond the scope of the present study. Nevertheless, some general vision of the future economic landscape in 25 years time is required to consider how global patterns of economic development may affect fisheries in the Pacific Islands. For simplicity, this study uses the scenario of one widely quoted investigation, Madison (2007), which used trends in population and GDP per capita, and assumed that world development will not be interrupted by new major military conflicts. That study foresees in 2030 a world population of 8.2 billion and a 2.25 fold increase in world GDP. With respect to specific regions, GDP per capita in western Europe, US, and Japan will grow at about the same as in 1990–2003. In Asia, there will be a continued high momentum and a large degree of catch up on US, while a modest improvement in per capita performance in Africa and Latin America is expected.

Other patterns of global economic development that are both relevant to the Pacific Island region and likely to endure for the long-term are: decreasing barriers to international commerce, increased consolidation in industries that involve international commerce, increasing the relative costs of energy, and gravitation of labour-intensive industries to low wages countries.

With respect to the present study, the impacts of the above scenario/trends can be placed in three categories (*which have been subject to various degrees of examination*):

- The impacts on fisheries in general (*well studied but considerable uncertainty remains*)
- The general impacts on PICTs (*studied to some degree*)
- The impacts on fisheries in PICTs (*open to considerable speculation*)

The general fisheries impacts of the above scenario (i.e. some major trends extending into future) have been well studied:

- Several studies indicate that the increasing global population and prosperity is likely to lead to a situation in which fish and other seafoods increasingly being perceived as luxury items.
- Birkeland (1997) states that the rapid economic growth of Asian nations is putting a new type of pressure on marine resources. The rapidly increase in dollar value of reef resources can override management policies, traditional practice, and Law.

- Delgado et al. (2003): China's fish consumption has grown rapidly of late, and will continue to grow rapidly relative to other countries. Projected annual growth in aggregate Chinese food fish consumption of 2.0 per cent per annum may seem high but is actually much lower than the recorded growth of 11.8 per cent per annum in the FAO figures for 1985 to 1997.
- Garcia and Grainger (2005) examine a large number of studies and state there appears to be general agreement that (a) Global per capita consumption from traditional marine resources will decrease, simply because of human population continued growth and development; (b) Asia will become a net importer and Latin America a leading exporter; (c) Rich countries, already net importers, will increase their trade deficit.
- Garcia and Cochrane (2009): The fact that fisheries are a commonly a minor if not marginal economic sector and that fisheries governance is part and parcel of a larger (national, regional, global) governance picture implies that the future of fisheries and their governance will be shaped by global and national political and economic considerations on which fisheries will have very little influence. ...the future of fisheries is largely shaped from outside the fisheries sector.

The general impacts on PICTs of the scenario outlined at the beginning of this section have been studied to some degree, but some salient points should be stressed:

- Crocombe (2007) indicates that the influence of US and Europe in Pacific Island countries is expected to continue to decline in importance; The influence of Japan, China, Taiwan and South Korea, as well as the ASEAN countries will rise. After looking abroad overwhelmingly to Europe and US for the past 200 years, the Pacific Islands will look increasingly to Asia.
- With increasing relative costs of fuel, carrying out business from locations that are relatively isolated becomes increasingly difficult. Almost all the Pacific Islands reside at the end of the supply chain when it comes to petroleum supplies and are sensitive to changes in fuel prices.

The impacts of the scenario of continuing general economic trends on fisheries and related issues in PICTs is more open to speculation, but some the features are likely in the future include:

- With barriers to international trade dropping, the advantages enjoyed by Pacific Island countries in the EU tuna market are likely to be eroded. This is likely to have a large impact on existing operations and the current incentives to establish tuna industries in the region.
- On the other hand, the longer term trend of increasing scarcity of tuna could help leverage the establishment of tuna industries in the tuna-endowed countries of the region.
- There is a trend for increasing consolidation of the tuna industry. The impacts of this on PICTs are far from certain but it could lead to a monopsonistic situation and less competition for tuna resources – unless PICTs use this as an opportunity, and take advantage of the industry's requirement for access to the resources.
- The gravitation of the tuna industry (both in fishing and in processing) to countries with low production costs is likely to continue. PICTs generally have high production costs.
- There will be an increasing struggle between using inshore fishery resources for domestic food and for export to lucrative Asian markets ("you can have your fish exports, but not eat it too.").
- It is inevitable that there will be stronger global demand and higher prices for the cheap imported canned fish products now popular in urban areas of PICTs.

- Increasing interest in marine tourism and pristine habitats will increase the potential for non-extractive uses, which, in turn, could lead to major conservation initiatives. The increasing prosperity of Asian countries and their increasing consumption of, and reliance on, fishery products could have an impact on the interest of those countries in becoming donors active in the fisheries sector of PICTs.
- An increasing attractiveness of PICTs for marine tourism, especially from nearby booming economies (e.g. China, Taiwan) is likely. The benefits from establishing beneficial fisheries/tourism linkages will increase.

The same drivers will also apply in regional setting, where strong, cohesive tuna agreements between PICTs will be necessary to resist increasing pressure from DWFNs for unsustainable fishing opportunities,

Many of the impacts cited above are advantageous to PICTs that can make long-term use of the growing value of owning increasingly scarce fishery resources. Higher prices for fishery products will bring greater benefits to PICTs that have strong fishery institutions and resilient regulatory schemes (i.e. ability to resist harvesting for maximum catch rather than maximum profitability). Higher prices for those countries with weak regulatory schemes could have negative consequences, including a devastating impact on the supply of fish for domestic consumption. Higher prices for fishery products could easily be a double-edge sword for the Pacific Islands region – much like oil/diamonds in some African countries.

E3. The status of fisheries resources and developments in other oceans

The condition of fisheries resources in other oceans, various developments in other fisheries, and the rise of aquaculture production appear to have a large effect on the fisheries of the Pacific Islands. This can occur both by altering patterns of participation and more indirectly through effects in domestic and international markets.

The fully exploited nature of most of the world's fisheries (Box E2) and various restrictions on fishing activities has created, and will continue to create, a “push/pull” situation: fishers being discouraged from operating in certain regions and/or being attracted by perceptions of opportunity in other areas.

Box E2: State of world fisheries and aquaculture 2008

- In 2007, about 28 per cent of world fish stocks were either overexploited (19%), depleted (8%) or recovering from depletion (1%) and thus yielding less than their maximum potential owing to excess fishing pressure. A further 52 per cent of stocks were fully exploited and, therefore, producing catches that were at or close to their maximum sustainable limits with no room for further expansion. Only about 20 per cent of stocks were moderately exploited or underexploited with perhaps a possibility of producing more.
- Most of the stocks of the top ten species, which account in total for about 30 per cent of the world marine capture fisheries production in terms of quantity, are fully exploited or overexploited and, therefore, cannot be expected to produce major increases in catches.

(Source: FAO 2009)

This has certainly occurred in the recent past in the offshore fisheries, with tuna longliners from China being a prime example:

“A significant reduction of fishing opportunities for domestic vessel operators in China due to resource depletion problems has led to reductions in the number of vessels allowed to operate, restrictions on the building of new vessels, and specific closed areas during certain times of the year. Recent conclusion or renewals of fishery delimitation agreements with China’s neighbors in both the north and south has resulted in shrinking opportunities for its domestic fleet. On the other hand, there is the perception in China of WCPO tuna resources as being greatly underutilized”. (McCoy and Gillett 2005)

This push/pull effect has occurred in other offshore fisheries in the region (e.g. purse seining for SJ, swordfish longlining by the Spanish). In coastal fisheries, Indonesia’s ban in 1987 on the capture/transport/export of trochus caused a price increase and large increase in harvesting of trochus in the Pacific Islands. Other examples include events in the live reef food fishery and coral extraction.

Relatively tight regulatory regimes “over there” and/or relatively good resource levels in this region have been important drivers of changes in participation in the coastal fisheries of the Pacific Islands.

Changes in fisheries in other oceans can affect fisheries in this region through consumer preference in the markets. The change in availability in specific overseas fisheries of eco-certified fishery products, perceptions of product purity, cost, and availability can affect consumer decisions, alter markets, and, potentially, exert large positive/negative influences on fisheries in this region. Consumers in Europe and US can choose from a wide variety of fishery products, including tuna, certified by the Marine Stewardship Council, none of which come from the Pacific Islands region.

An overseas fishery development that has had a profound effect on world fisheries generally, and likely to be a major driver of change in Pacific Island fisheries in the future, is large scale aquaculture. After growing steadily, particularly in the last four decades, aquaculture is for the first time set to contribute half of the fish consumed by the human population worldwide (FAO 2009). The 50 million tonnes of food fish produced annually by aquaculture in recent years have tended to moderate the pressure for fish price increases (especially at the top end of the global fish market, including white fish and prawns) created by rising demand and stagnating wild production.

Bearing in mind that both Pacific Island fishery exports and global aquaculture production are mainly concerned with high-value commodities, some downward pressure on prices for certain categories fish exports from the region is inevitable. Another effect is that large-scale aquaculture production in efficient low-wage countries with good transport links to major markets has reduced the potential for export-oriented aquaculture in the Pacific Islands region, with shrimp production in China being a good example. On the other hand, the type of aquaculture responsible for the boom was not about producing large quantities of cheap fish and therefore had minimal effect on lowering the cost of cheap canned fish imports popular in Pacific Island urban areas.

As illustrated above, the relative condition of fisheries resources in other oceans, various developments in other fisheries, and aquaculture production have been significant agents of change in the past in the fisheries sector. Of interest to the present study is the extent to which these factors will affect the long-term future of fisheries in the Pacific Islands region. The future effects are obviously uncertain, but the following scenarios are considered likely to exert some future influence:

- The failure of countries and regional fishery management organizations in other regions to prevent over-fishing of tuna in other areas, may result in the Pacific Islands region becoming increasingly attractive to global-roaming tuna fleets. It is also likely that for the long-term in many countries there will be substantial tuna fishing fleets with limited or no domestic opportunities. These factors are likely to result in increased interest in fishing in the region, and raise the value of fisheries access and/or present opportunities for leveraging domestic industry development.

- However, the relative attractiveness of tuna resources in the region will depend on the condition of the stocks and associated catch rates. There are limits to what the resource can sustain in terms of more fishing and recent assessments have shown there that the only substantial potential for catch expansion is associated with skipjack. The key is not to continue to take ever-expanding catches (which is impossible) but rather to effectively manage tuna resources to keep them profitable and demonstrably sustainable, and therefore attractive to both tuna fleets and markets. The degree to which this will occur will depend on the quality and timeliness of decisions taken by PICTs, both for their national waters and through WCPFC.
- Coastal fisheries for domestic nutrition should be somewhat insulated from impacts from fishery developments in other regions. The major impacts are likely to be on alternatives to fish from coastal fisheries: breakthroughs in small pond aquaculture, and on the prices of imported feed for chicken and imported canned fish.
- With respect to developments in aquaculture affecting the future of Pacific Island fisheries, it is important to note that global aquaculture growth is slowing. The average yearly growth rate was 11.8 per cent in the period 1985–1994, but reduced to 7.1 per cent in the following decade (FAO 2009) – so price competition with the high-value fishery exports typical of PICTs should be less than in the past. On the other hand, aquaculture advances are occurring for commodities that are important exports of the Pacific Islands, including tuna (including the feed aspect), beche-de-mer, and coral. Aquaculture production of these commodities could conceivably occur in the Pacific Islands (obviously beneficial to the region) or, more likely, in places where aquaculture production is more efficient (the impacts would be mostly detrimental).
- As populations grow and marine resources continue to decline in SE Asia and China, coastal marine resources in the Pacific Islands will likely become increasingly attractive and highly valued. The degree to which aquaculture developments will meet demand in SE Asia and China is uncertain, but substantial risks and opportunities will be present.

E4. Governance and political stability

Governance refers to the process whereby elements in society wield power and authority, and influence and enact policies and decisions concerning public life, and economic and social development. As such, governance is a broader notion than government (Barclay and Cartwright 2007).

It is logical to assume that governance and political stability can create change in the fisheries sector. In fact, in the consultations for the present study, many Pacific Islanders indicated that this is one of the *most* important drivers of change in the fisheries sector.

To examine how governance can affect the shape the future of fisheries, some analysis of past and current issues is required.

In the past 20 years in the region, there have been two extremes of change in fisheries caused by governance. Failing high-level government institutions have caused rapid negative changes (e.g. breakdown of fisheries management processes). At the other extreme, gradual positive change in the fisheries sector has been caused (or at least associated with) good government fisheries agencies that have a high degree of stakeholder input and competent staff.

In recent years much has been written about the problems of governance in the fisheries sectors of Pacific Island countries in general. This includes Clark (2006), Barclay and Cartwright (2007), FFA (2007), AusAID (2007), Gillett and van Santen (2008), and Hanich and Tsamenyi (2009). Common features that emerge from these analyses are:

- Low capacity of national fisheries agencies brought about by lack of qualified personnel at all levels, faced with increasing complex issues.
- Poor decision making: inconsistent, lacking policy objectives
- Poor leadership/organisational skills by department heads
- Structures of government fisheries agencies that are not conducive to transparency and stakeholder input.
- Low levels of government funding of government fisheries agencies
- Few staff incentives for performance in support of good governance

On a positive note, aspects of the quality of governance provided by government fisheries agencies in several Pacific Island countries have improved. Interventions at the fisheries level that have been associated with improvement are altering fisheries institutional structures to allow for increased stakeholder input, de-politicizing of fisheries management through creation of semi-autonomous fishing authorities, allowing young/educated staff to advance to positions of authority, increased transparency of decision-making by the use of formal fisheries management plans, strengthening of fishers' associations, revision of fisheries legislation, long-term fisheries institution strengthening programmes, increased involvement of NGOs in fisheries management, and empowering coastal communities (i.e. moving away from central regulation of inshore fisheries). Some lessons-learned for improving fisheries governance are given in Box E3.

Box E3: Improving fisheries governance

Improving national fisheries governance is a high priority for enhancing benefits from the fisheries sector. The issues and constraints associated with governance apply to both oceanic and coastal fisheries, as well as aquaculture. Increasing transparency is the number one area for action. Part of the problem is that many administrations do not have the right people with the right skills to support the shift in focus of fisheries policy from promoting fisheries to fisheries management. The few people with fishery and corporate management skills are heavily involved in regional fishery meetings and other activities that diminish their capacity to govern national fishery activities. Important ways to improve national fisheries governance involves preparing and implementing fishery management and development plans, and increasing the participation of stakeholders in fishery management and development processes.

(Source: Clark 2006)

Governance issues affecting the fisheries sector also occurs at levels higher than that of the government fisheries agency. Ideally, the national government would provide a degree of over-all stability and consistency, assure essential government services, fund the government fisheries agency at an appropriate level, have mechanisms for formulating/modifying fisheries policies, provide a favourable private sector investment climate, and not interfere with decisions at lower levels of government that are consistent with national fisheries policies.

Difficulties for the fisheries sector have occurred in the recent past with national governments attempting to liquidate fisheries capital during a financial crisis, gaining political advantage from expensive subsidies and unrealistic schemes (e.g. cannery in every province), trading-off fisheries access for concessions in other sectors, and using the government fisheries agency for placing unwanted staff.

Some general trends in high-level governance affecting the fisheries sector have been positive. Learning from past difficulties, most governments of the region currently have policies that restrain the government from commercial involvement and focuses on improving the policy environment. A noticeable improvement has been made in the past decade on transparency in the financial aspects of licensing arrangements – information on access fee payments is readily available in the public domain for most Pacific Island countries. Some countries increased national resolve in punishing corruption – which has benefited the fisheries sector. In comparisons to other sectors (i.e forestry), the developments in fisheries can appear quite positive

Assuming that governance is a major factor affecting change in the fisheries sector, then an examination of expected developments in fisheries governance can provide some insight into the shape of fisheries in the future.

- The future is likely to be an era of increasingly scarce fisheries resources, and the pressure on decision makers to satisfy all stakeholders will increase, testing governance structures.
- The enhancing of governance in the fisheries sector through provision of assistance to improve capabilities of government fisheries agencies is current a donor priority – and likely to remain so.
- Some countries and fisheries agencies may not embrace fisheries agency governance enhancement efforts.
- Some regional development specialists see the emergence of an “arc of instability”¹ within the Pacific Islands region. Even if this bleak scenario does not occur, national governments in some countries may be unable to provide even the minimum of fishery agency funding and stability for the fisheries sector.
- Measures for general government-wide improvements in the region (e.g. the growing trend of increased stakeholder input, improvements in staff education, performance-based budgeting) are likely to have positive spill-over effects in the fisheries management sector.

In view of the above, some situations can be envisaged. Those countries with currently poorly performing fisheries agencies that do not undergo significant enhancement will probably suffer major/magnified negative consequences in the future. Some high-level induced fisheries governance meltdowns could easily occur. Fisheries governance can be expected to rise, at least marginally, with any rising tide of general governance in the region.

E5. Climate change

A major regional project to assess the vulnerability of fisheries and aquaculture in the Pacific Islands region to climate change is being carried out by SPC and supported by AusAID. As this comprehensive study is focused specifically on this region and is the most current information available, an interim report of the project (Bell et al. 2009) updated to October 2009 is used here to portray the impact of climate change on the future of Pacific Island fisheries.

The build-up of carbon dioxide and other greenhouse gases in the atmosphere due to human activities is acting in two major ways that will ultimately affect fisheries and aquaculture in the Pacific: global warming and ocean acidification. There is broad concern around the world about the impacts on fisheries of these changes.

¹ A chain of countries with weakened economies, institutional deficits and significant domestic instabilities.

Preliminary assessments indicate that the offshore, coastal and freshwater fisheries, and aquaculture of the Pacific will be as equally subjected to the direct and indirect effects of climate change as comparable fish resources elsewhere in the world. A summary of the main potential positive and negative effects of climate change on the categories of fisheries in the region is provided below.

Offshore fisheries:

- Alterations in ocean temperatures and currents, and the food chains in the open ocean, are projected to affect the future location and abundance of tuna species in the Pacific Island region. Initial modelling indicates that the concentrations of skipjack and bigeye tuna are likely to be located further to the east than in the past. The simulations have yet to be done for yellowfin tuna and albacore tuna.
- Significant changes to the future distribution of tuna will make the zones of some PICTs more, or less, favourable for the surface fishery for skipjack tuna. Displacement of tuna stocks further east in the Pacific would be a windfall for the countries in those areas. Reduced abundance of skipjack tuna in Melanesia should have a far lower impact on their GDP in relative terms, but there will be substantial losses in real terms given the large quantities of tuna currently caught there. Identifying the preliminary implications of climate change for longlining operations is not practical at this stage because although initial simulations indicate that there will also be an eastward shift in adult bigeye tuna, the modelling has not yet been done for yellowfin tuna and albacore tuna.
- Projections that cyclones will become progressively more intense may increase the risk of damage to shore-based facilities, fleets for domestic tuna fishing and processing operations in countries located within the cyclone belt. Rising sea level will eventually make many of the existing wharfs and shore-based facilities unusable.

Coastal fisheries:

- The projected effects of climate change on coral reefs are better understood than for other coastal habitats. Rising sea surface temperatures and more acidic oceans are projected to have increasingly severe impacts on the growth of hard corals. The expected loss of structural and biological complexity on coral reefs will have profound effects on the types of fish and invertebrates associated with them. Species that depend on live coral for food, and on the intricate variety of shelter created by structurally complex reefs for their survival, are likely to disappear.
- Effects of climate change on coastal fisheries associated with coral reefs may not be immediately apparent, but result in slow, long-term (decadal) declines in yields as resilience and productivity are gradually eroded.
- Projected increases in temperatures, sea level, cyclone intensity and turbidity of coastal waters due to higher rainfall, can be expected to affect the growth and survival of mangroves, seagrasses and non-reefal algal habitats, and the nature of intertidal and subtidal sand and mudflat areas, in the tropical Pacific. These areas function as nurseries for juveniles and/or feeding habitats for a wide range of coastal fish species. Reductions in coverage and structural complexity of mangroves and seagrasses can be expected to reduce the recruitment success for many species of fish and invertebrates.

Freshwater fisheries:

- The projected increases of rainfall in the tropics are expected to increase the extent and duration of inundation. The effects of increased flooding and higher water temperatures on the fish themselves, and the vegetated lowland areas that support them, have yet to be determined.
- Freshwater fisheries throughout the region include species that migrate between the sea and freshwater. Small changes in either rainfall or sea level may have major impacts on the ability of fish to move between estuaries and freshwater, impacting recruitment.

Aquaculture:

- Climate change could result in losing fish from ponds during floods, invasion of ponds by unwanted species and damage to ponds through infilling and breaching of walls. On the other hand, heavier rainfall in low-lying tropical countries may increase the area suitable for rain-fed pond aquaculture.
- Pearl farming faces risks from increased acidification of the ocean. As aragonite saturation levels fall, the shells of blacklip pearl oysters will be weaker. This is likely to lead to higher rates of predation of juveniles and lower rates of collection of wild spat. Rising sea levels will make it increasingly difficult to dry out existing shrimp ponds in New Caledonia between crops. On the other hand, the winter mortality disease currently causing problems for the production of blue shrimp in New Caledonia may ease with the changing climate.
- Higher water temperatures combined with lowered salinity are factors linked to outbreaks of disease that affect production of seaweed. Warmer water temperatures, increased acidification and more severe cyclones can also be expected to influence the development of aquaculture for marine ornamental products.

In view of the expected changes above, some observations should be made. An important point is that, despite enormous recent research on climate change, there is still considerable uncertainty as to the precise changes that will occur, and when and where they will happen. Even where there is general agreement on broad changes across the region, there is considerable uncertainty of the effects on the scale of specific islands.

Another important point concerns responses. Attempts at mitigation of the effects of climate change at the fisheries level are likely to be futile. Adaption to changes will be the key to maintaining the flow of benefits from fisheries. One of the keys to successful adaptation will be diversification – the more options that industries and communities have to produce, process and distribute fish, the greater the chance that some of them may be favoured, or not affected, by climate change. Climate change will make certain species and habitats increasingly vulnerable to fishing and other anthropogenic impacts. Maintaining stocks at healthy levels and minimising habitat and ecosystem degradation will generally reduce vulnerability to climate change. The reverse applies.

E6. Limits to fishery production

There are limits to the production in all fisheries. The over-all production in the coastal fisheries of many PICTs does not appear to have expanded in recent years – despite increasing effort. In the offshore fisheries, some tuna species are approaching (or surpassing) the sustained production levels, while others can support increased catches – but that potential is certainly not infinite.

Two regional studies on fishery production in the Pacific Islands area offer some insight into limits. Figure E4 below indicates that the offshore fisheries have expanded considerably in the past decade and suggests that the coastal fisheries (subsistence and commercial) may have reached a limit.

