

MAKING THE VESSEL DAY SCHEME (VDS) WORK

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ABSTRACT

The Republic of Nauru a single island state located in the Western Central Pacific Ocean (WCPO), where much of its economy relies on its foreign fishing licenses and access fees in its post-phosphate transition. The recent implementation of the vessel day scheme (VDS) strategy in the WCPO region to ensure sustainability of its tropical tuna stocks and maximise national economic revenues raises contentious issues for a nation with limited natural resources. The challenge is in implementing the VDS strategy in a region where tuna abundance and distribution has been found to be clearly impacted upon by the El Niño Southern Oscillation (ENSO) events. This management strategy exposes nations with narrow-based economies to the sudden high fluctuations of the ENSO events. This study used Nash's game-theoretical approach to propose a side-payment scheme with a fixed share and a five-year moving average option to complement the VDS with respect to the PNA coalition. The recommendation for optimal management at this time for Nauru is a side-payment with the VDS. The principles of the side-payment scheme can be further enhanced to establish the core of this game, where the Pacific island countries (PIC) extend their management of the tunas in the high-seas enclave. The recently established Tuna Convention (Western Central Pacific Fisheries Commission) in the region can catalyse this opportunity. However, the next step to ensure that the conservation measures for tropical tuna stocks are addressed is to introduce a tax system with the VDS side-payment strategy in the WCPO region.

Key words: vessel day scheme (VDS), ENSO events, side-payment scheme

ACRONYMS

EEZ	-	EXCLUSIVE ECONOMIC ZONE
SPC	-	SECRETARIAT OF THE PACIFIC COMMUNITY
UNCCD	-	UNITED NATIONS CONVENTIONS TO COMBAT DESERTIFICATION
PIC	-	PACIFIC ISLAND COUNTRIES
AUD	-	AUSTRALIAN DOLLAR
NSDS	-	NATIONAL SUSTAINABLE DEVELOPMENT STRATEGY
DWFNS	-	DISTANT WATER FISHING NATIONS
NTFA	-	NAURU TUNA FISHING ASSOCIATION
NFMRA	-	NAURU FISHERIES & MARINE RESOURCES AUTHORITY
SOE	-	STATE-OWNED-ENTITY
FAO	-	FOOD AND AGRICULTURE ORGANISATION
FAD	-	FISH AGGREGATION DEVICE
VDS	-	VESSEL DAY SCHEME
ENSO	-	EL NINO-SOUTHERN OSCILLATION
VDS-s	-	VESSEL DAY SIDE-PAYMENT SCHEME
WCPO	-	WESTERN CENTRAL PACIFIC OCEAN
DWFN	-	DISTANT WATER FISHING NATION
WCPOFC	-	CONVENTION ON THE CONSERVATION AND MANAGEMENT OF HIGHLY MIGRATORY FISH STOCKS IN THE WESTERN CENTRAL PACIFIC
FFA	-	FORUM FISHERIES AGENCY
LOS	-	UNITED NATIONS CONVENTION ON LAW OF THE SEA
FSA	-	CONSERVATION AND MANAGEMENT OF STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS FISH STOCKS AGREEMENT
THE CODE	-	FAO CODE OF CONDUCT FOR RESPONSIBLE FISHERIES
IPOA	-	FAO INTERNATIONAL PLAN OF ACTION
IUU	-	ILLEGAL, UNREGULATED AND UNREPORTED FISHING
RFMO	-	REGIONAL FISHERIES MANAGEMENT ORGANISATION
CSA	-	CONVENTION STATISTICAL AREA
MCS	-	MONITORING, SURVEILLANCE AND ENFORCEMENT
VMS	-	VESSEL MONITORING SYSTEM
PNA	-	PARTIES TO THE NAURU AGREEMENT
US	-	UNITED STATES OF AMERICA
PDF	-	PROJECT DEVELOPMENT FUND
TAE	-	TOTAL ALLOWABLE EFFORT
FSM	-	FEDERATED STATES OF MICRONESIA
PNG	-	PAPUA NEW GUINEA
PS	-	PURSE SEINE

LL	-	LONGLINE
P&L	-	POLE AND LINE
ADB	-	ASIAN DEVELOPMENT BANK
FIAS	-	FOREIGN INVESTMENT ADVISORY SERVICE
NOAA	-	US NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
USD	-	UNITED STATES DOLLAR
OECD	-	ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT

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1 INTRODUCTION

1.1 Background

The Republic of Nauru (Figure 1) is a single raised coralline island situated in the central Pacific, 60 km south of the equator at a latitude of 0°55'S and longitude of 166°55'E (Yeeting and Thoma 2007). The island is approximately 21.9 km² and its coastal resources are restricted to a narrow 50-300 m wide coral "belt" surrounding the 19 km circumference of the island (SPC 2007). Nauru's Exclusive Economic Zone (EEZ) is 320,000 km². The population is 10,065 including foreigners (Nauru 2002).



Figure 1: Map and location of the Republic of Nauru

According to its first national report for the United Nations Convention to Combat Desertification (UNCCD) in 2003, Nauru is facing and adjusting to its post-phosphate transition. Nauru had experienced high economic growth fuelled by booming but unsustainable phosphate exports (and looming resource exhaustion) over the past decade. However, the unprecedented economic downturn has been characterised by mounting domestic and external constraints to its development which are similar to those of other Pacific Island countries (PICs), i.e. small domestic market, remoteness from major markets, limited resource base, lack of a skilled and trained workforce, a narrow export base, heavy reliance on imports, poorly developed infrastructure and vulnerability to natural disasters. Most of the current revenue is received from fishing licensing fees and in overseas businesses and investment funds (UNCCD 2003).

1.1.1 The economic downturn

The revenues from phosphate exports once provided wealth and sustained the Nauru economy and the government budget known then as the “hey-days”. Since 2000, the phosphate export revenues have declined from a value of AUD \$40 million to zero in 2006 (Nauru Treasury 2007). Hence, the mining industry could no longer cover operating costs, as well as royalties and dividends to the government (Figure 2). For the fiscal budgets of 2004 to 2005 and 2005 to 2006 the government introduced a range of revenue and expenditure measures to counter the severe reduction in phosphate related revenues. The budget was maintained in surplus in 2004 to 2005 and these surpluses are expected to continue into the future (NSDS 2005). The fisheries and access fee (%) contribution to the national income increased dramatically from 6% to 38% from 2000 to 2006 which correlates with the decline in phosphate exports (Figure 2).

The long-term challenge for the government will be to maintain public services as revenue flows from short-term capital return declines. The revenue base is narrow and heavily reliant upon fishing licenses, the only sizeable and sustainable item. The future of government revenues will continue to be exposed to fluctuations in revenues from fishing licenses (NSDS 2005) due to natural fluctuations in environmental conditions and fish stocks.

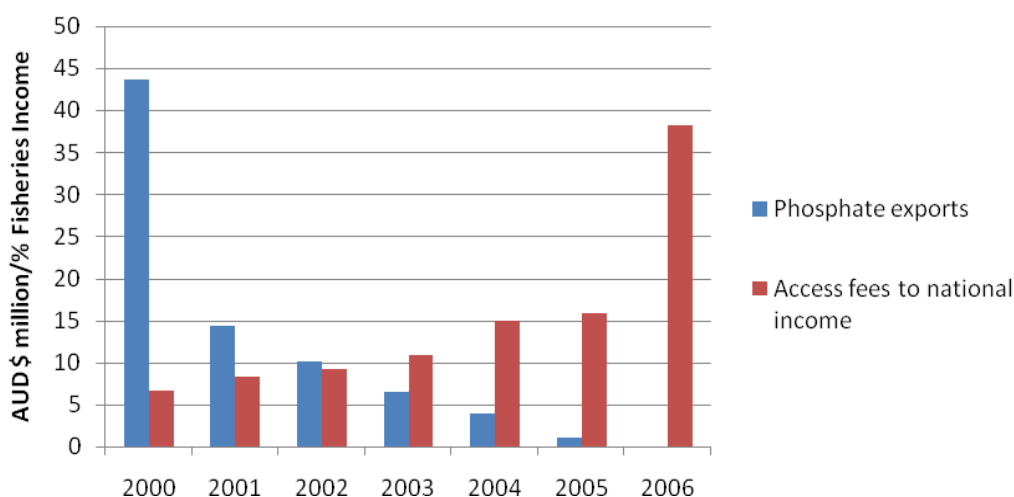


Figure 2: Phosphate exports (AUD million) and fisheries income (%) (Nauru Treasury 2007)

1.1.2 National strategies

In lieu of the economic downturn the government undertook reform measures in formulating policies and strategies in a “living document” known as the National Sustainable Development Strategy (NSDS) 2005-2025. This document provides a set of guidelines, principles and measures for its sectoral goals and is divided into short-term, medium-term and long-term goals. The national reform goal is to rebuild a stable economy by providing an acceptable standard of living for all on a rehabilitated Nauru (NSDS 2005). Hence in the current economic climate the significance of the fishing licenses and access fees to its economy has increased. This study will provide

the immediate set of guiding principles for the fisheries and its goals. The NSDS document formulates the following policies and goals for fisheries management.

- Improved overall fisheries management
- Maximising revenues from fishing licenses and access fees
- Developing quality fish exports from commercial fishing
- Ensuring sustainable supply of marine resources to satisfy local demand
- Developing aquaculture and mariculture programs
- Restore the reef and coastal waters to maximise sustainable yield

The intention of this study is to explore opportunities to maximise the revenues from fishing licenses and access fees and reduce the naturally occurring fluctuations in its revenues. And any factors that can potentially cause harmful fluctuations in the overall economy and constrain long term planning. Prior to proposing alternative opportunities for maximum returns from its license and access fees this study will provide the implications of the economic downturn for the Nauru economy and the fisheries institution and its management.

1.1.3 Nauru Fisheries & Marine Resources Authority

The Nauru Fisheries & Marine Resources Authority (Fisheries Authority) was established in 1998 as a statutory body bestowing with it the powers and functions to regulate and develop activities relating to Nauru's fisheries and marine resources (NFMRA 2007a). The Fisheries Authority was recognised as a state-owned entity (SOE) and this was brought about at that time by the government to attempt to privatise government-earning departments. The current economic situation has since deteriorated and the government has implemented measures to consolidate all revenue sources, control of license and foreign fishing vessel access fee revenues to be transferred from the Fisheries Authority to the government Treasury since 2006 (NFMRA 2007a).

The Fisheries Authority comprises three areas of management oceanic, coastal and the Nauru Tuna Fisheries Association (NTFA) with the two longline vessels and the national fish market. Prior to its establishment, the Fisheries Authority as a government department had facilitated current license and access fee arrangements through negotiation processes issuing bilateral licenses and access under national agreements and regional arrangements.

Since its establishment the Fisheries Authority has expanded its functions nationally by purchasing two tuna longline vessels, establishing a fish market and extending its responsibilities to the management of its coastal area. The Fisheries Authority paid the government a fixed annual surplus fee from its fishing licenses and access fees. This surplus fee is equivalent to AUD 3,000,000.00 per annum. It is difficult to provide the contribution to the revenues of these fees prior to 2000 as this was not well recorded in the Treasury Department at the time.

The recent stringent measures led the Fisheries Authority to become more innovative in negotiating license and access fees with the “flag states”¹. These negotiations have included assistance to national fisheries development projects and the value is not accounted for (in this paper but it is worth a mention as a value-added component of these fees).