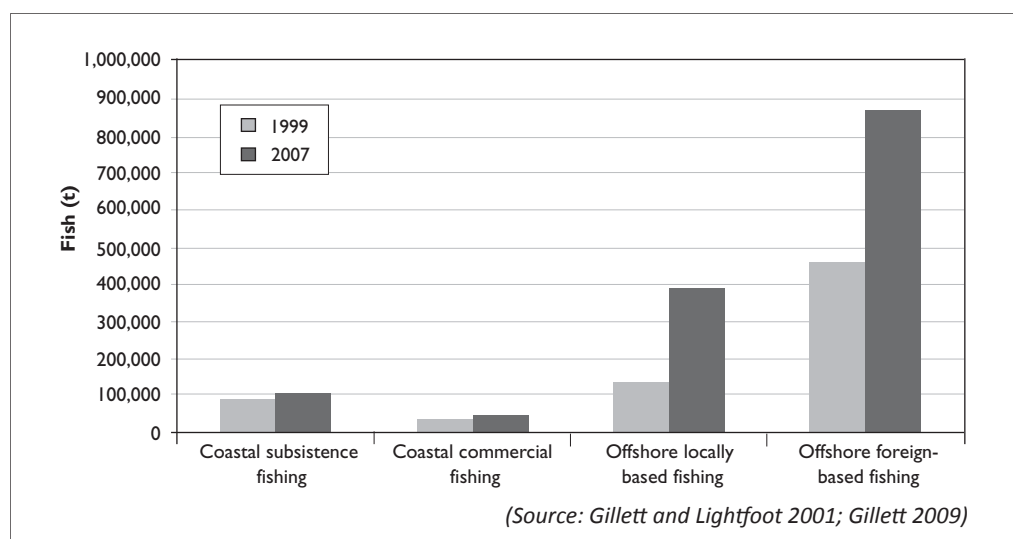


Figure E4: Fishery production change in the Pacific Islands region by category, 1999 vs 2007

When limits are reached, various types of change will occur. The timing of reaching the limits and the types of change induced are quite different for the various categories of fisheries in the region.

E6.1 Coastal, freshwater and aquaculture

Although there are some notable national exceptions, coastal fishery production may have reached a limit in many PICTs. Catches are likely to be constrained in areas that have access to markets by innate biological characteristics of the exploited populations and, in more remote areas, by marketing economics.

What kind of change is induced by reaching the limits of coastal fisheries? The various changes fall in different areas:

- **Target species:** As biological limits are approached catch per unit effort will fall and sizes of individual fish will get smaller; As biological limits are surpassed, total production will fall.
- **Serial depletions** will occur; heavily fished areas will see some species reduced to very low levels, which may not recover; the process will be repeated as fishermen deplete an area and move on to seek new places to fish.
- **Species extinctions:** It is inevitable that some of the more vulnerable species (e.g. humphead wrasse, some large tridacna species) will disappear from some countries of the region.
- **Commercial fishers:** Range further afield, fish offshore, change target species/gear, fish harder, develop new technology and methods and seek alternate employment.
- **Subsistence fishers:** Fish harder, range further afield, change target species/gear, and spend more time on agriculture

- Markets: Price increases, changes in species composition, fish obtained from more remote areas, export marketing restrictions
- Habitat/ecosystem: Expansion of abundance of non-exploited organisms, including algal coverage if reduction of abundance of herbivorous fish, some especially vulnerable species disappear.

The above changes are likely to lead to management responses, either in the lead up to limits or when limits have been reached. To some degree, the management implemented will determine the nature of coastal fisheries in the long-term future. Some management considerations that may impact future fishery scenarios are:

- Increasing pressure on the government fishery agency. Gone are the easy days of promoting development (“being the fisher’s friend”), as increasing restrictive regulations are required.
- The trend towards devolving management authority to communities is likely to continue – if for no other reason than the lack of success with centrally-controlled management.
- Increasingly, management will involve trade-offs dealing with the diminishing benefits, such as partitioning food fish for domestic consumption and for export.
- The increasing viability of transporting fish from remote areas to urban markets may result in over-exploitation problems in the remote areas if attention is not paid to sustainability issues (i.e. if transport schemes do not have built in management measures).
- The inability to expand coastal fisheries production likely to encourage more post-harvest value-adding.
- CITES and associated processes will probably play a greater role in the management of coastal export fisheries.
- In countries with large tourism sectors, pressure will grow for greater non-extractive use of coastal resources.

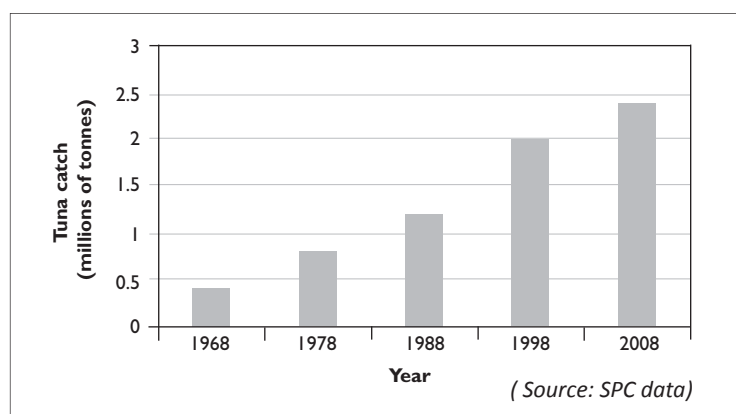
For freshwater fisheries, changes induced by reaching exploitation limits are not as great as those from the environment. In marine fisheries, the main drivers of change are often the influence of fishing activities (including limits to production), while in freshwater fisheries, the influence of the environment is the dominant driver of change. In some cases it is a situation of “the environment crumbling around the fishing”.

For aquaculture, changes induced by reaching the exploitation limits are not an issue. Aquaculture output in the region is not constrained by the resource productivity but by economics (demand in domestic markets; competition in export markets).

E6.2 Offshore fisheries

The history of the offshore fisheries in the region is one of expanding catches (Figure E5). In 2008, in catches of skipjack tuna in the western and central Pacific of skipjack tuna was the second highest ever, yellowfin tuna catches were easily the highest on record, and the bigeye tuna catches for was the second highest on record (Williams and Terawasi 2009).

Figure E5: The catch of the WCPO tuna fishery







Quite simply, this catch trajectory cannot continue forever. The biological characteristics of fish populations and the history of fishing in the world dictate that there are indeed exploitation limits to all fisheries.

The latest assessments of the condition of the major tuna species in the region are given in the table below. The information suggests that the “party is over”: three of the four important species of tuna in the region cannot support increasing catches – limits are being approached and/or surpassed. Unlike many other fish, different species or tuna are available to different fishing gears at different times of their life and some species are more vulnerable than others. Getting the species mix of catches right is essential for the long-term economic and biological future of the fishery.

Although there appears to be at last some potential for one species, skipjack tuna, its potential yield may be constrained by measures to mitigate overfishing/threats to bigeye tuna and yellowfin tuna.

Table E3: The condition of the tuna resources

Tuna species		Latest resource assessment
Skipjack		<ul style="list-style-type: none"> The major conclusions on skipjack are essentially unchanged from the last three assessments (2002, 2003 and 2005) Overfishing is not occurring and the stock is not in an overfished state. There is an increasing trend in estimated recruitment throughout the entire time series of the fishery which may reflect skipjack tunas’ high productivity, as well as its position in the ecosystem. These high recent catches are considered to be sustainable unless recruitment falls persistently below the long-term average.
Yellowfin		<ul style="list-style-type: none"> The yellowfin stock in the entire WCPO is not experiencing overfishing The entire stock appears to be capable of producing MSY. The yellowfin stock in WCPO is not in an overfished state.
Bigeye		<ul style="list-style-type: none"> The bigeye stock status is in a slightly overfished state, or will be in the near future with high levels of overfishing occurring. Current levels of catch are not sustainable even at the recent high levels of recruitment estimated for the last decade. Overfishing is occurring in the bigeye tuna stock. Greater overall yields could be obtained by reducing the mortality of small fish
Albacore		<ul style="list-style-type: none"> Southern albacore: Estimates indicate that overfishing is not occurring and that the stock is not in an overfished state. There is no indication that current levels of catch are not sustainable with regard to recruitment overfishing. Northern albacore: the stock is considered to be fully exploited.

(Source: Harley et al. 2009 and WCPFC 2009)

The reaching of limits on tuna production in the region will create change

- Management action will need to be made sooner rather than later; ‘lowest common denominator’ decision making by regional agencies on management action has not kept pace with the effects of fishing and the gap is set to widen.
- Scramble for resources: resource scarcity has already created a rush to secure long term fishing opportunities, which will increase over time. This could be an opportunity or it could result in chaos. Strong government and regional fishery agencies, robust regulatory schemes, regional solidarity and transparency will make the difference.
- Falling catches for a given amount of fishing will reduce profitability and is likely to impact on the goal of many PICTs in establishing domestic fishing industries and displacing DWFN fleets. Only the most efficient, low cost fleets will be able to function under scenarios of major overfishing.
- Pressure for “ocean MPAs”. There is an increasing belief that creating areas that are closed to fishing will prevent overfishing and restore stocks, despite scientific opinion to the contrary. Exceeding tuna production limits for some or a number of species could have important (and maybe irreversible) consequences:
- Upper-level predators, including tuna and other large pelagic species (sharks, billfish) have a major role in pelagic ecosystems, and their removal can have a major detrimental impact. The data now available on relationships in the pelagic environment do not allow definitive statements to be made on ecosystem effects of removing upper-level predators. Another very relevant ecosystem topic is the relationship between the species that occupy the upper levels of the pelagic food chain. Specifically, if the population of bigeye is exploited to a low level, will other species move into the vacant niche for the long-term (as for the cod in the north Atlantic) or can bigeye, under reduced fishing pressure, rebound.

E7. Other drivers of fisheries change

In addition to the major drivers of change in Pacific Island fisheries discussed above, there are other drivers can be important, but to a lesser degree. These include:

- Subsidies and protectionism
- Fuel costs
- Technology creep and innovation
- Foreign aid
- Eco-certification

E7.1 Subsidies and protectionism

Subsidies in the fisheries sector are being subjected to increased international scrutiny by the World Trade Organization (WTO) and elsewhere. This attention is due to the potential for subsidies to encourage over-fishing and to have distorting effects on international trade. Various organizations have

2 The WTO Agreement on Subsidies and Countervailing Measures contains a definition of subsidy as “a financial contribution by government or an agency designated by government that confers a benefit”. Alternatively, Campling et al. (2007) defines subsidies as “any number of financial programmes or government policies that offer an incentive for producers.”

attempted to estimate the magnitude of worldwide fisheries subsidies and present estimates range from USD 10 to 20 billion annually, or almost a quarter of the gross value of the global fish catch. About 60 per cent of fisheries subsidies globally involve fuel.

Markets for fishery products are protected in varying degrees by tariff and non-tariff barriers in most developed countries, including the destinations most important for tuna from the Pacific Islands. Protectionism and associated preferential treatment offer both constraints and opportunities to Pacific Island fishery exporters.

Globally, many types of subsidies relevant to offshore fisheries are gradually being reduced and the role of preferential treatment in markets for fishery products is being eroded. There are, however, some types of subsidies and market access arrangements where various factors may result in them being significant drivers of future change in Pacific Island offshore fisheries:

- Fuel subsidies, both for foreign and domestically-based operations will continue to be portant. Fishery fuel price spikes historically create domestic constituencies for fishery fuel de-taxation and/or other government relief.
- The subsidized export of excess fishing effort and of types of fishing perceived as being undesirable from developed countries to the Pacific Islands is likely to continue, or even accelerate. The current subsidized European swordfish longlining in the region may be an example of this.
- The environmental sensitivity of some types of fishing will probably come under increased domestic scrutiny in developed countries. This is likely to result in additional requirements on exporting countries to demonstrate that the fishery products were caught in a manner consistent with specified standards. Major changes to the global shrimp industry were caused in the past by turtle-related requirements of the US government. Similar requirements concerning bycatch from tuna fisheries have been mooted.
- Additional non-tariff market barriers are likely to arise in areas related to fish sanitary requirements, traceability of fishery products, bio-security, and a host of other topics. Brownjohn (2009) states that the goal of Pacific Island countries complying with these emerging requirements “is just practically and economically unattainable”.
- Subsidies that relate to fishery access agreements face an uncertain future. They will come under increased scrutiny in WTO negotiations but may be accorded some degree of exemption, justified that they help developing countries.

The situation for subsidies and barriers to overseas market access are very different for coastal fisheries. Few PICTs export fishery products that originate from subsidized coastal fisheries. Therefore coastal fisheries are not likely to be very exposed to the international forces in support of future subsidy reductions. Subsidies in coastal fisheries are mainly for small-scale development – but the practice of subsidizing is likely to be reduced in the future due to (a) decreasing ability for governments to pay for such subsidies, (b) the increasingly over-exploited condition of coastal resources, (c) the priorities of donors (the source of many past subsidy programmes) shifting to promoting conservation efforts, and (d) unfavourable past experiences in the region of using subsidies as a fisheries development tool.

3 Although only exported subsidised fish are likely to result in a dispute at the WTO, the current draft WTO rules require that fishery subsidies will have to be notified to the WTO and that only certain types of subsidies will be legal regardless of the impact on international trade. Therefore in principle, all WTO member countries will be open to public scrutiny, including by environmental NGOs. (L.Campling, personal communication, October 2009).

Issues related to barriers to overseas market access for coastal fisheries commodities are considerably different. Current and likely future exports from coastal fisheries include beche-de-mer, trochus, deepwater bottomfish, giant clams, live reef food fish, aquarium fish/invertebrates, lobster, prawns, and shallow water reef fish. This list contains many non-food items and items oriented to markets where barriers are not currently stringent – nor likely to be so in the future. With food exports from Pacific Island coastal fisheries likely to be reduced in the future, fish sanitary requirements should be less troublesome. There are likely to be increasing incentives to export to China where market barriers are less stringent. Barriers created by CITES are currently applicable to only a few Pacific Island exports (coral, giant clams, humphead wrasse), but the number of species is likely to grow in the future. Exports from the prawn trawl fishery of PNG will continue for the foreseeable future to require approval to access markets in US.

E7.2 Fuel costs

The real cost in USD of fuel for fishing has increased by a factor of about 240 per cent in the last three decades. Trends for the future of fuel prices are notoriously difficult to predict but are likely to continue to rise. Kelleher and Willman (2009) indicate that, in general terms, fuel price increases may:

- Reduce fishing effort as a result of higher costs
- Reduce fish supply and drive fish prices higher
- Change fishing patterns to less fuel intensive modes
- Result in higher fuel subsidies

A recent study on fishing fuel in the region (Wilson and McCoy 2009) indicates that tuna longliners have high consumption of fuel per ton of catch: on average over four times as much as purse seiners. Small-scale fisheries fall between the two, consuming about twice as much fuel per ton as seiners. Non-motorized fisheries of the region are obviously fuel efficient.

This fact, and the way in which longliners were tied up as a result of the last fuel increase during the 2008 spike, suggests that longliners will experience difficulty in the future, especially those that target markets that are not expanding. Purse seiners will experience relatively less difficulties from fuel price increases, but pressure to use fuel efficient fishing techniques (i.e. FADs) will increase. In coastal fishing, the strategy of responding to lower catch rates by ranging further afield will become less viable, while non-motorized fishing techniques will enjoy some advantages with respect to operating costs. Aquaculture that has relatively high energy costs (e.g. shrimp culture) will suffer greater cost increases, relative to those that consume less energy such as small pond aquaculture and pearl culture. All export fishery products from the region are likely to experience increase competition from equivalent products that originate from countries where fuel costs are low.

E7.3 Technology creep and innovation

In most fisheries changes in skill of the fishers, gear, logistics, and other factors results in more efficient fishing operations. Such change is often a case of evolution rather than revolution – a phenomenon known as “technology creep”. As an example, the average annual catch of a purse seine vessel in the region is much greater now than in the 1980s – when a captain received a new Mercedes from the vessel owner for catching 7,000 t of tuna in a year (a quantity that is not exceptional now).

Garcia and Grainger (2005) discuss fishing technology changes in world’s fisheries and give some ideas for the types of changes that may occur globally in the future (Box E4).

Box E4: The past and future in fishing technology changes

Fishing and processing technology have underpinned the fantastic boom in fisheries between 1950 and 1970: Freezing; diesel engines; synthetic fibers; acoustic devices; hydraulic power; skinning, filleting, dressing and filling machines; fishmeal machines; air transportation for high-priced goods or bulk shipment (e.g. for fishmeal). The past three decades have seen the continuous improvement of navigation, acoustic and fish location devices (including computers, spotter planes and helicopters, remote sensing, automated sea mapping) and processing methods for new products (e.g. fish protein extracts such as surimi).

Many technological developments are still in prospect with diverse impacts on the sector. As they are usually 'imported' from other sectors, they are not too difficult to identify, even though the likelihood and timing of their adoption can only be guessed. Without any priority ranking, potential developments include:

- better species/sex/size selectivity using hormones or Pavlovian reflexes (over short distances) and sounds (over longer distances);
- biodegradable fishing equipment;
- habitat mapping (acoustics) for better targeted fishing and habitat protection;
- autonomous fish/plankton detection devices to improve assessment and forecasts;
- more effective and automated information processing;
- generalization of the use of DNA tracking for fishery product identification (e.g. shark fins);
- low-impact aquaculture;
- better decontamination processes to mitigate the effect of growing pollution;
- fertilization of the iron-limited oceans to improve primary productivity;
- automatic fish sorting and measuring devices (e.g. through image processing);
- automated freezing at a very early stage of fish processing; and
- use of archival tags to monitor the delivery chain;

In the Pacific Islands, it is inevitable that fishers will become more efficient, placing greater pressure on both coastal and oceanic stocks – which has implications for effort control and stock assessments. Changes will be both incremental and in leaps.

Many of the past technology leaps affecting fisheries of the region were catalysed by the major shocks to the status quo. As an example, the technology advancement that led to catching tuna with purse seine gear was born in a price shock to the US bait-boat fleet.

By the late 1950s, Japanese tuna vessels had expanded into the eastern Pacific and much of the increased tuna production was for the US market, leading to a price drop. This was a major shock to the US tuna fleet, which consisted of bait-boats that could not compete with the low costs of Japanese tuna fishing. Faced with this major threat, US fishermen responded in a number of ways,

including experimenting with new fishing techniques. Tuna purse seining using modern hydraulic hauling equipment was developed, and proved effective in competing with the low production costs of Japanese tuna vessels. Starting in the late 1950s about 100 US bait-boats converted to purse seine gear and the US tuna purse seine fleet was born.

Some of the big technological innovations affecting Pacific Island fisheries in the future could include:

- Breakthroughs in offshore fisheries bycatch avoidance (as opposed to reduction), it is likely that gear/baits that repel unwanted species or attract desired species will eventually be developed. Such breakthroughs could be accelerated should the countries importing tuna products require that exporting countries demonstrate that the fishery products were caught in a manner consistent with specified standards.
- In tuna purse seine fisheries the technological advances will be primarily incremental. A breakthrough that could change the face of purse seining is the development economically efficient onboard processing.
- As the controls on the more vulnerable species become limiting on fisheries as a whole, acoustic technology and other systems will make it easier to target particular species and sizes of fish and avoid others.
- In tuna and swordfish longlining a breakthrough that could change the face of longlining would be equipment capable of fishing significantly more hooks than the maximum at present (3,500 to 4,000). The impact of such an innovation would be amplified if the equipment could be adapted to a range of vessel sizes, including those less than 24 metres in length.
- On the post-harvest side, likely advances include: (a) Improved connectivity to markets through better information technology could have an impact in both offshore and coastal fisheries; (b) Technology advances in processing, including that which allows canneries to operate with less fresh water.
- With respect to transport, alternative arrangements to air freighting tuna (i.e. affordable super-cold refrigeration systems) should emerge. This is encouraged by both the cost/availability of air cargo, plus by pressure to reduce the large carbon footprint of air transport.
- For aquaculture, due to the small size of the industry in this region, the usual situation will be technological advances occurring in other regions and copied (i.e. a situation of catching up).
- Technological improvement in fisheries management: real-time onboard monitoring of catches that do not require observers. This could have implications for employment of PICTs or others providing onboard observers, but could prove valuable for increasing the coverage of longline vessels.
- Alternative energy sources are developing rapidly, and advances with solar power, wind power, efficient power storage and propulsion systems are likely to evolve, particularly if the price of fuel climbs again, and is maintained.

With respect to regulations and technology, there has been an important lesson learned from fisheries in other regions that has applicability to future fisheries management in the region. Rather than governments researching and attempting to develop appropriate fisheries technology to meet management requirements, a better approach seems to be for regulators to set targets/requirements and allow industry to innovate.

E7.4 Foreign aid

With respect to general aid (non fisheries-specific), on a per person basis the Pacific Islands receive the most aid of any group in the world, ranging for USD 40 in PNG to USD 1,295 for Palau. It is unlikely that aid volumes will fall in the near future (AusAID 2006). The major bilateral donors recently active in Pacific Island fisheries are (in descending order of importance) Japan, EU, US, and Australia.

For aid targeting the fisheries sector, Governments and donors have moved away from promoting higher catches and expanded fleets. They are increasingly supporting policies aimed at sustainability and ecosystem-based and integrated management, recognising the basic dependence of economic sustainability on continued ecosystem health. There is increasingly an emphasis on improved fisheries policy, legislation and administration and institutional strengthening, fisheries research and compliance services, and increased education and training (AusAID 2007).

With respect to other patterns in fisheries aid, in the 1990s there a trend for an increasing proportion fisheries aid to be channeled through the regional organizations, mostly SPC and FFA. The 2000s spawned a series of relatively large and aid-supported national fisheries enhancement projects.

Some aid issues for the future are:

- With the budgets of many national fisheries agencies evolving to support staff costs at the expense of operations/activities, donor-support to these agencies will be increasingly important for any projects/activities. Donors (bilateral, multilateral, and NGOs) will, at least partially, move into the vacuum for management/development services, albeit with priorities that may be different from those of the host government.
- Bilateral fisheries assistance will continue to be dispensed by individual donors on the basis of self-interest. As shifts in tuna fishery access continue towards low cost countries, those countries are unlikely to be able to provide aid on the scale of past Asian fishing nations, particularly Japan. Japan's fishery-related aid will be reduced as their need for fishery access diminishes.
- To some extent, the level of donor funding to Pacific Island countries may reflect the "political realities of the irrelevant": Pacific Island countries involvement in international debates in which they have little substantive interest. Crocombe (2007) states that the islands most valuable non-mineral resource will be to take sides on issues that are irrelevant to them, but important to powerful countries.
- Donor funding levels may also be affected by the ability of Pacific Island countries to consolidate alliances with other small island developing states on key issues relevant to fisheries (e.g. ACP protective tariffs, climate change, ocean issues).
- If the Taiwan-China competition decreases, the aid generated from that struggle will decrease. The repositioning of political and economic balances between China and US may generate significant assistance, some of which will probably involve fisheries.
- Much of the work of NGOs that have involvement in the fisheries sectors of Pacific Island counties is funded by private US-based foundations (e.g Packard, MacArthur). Although it is unlikely that these organizations will pull out of the region, the areas of focus may change, with respect to countries and subject matter.

Several sections of the present study point to the increasingly crucial role that national fisheries agencies will play in an era of less abundant fisheries resources. Higher prices for fishery products will

bring greater benefits to PICTs that have strong fishery institutions and resilient regulatory schemes. Accordingly, the more altruistic of the donors active in the region's fisheries sectors are likely to prioritize fisheries institutional enhancement. On the other hand, the less altruistic donors are likely to prefer projects (including those in the fisheries sector) that confer immediate advantages on the government of the day. Some donors with significant fishing fleets may even not support the building of capacity in fisheries administrations, since increased management effectiveness might see their fishing opportunities diminish.

E7.5 Eco-certification

The concept that some consumers have a desire to buy marine products that do not contribute to overfishing or other destructive practices, is the idea behind "certifying" some seafood and marine products as "sustainable." If a fishery is certified as being sustainable, the products from that fishery are eligible to bear a distinctive logo or statement which certifies that the fish has been harvested in compliance with conservation and sustainability standards. The logo or statement is intended to make provision for informed decisions of purchasers whose choice can be relied upon to promote and stimulate the sustainable use of fishery resources (FAO 2005). More and more large fisheries will enter certifying programmes to promote how sustainable and well managed they are, but the main incentive is market advantage.

In developing countries a positive attribute of certification schemes is the watchdog function. Should effective (i.e. certified) management regimes crumble, there is an outside voice to call attention to the situation.

According to a recent FAO report, several recent developments will probably lead to an expanded use of certification schemes in fisheries and aquaculture. These include: (a) the increasing influence and concerns of civil society in relation to health, social and environmental issues; (b) legal requirements for companies to demonstrate "due diligence" in the prevention of food safety risks; (c) growing attention to "corporate social responsibility" and a drive by companies to minimize "reputational risks"; (d) "globalization" of supply chains and a trend towards vertical integration through the use of direct contracts between suppliers and retailers; and (e) expansion of supermarkets in food retailing both nationally and internationally. (FAO 2009)

The largest certifying group, the Marine Stewardship Council, has certified several tuna fisheries in other regions and has begun preliminary work in this region: pre-assessments for the purse seine, pole-and-line, and southern albacore longline fishery. Worldwide, the Marine Stewardship Council has certified fisheries for 50 species, covering about four million tonnes of seafood and 3,000 products (Holden 2009). Another certifying group, Friend of the Sea, has some involvement with tuna fisheries worldwide and has certified a tuna purse seine operation in PNG in August 2009.

Eco-certification is likely to be a powerful force for creating change in offshore fisheries. The tuna industry apparently believes that certifying schemes will be important in the future. An experienced industry representative has gone so far as to simply state: "Certified sustainability of tuna stocks will become a market requirement" (McGowan 2008). First to market tuna companies/fisheries with fully certified product are likely to reap the rewards. Some schemes are more likely than others to be effective as a means of using the market place to promote sustainable practice. Not to be left behind, various less transparent, industry-based schemes are likely to evolve, with lower standards and less rigorous third party assessment.

The impact of certification schemes on Pacific Island coastal fisheries and aquaculture is less certain. Any impact will be determined largely by (a) whether appropriate certification processes (and associated costs) can be developed for the types of coastal fisheries and aquaculture that are characteristic of the

Pacific Islands region, and (b) whether certification schemes will attain significant traction in many of the markets that are emerging as important for the coastal fisheries exports, especially those in Asian countries. There is a distinct possibility that the certification schemes could affect coastal fisheries and aquaculture of the region in a negative way – that Pacific Island fishery exports (for which there may be no appropriate certification scheme) could be forced to compete in overseas markets with certified products.

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The literature on the future of fisheries: Global fisheries and Pacific Islands fisheries

This Appendix is in two parts. The first summarises notable points and conclusions past Pacific fisheries studies. The second part provides a categorised, annotated reference list.

F1. Some concepts from past studies that are relevant to the future of Pacific Island fisheries

A number of fisheries studies sponsored by SPC, FFA, AusAID and other agencies give information helpful for obtaining insight into the long-term future of fisheries in the Pacific Islands region. While these studies do not comment on all aspects of region's fisheries in the future and there is by no means agreement between all the studies, some common features emerge. These can be placed in four categories of issues:

- **Offshore fisheries:** There is potential for greater catches of skipjack but the yellowfin tuna and especially the bigeye tuna resources have suffered from heavy fishing pressure. These last two stocks are expected to decline further unless decisive action is taken, which is likely to restrict overall catches of tuna. There is a lack of agreement over the management arrangements which should be applied to which gear types, which areas and which countries. Those countries causing the impacts (and gaining one form of benefit) may not benefit from conservation measures. This is because various actions have differing impacts on individual or groups of Pacific Island countries. A challenge for many countries is maintaining healthy tuna stocks, while the balancing of benefits obtained by licensing foreign fishing vessels with the net benefits of having a domestic tuna industry. Many management interventions will involve short-term losses for long-term gains. Many causes for optimism in the offshore fisheries will be dependent on the regional solidarity between, and decisions taken by, Pacific Island countries.
- **Coastal fisheries:** In the future there will be an increasing number of Pacific Islanders eating a reduced amount of fish – a situation caused by population, fisheries productivity, urbanisation, climate change, and lack of effective management. Coastal fisheries are “mature” in fishery development terms, and the main focus for the future should be on consolidation and protection of current benefits. Movement towards devolving fisheries management authority to coastal communities for most inshore species is an inevitable and positive trend but must be complemented by appropriate support and other measures.
- **Aquaculture:** Although the past achievements of aquaculture development in the Pacific Islands have been limited, aquaculture has the potential to generate greater benefits in the future. There is considerable debate over amount of aquaculture potential in Pacific Island countries, and the areas in which the potential exists. There is, however, general agreement that development efforts should be focussed more on the private sector, on commodities for domestic consumption, and on types of aquaculture where there is a comparative advantage.
- **Fisheries institutions and governance:** There are significant constraints placed on the fisheries sector by the quality of national fisheries governance. Some improvements have been made in recent years (e.g. use of formal fishery management plans). Efforts to improve the situation should be placed on improving interactions with stakeholders and with other related sectors, transparency of decisions, and the capacity and motivation of fishery managers.

F2. Annotated reference list

F2.1 Information on Pacific Island fisheries and related issues

Clark, L. (2006). Pacific 2020 Background Paper: Fisheries. Australian Agency for International Development, Canberra.

- The overall outlook to 2020 for fisheries in the Pacific Islands region is for a strengthening of current trends towards sustainability, achieved by increasing values rather than volumes of harvests from wild stocks, increasing the share of benefits from fisheries enjoyed by Pacific Island communities, and enhancing fisheries benefits from wild stocks by increased farming activities.
- Major constraints to securing greater gains from fisheries include weaknesses in national governance relating to both fisheries policies and the broader socioeconomic environment, gaps in regional fisheries governance, inadequacies in information, knowledge and understanding, limits in private sector capacities, a lack of infrastructure, poor market access, weaknesses in institutional and human resource capacity, relatively high risks for investors, increasing environmental concerns about the impact of fishing and threats from illegal fishing.
- This paper puts forward five practical policy actions for increasing the contribution of fisheries to economic growth and poverty reduction in the period to 2020:
 - « Improve transparency in fisheries decision-making
 - « Strengthen private sector institutional arrangements and government–stakeholder consultation
 - « Improve coastal fisheries management through community involvement
 - « explore innovative ways to secure more benefits from access to fishery resources,
 - « and establish mentoring or partnerships to develop entrepreneurs and business management skills.

SPC (2008). Status Report: Nearshore and Reef Fisheries and Aquaculture. Officials Forum Fisheries Committee, Sixty-Seventh Meeting, 12–16 May 2008, Secretariat of the Pacific Community, Noumea.

- Coastal fisheries are “mature” in fishery development terms, and the main focus with reef fisheries is on consolidation and protection of current benefit. If anything, the main prospect in obtaining economic and livelihood development from reef resources, over and above maintaining current levels of production, lie not in fisheries, but in tourism and other non-extractive uses.
- The risk to food security is a gradually increasing, medium to long-term worry in most places, as the gap opens up between the increasing nutritional needs of increasing populations and the finite production capacity of natural coastal fisheries ecosystems – capacity which will actually reduce if overfishing and pollution are significant.
- The potential future gap between local food fishery production capacity and future local food fish requirements can be addressed: a) by trying to prevent a decline in the “bottom line” by maintaining the production of coastal ecosystems through good management of fisheries and the mitigation of urban impacts and (b) by trying to increase the “top line” by gradually diverting some of the vast surplus (in Pacific Island national production/consumption terms) of Pacific

Island EEZ tuna production away from export and into local nutrition, and by developing low-cost fish production methods that are less dependent on the natural carrying capacity of natural marine ecosystems, particularly freshwater pond fish-farming.

- In order to maintain the current rate of fish consumption per capita against the growing population, it is expected that an additional 100,000 t of fish will be required. This need will be greatest in rural inland areas where fish consumption rates are already limited by poor access to coastal fisheries. Melanesian countries will face the largest increase in rural inland populations. Commodities such as tilapia and milkfish, which have well established fish farming methods, are amongst the most suitable species to help meet the food security needs of the Pacific people.

Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

- Six types of development aspirations are especially common: expanding the longline fleet/catch (12 countries), non-cannery value adding (11), new or expanded shore basing (7), small-scale development (7), expanding purse seine fleet/catch (7), and additional canning/loining (6).
- Many countries are struggling to balance two very different types of benefits related to tuna: government revenue from licensing versus jobs and spin-off benefits from domestic development. There is a large range in the flexibility that countries have in making concessions in access fees to promote development.
- It appears that the countries of the region can be placed in three categories with respect to resource endowment and access fees: (1) Countries that are well endowed with tuna resources but are not highly dependent on access fees: PNG and Marshall Islands, (2) Countries that are well endowed with tuna resources but are highly dependent on access fees: e.g. Kiribati, Tuvalu, Nauru, Solomon Islands, (3) Countries that are less endowed with tuna resources. It is no coincidence that most recent domestic tuna industry development in the region is occurring in the first category.
- A decade ago there was a sentiment of resign in several countries that could be paraphrased as “we tried domestic tuna industry development and it failed so we will pursue the relatively simple access fees”. In some of the same countries, a different attitude now prevails: It has changed to “although we tried domestic tuna industry development, we used the inappropriate model of a government fishing company, so now we will use the leverage of access to promote foreign or joint venture development onshore”.
- The contention that access agreements should give way to domestic tuna industry development is supported by most fisheries officials and by economic analysis and policy statements. Although total benefits of domestic development are likely to be greater, an important point is that they are in a different form, e.g. 100 jobs versus a million dollars of access fees. The beneficiaries also change. Consequently, there is likely to be varying degrees of institutional enthusiasm in the FFA countries for a change from the status quo.
- Data are given to show the evolution in total numbers of locally based tuna vessels, export packing facilities, dedicated cannery/loining plants, and number of jobs at facilities ashore. Decreases can be seen in the numbers of longline and pole/line vessels. Increases are apparent in the number of purse seine vessels, canneries, and jobs at shore facilities. Most countries have the aspiration to expand longline activities, whereas the reverse has occurred in the mid-2000s. Most of the gains that have been made in recent years are in activities associated with purse seining, both catching and processing. Activities in PNG are responsible for almost all the recent gains.

- The aspirations of senior officials and senior managers often extend to only the end of their current employment which, for some people, is just a few years into the future.
- Tuna industry development is very important in the FFA member countries, and for some of the countries represents one of the few opportunities for economic advancement. The aspirations associated with this development are to some degree safeguarded by a provision in the Convention. Efforts by DWFNs to delineate the aspirations may lead to limiting those aspirations and constraining critically important prospects for the future – leaving countries with fewer opportunities than was the case before WCPFC was established.

Harley, S., Hoyle, A. Langley, J. Hampton, and P. Kleiber (2009). Stock Assessment Of Bigeye Tuna In The Western And Central Pacific Ocean. WCPFC-SC5-2009/SA-WP-4, Scientific Committee Fifth Regular Session, Western and Central Pacific Fisheries Commission.

- The paper concludes that:
 - « Current levels of catch are not sustainable even at the recent [high] levels of recruitment estimated for the last decade.
 - « Overfishing is occurring in the bigeye tuna stock.
 - « It is likely that bigeye tuna is in, at least, a slightly overfished state, or will be in the near future.
 - « Greater overall yields could be obtained by reducing the mortality of small fish.

Hampton, J. and S. Harley (2009). Assessment Of The Potential Implications Of Application Of Cmm-2008-01 For Bigeye And Yellowfin Tuna. Working Paper 17, Scientific Committee Fifth Regular Session 10–21 August 2009 Port Vila, Vanuatu.

- A management measure (CMM2008-01), adopted by the Western and Central Pacific Fisheries Commission in December 2008, seeks to reduce fishing mortality on bigeye tuna by 30 per cent from the 2001–2004 average level and limit yellowfin tuna fishing mortality to its 2001–2004 level, in order to maintain stocks at levels capable of producing the maximum sustainable yield (MSY). This objective is pursued through a combination of measures involving longline catch limits, purse seine effort limits, a closure relating to purse seine fishing using FADs and a closure of two high-seas pockets (HSP) to purse seine fishing. Most of these measures have various exemptions or alternatives built in and are phased in over the period 2009–2011. The purpose of this paper is to conduct a technical evaluation of CMM2008-01 to see if it is capable of meeting its objectives.
- The projections showed that CMM2008-01 is highly unlikely to meet its objectives of a 30 per cent reduction in bigeye tuna fishing mortality from the 2001–2004 level, or maintenance of the bigeye tuna stock at a level capable of producing MSY over the long term. The measures are predicted to result in little if any reduction in bigeye tuna F/F_{MSY} from the high levels in excess of 2.0 estimated for 2007–2008, and accordingly, the spawning biomass (SB) is predicted to fall to around 0.4–0.6 of SB at MSY.
- The main reasons for the lack of effectiveness of the measure are (i) the reductions in longline catch do not result in the required reduction in fishing mortality on adult bigeye tuna; (ii) the increase in purse seine effort allowed under the measure, and the increase in purse seine catchability (fishing mortality per unit effort) that has occurred since 2001–2004, is not sufficiently

offset by the FAD and HSP closures to reduce purse seine fishing mortality below 2001–2004 average levels; and (iii) the exclusion of archipelagic waters, which encompasses most of the fishing activity of the Indonesian and Philippines domestic fleets and significant amounts of purse seine effort in PNG and Solomon Islands, from the measure effectively quarantines an important source of fishing mortality on juvenile bigeye tuna.

- For yellowfin tuna, projections suggest that levels of fishing mortality in 2018 ranging from 8 per cent below to 15 per cent above the 2001–2004 average level could result under CMM2008-01. Yellowfin tuna spawning biomass in 2018 is predicted to be similar to the 2001–2004 average or to decline slightly from that level, and to remain above or close to the MSY level, depending on the stock assessment model assumptions used.

Center for Ocean Solutions (2009). Pacific Ocean Synthesis Executive Summary: Scientific Literature Review of Coastal and Ocean Threats, Impacts, and Solutions. The Woods Institute for the Environment, Stanford University. California.

- In August 2008, a group of over 30 natural, physical, and social scientists from around the Pacific convened in Honolulu, Hawaii to review a synthesis of more than 3,400 scientific articles and reports regarding the threats, impacts, and solutions to negative trends facing the Pacific Ocean. The meeting, convened by the Center for Ocean Solutions (COS) in collaboration with the World Conservation Union (IUCN) and Ocean Conservancy resulted in a consensus statement signed by more than 400 scientists. This document, entitled “Ecosystems and People of the Pacific Ocean – Threats and Opportunities for Action,” identifies four major threats to the health and productivity of the Pacific Ocean. These threats are:
- Pollution: Organic pollutants from sewage, nutrient pollution from fertilizer runoff, plastic marine debris, toxic dumping and oil spills, urban runoff, and other pollutants combine to create one of the most critical classes of ocean threats.
- Habitat Destruction: Productive marine and coastal habitats are lost to destructive fishing practices, poor agricultural land use, inappropriate coastal development, and industrial wastewater discharges.
- Overfishing and Exploitation: Unsustainable resource use reduces fish stocks throughout the Pacific, limiting fish catches, and often causing ecological shifts that further reduce biodiversity and productivity.
- Climate Change: Carbon dioxide (CO₂) discharged to the atmosphere is both altering seawater chemistry resulting in ocean acidification and causing the ocean to warm leading to sea level rise, habitat shifts, increased storm intensity, altered precipitation patterns, and coral bleaching.
- ADDITIONAL PRIORITY CONCERNS: In addition to the major threat categories listed above, the literature points to the following as additional threats that require immediate attention:
 - « Invasive Species: Invasive species are non-indigenous species introduced into the environment either intentionally or incidentally as a result of human activities. These invasives compete with other species for habitat and food, can induce disease and can even alter the functions of entire ecosystems. Habitats already disturbed by human activity are particularly prone to invasions. Although invasive species concerns can be addressed as both pollution and habitat destruction, the pervasiveness of this threat warrants independent consideration.

- « Multiple Stressors: Marine species and ecosystems are adapted to cope with a significant level of stress. However, when subjected to multiple stressors, or threats, synergistic impacts can result. In the case of marine life, such multiple stressors come in the form of pollution, habitat destruction, overfishing, and climate change, and can cause the collapse of ecologically and economically important species and ecosystems.
- « Critical solutions for Micronesia/Melanesia/Polynesia include: Integrating Climate Change Adaptation and Mitigation into Coastal and Ocean Policy, Planning, and Management • Marine Management Areas: Networks, MPAs, Reserves, and LMMA • Regional Governance, Agreements, and Approaches • Ecosystem-Based Management • Regulation and Enforcement • Strengthening Institutions and Building Capacity • Alternative Livelihoods

Bell, J. (2007). Planning the Use of Fish in the Pacific for Food, Livelihoods and Revenue – A Report to the Manager, Regional Institutional Framework.

- Detailed planning by PICTs for using fish to provide nutritious food, income earning opportunities, and national revenue is often lacking. Basic questions like ‘How much fish is needed to feed our people? How do we supply it most efficiently? How many livelihoods can be supported sustainably from the fisheries sector?’ and ‘How do we optimise revenue from fisheries?’ are rarely addressed.
- To answer these questions, PICTs need to identify the realistic benefits that can be provided by fish, and integrate the use of all fish resources to supply them. The recommended approach for planning the optimum use of fish is to:
 1. Forecast the future need for fish for food, and assess the number of livelihoods, and the contributions to national revenue, that can be supported by sustainable capture fisheries and development of aquaculture.
 2. Harmonise the allocation of sustainable catches from oceanic, coastal and freshwater fisheries, and sustainable production from aquaculture, to meet the future needs for food and aspirations for livelihoods and revenue.
 3. Develop ‘vehicles’ for delivering the allocations of fish to meet the needs and aspirations, and the policies and management systems needed to support the efficient operation of these vehicles.
- The need for PICTs to mix and match the use of their different fisheries resources to meet their needs and aspirations in the way that delivers them the greatest benefits favours the establishment of a single Directorate to provide regional fisheries services. This Directorate should be structured along the lines of Resource Sections (oceanic, coastal and freshwater fisheries, and aquaculture) and a Planning Unit. Information supplied by the Resource Sections is synthesised by the Planning Unit into cohesive advice that PICTs can use in their national development plans.

McCoy, M. (2009). Assessing Trends In WCPO Tuna Fleets. Gillett/Preston and Associates.

Purse seine

- « Increased efficiency across major fleets resulting in upward trend of overall skipjack tuna CPUE and an increase in catch in WCPO each year from 2002–2007

- « A steady increase in the number of vessels in Pacific Island fleets, either as Pacific Island country flag or non-Pacific Island country flag but associated with onshore processing. After an approximate 10 per cent decline in 2008, the number is expected to increase.
- « An increase in the number of vessels operating under the FSM Arrangement up to 2007 with a resultant doubling of the catch between 2002 and 2007 from about 120,000 to 240,000 t.
- « Focus on PNG by vessel operators and outside investors.

Longline

- « Newer vessels capable of moving between fisheries and with increased flexibility in species targeting and product form. (South Pacific distant water albacore fishery)
- « Reductions in numbers of vessels active in the fishery (tropical distant water bigeye/yellowfin tuna fishery)
- « Reductions in numbers of domestic-based vessels in the South Pacific offshore albacore fishery and the tropical offshore bigeye/yellowfin tuna fishery
- « Technological improvements to existing vessels (tropical offshore bigeye/yellowfin tuna fishery; South Pacific distant water albacore tuna fishery)

Pole and line

- « Continued decline in number of vessels, particularly in 100–200 GRT size class

AusAID (2006). Pacific 2020. Australian Agency for International Development, Canberra.

- **Increasing value rather than volume.** The recent establishment of the Western and Central Pacific Fisheries Commission makes the timing favourable for some bold, innovative approaches to increasing the benefits from access to fishery resources. The opportunities include granting longer term, more secure, more valuable access rights either to earn higher access fees or to leverage domestic development. Additional opportunities lie in reciprocal access arrangements between Pacific Island countries and in dealing with individual boat-owning companies (instead of foreign fleets) and making them compete against each other through tendering and auctioning processes.
- **Improving transparency in the sector.** Regional organisations should take the lead in promoting greater transparency in the sector. Publicly disclosing licensing details would reduce corruption, and help the countries of the region drive better deals.
- **Strengthening private sector organisations.** Stronger private sector organisations would be able to put pressure on governments to perform and could help with negotiating international frameworks. The establishment in 2005 of the Pacific Islands Tuna Industry Association is a welcome development in this regard.
- **Developing fisheries management and technical skills.** A partnership between government and industry to promote training would help to empower workers in the sector to participate more fully and effectively in the fisheries business over the whole range of fishing, marketing and processing activities.

- **Maintaining the health of coastal fisheries through community involvement by drawing on regional success stories.** In the Pacific, there are recognised successes in improving coastal fisheries management. Fiji's legal recognition of community fishing rights is probably the most comprehensive in the world, and Samoa's Community Fisheries Programme has become a global model.

AusAID (2007). Valuing Pacific fish: A Framework for Fisheries-Related Development Assistance in the Pacific.

- Increasing the benefits from sustainable fisheries to Pacific Islanders offers one of the best opportunities to address some of the key economic issues facing the countries of the region. In the smaller island and atoll states in particular, where there is very little land, there are few other opportunities for sustainable economic development. For some countries, commercial fisheries are possibly the only sector with that potential. Improving the sustainability of fisheries is likely to become of increasing strategic significance in regional economic growth and stability.
- The five priority areas for AusAID's regional and bilateral engagement in the sector over the next five years are:
 - « improving fisheries governance and regulation, strengthening institutions, enhancing legal frameworks and compliance, and countering corruption
 - « supporting private sector led development in commercial fisheries and aquaculture, including improvements in the investment climate, trade and market access, infrastructure and in private sector capacity
 - « sustaining small-scale coastal commercial and subsistence fisheries, with the development of effective community-based management of inshore resources a key component supporting effective ecosystem-based management for sustainability, with an emphasis on capacity building, training and education in government agencies, in fisheries businesses and in the wider community
 - « Supporting effective ecosystem-based management for sustainability, with an emphasis on capacity building, training and education in government agencies, in fisheries businesses and in the wider community
 - « improving knowledge to build accessible information in key areas, including fisheries resources, levels of use and sustainability, impacts of factors such as climate change on ecosystem processes, fisheries and national food security and nutritional needs, and economic and social components.