The Fisheries Authority’s role extends to the coastal management resource programs and projects. Since the inception of the government measures there has been an increased need to advocate for community-based fisheries resource management plans at the district-level. Similar to other Pacific Island countries (PICs) marine resources are a significant source of protein and staple food in the diet of its people. These national coastal fisheries projects have largely been funded and assisted by regional bodies through projects and donor aid programs. The coastal marine resources lack the commercial value of the tuna species, hence their low development priorities. The priorities remain to change in the near future with the potential opportunities to develop an aquarium fish trade that has recently been undergoing research. The tuna species as a resource are significant due to their commercial value.

1.2 Tuna species and their significance

The principle market tuna species have been identified as the family of the *Thunnini* and include the most economically important species due to their global economic importance and the intensive trade practices (Maguire *et al.* 2006). The tunas that are specifically referred to in this study are those known as the tropical tunas. Tropical tunas have been identified as the following species:

- Skipjack (*Katsuwonus pelamis*)
- Yellowfin (*Thunnus albacores*)
- Bigeye (*Thunnus obesus*)

The contribution to the national income of these species is in the form of access fees which are received exclusively from the distant water fishing nations (DWFNs). These license and access fees give the DWFNs rights to access Nauru’s EEZ and fish for the tunas. These access fee arrangements are multilateral, regional and bilateral in nature. The value of these access fees ranges from USD 4 to 7 million per annum (Nauru Treasury 2007).

The tunas are exploited nationally for domestic trade and food. The domestic tuna longline vessels formerly operated and exported its tuna to Japan in 2002. The lapse in its current operations is the lack of capital investment from government since the economic downturn. One of the priorities is to re-establish this operation in the near future. A national tuna strategy was conducted late in 2007 (NFMRA 2007a) to assist and improve domestic tuna developments. The national fish market is supplied by the artisanal tuna fishers, since the lapse of its domestic tuna vessels.

The artisanal tuna fishers with their small boats include canoes, skiffs, boats with or without outboard engines and their numbers are 15, 4, 31 and 8 respectively (NFMRA 2007b). These fishers are involved in small-scale market trades with hotels, restaurants, the public and themselves. One of the national fisheries projects that have

¹ Flag states is defined in relation to fishing vessels that of/a state(s) is registered and licensed or fishing vessel is entitled to fly its flag (OECD 2002).

assisted the fishers to fish in the inshore areas for tuna is the deployment of fish aggregating devices (FADs) both in the inshore and offshore areas. The FAD project was funded by donor programs and deployed with the assistance of the Secretariat of the Pacific Community (SPC) coastal program section. The aim of the FAD projects is to alleviate the increased foraging pressure on the inshore marine resources and assist fishers with a continuous supply of pelagic fishes.

1.2.1 Objectives of the study

The license and access fees have been established over time with regional assistance. The bilateral agreements, although developed by individual countries in negotiating with DWFNs to access Nauru's EEZ, are assisted by the regional institution on request. One of the recent developments in the region is the implementation of a new management strategy that has implications to reshape the establishment of these national bilateral agreements. This management strategy is known as the vessel day scheme (VDS) and came into force on 1 December 2007 (this will be expanded on later). This recently implemented strategy may have consequences for Nauru's national income in lieu of its current economic situation.

1.2.2 Goals

This study will specifically attempt to:

- Identify the region, the tuna resources and their value, the regional institutions for tuna management and the current access fee arrangements for the Pacific Island countries
- Assess the nature of the vessel day scheme (VDS) and its implications to bilateral arrangements
- The El Niño Southern-Oscillation (ENSO) events and their implications for the distribution of revenues from the VDS among the PNA states
- Access fees and their contribution to national income for the PNA states and other tuna-derived benefits
- Current options for implementing the VDS
- Proposal for a complementary side-payment scheme with the VDS called VDS-s with a fixed share and a 5-year moving average
- The VDS-s and its implications for Nauru
- Provide recommendations

2 TUNA MANAGEMENT IN THE WESTERN CENTRAL PACIFIC OCEAN

This section identifies the Western Central Pacific Ocean (WCPO) region and the significance of its tuna resources as well as the current institutional bodies that are responsible for managing tuna fisheries in the region. The tuna management strategies and arrangements for the Pacific Island countries (PICs) have been significant in shaping the regional cooperative management regime.

2.1 The Western Central Pacific Ocean (WCPO) region

The WCPO region has been identified by the geographical boundaries of 150° meridian of west longitude (WCPFC 2007). The region is discussed in relation to the regional tuna catches. This region includes the combined zones of the Pacific Island countries, the Pacific Ocean waters of Indonesia, Philippines, Japan, USA (Hawaii and western Pacific territories) and considerable areas of international waters (Figure 3). The tuna species that occur in the region are the same stocks that occur in the EEZs of PICs (Gillet 2004).

2.1.1 *The significance of the tuna resources in the region*

The tropical tuna catches in the WCPO region comprise 47% of the world catches compared to the Indian Ocean, Eastern Pacific Ocean and Atlantic Ocean regions that comprised 26%, 19% and 8% respectively in 2005 (Figure 4). The WCPO region increased its catches in the early 1970s and since they have increased by 4-fold. The increased tuna catches have been attributed to the increase in the use of purse seine gears and the skipjack species is responsible for most of the increase (Gillet 2004). The issue that raises concern with tuna fisheries in the region is the sustainability of the tuna catches.

The value of the tunas in the region was estimated in 1999 to be US \$60 million in access fees, 25,000 jobs, expenditures approaching US \$130 million and substantial miscellaneous benefits (Gillet *et al.* 2001). The estimated (delivered) value of the purse seine tuna catch in the WCPO area for 2006 is US\$ 1,583 million the highest level since at least 1995 and this represents an increase of US \$82 million or 5% of the estimated (delivered) value of the catch in 2005. The increase was driven by an 8% increase in the value of the skipjack catch (Gillet 2007).

2.2 Overview of the institutional framework in managing the tuna resources

There are three main bodies that are responsible for the management of tuna catches in the WCPO region:

- The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western Central Pacific Ocean (Tuna Convention)
- The Secretariat of the Pacific Community-Oceanic Fisheries Programme (Scientific Commission) and
- The Forum Fisheries Agency (FFA)

2.2.1 *The Tuna Convention and its governance frameworks*

The Tuna Convention in the WCPO (Figure 4) was established in 2004 and its centrepiece governance framework is that of the 1982 United Nations Convention on the Law of the Sea (LOS). The LOS recognises the general principles for the conservation, optimum utilisation and management of the world's ocean and seas and its resources (Macguire *et al.* 2006). The Convention is mandated as a regulatory body

for all the member states² in the region and is responsible for management of the high seas and its living resources.

² As of December 2005, 28 states, territories or entities had become members under the Convention: Australia, Canada, China, Chinese Taipei (Taiwan), Cook Islands, European Community, France, Fiji, Federated States of Micronesia, French Polynesia, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, and Wallis and Futuna

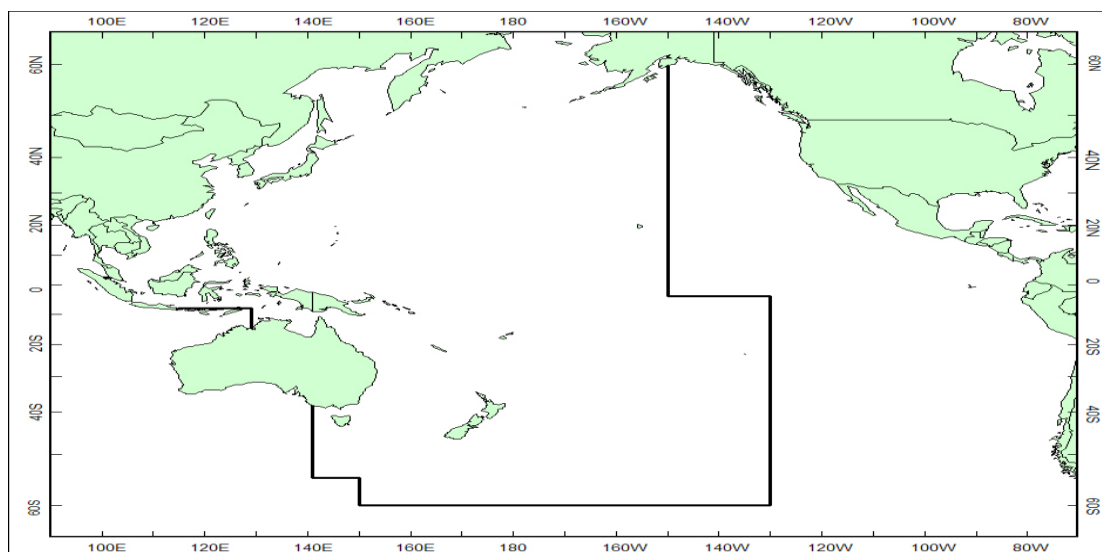


Figure 3: Map of the Western Central Pacific Ocean (WCPO) and Conventional Statistical Area (CSA) (SPC 2006)

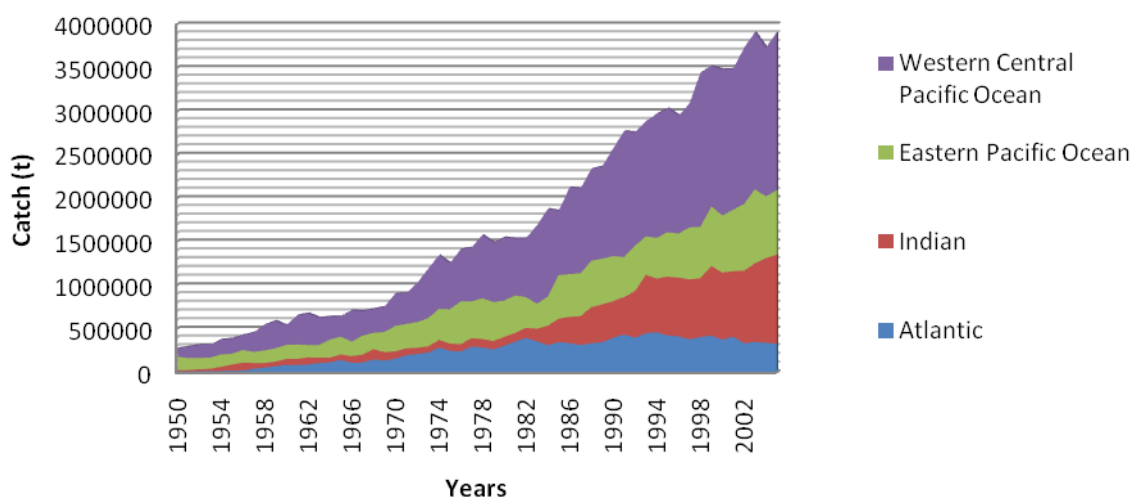


Figure 4: Tuna catches (tonnes) in the world's oceans by regions from 1950 to 2005 (FAO 2007)

The 1995 Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks or Fish Stocks Agreement (FSA) as it is commonly called was developed to supplement the existing framework of the LOS due to problems of sustainability in fisheries (Hoel and Kvalvik 2006). The FSA is limited to a fraction of the global fish catch and contains high value fisheries including the tropical tunas. The FSA directly measures national management and simultaneously provides guidelines for specialised regional agreements (Kimball 2001). The tunas are identified under the LOS and FSA framework as a transboundary fish stock.