Barclay, K, and I. Cartwright (2007). Governance of tuna industries: The key to economic viability and sustainability in the Western and Central Pacific Ocean. *Marine Policy* 31 (2007) 348–358

- PICTs' fisheries governance has on the whole been marked by a lack of consultation; between government departments, with affected communities, with social and environmental NGOs (ENGOs), and between government and industry. PICT officials have tended not to see the potential value of NGO input, and tended to treat fisheries governance as being a purely government responsibility, rather than engaging in consultative decision-making processes with other stakeholders.
- Governance of fisheries management and development should be conceived of broadly to include a range of biological, economic, social and political issues. The limited resources within PICT governments and in civil society constrain the extent to which fisheries governance can

be addressed in this way, but the examples presented in this paper show that significant achievements may occur through adjusting mindsets and ways of doing things, some of which may not require great funding increases.

- When PICTs are better able to promote economically efficient outcomes and sustainability in their domestic spheres through improved governance, they should also have greater will and capacity to achieve profitable and sustainable fisheries for the region.

Fonteneau, A. and Z. Suzuki (2009). Shimizu June 1979: 30 years after in Port Vila: what's new in the Pacific Ocean in terms of stock status and fisheries? Presentation at WCPFC Scientific Committee, August 2009, Port Vila.

- An historical tendency to underestimate the tuna stocks MSY in the Pacific, especially in WCPO. The real MSY of tuna stocks can be estimated only at high exploitation rates, major increases of fishing efforts, many gears and a wide range of areas and depth: tuna stock overfishing has been necessary to estimate the real MSYs
- Movement patterns & mixing at age, real interaction between surface and longline fisheries, and the stock/recruitment relationship remain widely uncertain today for most stocks
- Additional biological research and tagging programs were highly recommended in 1979: they are still necessary to allow any comprehensive modeling & improved diagnosis upon stock status and their prospects.

McCoy, M. and R. Gillett (2007). Consideration of Catch Retention as a Tuna Management Measure in the Western and Central Pacific Ocean. Gillett, Preston and Associates for the Forum Fisheries Agency, Honiara, 43 pages.

- In recent years about 50,000 tonnes of tuna is dumped at sea by purse seiners operating in the central and western Pacific.
- The primary objective of catch retention (CR) is to provide a disincentive for the capture of small/ juvenile size tuna by purse seiners. Such a measure relies on the prices for small tunas being relatively low, thereby making it uneconomical for at least some vessels to retain such catch. Other positive factors associated with catch retention, such as reduced wastage of tuna harvests, may occur as a result of catch retention but are not the management objectives.
- The Inter-American Tropical Tuna Commission (IATTC) is the only RFMO that has a catch retention measure for tuna. The IATTC experience: poor compliance with reporting by both vessels and member countries. CR continues to be employed as some Commission members believe it is working, others (IATTC staff in private) are not as enthusiastic because (1) less small fish discards over time is more a reflection of availability of fish and influence of fish price rather than compliance by vessels with the measure and (2) the provision in the IATTC CR requirement of "unfit for human consumption" creates a significant loophole to enable discards.
- SPC data indicates during the 11 year period 1995–2005, bigeye tuna represented about 2.3 per cent of total purse seine catch including discards, and yellowfin tuna was about 18.6 per cent of total purse seine catch including discards. SPC has explained that even though the proportion of bigeye tuna in the purse seine catch is small, it is still large enough to significantly affect bigeye tuna.
- Rising fuel costs will increase reliance on FADs and the fishery may experience increased retention of small fish if prices remain high.

- CR can contribute to food security, improved nutrition in some countries with offloading/transshipping; Availability of low-value fish to non-industrial markets at offloading points can also cause disruption, particularly for artisanal fishers and their local markets.

Gillett, R. (2009). *The Contribution of Fisheries to the Economies of PICTs*. Pacific Studies Series, Asian Development Bank, World Bank, Forum Fisheries Agency, Secretariat of the Pacific Community, and Australian Agency for International Development, 362 pages.

- This report contains a fisheries-oriented discussion of macroeconomics, country information on specific topics (fisheries production, contribution to GDP, etc.), a discussion important topics across all countries (e.g. the regional significance of access and exports of fishery products), some important features of the benefits from fisheries that have emerged from this study, and finally, and some major factors that influence the flow of benefits from fisheries.
- Information on benefits from fisheries is provided for each of the 22 PICTs. These country sections contain the recent, readily available data in the following areas:
 - « The recent annual fishery harvests: values and volumes covering the six fishery production categories – (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.
 - « Fishing contribution to GDP: the current fishing contribution, how it was calculated, and a locally production approach re-calculation based on annual harvest levels obtained during the study.
 - « Fishery exports: amounts, types, and the ratio to all exports
 - « Government revenue from the fisheries sector: access fees and other revenue
 - « Fisheries employment
 - « Fisheries contribution to nutrition.
- The total volume of fisheries production in the region in 2007 is estimated to be 1,327,361 t, plus an aquaculture production of 2,984 t and 305,336 pieces. The total value of fisheries and aquaculture production in 2007 is estimated to be about USD 2,049,500,000.
- Offshore foreign-based fishing is responsible for about half of the value of fisheries in the region, offshore locally based about a quarter, and for the remaining quarter, about equal shares of coastal commercial, coastal subsistence, and aquaculture.
- Fishery exports are very important to the countries of the region. In about half of the countries fishery exports represent over half of all exports. Where they represent less than half the value of national exports, they are mostly quite large in nominal terms: New Caledonia (USD 157 million), PNG (USD 101 million), Fiji Islands (USD 63 million), and Marshall Islands (USD 37 million).
- Access fees received by Pacific Island countries are provided and compared to the total government revenue, population, and value of the catch. Total access fees received in 2007 were USD 78.5 million, an increase of about 25 per cent since 1999.

World Bank (2000). *Voices from the Village*. Number 9, Pacific Island Discussion Paper Series, World Bank, Washington DC. The study examined perceptions of villagers at 31 locations in 5 Pacific Island countries. The results showed:

- **Community groups in general perceived coastal resources to be declining...** Only 10 per cent of the responses perceived catch per unit effort (CPUE) to have increased over the past decade, and only 3 per cent associated such an increase with management interventions. Moreover, respondents believed that coastal resources would continue to decline in the future in 21 of the 31 sites (67 per cent). In the midst of this somber outlook, however, there was an element of hope: 5 out of 6 sites in Samoa believed that marine resources would improve because of recent management efforts. This offers some hope that with intermediate interventions, the perceived decline in coastal resources can be contained.
- **...and the nature of the threats to coastal resources appears to be changing.** Communities perceived pollution as the fastest rising threat to coastal resources, while destructive fishing practices were perceived to be declining the most. Overfishing, destructive fishing, pollution and siltation were perceived to be the most important threats to coastal resources at the study sites.
- **Simple management rules work best...** The study found that the following types of rules were perceived as achieving the most compliance: (1) National regulations which were seen to be relevant to the community and which were subsequently adopted by village leaders as local rules; and (2) National rules enforced by buyers or exporters, such as the national ban on trade in crocodiles in the Solomon Islands. In general, the study found that the simpler the national rules, the better they were understood and followed by coastal communities.
- **...and most alternative income generation programs are not perceived to be successful.** The study findings suggest that programs focusing primarily on fisheries **Some of the most valued external partners play primarily an advisory role to the communities...** External partnerships appeared most effective where the external partner played the role of honest broker, providing technical expertise on demand and building upon existing institutions.
- **...and sanctuaries help increase community awareness.** The study found that one of the most important benefits of marine sanctuaries seems to be their catalytic role in increasing community interest and awareness in coastal resource management.
- **Communities need help...** The fact that land-based threats and commercial fishing (another fast-rising threat) cannot for the most part be handled by communities alone leads to the conclusion that communities need external help in managing their coastal resources.

Ferraris, R. (2008). *Review of Institutional Reform and Institutional Strengthening In Pacific Fisheries: Experiences And Lessons Learned*. Report Prepared For the Pacific Islands Forum Fisheries Under The GEF Oceanic Fisheries Management Project.

- Institutional change is long term; it requires commitment from leaders and political support to commence the process and to be maintained during implementation so that resistance to change is managed. Getting real participation is necessary. Reform lends itself to a process approach where outputs are defined more clearly as development proceeds.
- Obtaining participation of stakeholders to counter opposition from vested interests and from those who do not understand the rationale is a desirable strategy. Widespread stakeholder participation should develop a shared understanding of what needs to be changed and why, how

to bring change about, and acceptance of new “rules”, which need to be widely disseminated and well understood. The process should be inclusive and enabling to ensure long-term sustainability of the change.

- Co-management of fisheries resources is an accepted strategy for all fishers and fisheries; cost recovery is applied to varying degree by departments, and usually according to ability to pay. Regardless of administrative model, increased stakeholder input into management of fisheries is a prime consideration
- Early PNG NFA experience indicates the need for careful crafting of legislation to ensure accountability of the Authority to Parliament and stakeholders, whatever the level of Ministerial or Board control. This does not protect the Authority if governance as a whole becomes a national problem.
- The authority model was considered by most Pacific fisheries ministries or departments undertaking recent reform, but the departmental models were retained (though restructured) in all cases to better deliver their mandate to service, manage and develop subsistence, artisanal and semi-commercial coastal and inland fisheries as well as the commercial sector. The Authority model was seen as specific to commercial fisheries and interests.
- Should ministries or departments be merged or demerged? The Ministry of Marine Resources of Cook Islands is the only stand alone ministry or department among the PICTs reviewed. Tonga’s Ministry of Fisheries has recently merged into a department within a larger natural resources ministry. The response of commercial stakeholders to Tonga’s merger was that the sector had lost representation and the ability to influence decision makers. Government rationale for merger is on grounds of efficiency in administration and facilitation of integrated management of natural resources.
- There has been rationalization of services towards core functions in strengthened and restructured departments to varying degrees, depending on availability of alternative service providers.
- The relevant Act setting up the institution should delegate power for effective decision making and include engagement of stakeholders in decision making on fisheries management.
- Regional and national norms for transparency and providing information should be established, e.g. annual reports.
- Projects or defined program elements operating at the authority or department level can only be effective if critical elements are in place, eg, government ownership of the process, donor coordination, capacity enhanced, institutional accountability and a clear coherent strategic plan endorsed by all major stakeholders.

SPC (2008). Pacific Islands Regional Coastal Fisheries Management Policy and Strategic Actions: Apia Policy (2008–2013). Secretariat of the Pacific Community, Noumea.

- As stated in this policy, the collective vision of Pacific leaders and heads of fisheries agencies is ‘Healthy marine ecosystems and sustainable coastal fisheries that provide seafood security and continuing livelihoods for current and future generations of Pacific people’. The goal that addresses this vision is ‘To ensure the optimal and sustainable use of coastal fisheries and their ecosystems by Pacific Island communities’.
- The guiding principles for achieving the stated goal are as follows:

1. Improving our understanding of important fisheries species and of the ecosystems on which they depend.
 2. Sustainably managing coastal fisheries, reducing their adverse impacts on coastal ecosystems, and optimising production to meet local nutritional needs and contribute to economic development.
 3. Creating community partnerships to support the customary and traditional management of nearby ecosystems and fish stocks.
 4. Creating stakeholder collaborations to manage ecosystems and reduce the negative environmental impacts of non-fisheries activities, including those that result in high loads of silt and nutrients in coastal waters.
 5. Promoting the participation of women and youth in all fisheries-related activities.
 6. Enhancing regional exchange and sharing of information on common areas of interest relating to the management of ecosystems and fisheries.
- Strategic action required:
 - (a) To enhance the capacity of fisheries agency staff to carry out effective biological, social and economic stock assessments and manage sustainable fisheries.
 - (b) To manage fisheries using precautionary ('safe') levels of exploitation, even in the absence of formal stock assessments.
 - (c) To identify and control, reduce or ban damaging fishing practices.
 - (d) To develop comprehensive national coastal fisheries policies and subsequent fisheries management plans that incorporate the essential elements of effective management regimes, including maximising economic yield from all income-producing fisheries.
 - (e) To facilitate the attendance of Pacific Island regional representatives at relevant international forums.
 - (f) To assess costs and benefits associated with recreational fisheries and apply appropriate management measures.
 - (g) To employ near-shore FADs and, where suitable, artificial reefs to divert fishing effort from more sensitive coral reef ecosystems.
 - (h) To support appropriate aquaculture and stock enhancement activities that divert fishing effort from more sensitive coral reef ecosystems.
 - Areas where assistance is required:
 - (a) Follow-up training on fisheries policy analysis and formulation and development of a manual and template for national fisheries policies.
 - (b) Provision of in-country assistance on the preparation and implementation of national fisheries policies and management plans for coastal fisheries and ecosystems.

- (c) Provision of in-country assistance on the use of biological and socio-economic models to assess artisanal, recreational and subsistence fisheries.
- (d) Funding support to enable Pacific Island regional representatives to attend relevant international forums.
- (e) Provision of postgraduate scholarships in fisheries studies for fisheries agency staff.
- (f) Training in the preparation of project proposals, project design and report writing.
- (g) Training in the collection, use and analysis of minimal and appropriate data to assess and manage fisheries.
- (h) Production of a detailed manual, such as the PASGEAR manual, on statistics and stock assessment.
- (i) Biennial meetings to review stock assessment progress.
- (j) Support for re-surveying sites covered by PROCFish, and for surveying additional sites.
- (k) Training in the use of fisheries controls and regulations.
- (l) Working with fishing communities to ban damaging fishing methods.
- (m) Aquaculture development and stock enhancement of species including beche-de-mer.
- (n) Design and deployment of artificial reefs and FADs and development of plans to finance their maintenance and replacement.

Govan, H. (2009). Status and Potential of Locally-Managed Marine Areas in the South Pacific: Meeting nature conservation and sustainable livelihood targets through wide-spread implementation of LMMAs. Coral Reef Initiatives for the Pacific. COMPONENT 3A–PROJECT 3A3, Institutional strengthening & technical support Improvement of socio-economics of coral reefs.

- The South Pacific has experienced a remarkable proliferation of Marine Managed Areas (MMAs) in the last decade. These protected areas, implemented by over 500 communities spanning 15 independent countries and territories represent a unique global achievement. The approaches being developed at national levels are built on a unique feature of the region, customary tenure and resource access, and make use of, in most cases, existing community strengths in traditional knowledge and governance, combined with a local awareness of the need for action, resulting in what have been most aptly termed Locally Managed Marine Areas (LMMAs).
- The extent of this shift towards Community Based Resource Management in Melanesia and Polynesia is unprecedented on a global scale and is the subject of this report.
- The success of these community based management approaches comes at a time when the region faces enormous challenges to food security, biodiversity and adaptation to climate change. The population in the South Pacific is projected to double in the next 30 years. This combined with poor performance of national economies and growing inequalities due to the distribution and access to economic opportunities is leading to problems associated with poverty in most of the independent countries and increased pressure on natural resources leading to erosion of biodiversity and livelihood opportunities, increasingly resulting in conflict and law and order problems. The dependency on fisheries seems likely to spark a crisis of considerable proportions, particularly in Melanesia where high population growth and predominantly rural populations

with few economic alternatives have projected food requirements well in excess of what coastal areas are currently likely to produce without significant improvements in management and productivity.

- Though wide-spread implementation of LMMAs will result in an increase in the number of marine protected areas, concentrating on this aspect alone would be costly and hard to sustain. Significant environmental or fishery benefits from the possible increases in numbers of no-take zones are not likely unless communities address other issues in their wider fishing area and watersheds not necessarily addressed through closed areas.
- The Pacific Islands nations are facing formidable challenges in terms of mounting pressures on finite natural resources, market forces and the commoditization of natural resources, burgeoning populations and adaptation to the far-reaching impacts of climate change. The lessons learned in achieving the wide proliferation of locally managed marine areas will be key to adopting viable strategies for surmounting these challenges but only if focus can be widened to encompass their full potential as building blocks for integrated island management in support of resilient Pacific Island communities.

F2.2 The future of global fisheries

Garcia, S. and R. Grainger (2005). Gloom and doom? The future of marine capture fisheries. *Phil. Trans. R. Soc. B* (2005) 360, 21–46, Published online 29 January 2005.

- Two main difficulties are encountered in predicting the future of fisheries. (1) Forecasting methodology and underlying models. It is unlikely that any mathematical algorithm could satisfactorily capture the complex, chaotic, nonlinear and often undetermined nature of the fisheries' socioeconomic and environmental systems. This is particularly true at the global level. Consequently, seemingly well grounded predictions may easily fail while some of the most interesting developments might remain unforeseen. (2) It is impossible to predict the future of fisheries without a reliable prediction about the future of the world itself, an even higher-order challenge.
- In a well mediated review, *The Economist* (August 2003, p. 21) summarized this as 'If the past history of agriculture is of any guide, aquaculture will surely find a way to meet the world's demand for fish'. This sector has indeed demonstrated a strong potential for growth during the past two decades and will be a strong regulator of the supply chain in the future. It will therefore be a central conditioning factor of the future of marine fisheries and its growing production, functioning as a 'cooling agent' in the price formation process and in the chain reaction leading to overcapacity and overfishing. Increased supplies will come from an increase in the number of countries joining the production process, an expansion of the areas cultivated and an intensification of the processes (in yield per unit of area or volume).
- The State of World Fisheries and Aquaculture (SOFIA) 2002 contains a forecast for fisheries production until 2030. It forecasts that, over the next 30 years, the demand for seafood and its per capita consumption will continue to increase at decreasing rates. Total capture fisheries production will stagnate around the levels observed during the last decades (90–95 t, of which 80–85 t from marine capture fisheries). Total production will increase to ca. 190 t, compared with the 130 t of the early 2000s. Aquaculture production will continue to grow more slowly, from the present 36 t to ca. 83 t. In developed countries, consumption patterns will increase demands and imports of high-cost/high-value species from the developing world. In developing countries, high-cost/high-value species will be exported while low-cost/low-value species will be imported for local human food.

- The main driving forces include global economic development patterns, population growth and the state of the environment. Other forces include public awareness, wars, information, epidemics (HIV-AIDS), energy prices and global ethics. Many, if not all, of the driving forces such as market-based economic reforms, technological innovations, democratic proselytism, decentralization and participation, human population growth, etc., have the potential to pull the fishery sector towards a much better or much worse world. In the absence of a statistical or mathematical solution for the matrix of possible outcomes, the reply to the question above is necessarily subjective, affected by one's natural optimism or pessimism.
- The key unknown for the future is in the degree to which industry leaders and policymakers will indeed implement the wealth of high-level commitments mobilized in the last decade of the twentieth century. While this may be locally possible, it seems difficult to generalize, considering the past performance of fisheries management and the lack of implementation capacity in many areas.
- The fishery sector, however, represents a tiny part of the global society, and its economy and possible trajectories will be heavily conditioned by the evolution of its ecological, social and economic contexts, at local to global levels. The outlining of fisheries scenarios therefore requires a visionary representation of the possible futures of the world within which fisheries will operate.
- The future of fisheries will be conditioned by numerous interconnected driving forces and triggering factors affecting their ecological, economic, social and political development field, raising societal conscience about the risk for future generations in terms of poverty, mass migration, famine and epidemics. Ecological factors include environmental degradation, resource collapses or global climate changes. Economic factors include a long-predicted collapse of the stock market²⁴ or a new oil price shock²⁵ or both. Social factors include an unacceptable gap between poor and rich, major social dislocations provoked by major industries' relocation, emergence of instant and global awareness about inequity (e.g. through the internet), frustration leading to radicalization of ethnic and religious discourses with resulting conflicts and dislocations. The response to one set of triggering factors depends to some extent on the situation of the others and the final result depends on degree of preparedness, contingency plans, emergency assistance and effectiveness of international collaboration.
- Various studies on the future of fisheries are considered and it is concluded that there seems to be agreement that:
 - « Production will stagnate in capture fisheries and more than double in aquaculture, meeting the demand resulting from population growth and economic growth and containing price increases.
 - « Global per capita consumption from marine resources will decrease, simply because of human population continued growth and development. Wild fish prices may however remain rather stable.
 - « Asia will become a net importer and Latin America a leading exporter.
 - « Rich countries, already net importers, will increase their trade deficit.
 - « A strong market for fishmeal and oil will develop for aquaculture, affecting marine capture fisheries for the corresponding species.

Garcia, S. and K. Cochrane (2009). From Past Management to Future Governance: a Perspective View. In: S. Garcia and K. Cochrane "A Fishery Manager's Guidebook. Published by the Food and Agriculture Organization of the United Nations and Wiley-Blackwell.

- The reality of fisheries as complex and only partially predictable social-ecological systems is slowly being accepted.
- It is becoming widely accepted that the best way to help the poor fishers out of poverty may not be to help them become more effective fishers but to generate wealth in the fishery by reducing the number of people and technology used and through value adding technologies.
- The increasing complexity of the task requires an increase in the capacity of the management units which are still, in many countries, extremely understaffed and inadequately qualified.
- The culture of carnivorous species supports livelihoods but are not likely to produce large quantities of cheap protein for modest households or to reduce fishing pressure.
- There will be a larger connection in the future of use rights and human rights.

Garcia, S. and K. Cochrane (2009). From Past Management to Future Governance: a Perspective View. In: S. Garcia and K. Cochrane "A Fishery Manager's Guidebook. Published by the Food and Agriculture Organization of the United Nations and Wiley-Blackwell.

- The fact that fisheries are a commonly a minor if not marginal economic sector and that fisheries governance is part and parcel of a larger (national, regional, global) governance implies that the future of fisheries and their governance will be shaped by global and national political and economic considerations on which fisheries will have very little influence. Guessing how fishery governance will evolve in the future requires strong assumptions about the evolution of governance of the world itself.....the future of fisheries is largely shaped from outside the fisheries sector.

Grafton, R. et al. Positioning Fisheries in a Changing World. Marine Policy. doi:10.1016, j.marpol.2007.11.003.

- Marine capture fisheries face major and complex challenges: habitat degradation, poor economic returns, social hardships from depleted stocks, illegal fishing, and climate change, among others.
- The key factors that prevent the transition to sustainable fisheries are information failures, transition costs, use and non-use conflicts and capacity constraints.
- Using the experiences of fisheries successes and failures it is argued only through better governance and institutional change that encompasses the public good of the oceans (biodiversity, ecosystem integrity, sustainability) and societal values (existence, aesthetic and amenity) will fisheries be made sustainable.

Willman, R. and K. Kelleher (2009). Economic Trends in Global Marine Fisheries. In: R. Quentin Grafton, R. Hilborn, D. Squires, M. Tait and M. Williams, *Handbook of Marine Fisheries Conservation and Management*. Oxford University Press.

- The buildup of redundant fishing fleet capacity, deployment of increasingly powerful fishing technologies, and increasing pollution and habitat loss have depleted fish stocks worldwide. Despite the increased fishing effort, the global marine catch has been stagnant for more than a decade, while the natural fish capital — the wealth of the oceans — has declined.

- Globally, the proportion of fully exploited and overexploited, depleted, or recovering fish stocks has continued to increase from just above 50 per cent of all assessed fish stocks in the mid-1970s to about 75 per cent in 2005
- The global fish supply from marine capture fisheries increasingly relies on lower value species characterized by large fluctuations in year-to-year productivity, concealing the slow degradation of the demersal high-value resources (FAO 2007a). This change in the species composition of the catch is commonly referred to as “fishing down marine food webs” (Pauly et al. 1998).
- A recent joint World Bank and FAO study estimated the loss of potential net benefits from marine capture fisheries, expressed as foregone rents or economic profits, to be on the order of USD 50 billion in 2004 (World Bank and FAO 2009). Based on the declining state of the world’s fish stocks as reported by FAO at various intervals since 1974, the real cumulative global loss of wealth over the last three decades was estimated to be on the order of USD 2.2 trillion. To maximize sustainable rents from the global fishery, the study suggests that fishing effort should be reduced by between 44 and 54 per cent, giving sustainable marine fishery harvests on the order of 80 million tons per year.
- The depletion of global fisheries cannot be attributed solely to fishing. Pollution, destruction of wetlands and coastal zones, invasive species, climate change, and mineral extraction all play a role. However, fishing is considered the greatest single cause of such depletion.
- Marine fisheries reform can recapture a substantial proportion of the economic losses. Rather than being a net drain on the global economy, sustainable fisheries can create an economic surplus and be a driver of economic growth.
- The business as usual course of action will result in a continued decline in global fish wealth; harvest operations that, despite technological fixes, become increasingly inefficient; growing poverty in fishery dependent communities; increased risks of fish stock collapses; and compromised marine ecosystems. Business as usual means increasing political pressure for subsidies that carry the risk of enhancing redundant fishing effort and fishing capacity, growing public expenditure on ineffective fishery management and enforcement, and a sector that, rather than being a net contributor to global wealth, is an increasing drain on society. Global fish capital has been depleted, but can be rebuilt.
- The maximum wild capture fisheries potential from the world’s oceans has probably been reached.
- Most of the stocks of the top ten species, which account in total for about 30 per cent of the world marine capture fisheries production in terms of quantity, are fully exploited or overexploited and, therefore, cannot be expected to produce major increases in catches.

FAO (2009). *State of World Fisheries and Aquaculture 2008*. Food and Agriculture Organization of the United Nations, Rome.

- A milestone may be near. After growing steadily, particularly in the last four decades, aquaculture is for the first time set to contribute half of the fish consumed by the human population worldwide. Until a year or so ago, the production trends in aquaculture and capture fisheries were continuing without any drastic modification to those already in place at the start of this decade. The capture fisheries sector was regularly producing between 90 and 95 million tonnes per year, and aquaculture production was growing rapidly, albeit at a gradually declining rate.

However, the substantial increases in energy and food prices, which started in 2007 and have continued into 2008, as well as the threat of climate change, mean that the conditions for capture fisheries and aquaculture are changing.

- Given the strong likelihood that fish landings will remain stagnant in capture fisheries, aquaculture remains the only apparent means to expand world supplies. So, what does the future look like for aquaculture? More serious attempts to predict future fish supplies have tended to predict capture fisheries production independently (by considering the state of stocks and fishing effort in capture fisheries) and then deduct projected landings from demand (arrived at by considering population growth and income elasticities of demand for fish) in order to arrive at the quantity that aquaculture would have to produce. There have been few attempts to predict future aquaculture production by examining the prospects for culture of various species, culture systems and economic conditions.
- In 2007, about 28 per cent of stocks were either overexploited (19%), depleted (8%) or recovering from depletion (1%) and thus yielding less than their maximum potential owing to excess fishing pressure. A further 52 per cent of stocks were fully exploited and, therefore, producing catches that were at or close to their maximum sustainable limits with no room for further expansion. Only about 20 per cent of stocks were moderately exploited or underexploited with perhaps a possibility of producing more.
- The maximum wild capture fisheries potential from the world's oceans has probably been reached.
- Most of the stocks of the top ten species, which account in total for about 30 per cent of the world marine capture fisheries production in terms of quantity, are fully exploited or overexploited and, therefore, cannot be expected to produce major increases in catches.
- The percentage of stocks fully exploited, overexploited or depleted varies greatly by area. The major fishing areas with the highest proportions (71–80%) of fully exploited stocks are the Northeast Atlantic, Western Indian Ocean and Northwest Pacific. The proportion of overexploited, depleted and recovering stocks varies between 20 and 52 per cent in all areas except in the Northwest Pacific, Western Central Pacific and Eastern Central Pacific, where it is 10 per cent or less. Relatively high proportions (20% or more) of underexploited or moderately exploited stocks can be found in the Eastern Indian Ocean, Western Central Pacific, Eastern Central Pacific, Southwest Pacific and Southern Ocean, and for some species of tunas.
- The tunas reached a new maximum at more than 6.4 million tonnes, with skipjack catches higher than ever, whereas yellowfin tuna catches were reported to have decreased by about 20 per cent from the peak reached in 2003.
- Some of the major recent issues concerning international trade in fishery products have been:
 - « introduction by buyers and international retailers of private standards for food safety and quality, animal health, environmental sustainability and social purposes;
 - « continuation of trade disputes related to shrimp and salmon exports;
 - « the growing concern of the general public and the retail sector about overexploitation of certain fish stocks;
 - « the uptake of ecolabels by major retailers;

- « certification of aquaculture in general and of shrimp in particular;
- « the multilateral trade negotiations in WTO;
- « expansion of regional trade areas, and regional and bilateral trade agreements;
- « the negotiations on economic partnership agreements between the African, Caribbean and Pacific Group of States and EU;
- « global warming and its impact on the fisheries sector;
- « rising energy prices and their impact on fisheries; and
- « rising commodity prices in general and their impact on producers as well as consumers

Kearney, R., Foran, B., Poldy, F. & Lowe, D. 2002 Modelling Australia's fisheries to 2050: policy and management implications. CSIRO-University of Canberra.

- A model of the future of 200 Australian fisheries to 2050, incorporating their yields into a broader mathematical model, including population growth, energy available, total resource use and environmental quality.
- It is suggested future supply and demand scenarios testing predictions against known trends for three scenarios (optimum, status quo and caution).
- It was concluded that, for all scenarios, fisheries production would continue to decline for at least a decade, stabilizing below the levels observed in the 1990s, leading to questioning present management strategies, advocating a more holistic management of fisheries sub-sectors (including recreational fisheries) and including broader ecosystem impacts such as pollution, habitat degradation, etc., resulting from fisheries as well as other uses of aquatic resources.

Cury, P. and P. Cayre' (2001) Hunting became a secondary activity 2000 years ago: marine fishing did the same in 2021. *Fish Fish.* 2, 162–169.

- A fictitious retrospective description of the evolution of fisheries, supposedly written in 2051, indicate that marine capture fisheries disappeared, as a professional activity, c. 2020.
- Drawing a parallel with the end of hunting, they indicate that fishing disappeared, under societal pressure from young generations of stakeholders, discredited by conflicts, overexploitation, overcapitalization, demographic pressure, non-precautionary management and development, lack of stewardship, inappropriate institutions and climate change. These pressures and driving forces led to irreversible depletion of most resources.
- Technological innovations outpaced scientific capacity to predict and institutional capacity to adapt. Science was wasted in conflicts with NGOs and conservation agencies. Long- and short-term objectives could not be reconciled. Fishing rights and eco-labelling failed to provide the proper incentives. Fish prices increased dramatically, turning high-value species into luxury items for developed countries' wealthy consumers, leaving only small pelagic and other prey species to the less endowed.
- They conclude that this was not planned. It just happened.

Newton, K., I. Cote, G. Pilling, S. Jennings, and N. Dulvy (2007). Current and Future Sustainability of Island Coral Reef Fisheries. *Current Biology* 17, 655–658.

- Over half (55%) of the 49 island countries considered are exploiting their coral reef fisheries in an unsustainable way.
- Empirical island-scale field studies that have shown that the number of islanders per unit of coral reef is a good predictor of both fishing effort and the direct and indirect effects of fishing
- It is estimated that, overall, total landings of coral reef fisheries are currently 64 per cent higher than can be sustained. Consequently, the area of coral reef appropriated by fisheries exceeds the available effective area by 75,000 km², or 3.7 times the area of Australia's Great Barrier Reef, and an extra 196,000 km² of coral reef may be required by 2050 to support the anticipated growth in human populations.
- The high levels of current and projected overexploitation can only lead to longterm social and economic hardship for islanders, and forgone development opportunities.
- The large overall imbalance between current and sustainable catches implies that management methods to reduce social and economic dependence on reef fisheries are essential to prevent the collapse of coral reef ecosystems while sustaining the well-being of burgeoning coastal populations.
- [Note: The study used FAO fishery production data (in many cases derived from non-existent national fishery statistical systems). In the Pacific Islands area, only Palau, Samoa, and the Marianas were found to have present production higher than the sustainable production.]

World Bank (2004). *Saving Fish and Fishers – Toward Sustainable and Equitable Governance of the Global Fishing Sector*. Report No. 29090-GLB, The World Bank, Washington DC.

- While global fish production from capture fisheries during the 1950s and 1960s grew at a rate of 6 per cent annually, catches of the most sought after marine fish species have actually been in decline since 1988. Moreover, the current level of declining capture fisheries production has been achieved only by fishing harder and by targeting smaller and less-valuable species, as the large fish species have disappeared and fishers continue to “fish down the food chain.”
- The result is a declining net income in the sector. Since the 1950s, the total number of people fishing and fish farming worldwide has at least quadrupled (compared with a 35 per cent increase in the economically active population in agriculture), and average fishing power increased an estimated 270 per cent between 1965 and 1995. However, with dwindling resources, the corollary of this massive expansion of fishing effort has been a rapid decline of net income.
- More than any other cause, poor sector governance has enabled the creeping practice of overfishing to continue and negatively affect fisheries in ever larger coastal marine areas. Fisheries administrations have for decades aimed at expanding fishing capacity, or they have used ill-designed and poorly executed measures to limit catches of threatened species. Only relatively recently have some countries acknowledged that management of the sector is fundamentally a political and economic process, requiring changes in institutional, legal, and regulatory frameworks, and a more participatory role of the private sector, and have created entirely new approaches to managing the sector.

- Rapidly growing demand for fish, fuelled by population and income growth and health concerns, has increased many fish prices. Fish is one of the few agricultural commodities that has shown a strong increase in real prices, notably during the past 10 years. This has maintained incentives for investment in fishing vessels, despite falling catches.
- However, excessive fishing has not been the only culprit. The population living within 100 kilometers of the coast has grown to 2.2 billion people (39% of the global population), leading to pollution and degradation of major marine ecosystems.
- Once improved governance of the fisheries has been established, countries may avail themselves of a menu of proven good practices – often used in combination and often using approaches similar to those used in forestry, water, and community development – which can be used to help implement sector reforms, including:
 - « Strengthening co-management
 - « Establishment of Marine Protected Areas
 - « Changing exploitation patterns
 - « Restocking and stock enhancement programs
 - « Fishing capacity reduction
 - « Aquaculture
 - « Certification and food safety programs for fish products
 - « Promotion of alternative livelihoods

Tradefoodfish (about 2003). Report of the Study on the Impact of International Trade In Fishery Products On Food Security. Food and Agriculture Organization and the Ministry of Foreign Affairs of Norway.

- This study analyses the growing international trade in fishery products. The focus of the study is on the impact that trade has on people's food security – the physical and economic access to sufficient, safe and nutritious food at all times.
- The study makes a wide variety of observations and makes numerous conclusions. The ones listed below have special applicability to the Pacific Islands region.
- The importance of fish as a crucial element in the diet of a population is particularly important in countries where the staple crop is particularly low in protein – such as cassava or plantain – rather than a cereal grain for example. In such situations, as in many parts of Africa, a larger proportion of foods, such as fish that are rich in proteins and fat, may be essential especially in the diets of young children, infants and pregnant women. From a national food security perspective, fish is often not considered important because it contributes little by way of calories. Food security at the national level is usually measured in terms of carbohydrate availability per head of population. However, since people do not live on carbohydrate sources such as grains and tubers alone, there exists a strong case for broadening the components considered in the measurement of food security.

- Exports may deprive a section of the domestic consumers of a variety of fish. This may lead to a potential loss of food supplies for them. This is particularly true when fish is an integral part of the culturally conditioned diet of a section of the population. In such cases demand is likely to be relatively price inelastic and if supply is less than effective demand by even a very small margin, the price of fish will increase sharply. This can lead to undesirable nutritional consequences especially for the poorer consumers.
- The market, with its prime instrument of price signals, responds essentially to the paths with the greatest effective demand – need backed by purchasing power. However, millions who are food insecure have the need for food but not the purchasing power to translate this need into adequate effective demand. Therefore, catering to the food security of all – with or without the aegis of trade – warrants the involvement of the state (governments, judiciary, and parliaments) and the arms of civil society (social and ecological movements, citizen's groups etc).
- From the food value perspective, the earning per unit of Low Income Food Deficit Countries (LIFDCs) exports reduced more rapidly than the cost paid out for unit of import. The conventional terms of trade in fishery products for LIFDCs has deteriorated in the WTO phase. The potential earnings loss to their economies was considerable with attendant food security implications.
- We examine the data for the three categories 'developed' and 'developing' countries and 'LIFDCs' for the three time points 1990, 1995 and 2000. We take the value of the preserved and processed exports and express this as a ratio of the total value of exports. It is only for LIFDCs that we see an increase in the value of the ratios. This change towards more value-added processed and preserved products is welcome
- In the realm of exports of fishery products it may be desirable for national governments to place some degree of social control over the quantum and species of fishery products exported. When there is clear evidence that certain species are essential for the food security of local populations, certain developmental and social 'safeguards' may have to be instituted to ensure that the larger social good is optimized. There is the obligation of governments to act in accordance with Article 11 of the International Covenant on Economic, Social and Cultural Rights to ensure that there will be 'an equitable distribution of world food supplies in relation to need' and not exclusively oriented to the effective demand of the world market.
- What measures can be taken to put in place economic and social arrangements that would facilitate the achievement of greater direct and indirect food security through fish trade?
 - « Greater emphasis to 'micro' level local resource co-management obtains significance and has better chances for success if micro level producer organisations are in place. It is important to take advantage of the greater sense of 'community' and 'trust' which still exists at this micro level in most LIFDCs. They can be vital building blocks towards creating such local organisations. In marine coastal areas, granting preferred access, *both* seaward and landward, to coastal communities might also be the only way to ensure secure long term rights to fishery resources.
 - « Subsistence fishing is a major source of direct food security. This needs to be recognized and its extent judiciously assessed at the national level on an eco-system basis. The impact of international trade on subsistence fishing and the nutritional consequences of this warrant close investigation.

- Developing countries should take special efforts to regulate and upgrade the status of their domestic fish processing and marketing. This is particularly relevant in countries where women play a central role in these activities. From a national, fish-oriented food security perspective, this is an important field of action. Poor quality domestic fish processing and marketing practices often act as a strong brake to fostering quality standards for international trade.
- Developed countries should be lobbied to reduce the tariff on imports of processed fishery products. This is the only way LIFDCs can get out of being 'locked in' to an unchanging raw material processing mode. Such trade measures will be more important in enhancing food security than all the development assistance that can be offered to them on other counts.
- Attending to the food security implications of fish trade is a major step in the movement towards responsible fish utilization and trade as advocated by the FAO Code of Conduct for Responsible Fisheries. States should encourage the use of fish for human consumption. When a domestically consumed fish obtains an export market, its price tends to rise. The fishers will have a strong incentive to pass their catch to the exporters rather than the domestic market. The strong possibility of diversion of pelagic species world over for fish meal production highlights the importance of developing a code of conduct for trade in fishmeal to ensure that direct food security concerns are taken into consideration in doing so.

Delgado, C., N.Wade, M.Rosegrant, S.Meijer, and M.Ahmed. (2003). Fish to 2020. International Food Policy Research Institute, Washington, D.C. and WorldFish Center, Penang, Malaysia.

- Conventional fisheries are probably near the ceiling of their potential, though higher levels of production could probably be obtained by targeting small pelagic species, mesopelagic species, and krill. This strategy, however, would have severe consequences for the environment, as it would result in large species composition shifts and indirect harm to predator species.
- As a consequence of the probable slow growth in capture fisheries, the trajectory of aquaculture will play a large role in determining the relative prices of fisheries commodities. Aquaculture's course is far from certain, however. Several major challenges must be overcome if the rapid growth of the past 10 years is to be sustained
- On average, people in 2020 will be eating more fish, but the increases will accrue more slowly than in the past two decades. The baseline scenario forecasts global per capita food fish consumption to increase at an annual compound rate of 0.4 per cent from 1997 to 2020, with aggregate consumption increasing at 1.5 per cent per annum. China and India lead per capita growth.
- China's fish consumption has grown rapidly of late, and will continue to grow rapidly relative to other countries. Projected annual growth in aggregate Chinese food fish consumption of 2 per cent per annum may seem high but is actually much lower than the recorded growth of 11.8 per cent per annum in the FAO figures for 1985 to 1997.
- Consumers in China will continue to diversify their diets. Low-value food fish consumption is projected to grow at a lesser annual rate (1.5 per cent) than total food fish consumption (2 per cent) to 2020 under baseline assumptions, and aggregate Chinese consumption of crustaceans, mollusks, and high-value finfish is projected to grow much more rapidly, from 2.6 to 2.8 per cent per annum to 2020. Over time, the Chinese are projected to consume an increasing share of higher-value fisheries items, affecting both their current exports to the developed world and their **imports from neighboring countries in the South.**

- In summary, growth in fish consumption will very likely continue, but it will be driven primarily by the developing countries. Moreover, growth will occur slightly more in high-value than in low-value items, except in India and the rest of South Asia. **Most of the world's per capita consumption growth will occur in East and Southeast Asia.** Overall consumption growth of food fish will overwhelmingly occur in developing countries, where the effects of population growth will combine with consumer desire for a larger, diversified food basket.
- Looking forward to 2020, almost all of the 1.5 per cent per annum growth in total food fish production projected under the baseline scenario will come from aquaculture, and much of this from developing countries. Global food fish production from capture was 56.2 mmt in 1985 and 64.5 mmt in 1997, and is projected to reach 76.5 mmt in 2020 under baseline assumptions. If the lower China production hypothesis is correct, the 2020 projection falls to 69.2 mmt; in the event of a disastrous and global ecological collapse in marine fisheries, the low-end figure is 53.4 mmt. Slower aquaculture expansion puts substantially more pressure on capture fisheries with only small production gains, for a projected total of 77.9 mmt.
- Domestic needs and pressures will help to shape institutions, policies, and technologies for resource management, especially in developed countries and in some of the large developing countries such as China and India. However, unlike the red meat sector, the main pressure for environmental sustainability and food safety in developing countries will probably not come from domestic sources. Rather, it is likely to come from trade opportunities and barriers that will create incentives for change.
- The key to allowing aquaculture to achieve its potential of alleviating pressure on ocean fisheries is to concentrate resources on non-carnivorous forms of aquaculture, and to promote improvements in fishmeal efficiency for the carnivorous species that are farmed.
- Five major structural shifts can be predicted for global fisheries in relation to developing countries:
 - « First, developing countries, particularly in Asia, will dominate production systems; aquaculture development is central to this shift, but it will become more apparent in capture fisheries as well. The remaining quarter of world marine capture fisheries that are not fully exploited (and which are all in the tropics, largely within EEZs of developing countries) will become more heavily fished.
 - « Second, the source of net fisheries exports on a global scale has already shifted from the North to the South, and South–South trade will become increasingly important with the further emergence of urban middle classes. Developed countries will continue to be large net importers, and their domestic producers will continue to gradually exit the sector. Over time, it is likely that public policy in the North will increasingly favor import-friendly regimes for fish. On the other hand, it is quite possible that trade wars – perhaps based on both real and spurious food safety claims – will become more prominent in the South. Fish will become an increasingly high-value food commodity in relative terms, and trade is likely to continue to shift from low-grade and frozen whole fish to fresh fillets and the like.
 - « Third, environmental controversy will continue in the fisheries sector but will change focus. Overfishing in marine areas will remain a huge concern. Sustainability-motivated environmental regulations and institutions will rapidly become more prominent, starting in the developed countries and then spreading to developing countries. Relatively more attention will be devoted to the exploitation of reduction fisheries and of the stocks preyed on by traditional marine food fish. It seems likely that the relationship between pollution and food safety in fisheries will be given much more attention in both the North and the South.

- « Fourth, the importance and focus of fisheries technology development will also shift to meet new challenges. Technology to profitably reduce the fishmeal and fish oil requirements for carnivorous aquaculture are key, and efforts will be expanded by private-sector interests. Some efforts will be focused on fish, others on synthetic feeds, and still others on modification of crops used in aquafeeds. Private-sector technology development will also continue to find ways to lessen the negative environmental impacts of intensifying large-scale aquaculture, through the design of relatively capital-intensive innovations. In the public arena, interest will increase in finding technological solutions to mitigate the negative environmental externalities associated with progressive intensification of small-scale pond aquaculture under tropical conditions, where, to date, technological solutions to environmental problems have not been forthcoming. Environmental and foodsafety regulations that require capital-intensive approaches to compliance will receive increased scrutiny. In capture fisheries, information technologies for improved management will become increasingly important both in the North and the South but will pay off for public purposes only where the right form of institutional development accompanies use of the technology.
- « Fifth and finally, the issue of institutional development in fisheries will be a necessary condition for poverty reduction through fisheries development, as it is for improving environmental sustainability and food safety. The outlook for traditional fishers in developing countries in the absence of such institutional innovation is not bright. Both capture and culture fisheries are scaling-up and becoming more capital-intensive, and increased focus on food safety and environmental externalities under current technologies is likely to further this tendency. Food safety certification will become important to the survival of all fishers in the next two decades, and eco-labeling will become important to most. The world has not yet found a way to deliver such certifications cost-effectively and credibly to large numbers of small-scale fish producers, but the stakes are increasingly clear.

Worm, B., E. Barbier, N. Beaumont, J. Duffy, C. Folke, B. Halpern, J. Jackson, H. Lotze, F. Micheli, S. Palumbi, E. Sala, K. Selkoe, J. Stachowicz, and R. Watson. Impacts of Biodiversity Loss on Ocean Ecosystem Services. Vol 314, Science.