The Tuna Convention, the area and its governance frameworks provide the scope of tuna management that is found in all oceans due to its global nature. The distribution of the tropical tunas is identified by the annual catches by all gears (Figure 5). The dark shaded areas identify the concentrated catches of the tropical tunas in the

equatorial zones with an annual catch higher than 880 tonnes. The lightly shaded areas average annual catches are from 177 to 880 tonnes and the lightest shaded areas represent catches that are less than 177 tonnes. The catches are highly concentrated in the equatorial zones of the WCPO region, the Eastern Pacific Ocean region, the Eastern Atlantic Ocean and the Western Indian Ocean.

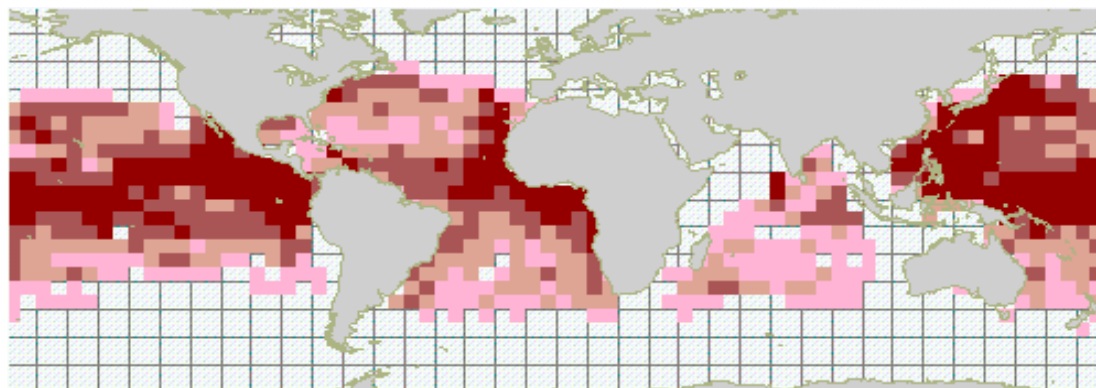
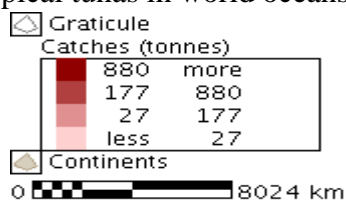


Figure 5: Distribution of tropical tunas in world oceans by all gears (FAO 2008)



Since tunas are global in nature recognition has been given to Regional Fisheries Management Organizations (RFMOs) for their management. The Tuna Convention addresses the prevalent issues of uncontrolled fishing in the high seas. A guiding principle for fisheries management is the non-binding 1995 Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries (the Code). The Code established principles for management in the absence of scientific research and recommendations and it applies to all fisheries within and beyond national jurisdiction.

The Code is complemented by the 1993 FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Kimball 2001). Since the development of the above, the following series of FAO International Plan of Actions (IPOAs) on the by-catch (seabirds, sharks), the over-capacity problem, and the illegal, unregulated and unreported (IUU) fishing (Hoel and Kvalvik 2006). The Tuna Convention in the WCPO region has adopted conservation and management measures for the bigeye and yellowfin tuna, northern and southern albacore tuna, and resolutions regarding fishing capacity and by-catch of non-target species, seabirds, and sea turtles under these guidelines (WCPFC 2007).

2.2.2 Regional framework for tuna management for the Pacific Island countries

Secretariat of the Pacific Community (Scientific Commission)

The Scientific Commission plays a key and mandatory role with its statistical programs and projects for the tunas in the WCPO region. Since the establishment of the Tuna Convention the Scientific Commission has extended its statistical responsibilities to cover the whole Convention Statistical Area (CSA) and its statistical area for the Pacific Island countries (PICs) (Figure 3). The Scientific

Commission has published annual stock assessment reports and has conducted research programs such as the tuna tagging projects in the region. The Scientific Commission aims to assist the PICs to make well-informed decisions and policies based on sound scientific research with its tuna management.

Forum Fisheries Agency (FFA)

The FFA is a regional institution that was established in 1979 under the South Pacific Forum for its 17 members³ where 16 are independent states and one territory state (Figure 6). FFA's mandate is to enable its members to manage, conserve and use the tuna resources in their Exclusive Economic Zones (EEZ) and beyond, through enhancing national capacity and strengthening regional solidarity (FFA 2008). The FFA is tasked as an administrative and advisory body for economic developments in tuna development and management. The FFA works along with other international and regional agencies in the Pacific region and the other key institutions with respect to regional tuna management, i.e. the Tuna Convention and the Scientific Commission.

2.3 The cooperative management regime

The PICs as members of FFA have developed a unique cooperative management regime over time for the management of the tuna species. The tuna stocks that are found in the PIC waters are the albacore, bigeye, yellowfin and skipjack tunas (Figure 6). Since the advent of the EEZs, the PICs were given jurisdiction over vast water areas and lacked the capacity to manage their own waters (Arnason and Bjorndal 1991) which was the underlying principle for the establishment of the FFA.

The FFA has been instrumental in developing regional monitoring, surveillance and enforcement (MCS) measures in assistance to the PICs. The large ocean areas and the vast spread of the PICs and limited capacity to monitor and control their own waters raises contentious issues of effective management. However, the FFA has implemented the use of a vessel monitoring system (VMS) that is interlinked with the states and the fishing vessels. One other arrangement that assists the PICs in the monitoring and surveillance program is the Niue Treaty that recognises the intra-regional cooperation in combating issues of illegal, unregulated and unreported fishing (IUU) and has established provisions for New Zealand to conduct random spot checks (by air) in the PIC waters and report any IUU. The regional MCS systems are not robust but improvements of these are ongoing. There are also observer-coverage programs in the region as part of the monitoring and data collection programme.

Naturally, with the vast ocean resources it bore the establishment of licenses and access fees with the distant water fishing nations (DWFNs) to fish in the respective EEZs. Since the inception of these licenses and access fee arrangements the tuna stocks have been identified to be not equally distributed in the Pacific region (Figure 6) and these are reflected in the current management arrangements (Arnason and Bjorndal 1991). The sub-regional coalition known as the Parties to the Nauru Agreement (PNA) group has been identified to have rich tuna resources (Figure 6).

³ FFA member states are: Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu

2.3.1 Parties to the Nauru Agreement (PNA)

The PNA⁴ group is found in the equatorial zones of 10°N-10°S where a high productivity of tunas is found in their waters (Figure 6) and has given them considerable leverage in negotiations concerning access and management of the tuna resources. It has been identified that access to the EEZs of the PNA group is essential for the operations of the distant water fishing nations (DWFNs) with respect to the purse seine fishery (Tamate 2003).



Figure 6: EEZs of the PNA group in the Pacific Islands region

2.4 Access fee arrangements

The access arrangements developed since the advent of the EEZs have been instrumental in shaping the cooperative management regime of the PICs. The overall level of access revenue appears to have risen since 1999, from US \$60.2 to US \$68 million and these do not include supplementary payments, nor aid-in-kind associated with several DWFN access agreements. The purse seine fishing provides the majority of access revenues, about 79% in 1999 to 2003 (Gloerfelt-Tarp 2003).

2.4.1 United States (US) Multilateral Treaty

The United States (US) Treaty is an access fee shared by the PICs and this arrangement is conducted regionally where the US vessels have the right to access the EEZs of the PICs. The US Treaty has contributed much to the success of the cooperative management in using a side-payment scheme (Arnason and Bjorndal 1991) but does not remove the open-access issue of the fishery.

⁴ PNA member countries consists of eight Pacific Island countries (PICs) and these are Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Papua New Guinea, Palau, Solomon Islands and Tuvalu

The US Treaty revenue is fixed at US \$21 million where US \$18 million and US \$3 million are paid by the US government and its fishing industry respectively on an annual basis. Each year the fees are apportioned as follows:

1. FFA administration costs at US \$0.5 million
2. The project development fund (PDF) has US \$3 million that is shared equally between the 16 members and accounts for 15% of the revenues
3. The remaining 85% of the revenues are shared according to the catches in the respective waters of the PNA group (Table 2). Due to confidentiality the apportioned estimates are not specifically identified to the individual member PNA states.

Table 1: US Multilateral Treaty apportioned revenues (Jimwereiy pers. comm. 2007)

PNA states	Apportioned estimate
Highest earning group	US \$7m
Middle earning group	US \$2m
Low earning group	US \$0.5-1.0m
Lowest earning group	US \$0-0.5m

2.4.2 Federated States of Micronesia (FSM) arrangement

The US Treaty assisted the framework for the Federated States of Micronesia (FSM) arrangement and this is for the PNA group with the exception of Tuvalu who is an observer in this arrangement. This is a grant for preferential access to vessels of the parties to encourage domestic participation (Joseph *et al.* 2001). This arrangement attracts domestication of tuna operations for the purse seine vessels. The FSM arrangement permits purse seine vessels and members pay one access fee to fish in the PNA waters.

The national governments are known to heavily subsidise the regional tuna fishing fleets entering into this competitive fishery and some have undertaken joint ventures with a partner (most cases DWFNs) and operate under this arrangement. Economic theory has identified that the effect of subsidies and lower costs of fishing will lead to higher effort levels and greater depletion of stocks (Clark 2006).

The revenues for the FSM arrangement varies according to the number of vessels licensed in the year and is given as follows:

Revenues earned were approximately US \$7 million and this is apportioned to catch levels and is based on 5% of the value of the catch.

Table 2: FSM arrangement apportioned revenue (Jimwereiy pers.comm. 2007)

PNA states	Value of catch
High earners	US \$2 m
Middle earners	US \$0.5-1m
Low earners	US \$0-1m

2.4.3 Palau arrangement

The Palau arrangement was established to limit the number of purse seine vessels operating in the PNA waters. In 1990 a provisional limit was set at 164 purse seine vessels to enter the waters and this progressively increased due to the demand of the member states and in 1993 the current vessel effort was increased and remained at 205 (Joseph *et al.* 2001). This arrangement included the limit of vessel numbers in the adjacent high seas in the region but there was no support from the fishing countries (Moron 2002).

2.4.4 Bilateral agreements

The bilateral agreements are nationally negotiated by the individual PIC states with the DWFNs to access their respective EEZs. The revenues earned from this fishing access are usually attained at 5-6% of the valued catches in the respective waters of the PIC. The PICs can request assistance from FFA to provide briefings as mentioned earlier with these negotiations. However, access to the waters is based on the national preference of individual states (political in nature). The purse seine gears are subject to a maximum effort capacity of 205 vessels with the Palau arrangement. The bilateral agreement has recently changed and is replaced by the newly introduced vessel day scheme (VDS).

2.5 Vessel day scheme (VDS) replacing the bilateral agreements

The purpose of the VDS replacing the bilateral agreements is to ensure the reduction of by-catch or non-target tuna species in the purse seine gears. The by-catch/non-target species are the yellowfin and bigeye tunas. The purse seine gears are responsible for most of the juvenile catches of these by-catch/non-target species in the region. Therefore, the aim of the regional institutions (Scientific Commission and FFA) was to develop a scheme with the objective of conservation of the by-catch/non-target species and enhance the opportunities for the states to maximise economic rents in the fishery.