- Human-dominated marine ecosystems are experiencing accelerating loss of populations and species, with largely unknown consequences. We analyzed local experiments, long-term regional time series, and global fisheries data to test how biodiversity loss affects marine ecosystem services across temporal and spatial scales.
- Overall, rates of resource collapse increased and recovery potential, stability, and water quality decreased exponentially with declining diversity.
- Restoration of biodiversity, in contrast, increased productivity fourfold and decreased variability by 21 per cent, on average.
- We conclude that marine biodiversity loss is increasingly impairing the ocean's capacity to provide food, maintain water quality, and recover from perturbations. Yet available data suggest that at this point, these trends are still reversible.

UNEP/RIVM (2004). José Potting and Jan Bakkes (eds.). The GEO-3 Scenarios 2002-2032: Quantification and analysis of environmental impacts. United Nations Environment Programme, Nairobi.

- The Global Environment Outlook (GEO) is UNEP's flagship report series. It delivers modern environmental assessments based on broad and active participation by a large number of expert

organisations. A key role is played by the GEO network of collaborating centres, carefully spread over the regions of the world.

- The following four contrasting scenarios were developed in the GEO-3 process:
 - « Markets First – a world in which market-driven developments converge on the prevalent values and expectations in industrialized countries.
 - « Policy First – a world in which concerted action on environmental and social issues occurs through ambitious but incremental policy adjustments. This world is aimed at maximizing the benefits offered by better management and technology.
 - « Security First – a world of fragmentation, where inequality and conflict, brought about by social, economic and environmental stresses, prevail.
 - « Sustainability First – a world in which a new development paradigm emerges in response to the challenge of sustainable development, and supported by new values and institutions.
- The number of red signals for Africa, Asia and the Pacific, Latin America & the Caribbean and West Asia is strikingly larger than for Europe and North America. Moreover, only for North America do green signals outnumber red signals. Obviously, the continued momentum of population growth in the South plays a major role. Connected to this is the double challenge of reducing poverty among a growing population in these regions, and at the same time reducing pressures on the environment.

Failler, P. (2007). Future prospects for fish and fishery products. 4. Fish consumption in the European Union in 2015 and 2030. Part 1. European overview. FAO Fisheries Circular. No. 972/4, Part 1. Rome, FAO. 2007. 204p.

- This report presents the major results for fish consumption (consumption per capita and apparent consumption), production (captures, aquaculture and commodities) and fish trade exports and imports) estimations and projections for 28 countries in Europe from 1989 to 2030.
- The projections show an increase in the demand for seafood products to 2030. The average per capita consumption by the 28 countries will move from 22 kg/caput/year in 1998 to 24 kg/caput/year in 2030.
- The two additional kilograms per capita signify that the net supply will have to increase by 1.6 million tonnes (respectively 1.1 million tonnes for the 2 extra kg per person and 550,000 tonnes due to the 22 million population growth over the period).
- Aquaculture growth will not be able to meet the increasing demand; therefore, imports are projected to rise to 11 million tonnes (+15 per cent from 1998), increasing the dependency of Europe on the rest of the world for its fish and fish products.

McGowan. M. (2008). Tuna Cannery Requirements. Chairman's Tuna Stakeholders Workshop, Western and Central Fisheries Commission. The presentation makes some prediction with respect to tuna industry trends:

- Certified Sustainability of tuna stocks will become a market requirement
- Global tuna demand will continue to increase due to population growth and per-capita seafood consumption increases

- Most tuna stocks will have reached the maximum sustainable yield
- If RFMOs do not begin to effectively manage tuna stocks other international governmental organizations and non governmental organizations may step into dictate tuna management requirements
- Increase in coastal developing countries participation
- Continued consolidation of tuna processor ownership
- Some tuna stocks may collapse
- Skipjack tuna will continue at prices above USD 1,000 m/t
- More pressure on FAD fishing due to high fuel prices at the same time tuna conservation management on juvenile YF/BE catches required
- Overfishing likely to get worse given current tuna conservation and management regimes in RFMOs

F2.3 Fisheries aspects of food security

SPC (2008). Fish and Food Security. Policy Brief 1/2008, Secretariat of the Pacific Community, Noumea.

- What is food security? Food security means that all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active and healthy life (World Food Summit 1996).
- Threats to availability of fish for food:
 - « Population growth: The total number of people in the region is predicted to increase by around 50 per cent by 2030. To provide the recommended amount of fish for good nutrition, or maintain traditional patterns of consumption, access to another 115,000 t of fish must be provided across the Pacific by 2030 .
 - « Limited productivity of coastal fisheries: Most of the fish eaten in the Pacific currently comes from coastal stocks. The problem facing many PICTs is that even well-managed coastal fisheries do not have the capacity to provide the extra fish required for future food security. The gap between the coastal fish available and the amount of fish required for food security will be even wider if coastal stocks are not managed well.
 - « Climate change: Increased water temperatures, ocean acidification and wave surge associated with climate change are expected to damage coral reefs and reduce the number of fish they produce. This will increase the food security gap further.
 - « Over-exploitation of tuna: The rich tuna resources of the Pacific can supply much of the dietary protein needed by the region. However, their contribution to food security could be jeopardised by excessive industrial fishing.
- Recommended policy actions:
 - « Maintain the contribution of coastal fisheries to food security – monitor catches to keep harvests within sustainable limits and ensure coastal developments do not damage fish habitats.

- « Use more of the national tuna catch for food security.
- « Expand the national infrastructure for food security by installing low-cost inshore fish aggregating devices to assist rural subsistence fishermen to catch tuna.
- « Introduce regulations for landing 'discards' and 'bycatch' from commercial tuna vessels at urban centres to provide low-cost fish.
- « Diversify the supply of fish in rural and urban areas by developing sustainable small-pond aquaculture for freshwater fish, such as Nile tilapia.

Gillett, R. and G. Preston (1997). The Sustainable Contribution of Fisheries to Food Security in the Oceania Sub-Region of the Asia-Pacific Region: Review of Food Security Issues and Challenges in the Asia and Pacific Region. UNDP TSS1 Project – Ras/95/01T, Gillett, Preston and Associates, 50 pages

- The study identifies several major policy issues relating to fisheries and food security in the sub-region, and suggest possible actions that may be taken at regional or national level in order to address these issues. Those issues that are especially relevant to the long-term future of fisheries in the region are:
- **Policy issue:** *Lack of appreciation of the contribution of fisheries to food security.*
 - « Recognising that this lack of appreciation may stem from a scarcity of data on the subject, quantitative studies on the contribution of fisheries, especially the subsistence sector, to food security.
 - « Information on the large contribution of fisheries to food security of the region should be brought to the attention of the national food/nutrition committees and to the regional programs involved in nutrition and food security (South Pacific Commission, UNICEF, WHO, UNDP).
 - « The collection, collation and routine publication of statistics on all aspects of fisheries in Pacific Island countries should be improved and upgraded as a means of improving understanding and increasing awareness of the role of fisheries in food security and in national economies;
 - « ALL primary resource development – not just agriculture, but also livestock, forestry and fisheries – should be integrated into food national-level security strategies and action programmes.
- **Policy Issue:** *Aquaculture not contributing substantially to food security in many Pacific Island countries.*
 - « Pacific Island countries should realistically re-assess the aquaculture situation in their countries: take stock of their previous experiences in aquaculture and based on their successes and, particularly, failures, determine the likely extent to which aquaculture can be developed in the country for domestic consumption and export markets.
 - « Countries should give careful consideration as to the amount Government intervention to be channelled into aquaculture development relative to fisheries management
 - « In view of the low success rate of both aquaculture in the region and of Government involvement in development initiatives, consideration should be given to channelling aquaculture-related assistance directly to the private sector.

- **Policy issue:** *Coastal fishery production constrained by post-harvest situation.*
 - « Governments should intervene and take measures that will facilitate the marketing of fishery products from remote locations, taking particular account of those measures which have historically been unsuccessful (e.g. specialised collection vessels, freezers at remote locations)
 - « Additional research should be channelled into the production of fishery food products which do not require freezing or rapid transportation to distant markets
 - « In the design and operation of urban fish markets, special attention should be focused on the needs of producers from remote location (e.g. distance from shipping terminals, charges for using marketing facilities)
 - « Government fisheries extension services should place greater priority on providing marketing support to small-scale fishermen from remote locations
 - « Government fisheries extension services should facilitate the establishment of linkages between private sector producers in remote locations and private sector marketing opportunities in urban areas
- **Policy issue:** *Reconciling development of export-oriented fisheries with the encouragement of fisheries for domestic consumption.*
 - « The export of fishery products should be regulated by legislation and accurate/verified statistics should be collected on the exported fishery products
 - « Mechanisms should be established to evaluate the national interests involved in each export fishery, and where it is determined that the net benefits are negative, the export of the products should be prohibited
 - « Fishery development efforts, especially those by Governments, should include an evaluation of the impacts that those efforts may have on subsistence fisheries contributing substantially to household food security.
 - « The comparative advantages of Pacific Island fisheries should be analysed/recognised; there may be cases in which it may be beneficial to export high value fishery products (e.g. sashimi tuna) and use the income to import more appropriate fishery products (e.g. canned fish).

Gillett, R. (1995). Demand and Supply of Fish and Fish Products in the Pacific Islands - Perspectives and Implications for Food Security. Chapter 10 (pages 165–177) In: Demand and Supply of Fish and Fish Products in Selected Areas of the World. International Conference on Sustainable Contribution of Fish to Food Security, Kyoto Japan, December 1995.

- The objective of the paper is to identify Pacific Island characteristics and issues relating to fishery aspects of food security, examine regional perspectives on demand and supply of fish and fish products.
- With respect general food security, the major issues in the Pacific Islands are: There is a high dependence on imported food, The region is subject to a high incidence of natural disasters

which often have large negative effects on the supply of locally-produced food, Cash remittance by Pacific Islanders residing overseas forms an important source of national income and hence ability to purchase food, Chronic food security problems are most common in urban areas while acute food security problems are greatest in isolated locations, Starvation is virtually unknown in the region but malnutrition occurs, usually from lack of a balanced diet

- Fisheries play an important role in many aspects of food security in the Pacific Islands region. The high per capita consumption of fish (on some islands as high as 250 kg per year) attests to the importance of fish as a source of animal protein. In many cases the most likely alternative is imported food, which would further increase the already large foreign food dependence and hence vulnerability to factors beyond the control of countries in the region.
- The high rate of population growth for most countries PICTs, taken in conjunction with the limited nature in the inshore fishery resources, is likely to result in lower per capita supplies of local fish in the future.
- Natural disasters, including tropical cyclones, storm surges, drought and volcanic eruptions are common in the region. In some of these events fisheries suffer substantially while in others fishing is an option for disaster relief by providing a ready source food and/or cash. Canned fish from outside the region is often provided as alleviation for the food shortages accompanying natural disasters. It has been observed that relief efforts can encourage reliance on imported food.
- The difficulties of marketing fishery products from isolated islands in urban centres where the commercial demand exists will continue to challenge governments. It is likely that in the future additional attention will be paid to the effects of global climate change on the region's fisheries, the interaction between industrial and small-scale fisheries, and greater use of the region's tuna as food within the region.
- As most of the fish in the region is consumed on a subsistence basis, population is by far the largest determinant of fish demand.
- Although city dwellers have more difficult access to fishery resources, urbanisation does not necessarily decrease fish demand, but rather shifts demand to the products of commercial fisheries, especially imports.
- Because ciguatera fish poisoning results in significant wastage, a breakthrough in research on in this field could have a positive effect on the supply of fish. This would be most applicable for the island groups in the east where the incidence of ciguatera is highest.
- In view of the population increases expected and the limited coastal resources of most of the countries, the most likely situation is that fish consumption per capita from coastal resources will decline. If this occurs there are two consequences: either there will be greater consumption of non-coastal fish resources (tuna or imports) or total fish consumption per capita consumption will decline.
- To maintain per capita consumption levels, governments should consider greater utilization for local food of the catch from tuna fisheries. This could occur either by requiring retention of non-target species, encouraging local sales by the industrial fleet of a portion of the fish which are normally delivered to canneries for shipment out of the region, or encouraging tuna fishing activity by small and medium scale commercial operations.

F2.4 Pacific Islands population and urbanisation

World Bank (2000). Managing Pacific Towns. PNG and Pacific Island country Unit, The World Bank.

- Throughout the Pacific, high population growth has led to migration from smaller islands to larger islands and from rural areas to towns, especially national capitals. Key drivers of these trends include push factors, such as declining agriculture commodity prices and livelihood opportunities and insufficient rural land to confer social standing, as well as pull factors, such as the prospect of cash employment, perhaps with the government, the availability of public services in towns and the intrinsic excitement of urban areas.
- The young age structure and high fertility rates of many Pacific towns virtually ensure that towns will continue to grow rapidly, even where urban conditions and the quality of life are deteriorating.

Haberkorn, G. (2007). Pacific Islands Population and Development: facts, fiction and follies. Population Association Of New Zealand, 2007 Biennial Conference: Looking into the Future: People, Diversity and Social Outcomes 3–4 July 2007, Te Papa, Wellington, New Zealand.

- Two of the most important features of Pacific Island populations are: (1) Sustained high levels of natural increase throughout most of the Pacific; and (2) The continued importance of migration in regard to Pacific Island population dynamics, with urbanisation becoming more prominent
- The present population growth rate translates into an additional 177,100 people each year between now and 2011, when the region's population is expected to pass the 10 million mark.
- According to these projections, population growth in the immediate future (2007–2010) is expected to grow at an annual rate of 2 per cent in Melanesia, 1.84 per cent across Micronesia, and 0.7 per cent in Polynesia.
- With moderate to high fertility prevailing in just over half of PICTs (which also explains most of these countries' continued high population growth), an emerging success story is that fertility has declined everywhere over the past decade, with only Tuvalu and Tokelau showing a modest trend reversal.
- Mortality has a much smaller impact on population structure, distribution and dynamics relative to fertility and migration, but with *non-communicable* (or life-style) diseases on the rise throughout the region, and the prospect of increased HIV/AIDS prevalence in some countries, mortality may assume a much greater prominence there in the future, in impacting on population structure, distribution and growth. that the growing prevalence of non-communicable diseases, primarily diabetes and cardiovascular problems, have the potential to undermine earlier health gains achieved with communicable diseases
- The SGS findings help to inform programme development and to monitor the impact of regional- and national-level activities in relation to HIV and other STIs. They also provide strategic information to enable appropriate targeting of national-level responses and interventions. The main findings of surveys for STDs include high prevalence of STIs; limited knowledge of modes of HIV transmission; low rates of condom use, particularly among young people; multiple sexual partners; and commercial sex activities occurring in most countries. This shows how the Pacific Islands are most vulnerable to HIV.

- Continued migration to metropolitan countries, particularly from Micronesian and Polynesian countries and territories, is likely to continue in years to come, considering that few if any of the key social, political and economic determinants (or ‘push’ factors) have significantly changed over the years, with ‘perceptions’ of a better life remaining a powerful motivator.
- Urban growth rates over the past 25 to 30 years have outpaced rural population growth everywhere in the Pacific. At these rates, urban populations throughout Melanesia are expected to double in one generation (25 years), with the Solomon Islands and Vanuatu likely to achieve this in 16 and 17 years respectively, with American Samoa, Kiribati and the Northern Marianas not far behind in 20 years. This poses serious challenges for planning, land use, water and sanitation, housing and general infrastructure, as well as some serious rethinking of current social, health and employment policies.
- If PNG is removed from this equation Pacific Island urbanisation is 46%, with 10 countries and territories showing most of their populations living in urban areas,
- The smaller prominence of urbanisation across Polynesia/Micronesia does not mean, however, urbanisation is absent from their demographic landscape – it simply means that their urbanisation is taking place elsewhere (i.e. New Zealand, US).
- Urban population densities in excess of 5,000–10,000 people / square kilometer usually associated with urban poverty (and associated physical and social health issues) in Africa and Asia are becoming quite widespread in the region.
- With rural-to-urban migration responsible for the initial onset of Pacific Island urbanisation, it is a demographic double-whammy with urbanisation really taking off, once an urban population base has been established, having largely attracted a young population, and urban growth now being fuelled by dual process of (a) natural growth (higher birth rates due to a greater number of women, often reflected in a much younger urban than rural age structure), and (b) ongoing urban-bound migration, again of a largely younger (and often, single) population
- Persistent high rates of rural-to-urban migration are caused by continued high rural fertility, and a multitude of structural causes (unbalanced regional development; absence of employment opportunities and services; lacking infrastructure, including transport and communication), individual aspirations and motivations, as well as cultural and political institutions and practices (both real and ‘merely’ perceived to be real) *pushing* and *pulling* rural people everywhere to make a new life for themselves and their families in regional towns, their nations’ capital cities

Haberkorn, G. (2006). Preliminary Stocktake of urbanisation policies in the Pacific Island Region, Statistics and Demography Program, Secretariat of the Pacific Community. September 2006.

- The continued perception of Pacific people as primarily rural dwellers is factually correct, but in wider political and development terms a myth, lulling national policy-makers and their international development partners into a false sense of security that traditional village social structures and support networks are able to handle sustained high population growth and associated developments. Most observers seem unaware that the perpetuation of this “rural myth” is largely the result of three predominantly rural societies — PNG (87%), Solomon Islands (84%) and Vanuatu (79%) dominating the Pacific demographic landscape and accounting for 74 per cent of the region’s overall population.

- The main reason behind the likelihood of persistent high urban population growth are *high levels of rural-to-urban migration and high levels of fertility*, with women in most PICTs giving birth to around four children during their reproductive years. While most family and reproductive health activities over the past decade managed to contribute to a lowering of fertility, which, from a population and development perspective, are very laudable achievements indeed, fertility rates (TFR) of between 3 and 4 mean population growth will persist in most countries for years to come. Such relatively high fertility rates, when combined with ongoing high rural-urban migration, have a double (demographic) impact on urbanisation, in adding not only additional people each year to Pacific cities and towns *per se*, but additional women of child-bearing age.

F2.5 General economic development

Chhibber, A. (2009). “The Global Economic Crisis and the Pacific Island Countries: The Human and Social Dimensions”, United Nations Development Programme, Prepared for The Lowy Institute Conference for International Policy “Pacific Islands and the World: The Global Economic Crisis” Brisbane, 3 August 2009.

- UNDP-supported national MDG reports indicated that only a few – mostly small, Polynesian – countries were on track to achieve most of MDGs by 2015 before the crisis.

AusAID (2009). Tracking development and governance in the Pacific. Australian Agency for International Development, Canberra.

- This report addresses development and governance in the Pacific region. It provides an update on progress towards MDGs and key governance indicators using the latest available information. The information it provides is intended to help governments design policies and programs that hasten progress towards MDGs.
- While some countries in the Pacific have made good progress against, and even achieved, some MDG targets, the same cannot be said of the entire region. While recent data on poverty and other key development outcomes is often missing, **the Pacific still appears to be seriously off track to achieve MDGs by 2015.**
- Looking at the region overall, progress against common development indicators reveals the scale of the challenge faced by the Pacific in meeting MDGs. Approximately 2.7 million people in the region are living in poverty and do not have the income to satisfy their basic human needs. Around 400,000 children are not enrolled in primary school and 64 out of every 1,000 children die before the age of five. At least 80,000 adults have HIV and the rate of infection is growing by more than 40 per cent a year. The number of people living in poverty increases to 3.2 million and the number of children not in primary school increases to 480,000 if Timor-Leste is included.
- **Progress towards MDG 1—reducing poverty and hunger by half by 2015—has been the slowest and is of most concern** in the region. While tracking poverty in the Pacific is challenged by weak data, it appears that the number of people living in poverty is rising. Only Vanuatu has made significant improvements in reducing poverty, due largely to sound policy choices leading to strong economic growth, and it is the only country on track to achieve this MDG. Some countries are translating economic growth into reducing poverty and meeting the MDGs. Samoa and Tonga are on track to achieve four of the goals. Fiji Islands, Niue, Palau and Vanuatu are on track to achieve three MDGs.
- The evidence suggests that for many of these countries, **gains made during the 1990s in health and education have stalled in recent years. In some cases progress has reversed**, as in the case of child and maternal health. Clearing the final hurdles to achieve universal primary education

Table F1: Real GDP per capita growth (2004–20): GNI per capita 2007

	Real GDP product per capita growth (annual %) ¹							GNI per capita (Atlas Methodology, USD 2007 ²)
	2004	2005	2006	2007	2008	2009 ^f	2010 ^f	
The Pacific	1.9	0.8	-0.5	1.1	3.3	1.2	0.9	
Melanesia								
Fiji Islands	4.8	0.2	2.8	-7.1	0.7	-1.2	-0.5	3,750
PNG	0.1	0.8	-1.7	4.3	5.0	1.9	1.4	850
Solomon Islands	5.1	2.1	3.2	7.3	3.5	-0.4	-0.9	750
Vanuatu	2.9	3.9	4.6	4.2	3.6	1.0	-1.7	1,840
Polynesia								
Cook Islands	-5.4	0.5	-2.2	0.3	1.1	-1.8	-2.0	13,100
Samoa	2.9	3.5	1.5	5.1	-0.1	-1.4	-0.5	2,700
Tonga	1.1	2.0	0.5	-3.8	0.8	-2.4	-1.0	2,480
Tuvalu	3.5	1.5	0.5	1.5	1.2		0.6	2,440*
Micronesia								
FSM	-3.4	-0.7	-2.4	-3.2	-1.0	-0.1	0.0	2,280
Kiribati	-3.5	-0.7	-6.9	-1.3	-0.8	-0.8		1,120
Marshall Islands	5.6	0.5	0.2	0.6	0.5	-0.8	-0.5	3,240
Nauru		-12.7	8.8	-28.4	-0.5	-0.5	-0.5	2,818*
Palau	5.2	5.0	4.1	1.3	-1.6	-2.6	-0.8	8,270
Timor-Leste	2.0	-0.3	-8.8	4.6	6.6	6.7	4.8	1,510

Sources: (1) ADB, *Asian Development Outlook, March 2009*. (2) World bank, *World Development Indicators database* and ADB, *Statistical Database system (for Cook islands, Nauru and Tuvalu)*

Notes: Data for Niue not available. Cook Islands GNI data is for 2005, Nauru and Tuvalu GNI data is for 2006; f = forecast

and improve mother and child health will often require more effective interventions in service delivery in remote areas and innovative approaches to reaching vulnerable groups, such as people with disability. Cook Islands, Kiribati, the Marshall Islands, Nauru, Solomon Islands and Tuvalu are positioned to meet very few of MDGs.

AusAID (2006). *Pacific 2020*. Australian Agency for International Development, Canberra.

- What are the long-term growth prospects for Pacific Island countries? And what can be done today to improve these prospects? *Pacific 2020* aims to answer these questions. *Pacific 2020* is based on the study of nine topics: four crosscutting 'growth factors' – investment (or capital), labour, land and political governance – and five important 'productive sectors' – agriculture, fisheries, forestry, mining and petroleum, and tourism.
- The region has experienced low or negative growth in income per person. In the period 1990–2004, four of the five Micronesian countries had negative growth and, of the Melanesian countries, only Fiji Islands achieved an average growth of more than 1 per cent a year. In general, the Polynesian countries have done better, but only when compared with the rest of the region. Their growth is well below the average for developing countries.

- Some commentators foresee a ‘doomsday’ scenario where the Pacific Islands region completely fails to meet its mounting challenges. Others foresee ‘muddling on’, where collapse is prevented by the continuation of aid and migration opportunities. Neither of these scenarios is comforting. *The Pacific 2020* also highlights a third scenario – rapid growth – in which a range of reforms along the lines outlined in this report is undertaken and where, as a result, economic growth accelerates. This scenario is the only one that enables the Pacific to meet its challenges.
- Four themes emerged from the study of the nine Pacific 2020 growth topics as critical for growth. These are governance and institutions, infrastructure, integration and regional cooperation, and implementation.
 - « International indicators show that the Pacific suffers from weak governance. The Pacific 2020 studies revealed that this is holding growth back.
 - « Infrastructure (transport, telecommunications, power) emerged repeatedly from the Pacific 2020 studies and consultations as a fundamental constraint to growth in the region.
 - « Integration and regional cooperation are not options for the Pacific Island countries, but necessities borne of their small sizes.
 - « Perhaps the single clearest message from Pacific 2020 is that poor implementation is the most serious constraint to successful reform and thus rapid growth.
- Key overall findings:
 - « Private sector investment will drive growth if business costs are reduced.
 - « Land tenure reform is a sensitive issue, but one that requires demand-driven, incremental change.
 - « The fundamental requirement for more employment is faster economic growth, but labour-related reforms and actions are also needed.
 - « Improving political governance is a long-term challenge, but perhaps the most important one facing the Pacific between now and 2020.
- The Pacific Island countries control massive fishery resources. But oceanic fisheries are approaching the limits of sustainability after decades of steady growth in catches, and coastal fisheries are facing environmental risks. Misgovernance in the fisheries sector is manifest in weak management.

Crocombe, R. (2001). *The South Pacific*. University of the South Pacific.

- Real buying power of Pacific Islanders has been static for years. But in terms of the true economy, it has probably declined everywhere for the figures presented by governments and international organizations make no provision for the depletion of the economic base, the raiding of the natural reserve of non-renewable assets.
- No one can foresee all the opportunities and forces, or their relative importance, for the future is not a simple projection of the present. New factors keep emerging, but the more we explore the possibilities and act on the best options, the better the futures are likely to be.

Hess, M. (2006). Pacific 2020 Background Paper: Employment and labour markets. Australian Agency for International Development, Canberra.

- The region faces labour market demand and supply problems. The most important characteristic of employment in the region is that a high percentage of the population at a 'job seeking' age (15–29 years) has little chance of gaining formal sector employment. With a few exceptions of specific industries for short periods, growth rates in gross domestic product have not kept pace with population growth. With continued low economic growth projections and the population phenomenon of the 'youth bulge' this situation is likely to become worse.
- There is potential for large numbers of young people to be drawn to urban areas with no prospect of employment and every chance of joining any social unrest. In some areas this process is well advanced.
- Donors have been disappointed that the funding that has flowed into education and training (often at rates well above the public spending on education and training in other parts of the world) has not materialised into anticipated employment benefits. Governments have sought to attract foreign investment but have been frustrated by their limited success. Decision makers in business and government who put their faith in labour intensive export oriented production have been discouraged that the economic size, remoteness and land issues which contribute to the high transaction costs of doing business have undermined their efforts. Economic reformers, particularly where reform has been seen as successful (e.g. in Samoa), have been frustrated that this has not resulted in the creation of more jobs.
- However, there is a point of agreement from which future discussion can begin. This is that strategies to promote future economic and employment growth need to focus on **areas of comparative advantage** for nations of the region and ways of reducing barriers to their development.
- Given that many nations face inherent economic disadvantages, recent thinking has shifted to emphasise the ways in which governments within the region can act to reduce disincentives to private investment and employment growth. Attention has increasingly focused on the 'costs of doing business' in the region.

Holden, P. (2005). Pacific 2020 Background Paper: Private Sector. Australian Agency for International Development, Canberra.

- The countries of the Pacific region have gone through an extended period of low or zero economic growth, despite levels of foreign aid that have been among the highest in the world. Both leaders and donors are seeking new ways to ensure higher standards of living for the people in the region and they have identified supporting private sector growth as a central part of a new paradigm to raise growth rates by encouraging investment and entrepreneurship.
- The countries of the region are small and remote. They require policies that promote economic integration with the outside world. This means that communication and transport costs should be kept as low as possible, and legal systems should encourage arms-length contracting. In most countries, however, there has been restricted entry and competition in the telecommunications and transport sectors with the result that communication and transport costs are among the highest in the world. Legal systems are outdated and costly to use, making them available only to foreign investors or to the wealthiest members of local communities.

- Above all, promoting change requires an ongoing policy debate that promotes a vision of the Pacific Island countries as low-cost, private sector friendly business environments that exploit their comparative advantage. In the past, initiative often went unrewarded, with the result that many of the most entrepreneurial citizens in the region left to seek opportunities elsewhere. Their abilities were stifled by states that engaged in business activities in which they have no expertise and that fail to provide the essential elements of an environment in which private sector activities can succeed.
- In most countries in the region most of the population still live in rural areas, which are often perceived as targets for social policies or for agricultural extension services. This view overlooks the potential contribution that the rural economy – small farmers, fishermen, small traders, small-scale distributors and processors – can make. It is an archetypical small business sector. Yet rural entrepreneurs, including farmers and fishermen, suffer disproportionately from a dysfunctional private sector environment.
- The effects of high-cost or non-existent infrastructure, limited access to finance, limited transport facilities, high-cost communications and trade barriers are intensified in rural areas. With populations increasing and with virtually no potential to engage in entrepreneurial activities in rural areas, many Pacific Islanders are facing the inevitability of migrating to urban areas, thereby putting pressure on urban services. In many countries in the region this migration has resulted in increasing urban poverty and rising social problems.
- There is substantial evidence that clearly defined property rights to land is a necessary precondition for long-term economic development. It is difficult to argue against this claim as most industrialised countries have strongly protected property rights, particularly for immovable property, and well-functioning land markets. In virtually all industrialised countries financial markets support the purchase and improvement of property, which constitutes a major portion of the assets of their financial systems. Secure property rights to fixed property encourage investment in land and buildings and promote a more equal distribution of wealth. Countries where property rights to land are not secure have much lower rates of investment and, eventually, growth than they might otherwise have. In most developed countries the bulk of small businesses are started using loans that are backed by land.
- At the moment there is little meeting of minds between government and private sector operators and little understanding of each other's positions. Government officials claim that they have undertaken reform but the private sector has not responded. Private sector operators blame government bureaucrats for their failure to implement reform without admitting the extent to which entrenched private sector interests benefit from the distortions in the economy. Many employed in the public sector also benefit from the extensive role of the state in the economy – from high public sector salaries to overstaffing of ministries and agencies.
- Both within the public sector and in the private sector itself, there are forces that profit from the status quo. Resistance to change, as well as inertia, has to be overcome. The reform process cannot be imposed from the outside, although some models of how to start the transformation are beginning to be tested. Nevertheless, governance issues remain a challenge and political instability has had a negative effect on rates of investment in the region.
- Changing minds and attitudes requires more than simply writing reports. Improving the environment for business requires commitment, analysis, persuasion, political action, and coordination at the country level between governments and the private sector, in addition to coordination and support on the part of the donors.

- The time for reform is ripe and requires the energies of visionaries within the region, as well as far-sighted donors, to promote change – not by doing more of what has not worked in the past, but by experimenting with alternative means to bring about transformation that provides prosperity without undermining the underlying strength of Pacific societies.

Maddison, A. (2007). *Contours of the World Economy 1–2030 AD*. Oxford University Press, New York.

- This study uses trends in population and GDP per capita, and assumed that world development will not be interrupted by new major military conflicts.
- It foresees in 2030 a world population of 8.2 billion and a 2.25 fold increase in world GDP.
- With respect to specific regions, GDP per capita in western Europe, US, and Japan will grow at about the same as in 1990–2003. In Asia there will be a continued high momentum and a large degree of catch up on US, while a modest improvement in per capita performance in Africa and Latin America is expected.

F2.6 The future of agriculture and tourism sectors

MacGregor, A. (2006). *Agriculture*. Background Paper for Pacific 2020, Australian Agency for International Development, Canberra.

- This paper offers projections of likely best and worst case scenarios for the agricultural sectors of the Pacific Island countries in the year 2020. A discussion is then made of possible strategies to help achieve the projected best case scenario.
- The likely best case scenario would leave the Melanesian and the larger Polynesian countries with an increased level of sustainable prosperity and a higher degree of self-reliance. While the atoll micro-states would remain relatively poor because of their special circumstances, they would be more self-reliant and better able to cope with the challenges of survival.
- Rural people could improve their livelihoods by taking advantage of identified agricultural opportunities: enhancing household self-sufficiency, supplying growing urban, rural and tourism markets, increasing traditional tree crop exports, exporting to Pacific Island and Asian communities, and exporting new horticultural and spice products in which they have a comparative advantage.
- A key role for agricultural policy is to empower people to take advantage of agricultural opportunities. Such empowerment requires policymakers and donors to recognise small-scale farmers as part of the private sector. There is a need to build public and private sector partnerships that accept that agricultural development is led by the private sector, with government playing a facilitating role.
- To take advantage of agricultural opportunities, the private sector needs: infrastructure (roads, ports and jetties, affordable shipping, telecommunications and market facilities), good governance, market access, information and skills, an enabling policy environment, access to affordable financial services, and, access to land and security of tenure.
- The agriculture round-table identified three priority policy actions: invest in infrastructure and its maintenance, generate, share and use information, and improve policy formulation. Of these, investing in infrastructure is deemed to be the most important.

- Outcomes approaching the likely worse case scenario would leave all countries decidedly worse off than they were in 2005, regardless of developments in other sectors of the economy. The countries of western Melanesia, Fiji's outer islands, the atoll micro-states would find themselves in dire straits. By 2020, the income-generating capability of the non-renewable resources sectors of PNG and Solomon Islands are likely to have substantially diminished, although exports of gas from PNG will provide some cushion. For most of these countries there is limited scope for developing manufacturing and service-based industries. Unless appropriate policy actions and resource allocations are adopted, outcomes approaching the worse case scenario are considered likely.

Allcock, A. (2006). Background Paper for Pacific 2020: Tourism. Australian Agency for International Development, Canberra.

- Although tourism activity in the Pacific has varied considerably in recent years, the long-term trend has been for gradual, positive growth. It is likely that the underlying trend will continue, with some variations caused by natural and man-made disasters, the threat of terrorism, the instability of governments, new technology or changes in policy. These events cannot be predicted accurately.
- WTO and South Pacific Tourism Organisation (SPTO) forecast tourism growth of between 5 and 8 per cent in the short term. However, no forecast is available for the South Pacific to 2020. Projected growth in tourism activity assumes that the region will remain politically stable and free of natural disasters, that the policy environment will be supportive, with planned infrastructure and tourism investment for the region fulfilled, and that there will be continued economic growth in major source markets.
- The market mix is likely to have changed considerably by 2020. China recently granted Approved Destination Status to Fiji Islands and Vanuatu, allowing its citizens to travel to those destinations for holidays. This policy is likely to be extended to other Pacific Island countries in the future. Countries with such status usually experience a rapid increase in arrivals from China if airline and other services are provided to meet the demand. Shopping and casino gambling are recreational pursuits often associated with the Chinese market. Improved economic conditions in India indicate its potential as another emerging market and it is likely that visitors from India will represent an increased share of the total market in 2020.
- Changes will also occur in the product mix to meet the demands of a changing market. These could include activity-based and adventure tours, community-based ecotourism and products associated with specific natural or cultural assets.

F2.7 Climate change

Bell, Johann, Mike Batty, Alex Ganachaud, Peter Gehrke, Ove Hoegh-Guldberg, Johanna Johnson, Robert Le Borgne, Patrick Lehodey, Janice Lough, Tim Pickering, Morgan Pratchett, Marcus Sheaves, and Michelle Waycott. (2009). Preliminary Assessment of the Effects of Climate Change on Fisheries and Aquaculture in the Pacific. In: *The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories*. Pacific Studies Series, Asian Development Bank, World Bank, Forum Fisheries Agency, Secretariat of the Pacific Community, and Australian Agency for International Development, 362 pages.

- Alterations in ocean temperatures and currents, and the food chains in the open ocean, are projected to affect the future location and abundance of tuna species in the Pacific Island region. Initial modeling indicates that the concentrations of skipjack and bigeye tuna are likely to be located further to the east than in the past. The simulations have yet to be done for yellowfin tuna and albacore tuna.

- Significant changes to the future distribution of tuna will make the zones of some Pacific Island countries more, or less, favourable for the surface fishery for skipjack tuna. Displacement of tuna stocks further east in the Pacific would be a windfall for the countries in those areas. Reduced abundance of skipjack in Melanesia should have a far lower impact on their GDP in relative terms, but there will be substantial losses in real terms given the large quantities of tuna currently caught there. Identifying the preliminary implications of climate change for longlining operations is not practical at this stage because although initial simulations indicate that there will also be an eastward shift in adult bigeye tuna, the modeling has not yet been done for yellowfin tuna and albacore tuna.
- Projections that cyclones will become progressively more intense may increase the risk of damage to shore-based facilities, fleets for domestic tuna fishing and processing operations in countries located within the cyclone belt. Rising sea level will eventually make many of the existing wharfs and shore-based facilities unusable.
- The projected effects of climate change on coral reefs are better understood than for other coastal habitats. Rising sea surface temperatures and more acidic oceans are projected to have increasingly severe impacts on the growth of hard corals. The expected loss of structural and biological complexity on coral reefs will have profound effects on the types of fish and invertebrates associated with them. Species that depend on live coral for food, and on the intricate variety of shelter created by structurally complex reefs for their survival, are likely to disappear. Effects of climate change on coastal fisheries associated with coral reefs may not be immediately apparent, but result in slow, long-term (decadal) declines in yields as resilience and productivity are gradually eroded.
- Projected increases in temperatures, sea level, cyclone intensity and turbidity of coastal waters due to higher rainfall, can be expected to affect the growth and survival of mangroves, seagrasses and non-reefal algal habitats, and the nature of intertidal and subtidal sand and mudflat areas. These areas function as nurseries for juveniles and/or feeding habitats for a wide range of coastal fish species. Reductions in coverage and structural complexity of mangroves and seagrasses can be expected to reduce the recruitment success for many species of fish and invertebrates.
- Climate change will also affect the freshwater fisheries of the region. The projected increases of rainfall in the tropics are expected to increase the extent and duration of inundation. The effects of increased flooding and higher water temperatures on the fish themselves, and the vegetated lowland areas that support them, have yet to be determined. Freshwater fisheries throughout the region are based largely on species that migrate between the sea and freshwater. Small changes in either rainfall or sea-level may have major impacts on the ability of fish to move between estuaries and freshwater, impacting recruitment.
- With respect to aquaculture, climate change could result in losing fish from ponds during floods, invasion of ponds by unwanted species and damage to ponds through infilling and breaching of walls. On the other hand, heavier rainfall in low-lying tropical PICTs may increase the area suitable for rain-fed pond aquaculture. Pearl farming faces risks from increased acidification of the ocean. As aragonite saturation levels fall, the shells of blacklip pearl oysters will be weaker. This is likely to lead to higher rates of predation of juveniles and lower rates of collection of wild spat. The winter mortality disease currently causing problems for the production of blue shrimp in New Caledonia may ease with the changing climate. Higher water temperatures combined with lowered salinity are factors linked to outbreaks of disease that affect production of seaweed. Warmer water temperatures, increased acidification and more severe cyclones can also be expected to influence the development of aquaculture for marine ornamental products.

WWF (2009). The Implications of Climate Change for Australia's Great Barrier Reef. Worldwide Fund for Nature.

- This report confirms the extreme risk that the world's most diverse marine ecosystem, coral reefs, face if the earth continues to warm. By using a new index developed by the National Oceanic and Atmospheric Administration and the Centre for Marine Studies at the University of Queensland in Australia projections of coral reefs under a warming world were developed.
- All projections in the reveal that even under the best circumstances, less than 5% of the coral populations on the Reef today will be left. The key though is how corals fair beyond 2050. Under scenarios in which greenhouse gases continue to build up in the atmosphere, coral populations will be decimated to a point where recovery may have to wait centuries. Under more responsible scenarios in which greenhouse gas emissions are reduced rapidly and global average temperature change stays below 2°C, large scale coral populations will rebuild much quicker. This has to occur with a concerted effort to afford reefs much greater protection.
- The report also develops four scenarios for the future of the Great Barrier Reef and the industries that depend on them, primarily tourism and fisheries. The news is not good.
- Under the worst case scenario, coral populations will collapse by 2100 and the re-establishment of coral reefs will be highly unlikely over the following 200–500 years. Under the best case scenario, coral cover will be dramatically reduced by 2100 but will recover over the following century as the climate stabilizes again."
- Under the best case scenario, which involves deep cuts to greenhouse emissions, solutions remain for people and industry. Under all other scenarios, devastating impacts are inevitable.
- Tourism and fisheries appear to be the casualties of the worst-case climate change scenarios, as reefs degrade to less appealing and less ecological supportive ecosystems.

F2.8 China and the Pacific Islands fisheries

Crocombe R. (2007). Asia in the Pacific Islands: Replacing the West. IPS Publications, University of the South Pacific, Suva.

- The influence of US and Europe in Pacific Island countries is expected to continue to decline in importance; Influence of Japan, China, Taiwan and South Korea, as well as ASEAN countries will rise. After looking abroad overwhelmingly to Europe and US for the past 200 years, the Pacific Islands look increasingly to Asia.
- The islands most valuable non-mineral resource will be to take sides on issues that are irrelevant to them, but important to powerful countries.
- In 1993, less than 5 million Chinese tourists went abroad. By 2004, it was 20 million and increasing exponentially.
- In the past 20 years, Northeast Asian companies have been the main lessees of fishing rights in the islands. The next emphasis is likely to be on aquaculture in coastal, lagoon, and inland waters.
- The balance of influence in aid will turn increasingly to Northeast Asia where the capacity to pay is growing faster than in the West.

- The 700+ Asia-Pacific regional organizations constitute a new and intensifying network that will reduce the influence of island governments, organizations, and individuals.
- As government accede to ever more international agreements, in many of which the decision-making power favours Asian interests more than those of the islands, the freedom of action of Island government shrinks.
- The likely trends are for gradual change following shifting economic, military, and political power, leading to periodic major shocks.

Birkeland, C. (1997b). Disposable income in Asia – A New and Powerful External Pressure Against Sustainability of Coral Reef Resources on Pacific Islands. Reef Encounter 22, December 1997.

- The rapid economic growth of Asian nations, especially mainland China, is putting a new type of pressure on marine resources. In normal circumstances economics compels fishermen to switch gear or locations before the resource population nears local extinction. However, the high dollar value placed on many coral reef resources by Asian economies can encourage effort even after the targeted species is too rare to sustain a viable reproductive population.
- The rapidly increase in dollar value of reef resources overrides management policies, traditional practice, and Law.

Delgado, C., N.Wade, M.Rosegrant, S.Meijer, and M.Ahmed. (2003). Fish to 2020. International Food Policy Research Institute, Washington, D.C. and WorldFish Center, Penang, Malaysia.

- On average, people in 2020 will be eating more fish, but the increases will accrue more slowly than in the past two decades. The baseline scenario forecasts global per capita food fish consumption to increase at an annual compound rate of 0.4 per cent from 1997 to 2020, with aggregate consumption increasing at 1.5 per cent per annum. China and India lead per capita growth.
- China's fish consumption has grown rapidly of late, and will continue to grow rapidly relative to other countries. Projected annual growth in aggregate Chinese food fish consumption of 2.0 per cent per annum may seem high but is actually much lower than the recorded growth of 11.8 per cent per annum in the FAO figures for 1985 to 1997.
- Consumers in China will continue to diversify their diets. Low-value food fish consumption is projected to grow at a lesser annual rate (1.5%) than total food fish consumption (2%) to 2020 under baseline assumptions, and aggregate Chinese consumption of crustaceans, mollusks, and high-value finfish is projected to grow much more rapidly, from 2.6 to 2.8 per cent per annum to 2020. Over time, the Chinese are projected to consume an increasing share of higher-value fisheries items, affecting both their current exports to the developed world and their imports from neighboring countries in the South.
- In summary, growth in fish consumption will very likely continue, but it will be driven primarily by the developing countries. Moreover, growth will occur slightly more in high-value than in low-value items, except in India and the rest of South Asia. Most of the world's per capita consumption growth will occur in East and Southeast Asia. Overall consumption growth of food fish will overwhelmingly occur in developing countries, where the effects of population growth will combine with consumer desire for a larger, diversified food basket.

F2.9 Institutional aspects

Lindley, R. and L. Zann (2009). SPC Marine Resources Division 2009 – Review of the Oceanic and Coastal Fisheries Programmes. MRAG Asia Pacific Pty Ltd.

- The purpose of this review is to assess the performance of MRD of SPC over the last four years. Additionally the review is intended to (a) help SPC to develop more effective Programmes and Strategic Programme Plans to allow PICTs to maximise the sustainable contributions of fisheries and aquaculture to economic growth, food security and livelihoods and (b) assess and recommend changes to MRD functions, management, staffing, methods of service delivery and structure to support the revised Programmes. The main recommendations of the Review are:
- RECOMMENDATION 1: That MRD adopt a structure that is far more objective-orientated. A suitable model may be the SPC Land Resources Division, based in Suva.
- RECOMMENDATION 2: That the MRD employs a more strongly Objective Orientated Project Planning approach to the preparation of the 2010–2013 plan.
- RECOMMENDATION 3: That the Fisheries Management Section be merged with the Reef Fish Section into a single broader Section (called, for example, the “Coastal Fisheries Science and Management Section”).
- RECOMMENDATION 4: That in establishing a new structure to allow the Division to become more objective orientated, a formal Support Section be established to provide a range of services to the technical sections of MRD.
- RECOMMENDATION 5: That the Joint Country Strategy Papers are used far more actively by MRD to guide interventions in individual countries.
- RECOMMENDATION 6: A longer planning horizon should be adopted for MRD. This will assist funding agencies’ planning, as well as helping ensure that future funding is secured for essential project activities that will eventuate from the adoption of the Apia Policy, the Aquaculture Management Plan and the Regional Bio-security Project
- RECOMMENDATION 7: The country by country approach to implementing projects and programmes should be encouraged, particularly within the CFP. It reduces costs and concentrates resources on countries and areas where there is greatest likelihood of success
- RECOMMENDATION 8: That MRD, through JCSPs, assess the capacity of the country fisheries departments and divisions to absorb and benefit from its services. Should the capacity of the division or department be lacking, MRD should modify the implementation schedule and scope of involvement to reflect the capabilities of the recipient country
- RECOMMENDATION 9: This review recommends that CFP seek funds to undertake an external and objective study of Pacific Island aquaculture so as to identify the most rewarding strategies for the Aquaculture section to focus on in the future.
- RECOMMENDATION 10: That the Training Officer currently in the Nearshore Fisheries and Training Section be transferred to the proposed Support Section and take on the administrative and coordination responsibilities for training for all the Sections of MRD.