The VDS is an input control measure that limits the level of effort of purse seine fleets through the allocation of days at sea. The PNA waters where much of the purse seine fishery is undertaken are allocated days based on historical catches in their respective waters (Table 3). The objectives and strategies of the VDS are as follows:

- To ensure the biological sustainability of the world's largest and most valuable exploited tuna stocks in the Western Central Pacific Ocean
- To limit the total number of fishing days for purse seine fishing vessels fishing in PNA member countries EEZs in the Western Central Pacific Ocean region (WCPO) to the Total Allowable Effort (TAE)
- The TAE is determined and reviewed annually by the PNA
- The FFA VMS will be used to monitor and record the purse seine vessel position reports in the WCPO from which the VDS will compute the number of fishing days for each purse seine vessel/fishing fleet in the PNA members EEZs
- Non-compliance by vessels to the FFA VMS requirements may render the vessels' licences withdrawn by the PNA

Table 3: Total Allowable Effort (TAE) in the PNA states (FFA 2008).

PNA states	TAE in days
Federated States of Micronesia (FSM)	6,253
Kiribati	6,194
Marshall Islands (RMI)	2,722
Nauru	1,452
Papua New Guinea	7,907
Palau	595
Solomon Islands	2,361
Tuvalu	979
TOTAL ALLOWABLE EFFORT (TAE)IN DAYS	28,469

The VDS is imposed on the bilateral arrangements for the PNA states targeting the purse seine fishery. The VDS is run on a three year rolling basis (Joseph *et al.* 2001) and is set after the three year period. The current US Multilateral Treaty and FSM arrangement are exempted from this management strategy except for the latter to a certain extent as explained in the following.

The FSM arrangement does have a minimum degree of the VDS if it is where country A fishes in its own waters it constitutes as a day under the VDS but if country A fishes in country B's waters it is not accounted for under the VDS. It may be complex but the VDS does constitute a form of property rights. The Palau arrangement still maintains the maximum number of vessels to 205. The management of the tuna stocks in the WCPO region, the institutions, the access fee arrangements and the VDS (Figure 7) play a key role in the development of changing fisheries management.

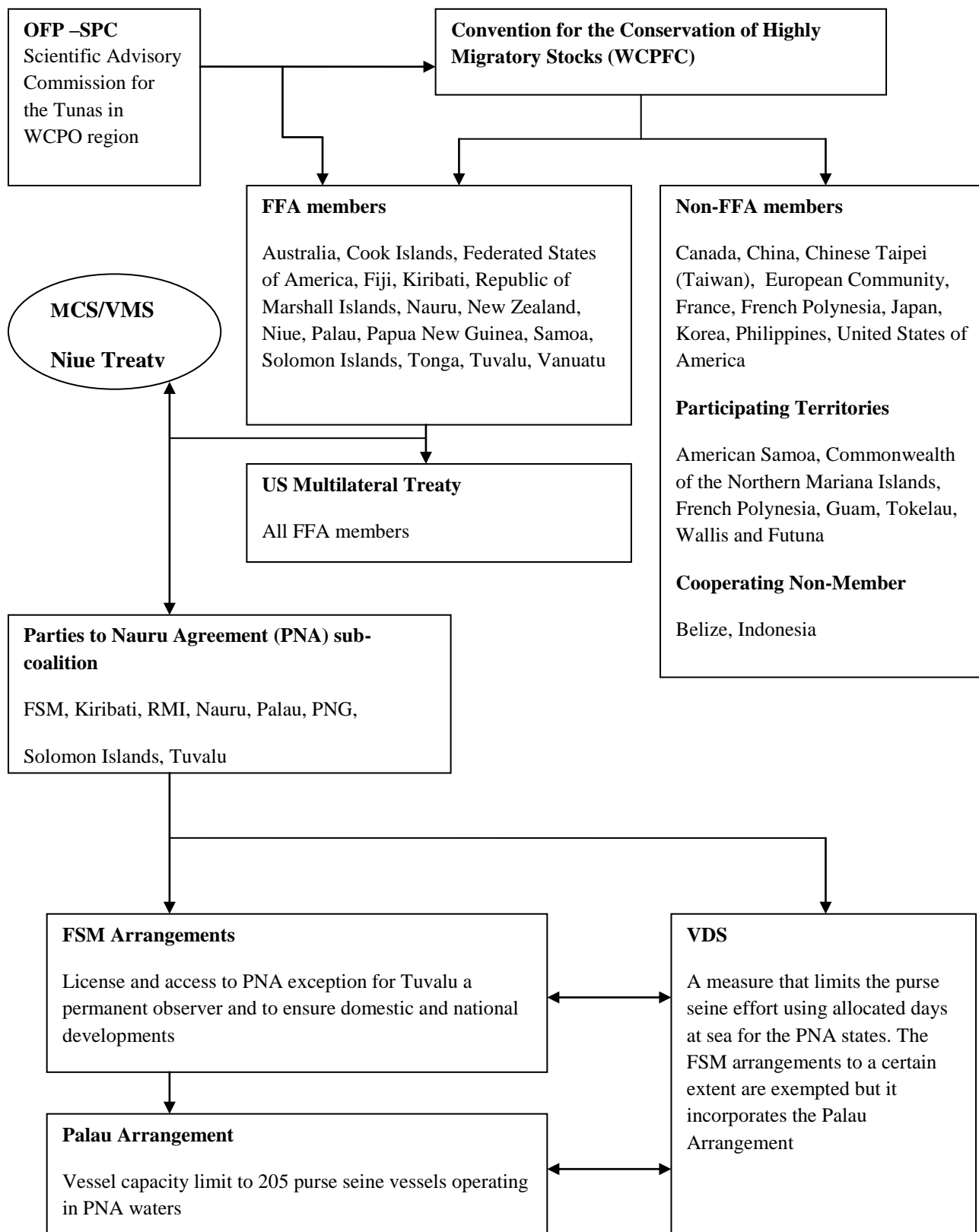


Figure 7: The WCPO region, its institutions and arrangements

3 THE VDS AND ITS IMPLICATIONS FOR PNA STATES

This section will highlight the concerns and issues of the PNA states with the implementation of the VDS strategy. The success of the cooperative management has largely been attributed to the US Treaty arrangement that has been instrumental in leading for example further cooperative arrangements within this coalition. Since the introduction of the Palau arrangement and now the recent VDS measures that the PNA states have undertaken, in essence, to ensure the sustainability of their tuna stocks. This VDS strategy is considered with the significant impacts of the El Niño-Southern Oscillations (ENSO) events for the tropical tunas in the region.

3.1 El Niño-Southern Oscillations (ENSO)

The El Niño-Southern Oscillations (ENSO) is a global coupled ocean-atmosphere phenomenon in the Pacific Ocean (Wikipedia 2008). ENSO is linked to climatic changes in prominent normal weather features. The impact of the ENSO events (in the Pacific) affects the ecosystem dynamics in the equatorial and subtropical Pacific by considerable warming of the upper ocean layer, rising of the thermocline in the western Pacific and lowering in the east, strong variations in the intensity of ocean currents, low trade winds with frequent westerly's, high precipitation at the dateline and drought in the western Pacific (McPhaden and Picaut 1990). During an El Niño event rainfall increases over a distance of several thousand kilometres along the equator from the central to the eastern Pacific in response to the warming of the underlying sea surface temperatures (NOAA-CIRES 2008) where the warm equatorial waters at 25-29°C in the western part of the Pacific Islands expand towards Latin America (Gillet 2004) (Figure 8). During a La Niña the opposite effects occur (Figure 9) (NOAA-CIRES 2008) where the surface temperatures at 25-29°C of warm water are restricted to the western equatorial area (Figure 9). One of the most significant influences in the region is the impact of these ENSO events on the purse seine catch distribution of the tuna stocks (Langley *et al.* 2005).

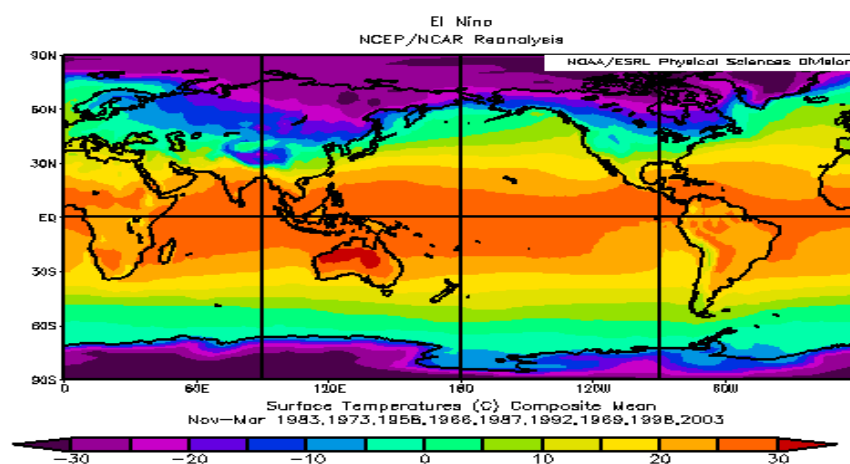


Figure 8: Effects of the ENSO events: surface temperatures during an El Niño event (NOAA-CIRES 2008)

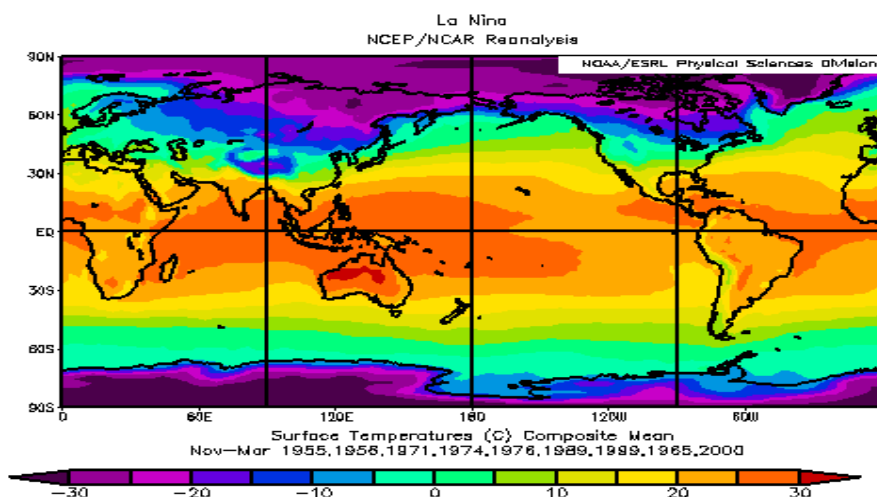


Figure 9: Surface temperatures during a La Niña event (NOAA-CIRES, 2008)

3.2 The effects of ENSO

The catch distribution in tropical areas of the WCPO region is highly influenced by ENSO events (Williams and Reid 2005). The Multivariate ENSO Index (MEI) on the six main observed variables over the tropical Pacific. These six variables are: sea-level pressure (P), zonal (U) and meridional (V) components of the surface wind, sea surface temperature (S), surface air temperature (A), and total cloudiness fraction of the sky (C) (Wolter 1987). The negative values of the MEI represent the cold ENSO phase, La Niña, while positive MEI values represent the warm ENSO phase (El Niño) (Figure 10). This ENSO index graph is used as a comparative indicator on the tuna catches in the region for the parties to the Nauru Agreement (PNA) waters and reflects the ENSO effects. These ENSO events have been recorded since the 1950s (Figure 10) and these events illustrate the high probability that these events are occurring and will recur (cyclic or acyclic) forming a natural part of the environment and its ecosystem.

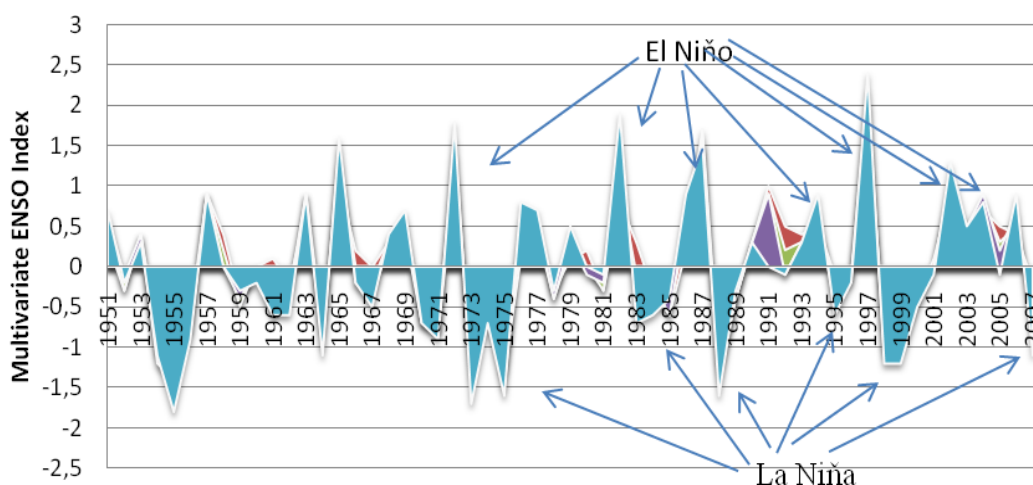


Figure 10: Historical data on the ENSO events (NOAA 2007)

3.2.1 *Distribution of tunas in PNA waters*

The purse seine tuna catches in the eastern-lying states of Kiribati, Nauru, Tuvalu and Marshall Islands (Figure 11) are reflective of the El Niño events. The El Niño events are identified for the years of 1997-8, 2002 and towards the end of 2004 and early 2005 (Figure 10). Marshall Islands and Tuvalu tuna catches were high during the El Niño event in 1998 (Figure 12). The tuna catches for these states fluctuate distinctly in 2002 and 2003 between the El Niño and La Niña events. Kiribati catches in its EEZ peaked at over 300,000 tonnes, Nauru's catches increased to about 100,000 tonnes in 2002. During the La Niña event in 2003, all the eastern-lying states (Figure 11) catches dramatically decreased to 80,000 and 19,000 tonnes for Kiribati and Nauru respectively (Figure 12). Both Tuvalu and Marshall Islands catches declined to about 4,000 tonnes in 2003. In the following years of 2004 to 2005 it has been identified that the La Niña event changed to an El Niño event at the end of 2004 (SPC 2005). The catches increased in the waters for all the states in the eastern-lying states (Figure 12).

The La Niña events have the opposite effect to the El Niño which can be shown in its impact on the western-lying states (Figure 10) among the PNA coalition (Figure 11). During the El Niño event of 1998, the Solomon Islands increased its catches from 37,000 to 140,000 tonnes in 1997 to 1998 (Figure 13). It seems contrary to the argument, however, one should look at the geographical position of this state with respect to its EEZs and identify that this state is not as vulnerable to the ENSO events as the eastern-lying counterparts previously studied (Figure 11). During the La Niña event of 1999, the Federated States of Micronesia (FSM) had increased catches in its waters from 79,000 to 179,000 tonnes (Figure 13). During these El Niño and La Niña shift, Papua New Guinea (PNG) catches remained stable at about 150,000 tonnes but in 2000 the catches in its waters increased to around 280,000 tonnes. The El Niño in 2001 and 2002 marked a decline for all the western-lying states and their catches declined (Figure 13).

PNG its catches decreased to about 160,000 tonnes, FSM to 60,000 tonnes, Solomon Islands from 27,000 to 8,000 tonnes in its waters which is dramatic (Figure 13). After the La Niña event in 2003, all the catches in these states increased; PNG catches peaked at almost 400,000 tonnes, FSM at about 200,000 tonnes, Solomon Islands at 50,000 tonnes in their respective waters. In 2004 and 2005 although experiencing a change from La Niña to El Niño events, the three states' catches declined but overall the catches were constant in their waters (Figure 13).

It has to be noted that Palau was included in the western-lying states (Figure 11) but the comparison of its catches to that of PNG could not be highlighted due to the small catches in its waters (Figure 13). It is valid to know that during the El Niño events of 1998, 2001 and 2002 there were no recorded catches in Palau's waters and it can be assumed that there were no catches. During the La Niña events, Palau's highest catches in 2003 and 2004 were 3,000 to 4,000 tonnes (Figure 13).

The impact of the ENSO events does play a significant role in the region to the distribution and abundance of the catches in the respective waters of the PNA states either they are eastern or western lying islands (Figure 11).

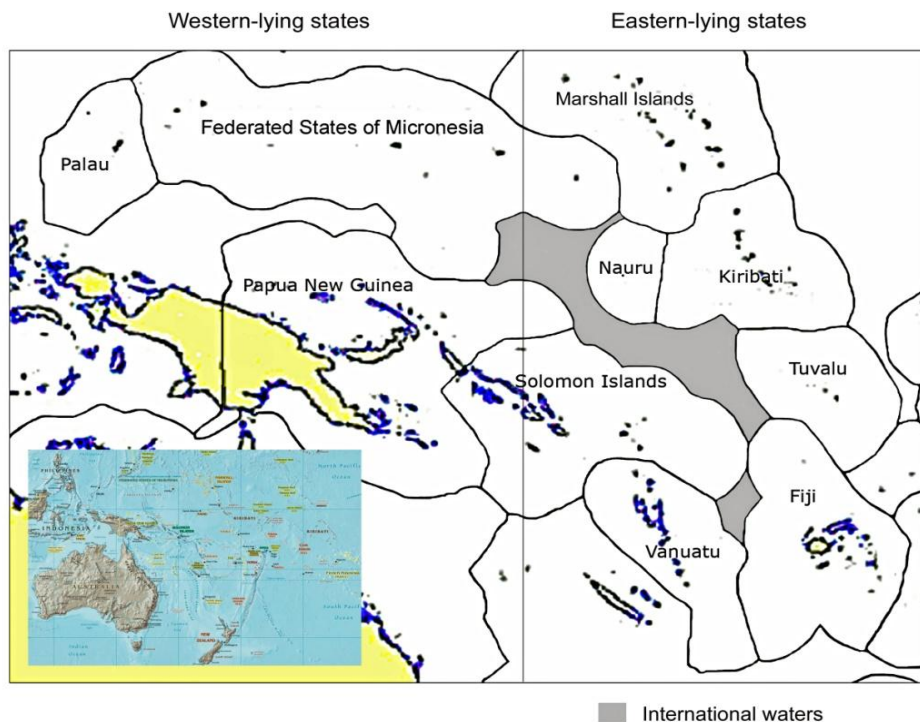


Figure 11: Map of PNA states and their EEZs divided in a west to east location (Adapted from FAO 2007)

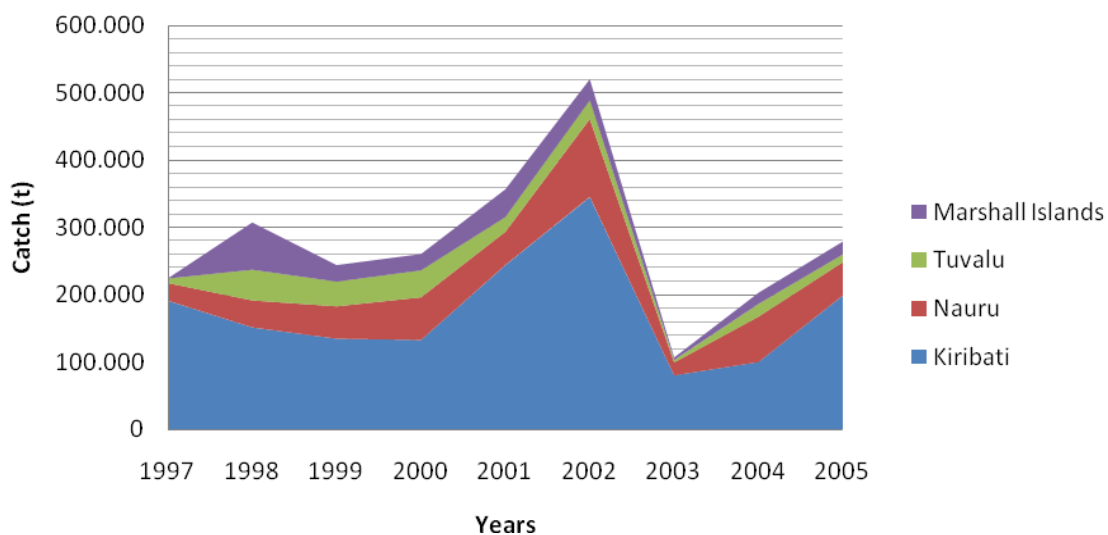


Figure 12: Eastern-lying PNA states' purse-seine gear/catch in tonnes (FFA 2008).

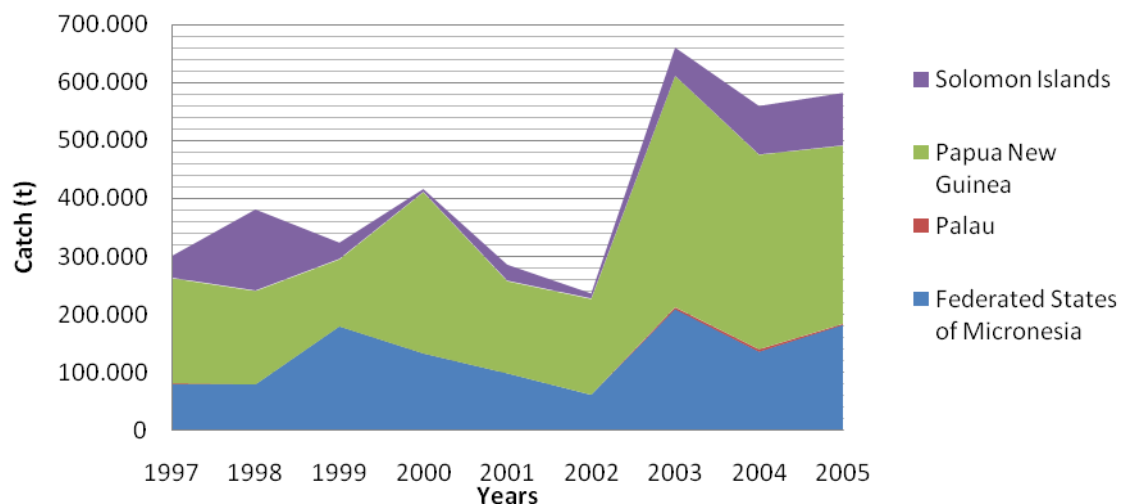


Figure 13: Western-lying PNA states' purse-seine gear/catch in tonnes (FFA 2008).