- RECOMMENDATION 11: That the MRD seek to retain two scientific positions (and one support position) to maintain the initiative and history of the PROCFish project.
- RECOMMENDATION 12: That, when funds permit, the CFP Information Section undertake a brief study (in a suitable country) to assess their success in distributing materials and information to its intended audience.
- RECOMMENDATION 13: That MRD continues to accommodate CRISP, but does not try to fully integrate its activities into its own
- RECOMMENDATION 14: That OFP's scientific advice and technical reports be subject to greater external scientific peer review.
- RECOMMENDATION 15: That the issue of potential conflicts of interest amongst SPC/WCPFC/FFA/PICT national fisheries agencies are considered by SPC senior management, and if necessary, be addressed by a small reference group representing all interests.
- RECOMMENDATION 16: That CFP alter the skills composition of its staff to meet the changing needs of PICTs. All staff TORs should be updated, and effort made through the existing process of triennial staff reviews and other processes to ensure persons with appropriate skills are appointed to each position.
- RECOMMENDATION 17: That an economist is available to all sections of CFP so that projects and programmes receive appropriate economic oversight. This could be achieved in a number of ways including recruiting an economist to sit in the proposed Support Section, ensuring that one of the senior staff (possibly the Programme Manager) has a background in economics or hiring in short term expertise as required.
- RECOMMENDATION 18: That MRD in Nouméa first deal with its priority issues (e.g. adopting the new structure, adapting to funding constraints) before beginning to emphasize the policy of decentralisation. Only once these issues have been addressed to the satisfaction of the Director of MRD and the SPC Secretariat should MRD operationalise the decentralisation policy, including placing staff in the Regional Offices.
- RECOMMENDATION 19: That communication, coordination and collaboration within MRD and SPC generally should be improved. MRD through the new Director will, in time, address CFP and OFP issues, but the SPC management will need to address the larger corporate imperative of cross cutting cooperation between Divisions and their Sections through their regular executive meetings.
- RECOMMENDATION 20: That SPC, in coordination with other CROP agencies, assess ways of better developing capacity in PICTs. For oceanic fisheries, this would involve methods of building of regional capacity in oceanic fisheries science and management, particularly the use and interpretation of the results of stock assessments. For coastal fisheries this would involve enhancing capacity in management and technical issues, as well as administrative matters and good governance.

Willock, A. and M. Lack (2006). Follow the leader: Learning from Experience and Best Practice in Regional Fisheries Management Organisations. WWF International and TRAFFIC International.

- Despite the proliferation of RFMOs and the development and evolution of instruments aimed at empowering them, RFMOs have generally failed to prevent over-exploitation of straddling and

highly migratory fish stocks, to rebuild overexploited stocks and to prevent degradation of the marine ecosystems in which fishing occurs. Although the past performance of most RFMOs has been poor, this report has identified that a number of these organizations are taking steps to embrace some of the more recent international standards and expectations.

- Attempts to improve the performance of RFMOs require the causal factors of poor performance to be clearly identified. Although each individual RFMO operates in a relatively unique geo-political environment there is nevertheless a strong degree of commonality in the factors affecting their performance. IUU fishing by highly mobile fleets under the control of multinational companies is widely recognized as a major threat to the sustainability of the world's living marine resources as well as the broader marine environment in which fishing activity takes place and much work has been done in attempting to identify ways in which IUU fishing can be prevented, deterred and eliminated.
- This report has identified that some RFMOs are already moving towards some form of internal reform, with evidence that these rather insular, inward-looking bodies are increasingly responsive to external views and are seeking to embrace more recent developments in international law, both hard and soft. The experience of RFMOs clearly shows that best practice is not a static thing. The dynamic nature of fishing, fluctuations in stock availability, changes in market demand, technological advances and international developments all influence both the effectiveness of existing conservation and management measures as well as attitudes to whether these represent 'best practice'.
- Individual RFMOs have, to some extent, shown a willingness to innovate and adapt their management responses; for example, advances in the use of trade-related measures and the development of black and white lists. While there have been useful advances in compliance and enforcement measures in recent years, there would appear to be a need to test more broadly some of the more recent and innovative initiatives under international law. Specifically, the balance between the concept of freedom of fishing on the high seas and the fact that, given the depleted state of the world's marine fisheries, this freedom is now so over-subscribed as to make its exercise by States a contravention of their obligations.
- The newest RFMO to enter into force, WCPFC, reflects some of the lessons learned from other organizations, instituting a scientific committee, a technical and compliance committee, and making provision for independent scientific advice within its governing convention. Despite this convention only having been in force since mid-2004, these subsidiary bodies are already functioning, providing advice and recommendations to the Commission. Further, WCPFC also reflects lessons learned and evolving best practice in other areas, including innovative decision-making provisions, explicit recognition of developing States, transparency, and 'hard-wiring' crucial elements of compliance and enforcement into the convention text.
- One of the oldest organizations, the Southern Ocean Marine Conservation (CCAMLR), demonstrates that application of the ecosystem approach and the precautionary approach can deliver strong fisheries and ecosystem outcomes. It provides clear guidance for other RFMOs on the structures, processes and innovative thinking that are required to operationalize these concepts.
- Specific recommendations are made in the areas of political will and capacity, precautionary and ecosystem approaches, collaboration, and transparency and accountability.

F2.10 Eco-certification

Leadbitter, D. (2006). Demand for MSC labelled tuna growing quickly. Marine Stewardship Council, Tuna 2006, 25-27 May, Bangkok, Thailand.

- Now, far more so than in 2002, the market interest in MSC certified tuna is very evident. Every retailer we deal with asks us about the potential availability of MSC certified tuna. Those retailers with major MSC commitments can now source bulk salmon and groundfish products plus, increasingly, some local fresh/chilled species but the lack of MSC certified tuna is seen as a major gap in the consumer offer.
- The first tuna fishery to seek certification is that for albacore pursued by members of the American Albacore Fishing Association in the waters of the north and south east Pacific ocean. Information on this fishery and its progress through the MSC process can be found at www.msc.org. However, it has become obvious to MSC staff that retailer inquiries to supply fisheries are starting to have an impact as we have had strong expressions of interest from fisheries in all oceans covering skipjack tuna, albacore tuna and yellowfin tuna.
- The challenge for MSC certifiers is to find those combinations of stock status, acceptable impact and effective management that define tuna fisheries that may meet the MSC Standard.

Holden, B. (2009). MSC Certification for the Pacific Tuna Industry. Pacific Tuna Forum, Port Moresby, Papua New Guinea, 2–3 September 2009.

- The largest certifying group, the Marine Stewardship Council (MSC) has certified fisheries for 50 species, covering 2,652 products.
- MSC has certified several tuna fisheries in other regions and has begun preliminary work in this region.
- These includes “pre-assessments” for the purse seine, pole-and-line, and southern albacore longline fishery.

F2.11 Other

Carpenter, S. (2005). Ecosystems and human well-being scenarios: findings of the Scenarios Working Group, Millennium Ecosystem Assessment. Island Press.

- The Millennium Ecosystem Assessment (MA) was carried out between 2001 and 2005 to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being. The assessment focuses on the linkages between ecosystems and human well-being and, in particular, on “ecosystem services.”
- MA examines how changes in ecosystem services influence human wellbeing. Human well-being is assumed to have multiple constituents, including the basic material for a good life, such as secure and adequate livelihoods, enough food at all times, shelter, clothing, and access to goods; health, including feeling well and having a healthy physical environment,
- The conceptual framework for MA posits that people are integral parts of ecosystems and that a dynamic interaction exists between them and other parts of ecosystems, with the changing

human condition driving, both directly and indirectly, changes in ecosystems and thereby causing changes in human well-being. At the same time, social, economic, and cultural factors unrelated to ecosystems alter the human condition, and many natural forces influence ecosystems.

- Several overarching questions, along with more detailed lists of user needs developed through discussions with stakeholders or provided by governments through international conventions, guided the issues that were assessed:
 - « What are the current condition and trends of ecosystems, ecosystem services, and human well-being?
 - « What are plausible future changes in ecosystems and their ecosystem services and the consequent changes in human well-being?
 - « What can be done to enhance well-being and conserve ecosystems?
 - « What are the strengths and weaknesses of response options that can be considered to realize or avoid specific futures?
 - « What are the key uncertainties that hinder effective decision-making concerning ecosystems?
 - « What tools and methodologies developed and used in MA can strengthen capacity to assess ecosystems, the services they provide, their impacts on human well-being, and the strengths and weaknesses of response options?
- This volume has been produced by the MA Scenarios Working Group and examines possible changes in ecosystem services during the twenty-first century by developing four global scenarios exploring plausible future changes in drivers, ecosystems, ecosystem services, and human wellbeing.
- Scenarios are plausible, challenging, and relevant sets of stories about how the future might unfold. They are generally developed to help decision-makers understand the wide range of potential futures, confront critical uncertainties, and understand how decisions made now may lay out in the future. They are intended to widen perspectives and illuminate key issues that might otherwise be missed or dismissed. The goal of developing scenarios is often to support more informed and rational decision-making that takes both the known and the unknown into account.
- In order to plan for a changing and uncertain future, we must have tools for organizing extensive information about socioecological systems. Scenarios are such a tool. Scenarios are plausible, provocative, and relevant stories about how the future might unfold. They can be told in both words and numbers. Scenarios are not forecasts, projections, predictions, or recommendations, though model projections may be used to quantify some aspects of the scenarios. The process of building scenarios is intended to widen perspectives and illuminate key issues that might otherwise be either missed or dismissed. By offering insight into uncertainties and the consequences of current and possible future actions, scenarios support more informed and rational decision-making in situations of uncertainty. Scenarios are a powerful way of exploring possible consequences of different policies. They force us to

state our assumptions clearly, enabling the consequences of those assumptions to be analyzed. Scenarios, and the products of scenarios, are not predictions. Rather, they explore consequences of different policy choices based on current knowledge of underlying socioecological processes.

- Framed in terms of these contrasts, the four scenarios developed by MA were named:
 - « Global Orchestration (socially conscious globalization, with an emphasis on equity, economic growth, and public goods and with a reactive approach to ecosystems)
 - « Order from Strength (regionalized, with an emphasis on security and economic growth and with a reactive approach to ecosystems),
 - « Adapting Mosaic (regionalized, with an emphasis on proactive management of ecosystems, local adaptation, and flexible governance)
 - « TechnoGarden (globalized, with an emphasis on using technology to achieve environmental outcomes and with a proactive approach to ecosystems).

Cunningham, S., A. Neiland, M. Arbuckle, and T. Bostock (2009). *Wealth-based Fisheries Management: Using Fisheries Wealth to Orchestrate Sound Fisheries Policy in Practice*. Marine Resource Economics, Volume 24, MRE Foundation, Inc.

- The importance of resource rent in fisheries has long been acknowledged. By generating such rents, economically efficient management systems increase value added and the sector's contribution to GDP and growth.
- However, despite the successful adoption of such systems in some countries around the world, economics continues to have relatively little influence on fisheries policy. This lack of influence is particularly noticeable in developing countries, precisely where the contribution that effectively managed fish resources might make to GDP is most urgently needed.
- The key requirement to increase the adoption of economically rational fisheries management is to convince policymakers to focus explicitly on the wealth-generating potential of fish resources. Such a focus provides a general policy framework within which other approaches, such as rights-based, incentive-based, and ecosystem-based, may be nested.
- This approach is likely to prove more effective in influencing policy, especially in situations where rights-based systems either will not work or are politically unacceptable.

Future scenarios for fisheries in the Pacific Islands

Table G1: Offshore fisheries scenarios in 2035

Scenario Impact on benefits	Best	Worst	Most likely
Production	Catch volume/value increase; biological/ economic/ social optimisation between gear/species agreed and implemented. Bycatch interaction problems solved. Optimisation occurs in favour of the needs and aspirations of PICTs, as balanced regionally. Purse seine catches of YF/BE (and some skipjack) used for higher value products than traditional canned product.	Severe YF and BE stock declines, reduced demand in key high-price markets, and rising fuel and other costs result in non-viable longline fisheries. Range contraction and/ or stock declines of YE and BE make some domestic longline fisheries uneconomic. Skipjack fisheries decline in value due to falling CPUE and smaller fish; Fishing & processing affected by progressively by changing climate patterns, including more intense cyclones in some areas.	Despite best efforts, pace of national and regional agreements slower than rates of stock declines. Volume/ value of skipjack catches rises substantially, but YF and BE stock declines resulting in lower or marginal profitability of domestic longline fisheries. Growing interest in albacore not met due to failure to control longline mortality leading to lower catch rates
Exports	Effective control of the fishery by PICTs through licensing/ WCPFC negotiated outcomes results in substantial increase in onshore processing and increase in exports of value-added fish; Preferential access to markets maintained or achieved. New, profitable markets for alternative tuna products being supplied. Products from PICTs recognised as being fully “green” and achieve preferential prices. Financial participation of PICTs in rest of value chain (processing, broking, marketing) linked to licensing policies enhances PICT benefits from growth of value added of entire industry.	For purse seining, preferential access removed resulting in PIC-based fleet’s inability to compete with efficient producing nations. Region’s cost and productivity disadvantages reduce ability to grow domestic industry development and associated exports despite access leverage. For longlining, production moves to low cost fleets. Leverage from access control not utilized to gain access to rest of value chain.	For purse seining, preferential access removed resulting in less export value due to competition with efficient producing nations, although growing demand, improved technology and control of catches by PICTs may result in increasingly profitable exports. New products/species cater for rising demand for middle-end products (sushi, steaks) For locally based longlining, production moving to low cost fleets, reducing exports. Benefits to PICTs from licensing and fishing decline relative to growth of the entire value chain.

(Table G1 continued)

Scenario Impact on benefits	Best	Worst	Most likely
Employment	Pacific nationals assume increasingly responsible officer roles in tuna fleet. Domestic industry development in fishing and processing, and comprehensive management results in substantial increase in employment in many countries, including 'good' jobs associated with tuna fisheries, (e.g. data management, observers, marketing) Continued demand for traditional, and innovative new tuna products that require large labour input commensurate with PICT labour costs	DWFN fleets, fishing under agreements unfavourable to PICTs continue to dominate the fishery. Domestic industry development not successful; population growth is such that employment gains made in domestic industry development are dissipated. Profits, wages and conditions are all low and are unattractive to nationals of many PICTs, requiring import of labour resulting in political and social problems.	Domestic industry development continues to grow in two or three countries but is unsuccessful in countries with inadequate infrastructure and/or high production costs. Some growth in other jobs (observers, crew, officers) continues. Education and training for higher level jobs in entire value chain continues to lag behind potential requirements.
Food	Offshore fisheries close the gap between the supply and demand for affordable fish. Off shore fisheries are managed such that coastal pelagic fisheries remain healthy. Bans on discards create major source of affordable fish in states where transshipment occur	Due to global demand and an inability for local markets to compete on price, substantial food for domestic consumption is not generated from offshore fisheries. Failure to manage interaction between coastal and offshore fishery severely constrains small scale tuna fishing (troll / dropline) for local markets	Offshore fisheries do not fully close the gap between the supply and demand for affordable fish. Cheap tinned fish continues to be affordable, and is augmented by discards and bycatch species.
Government income	Trade offs between domestic industry development and license fees for countries with licensed foreign fleets; Increased domestic license fees generated from the substantial resource rents obtained from good management.	License fees foregone to promote domestic industry development does not come close to generating the expected indirect government income. Failure of PICTs to adequately present a united front with respect to license fees allows DWFNs solidarity and forces license fees down.	License fees will continue in many countries; Some success of domestic industry development to compensate for foregone access fees.

Table G2: Coastal fisheries scenarios in 2035

Scenario Impact on benefits	Best	Worst	Most likely
Production	Total fisheries production slightly above 2010 level due to fisheries near urban area maintaining production and rural areas increasing production to sustainable levels due to judicious use of transport links, MPAs, and other interventions. Climate change impacts not as severe as forecast and reefs adapt to gradual climate change	Massive overfishing due to domestic, export demand, and lack of management controls; abundance of resources driven so low that production drops remarkably below the 2010 level. Many high value species are wiped out. Coral bleaching and other effects of climate change substantially reduce fishery production from reefs.	Production falls significantly below 2010 level due to uncontrollable fishing effort near urban areas; CBM is effective in some areas. Fishery resources in some remote areas depleted by govt-subsidized transport of catches. Some transport of fish to urban areas. Coral bleaching effects have some negative effects on fishery production
Exports	The value of exported non-food items increases, while the volume is stable; Some highly controlled exports of very high value coastal food fish.	Exports after 2010 surge but subsequent overfishing causes export volume to crash. Much of the food-fish exports at the expense of domestic nutrition.	Volume of exported items falls, but rising prices allow trade to continue. Some countries have banned exports of food fish, which gives some help in reducing fishing pressure but many bans are “leaky” due to exemptions and poor enforcement.
Employment	Level of employment rises from that in 2010 due to transport links to remote locations, value-adding, and links to tourism industry (supplying hotels, sportfishing, diving). Jobs associated with non-extractive industries, including tourism and sportfishing, grow in importance as Pacific becomes one of the last areas of healthy reef/ inshore tropical ecosystems	Fishery resource declines near urban areas result in large decrease in informal and formal employment. Initial increase in jobs from level in 2010 due to fishing for high-demand export products, but those fisheries (and associated employment) crash due to lack of even simple management. Tourists repelled by barren reefs.	Fishing employment near urban areas tapers off gradually, with decreasing catch rates and profitability, mitigated somewhat by higher prices & technology improvements. Fishers from urban areas range further, but are constrained by high fuel prices. Employment in remote areas tapers off with decline in abundance of non-perishable items. Tourism jobs related to marine environment grows.
Food	Flow of total fish volume to urban areas steady, but declining on a per capita basis. Controls on export of food fish result in use of all coastal fish for domestic nutrition. Use made of fish from new fisheries.	Flows of fish to urban areas crash due to low catch rates in nearby areas, and non-viability of transporting fish to urban areas. Failed “development” schemes and habitat destruction result in declines in flow of fish to villages. Some food fish exported – at the expense of domestic food supplies.	Flow of fish to urban areas tapers off, with a major reduction on a per capita basis. Some countries have banned exports of food fish, which gives some help, but many bans are “leaky” due to exemptions & illegal exports. Some successful cases of transporting fish from remote areas, but all such attempts by governments fail.
Government income	Small but steady revenue from licensing domestic fishing operations and by taxing some types of fishery exports and marine tourism.	No revenue, but rather subsidies for fisheries development projects, many of which do not make a profit and increase the overfishing problem.	Only a small amount of revenue from fishing businesses, many of which have exemptions from indirect taxation.

Table G3: Aquaculture scenarios in 2035

Scenario Impact on benefits	Best	Worst	Most likely
Production	Real comparative advantages are identified and associated marketing arrangements developed, targeting a small number of key species. Development assistance has been focused on the private sector. Govt fishery agencies refrain from “growing things” but focus on mitigating constraints and facilitating investment in most promising species. Aquaculture for both domestic use and exports approaches or surpasses that from coastal capture fisheries production in volume and in value.	Aquaculture for export withers due to inability to compete with countries that are relatively inefficient producers. Energy and feed prices become prohibitive. Subsidised inputs into aquaculture result in no net benefits and detract from other aquatic production initiatives. Aquaculture for domestic use withers due to inability to compete with capture fish, tuna bycatch, imports or alternative sources of food (e.g. chicken). Aquaculture facilities affected by progressively more intense cyclones.	Production for domestic purposes continues to be associated with subsidies, domestic tourist markets, and govt/donor projects. In addition, private sector production expands considerably for the fast-growing domestic urban markets which have fish shortages. Export aquaculture production withers, except in special cases of exceptional entrepreneurial skill or the rare comparative advantage.
Exports	Comparative advantages emerge, private sector investment pours in, and exports surge.	No real comparative advantages emerge; exports wither to zero with the phasing out of subsidies and govt aquaculture operations.	Export aquaculture production declines, except in special cases of exceptional entrepreneurial skill or comparative advantages
Employment	For export aquaculture, comparative advantages emerge, private sector investment pours in, and employment surges. For domestic aquaculture, capture fish shortages, healthy economies, and growing tourism combine to create strong demand and the associated employment surges.	With the decrease in production due to problems with export and domestic aquaculture production given above, employment withers. Demand in inland areas of large island does not materialize and subsistence activities do not take off.	Employment oriented at producing fish for rapidly expanding urban areas increases. Increases in Involvement with aquaculture in inland areas of large island vary greatly between countries and are dependent on subsidies, development models used, and the availability/desirability of alternatives.
Food	Significant addition to urban food supplies and to food supplies in the inland areas of large islands. Aquaculture satisfies the fish supply/demand gap.	Aquaculture for domestic food withers due to inability to compete with capture fish, tuna bycatch, imports or alternative sources of food (e.g. chicken). Governments unwilling or unable to continue subsidies.	Substantial amounts of food produced for the fast-growing urban markets which have fish shortages. Variable increases in aquaculture food produced in the inland areas of large islands.
Government income	Indirectly through taxation of salaries and other activities produces significant revenue.	No revenue, but rather government subsidies and other costs to control and support industry (i.e. negative revenue).	A modest amount of indirect revenue through taxation of salaries and other activities will probably be exceeded by the costs of quality and disease control and other public services.

Table G4: Freshwater fisheries scenarios in 2035

Scenario Impact on benefits	Best	Worst	Most likely
Production	Extensive interventions to improve water quality for cities results in rehabilitation of many freshwater fisheries. Production in 2035 is considerably greater than in 2010.	Substantially increased logging, mining, agriculture, and other human activities result in substantial habitat damage & fishery production crashes. Change in rainfall patterns also has huge negative impacts.	Some increase in logging, mining, agriculture, and other human activities results in habitat damage & fishery production declines between 2010 and 2035. Change in rainfall patterns also has some negative impacts.
Exports	Tiny amounts	None	None
Employment	Subsistence activities increase; some commercial activity (e.g. barramundi) re-commences after rehabilitation of some major rivers.	With production crashes, subsistence activities also crash.	Moderate decline of subsistence activities, mirroring the decline in production.
Food	As per fisheries production above; total food production is considerably greater in 2035 than in 2010, but per capita supply does not increase.	As per fisheries production above, food production crashes.	As per fisheries production above; decline in total food production and sharper decline in per capita supply.
Government income	Small amounts	None	None



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The report was produced with the financial support of the Australian Agency for International Development (AusAID).