3.2.2 The VDS to the ENSO events

The application of the VDS with the variable ENSO conditions may have a marked effect on the value of the fishing days for each respective state. For example, if a fisher purchased the fishing days to fish in either respective waters of the PNA group, the fisher will most likely check the seasonal forecast for either an El Niño or a La Niña event before purchasing. Then the fisher will purchase these fishing days in the respective states that are indicative to either event and favourable at the time. This then becomes a risk for states that are significantly impacted by these ENSO events and are highly dependent on the access fees as revenues as in the case of Nauru.

3.3 Access fees contributions to national income

As stated, the vessel day scheme (VDS) is the new management strategy that replaces the bilateral agreements with the purse seine gears in this sub-coalition known as the PNA group. Nauru's case with implementing the VDS raises the conflicting issues of its economic situation and its vulnerability to the ENSO events in the region. The other PNA states under this arrangement are considered in this study to fully understand the implications of the VDS. This section will particularly look at the situations of the other member states within this coalition and to identify the risks involved in the VDS.

The significance of access fees contribution to both the national income and/or its gross domestic product (GDP) is used as an indicator for each of the following states (Table 4). Most of the PNA states in general are highly dependent on these access fees and their contribution to the GDP. These states include those of FSM, Kiribati, Marshall Islands, Nauru and Tuvalu, where the access fees contributing to its national income or GDP range from about 20 to 50%. Solomon Islands access fees contribute more or less about 10% to its GDP. Palau's access fees contribute about 4% to 34% given to its individual national (16) states by its government which is considerably small compared to the others in the coalition. Palau is known for its lucrative tourism industry. PNG its access fees to its GDP is 2% which is relatively small compared to the other states in the coalition. It should be noted that PNG is the largest state in this coalition and is richly endowed with natural resources. It has rich mining and

agriculture sectors where the other smaller states in this coalition have limited to no natural resources other than their fisheries.

Table 4: Contribution of access fees to GDP of the PNA members (Gillet *et al.* 2001 and FIAS 2000)

PNA states	Access fees to GDP (%)
Federated States of Micronesia (FSM)	25 (2002)
Kiribati	45 (2002)
Marshall Islands	25 (2002)
Nauru	38 (2006) ⁵
Papua New Guinea (PNG)	2 (2000)
Palau	4% of 34% (for its 16 states)(2002)
Solomon Islands	± 10 (2000)
Tuvalu	30-50 (2000)

3.3.1 Other tuna derived benefits

It has been established that these license and access fees are of high economic significance to the states. Further to this it is important to note that the VDS targets the purse seine (PS) gears, and that there are other gears in this fishery, therefore it is best to examine the national developments for the PNA states. The other gears in the tuna fishery that contribute to these license and access fees for each of the coastal states are the foreign vessels using the purse seine (PS), longline (LL) and pole and line gears (P&L) (Table 5). This literally means that the foreign purse seine (PS) vessels are under control measures and those gears (as listed) are currently not under any control measures in the region. The VDS is subject to control the purse seine gears and this illustrates the fact that other states in the coalition have other means to derive benefits from its tuna resources unlike that of Nauru.

The domestic or locally based vessels are the responsibilities of each respective state and it is necessary to emphasise that the states in this coalition have other means to maximise their domestic tuna operations. This argument to controlling the purse seine gears is founded by its contribution of about 55-60% of the tuna catches in the region (SPC 2005).

The coastal states' benefits from the tuna resources include national employment in the tuna cannery and tuna loining plants for the FSM, Marshall Islands, Palau, PNG and Solomon Islands. In most of the PNA states transshipment fees are exercised with the access fees with the exception of Nauru (lacking in port facilities).

Therefore, the VDS in replacing the current bilateral agreement are a considerable risk for much of the narrow-based economies and smaller island states in this coalition. The variable ENSO events in the region may dominate fishers' purchasing preferences over time in this scheme. The next section will provide options with respect to the VDS that these coastal states should consider. However, the options provided are in the context of Nauru's case.

⁵ Nauru's access fees to national revenues (%) but not to its GDP provided in the introduction of the paper and source

Table 5: Tuna-derived benefit for the PNA states (Adapted from Lewis 2005)

PNA countries	Foreign vessel gears	Domestic and locally-based vessels	Derived benefits from tunas
FSM	PS, LL, P&L	LL, PS	Export, licensing, employment, transshipments
Kiribati	PS, LL, P&L	PS	Licensing, transshipment
Marshall	PS, LL, P&L	PS, LL	Tuna loining plant, licensing, transshipment, employment
Nauru	PS	LL	Licensing
Palau	PS, LL	LL	Export, licensing
PNG	PS	PS, LL	Licensing, tuna cannery, transshipment, employment
Solomon Islands	PS, LL, P&L	PS, LL, P&L	Tuna cannery, tuna loining plant, transshipment, export, employment
Tuvalu	PS, LL, P&L	LL	Licensing, transshipment, employment

4 VDS AND ITS IMPLEMENTATION

This section will attempt to provide the various current options that the states in the region can choose to undertake to implement the VDS. The VDS strategy replaces the bilateral agreements for the purse seine gears from the license and access fees to fishing days with the maximum regional capacity effort of 205 vessels. The value of the fishing days for each member is determined by the value for its alternative use. It has been identified that there are a number of alternative uses for a fishing days (Reid 2006).

1. Allocate to domestic fishery
2. Sell to DWFN
3. Sell to other PNA
4. Sell to others (Conservation Trust)
5. Use in another year
6. Don't use or sell

Recognising the value of the fishing days to the states, it has been identified then that most of these states will presumably be selling these fishing days. The Asian Development Bank (ADB) identified that the VDS strategy and its benefits from access agreements will not be equitably distributed and the potential to benefit a large function of geographical location, size and productivity of individual EEZs (Lewis 2003).

4.1 Free riding

Free riding is identified as the case where coastal states sharing a transboundary stock might stay out of the cooperative arrangement and 'free ride' on the fruits of the cooperative endeavours of its neighbouring coastal states (Munro *et al.* 2004). This idea stems from Nash's theory of cooperative games where this can be seen as a theory of bargaining. This free riding behaviour often results in the failure of having effective management arrangements to protect the shared stocks and its outcome is usually negative to control overfishing and overexploitation of the stocks. The game theory states that when the states have identical management goals they will institute a

management strategy that will maximise global economic returns from the fishery over time and thus bargain over the division of the returns (Munro *et al.* 2004) (similar to the US Treaty arrangement).

4.2 Auctioning the days

The auctioning of the days method has been recognised by coastal states as a favourable option. The strategy is founded on the economic theory of scarcity whereby the allocated fishing days are scarce then the demand is high and increases the value of the fishing days. There are three methods that have been identified with this option:

1. Sell the fishing days based on a minimum value (benchmark)

This means that the states simply calculate their previous year catches (or annual income) and divide this by the current number of its bilateral licensed vessels and use this figure as a benchmark to sell its days.

2. Sell the fishing days to the highest bidder

The idea is to auction the fishing days through online services or other means where the fishers are assumed to outbid each other to purchase the fishing days.

3. Other alternatives to selling is leasing or renting the fishing days

The study does not focus on either of these methods. It suffices to say that with the selling of the days, the fear with auctioning is that the best price on the day may not be the best over time (ADB 2005). Regarding the last method, it has been found that fishers who rent or lease their days are not favourable to any conservation measures in the fishery (Clark 2006). This means that fishers renting or leasing the fishing days tend to maximise on their available fishing days without regard to the stocks as these fishing days lack a sense of ownership and thus relegate the fishers' responsibilities to conserving the stocks.

4.3 VDS and the flag states

The next option is the side-payment scheme with the VDS that is identified in this study which is the vessel day side scheme (VDS-s). A side-payment, in its simplest form, is a type of transfer, where the term transfer is defined broadly and can be in monetary form or non-monetary form. It has been seen that side-payments can mitigate some difficulties arising from coastal states having differing resource management goals (Munro *et al.* 2004).

At this point, the study will use the process of elimination with respect to the fisher and management arrangements (multi-lateral, regional and bilateral) in the region. This method would allow the elimination of all the United States (US) vessels and the domestically licensed (FSM arrangement) vessels. The elimination process thereby has identified those flag states that were formerly under the respective bilateral agreements and are subject to the recently implemented VDS strategy (Figure 14).

The flag states⁶ and their respective catches under the bilateral agreements (Figure 12) are Taiwan and Korea responsible for 30-40% of the catches (within the bilateral arrangements). Japan has been responsible for catches of about 10-20% and the Philippines of about 5-8% (fish in PNG waters only). China entered the fishery in 2001 and has since increased its catches to about 6%. Vanuatu has increased its catches considerably from 2-10% in 2005. New Zealand shows steady catches throughout the years of about 2-3%. Australia and Spain also fish in the area but their respective catches are small compared to the rest of the flag states in this arrangement, ranging from 0-1%.

The flag states that are responsible for catches over 50,000 to 300,000 tonnes annually are Taiwan, Korea and Japan (Figure 14). The data (Appendix I) used is the gross value per day fished in the PNA waters for the following fleets Japan, Korean and Taiwan (Reid 2006). The analysis of this study will build upon this work (Appendix I) and develop a side-payment scheme for the PNA states with respect to the flag states. It is noted that these flag states do not fish in all the PNA states. It would be difficult for this study to analyse all the flag states at this time; however, an attempt is warranted to provide a case example to improve the VDS.

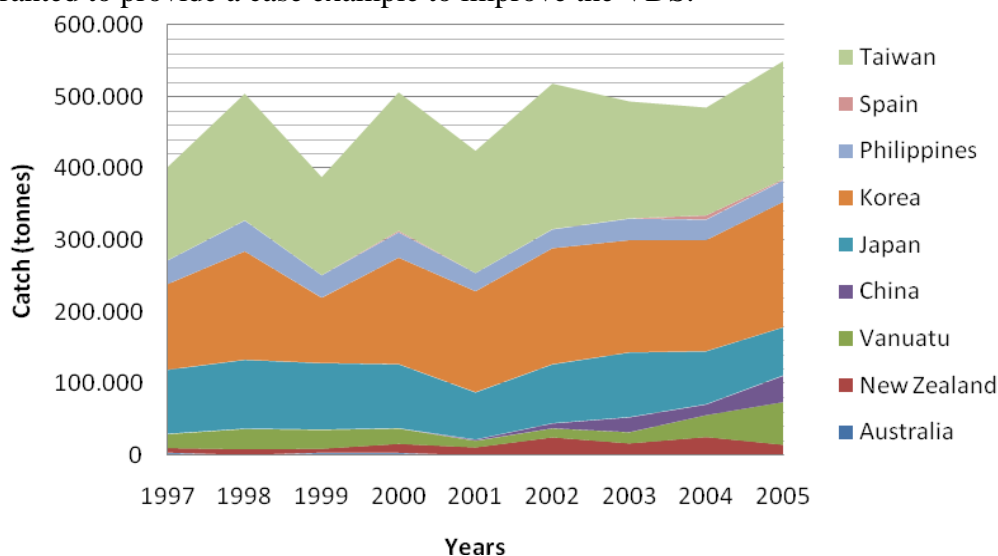


Figure 14: Flag states (purse-seine gear) catch (tonnes) under bilateral agreements (FFA 2008).

4.3.1 Japan

Japanese fleets landed catches under the former bilateral agreement (license and access fees) which are valued at 5%. The data (Appendix I) estimated gross value of catch per day fished (CPUE from the Scientific Commission) with respect to tuna market prices (from Thailand imports and Japan market). All values expressed are used in terms of USD unless specified otherwise.

The states that have current bilateral agreements with Japan are included in this analysis with the exception of Papua New Guinea (PNG) in this coalition (Figure 15). PNG has no fishing agreements with Japan. It has been previously established that

⁶ Flag states subject to the VDS are identified as Taiwan, Spain, Philippines, Korea, Japan, China, Vanuatu, New Zealand and Australia (purse seine gears) fishing in the PNA waters

catches in the region are highly influenced by the ENSO events. Therefore, the coastal states in the next analysis are in accordance to a west-east location in the region (Figure 11). The value of the fishing days is estimated according to the former license and access fee arrangement that states have been currently receiving from total landed catches that has converted to fishing days (Appendix I).

The states are assumed for the ease of this study as Palau, FSM and Solomon Islands are western-lying states and the rest, i.e. Marshall Islands, Nauru, Tuvalu and Kiribati are eastern-lying states. Hence the western-lying states (Figure 11):

1. Palau (Figure 15): 1997 \$2000/per day fished, 1998 no catches (El Niño), 1999 about \$1000/per day fished, no catches in 2000 to 2002 (El Niño), 2003 to 2005 \$1300/per day fished to \$1000/per day fished and over \$2000/per day fished (La Niña)

2. FSM (Figure 15): although the catches fluctuated it remained above \$1000/per day fished to \$1800/per day fished

3. Solomon Islands (Figure 15): the fluctuations are high, no catches in 1997, 1998 about \$2500/per day fished (El Niño), 1999 about \$3000/per day fished (La Niña), 2000 saw a sharp decline to about \$1700/per day fished, 2001 decline to about \$1400/per day fished, 2002 under \$500/per day fished (El Niño), 2003 increased to about \$900/ per day fished, 2004-5 improved to above \$1000/per day fished (La Niña)

Eastern-lying states (Figure 11):

4. Marshall Islands (Figure 15): 1997-8 from about \$800/per day fished to about \$1800/per day fished (El Niño), 1999-2002 about \$1000/per day fished in those years with slight fluctuations, 2003 a drop to about \$300/per day fished (La Niña), 2004-5 saw an increase from \$800/per day fished to \$1300/ per day fished (El Niño)

5. Nauru (Figure 15): 1997-8 about \$1700/per day fished (El Niño), 1999-00 a drop to about \$1200/per day fished (La Niña), 2001-2 \$1300 to \$1500 per day fished (El Niño), 2003 a dramatic drop to \$700/per day fished (La Niña), 2004-5 an increase from \$900 to \$1200/per day fished

6. Tuvalu (Figure 15): 1997 no data, 1998 about \$1400/per day fished (El Niño), 1999-2001 a gradual decline from \$1200 to \$900/ per day fished (La Niña), 2002 a slight increase to about \$1000/per day fished, 2003 to about \$700/per day fished (La Niña), 2004-5 about \$900/per day fished

7. Kiribati (Figure 15): 1997-8 above \$1500/per day fished (El Niño), 1999 a drop to about \$1200/per day fished (La Niña), 2000-2 above \$1000/per day fished, 2003 a dramatic drop to \$700/ per day fished (La Niña), 2004-5 saw a slight increase to about \$1000/per day fished

The value of the (per) day fished is consistent with the influence of the ENSO events and thus causes annual fluctuations to the revenues (Figure 15). The Japanese fleets under the bilateral agreements clearly reflected the ENSO impacts. It is necessary to

consider the other two major fleets in the arrangements to understand the significance of these fluctuations to the current VDS strategy.

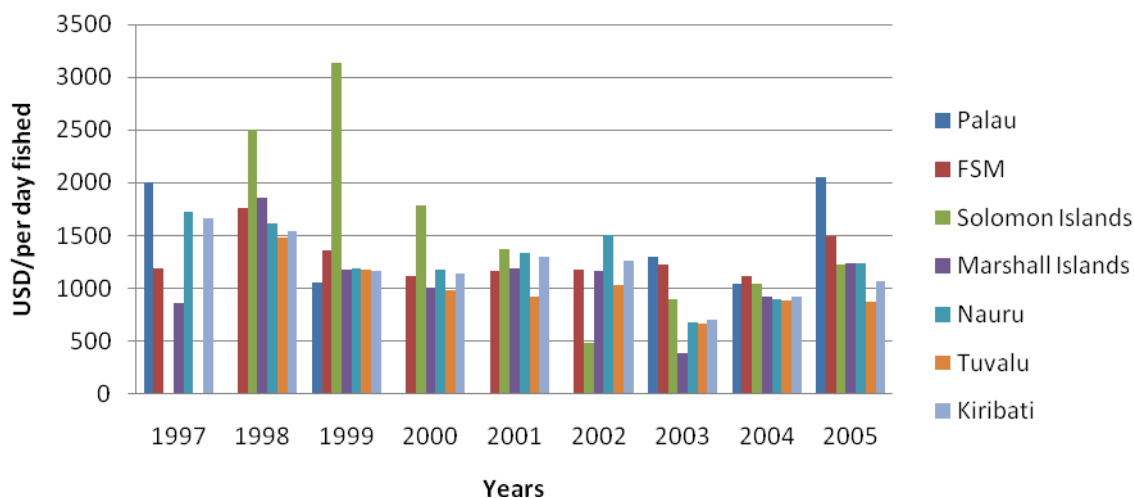


Figure 15: Japan % gross value per day fished in PNA waters (FFA 2008).

4.3.2 Korea

Korean fleets in the region; the value of their catch per day fished is calculated at 6% to its catches. Similar to the Japanese analysis, states are discussed with respect to their west-east lying geographical positions in the region.

Palau and Tuvalu are not listed in the analysis (Appendix I) and it can be assumed that they have no agreements with Korea. The western-lying states (Figure 11) are identified here in the following:

1. FSM (Figure 16): 1997-8 \$1100 to \$1800/ per day fished (El Niño), 1999-2002 a dramatic drop to \$800 to \$700 (La Niña) to \$900- \$1000 per day fished (El Niño), 2003 a slight increase above \$1100/per day fished (La Niña), 2004 a slight decrease to under \$1000/per day fished, 2005 increased to \$1400/per day fished

2. PNG (Figure 16): 1997-8 above \$1500/per day fished, 1999-2002 declined and remained constant at above \$1200/per day fished, 2003-5 a slight increase and remained constant at about \$1500/per day fished

3. Solomon Islands (Figure 16): 1997-8 from \$1200 to \$2000/per days fished a dramatic increase (El Niño), 1999 a dramatic drop to about \$300/per day fished (La Niña), 2000 no fishing, 2001-2 a dramatic increase then drop from \$1300/per day fished to \$800/per day fished (El Niño), 2003- 5 increased from \$1100 to \$1600/per day fished (La Niña)

Eastern-lying states (Figure 11):

4. Marshall Islands (Figure 16): 1997-8 increased from \$1000 to \$2500/per day fished (El Niño), 1999-2000 dramatic drop from previous year to under \$1000/per day fished to about \$600/per day fished (La Niña), 2001-2 increased to above

\$1000/per day fished (El Niño), 2003 dropped significantly to about \$300/per day fished (La Niña), 2004-5 above \$1200/per day fished (El Niño)

5. Nauru (Figure 16): 1997 above \$1200/per day fished, 1998 no fishing, 1999 above \$1000/per days fished (La Niña), 2000-1 constant at above \$1000/per day fished, 2002 dramatic increase to \$1900/per day fished (El Niño), 2003 dropped to under \$500/per day fished (La Niña), 2004-5 at above \$1500/per day fished declined to under \$1000/per day fished

6. Kiribati (Figure 16): 1997-8 from \$1000 to \$2500/per day fished (El Niño), 1999-2000 a dramatic decline from \$900 to \$600/per day fished (La Niña), 2001-2 at above \$1000/per day fished (El Niño), 2003-4 from \$700 to under \$300/per day fished (La Niña), 2005 at \$1900/per day fished

The ENSO events with the west-east analysis conveyed a similar pattern to that of the Japanese fleets. However, in this group, PNG and FSM are much more resilient to the fluctuations that are experienced by other states. Solomon Islands, although categorised under the western-lying states, has a central position which means it is more attuned to the ENSO events as those of the eastern-lying states in this analysis.

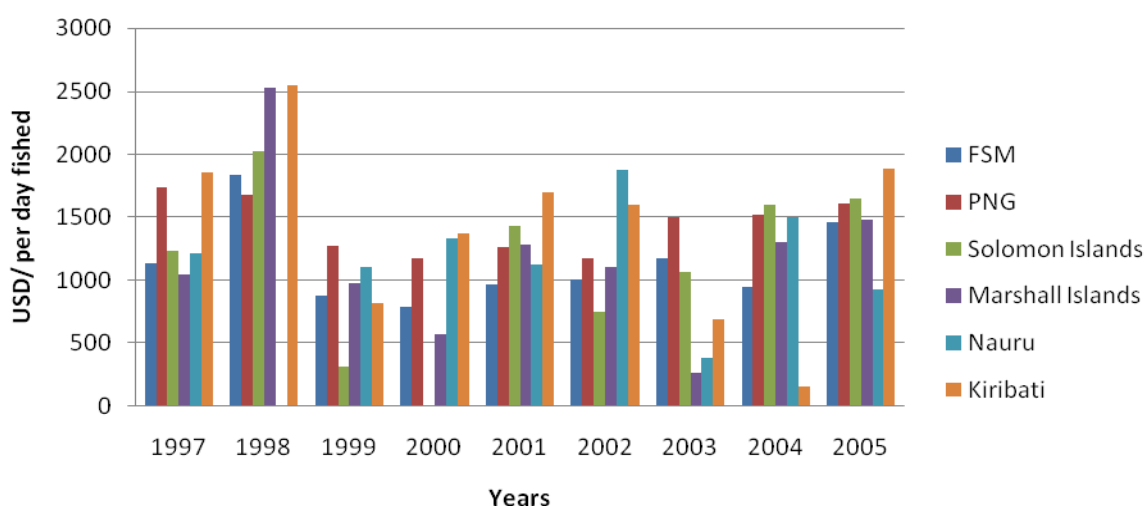


Figure 16: Korea % gross value of per day fished in PNA waters (FFA 2008).

4.3.3 Taiwan

Taiwanese fleets have been identified to be one of the fleets responsible for the highest catches in the region. Taiwanese boats operating in these waters have a value catch per day fished calculated at 6% (Appendix I). Palau and Tuvalu are not mentioned in this analysis, therefore an assumption is that Taiwan has no bilateral agreements with these states. The western-lying states (Figure 11):

1. FSM: 1997-8 from \$900 to about \$1600/per day fished (El Niño), 1999 dropped to \$700/per day fished (La Niña), 2000-1 an increase to \$1100/per day fished and sustained to 2002 (El Niño), 2003 at \$1000/per day fished (La Niña), 2004-5 increased to \$1200/per day fished

2. PNG: 1997-8 \$1200 to \$1300/per day fished, 1999 \$1600/per day fished (La Niña), 2000 a drop to \$1000/per day fished, 2001-3 increased to above \$1500/per day fished to a gradual decline to \$1200/per day fished, 2004-5 from \$1500/per day fished to slight decrease to \$1300/per day fished (La Niña to El Niño). Overall PNG's fluctuations maintained above \$1000/per day fished

3. Solomon Islands: 1997-8 increased from \$1400 to \$1800/ per day fished (El Niño), 1999 a drop to \$800/per day fished (La Niña), 2000 an increase to \$1200/per day fished a slight decrease in 2001, 2002 a dramatic decline to \$300/per day fished (El Niño), 2003-5 an increase of about \$300/ per day fished to reach \$1300/per day fished (La Niña to El Niño)

Eastern-lying states (Figure 11):

4. Marshall Islands: 1997-8 a steep incline from about \$100/ per day fished to \$1900/per day fished (El Niño), 1999-2000 a dramatic decline to \$600 to under \$500/per day fished (La Niña), 2001-3 a slight increase of \$200/per day fished (El Niño), 2004-5 a decline with a slight increase from \$600/per day fished to \$700/per day fished

5. Nauru: 1997-8 a steep incline from \$300 to \$2200/per day fished, 1999-2000 a sharp decline to about \$600/per day fished (La Niña) then incline to about \$900/per day fished, 2001-2 an increase to \$1400/per day fished (El Niño), 2003 a decline to \$800/per day fished (La Niña), 2004-5 an increase to \$1600 to \$1400/per day fished (La Niña to El Niño)

6. Kiribati: 1997-8 constant at about \$1800/per day fished (El Niño), 1999 a drop to \$1000/per day fished (La Niña), 2000-2 a gradual increase to \$1400/per day fished (El Niño), 2003 a decline to about \$1000/per day fished (La Niña) and then an increase in 2004-5 to \$1500/per day fished (La Niña to El Niño)

The value of days fished in the eastern lying states including that of the Solomon Islands and FSM (to an extent) all reflect the fluctuations of the ENSO events. PNG is the only state that can be identified to be resilient to the ENSO events as compared to the other states in this group.

4.3.4 *Value of the days and ENSO events*

The significance of the ENSO events has been highly understated with respect to the valued catches per day done in most of these PNA waters. It is identified that with the exception of PNG and FSM (to an extent) all the PNA states display high fluctuations (of income) with respect to the catches in their waters. The study used the flag states of Japan, Korea and Taiwan to illustrate a clear example that the VDS can increase the value. However, the expected income by the states is variable and much dependent on the ENSO events. The ENSO events and the market prices to the value of the fishing days play a significant role that can dictate the income of the states. Therefore, the study will attempt to propose a side-payment scheme that is fundamental to address any sudden high undulating fluctuations of income for the states by the ENSO events. It is known that fluctuations of income are detrimental to any national economy.

The premise then that these impulses (or shocks) change the demand or supply conditions (in the economy), once randomly disturbed the economy embarks on deterministic adjustments until the occurrence of the next shock and the economic system reacts by generating business cycles⁷ (Burda and Wyplosz 1997). Such boom-and-bust cycles in the economy can have very negative effects on the long-term development of the economy and it is therefore important to reduce or avoid them if possible.

The following sections use the same flag states and the estimated value per day fished to demonstrate the side-payment scheme. This method is limited to these three flag states and the examples are used to further elaborate the side-payment scheme concept. The assistance of the regional institutions (FFA and SPC) can thus be requested to formulate a more robust or fair side-payment scheme using the following examples. This study is essential to understand the underlying principles with the concept of a side-payment scheme. Hence, the following methods prescribed in this study are simple and easy, but the principles are significant to the success of the VDS.

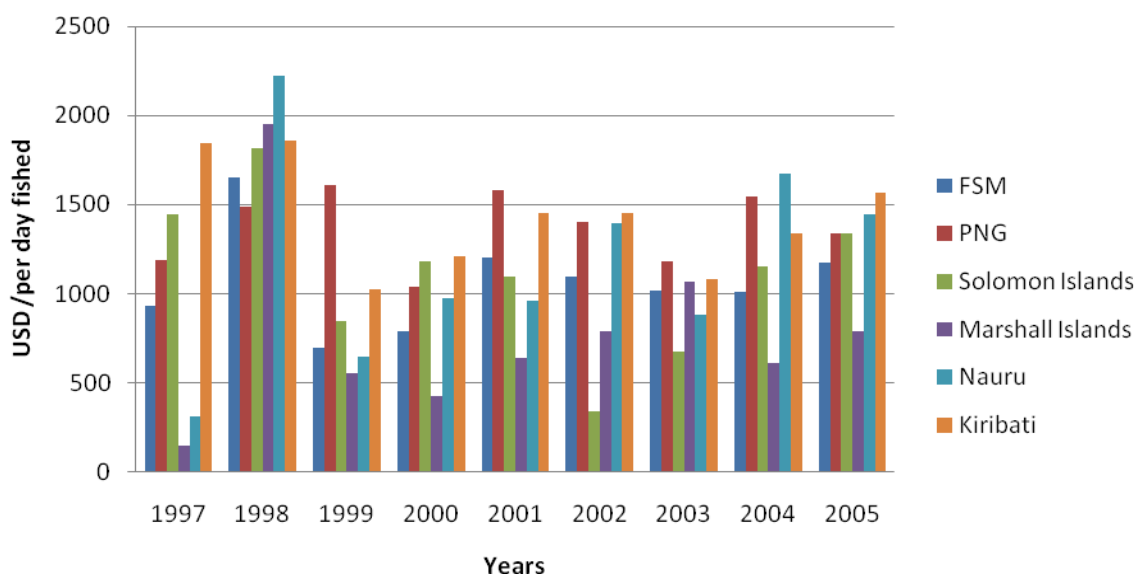


Figure 17: Taiwan (ROC) % gross value of per day fished in PNA waters (FFA 2008).

4.4 Vessel day side-payment scheme (VDS-s)

The method:

1. Grouping the coastal states with their respective flag states i.e. Japan, Taiwan and Korea
2. Pool the days for these coastal states (average days divided by each state) sold to their respective flag states (the days are limited)
3. The value of the fishing days according to the market prices and catches are calculated on a monthly basis

⁷ Business cycle is the tendency for an economy to fluctuate through patterns of expansion and contraction in activity

4. Calculate the current revenues to the (estimated) value of catches to the day scheme (US\$/per day fished)

5. Calculate the fixed shares as a percentage with the day scheme and this is paid to individual coastal states (from annual current revenues)

6. The fixed share (%) value ensures that there are zero gains/losses annually

7. The coastal states in the pool compensates other coastal states during the ENSO events

Hence now that the simple method is provided we will look at the three flag states of Japan, Korea and Taiwan to illustrate the concept.

4.4.1 Side-payment (fixed share) for Japan, Korea and Taiwan

The VDS scheme allocates fishing days (similar to that of a quota) for each PNA state. If the coastal states with former bilateral agreements with Japan, Korea and Taiwan, pool their days together with the average allocated fishing days per annum (this is then calculated by a total sum of days divided by the years) (Table 6).

The average pool days are sold to Japan, Korea and Taiwan giving them the rights to fish in the respective waters of the coastal states. These days are deducted from their total pool days of the respective coastal states. For example, Nauru's days with Japan, Korea and Taiwan its average fishing days of 523.7, 306.5, and 608.7 respectively on an annual basis these sums can be deducted from days in the pool. The total allocation of 1452 has 13 fishing days left for Nauru; the idea is to use the pooled days thereby these allocated days are generated within the pool. As in the case of Japan, the coastal states that have agreements use the total pool days of 20,025 fishing days. Although the example is illustrated it should be mentioned that these fishing days are limited thus increasing demand (and raising the value). The study does not focus on the proper divisions of allocated pool days for the side-payment scheme.

Table 6: Average pool days for the Japanese, Korean and Taiwanese fleets

Fleets/Years	Japan	Korea	Taiwan
1997	4351	4951	7874
1998	3319	4876	6707
1999	4263	4092	6761
2000	4093	4936	7173
2001	3691	5150	6597
2002	3936	5487	7144
2003	4066	3982	7007
2004	3964	6083	6204
2005	3594	5959	7185
Average pool days	3919.67	5057.33	6961.33

Now that the study has mentioned the significance of these days, it will consider the revenues earned by each of the states with the respective flag states using the side-payment scheme. The next step is the valued (per) day fished where it is multiplied by the days fished (by the flag states) and this represents current annual revenues for the states. The current revenue estimated is used to formulate the fixed shares (%) for the side-payment scheme for the individual states within the respective 'flag state' group.

1. Japan

The current revenues received with the day scheme for the following years from 1997 to 2005 with respect to coastal states in the group; an annual total current revenue of about; \$4 to 6 million (Table 7a). The total revenues that these states within this coalition earned over the time period is about US \$45 million in the day scheme. For the side-payment to work, it is best to identify the fixed shares for each individual state to the total annual current revenues (day scheme) in the period of 1997 to 2005 (Table 7a).

Palau earned about US \$590,000, FSM earned about US \$19 million, Solomon Islands earned US \$1.6 million, Marshall Islands earned US \$4.3 million, Nauru at US \$6 million, Kiribati earned about US \$11.7 million and Tuvalu earned US \$1 million (Table 7a). These earnings over the years are then divided by the total annual income for the percentage of the fixed shares in this group. The fixed shares are: Palau 1%, FSM 44%, Solomon Islands 3.5%, Marshall Islands 9.5%, Nauru 14%, Kiribati 26% and Tuvalu 2% (Table 7a).

The fixed shares are then used to estimate the distribution of the revenues according to per days fished in each of the respective states for the years 1997 to 2005 (Table 7b). The change is reflected in the distribution of the revenues according to the calculated fixed shares with respect to the recorded catches in each of the states' waters. The side-payment scheme then identifies that all the states in this group, have incurred either positive or negative values by the difference between the fixed share revenue to the current revenues (Table 7b). The negative values represent the amount (US\$) that the individual state(s) should pay or compensate other states (Appendix II). The positive values (in US\$) represent the amount in US\$ that the individual state(s) should receive (Appendix II) annually.

For example in 1997, Palau, Nauru and Kiribati have negative values meaning that they earned more than their fixed share so therefore these states compensate the other states in this group. The compensation amounted to about US \$1.5 million in that year but overall in the nine years no net gains/losses were experienced by any of the states (Appendix II). This compensation scheme ensures that there are no net gains in this group during the ENSO events for each state gained according to its fixed shares. In 1998, Marshall Islands and Tuvalu compensated by paying the other states in according to the fixed shares (Table 7b). This side-payment is perfect over the time period (9 years) there are no net loss/gains for each state (Appendix II). This side-payment is a perfect scheme with respect to the fixed percentage shares overall.

Table 7: Current and fixed share revenues for Japan with PNA states

a) Current revenues received to the value per day fished (all values in USD except the fixed share in percentage)								
Years	Palau	FSM	Solomon Islands	Marshall Islands	Nauru	Kiribati	Tuvalu	Total
1997	122,061	2,195,805	0	38,700	1,064,565	2,956,928	0	6,378,059
1998	0	1,678,890	47,652	1,697,232	687,897	1,022,346	507,297	5,641,314
1999	90,816	2,727,165	12,564	687,904	566,430	1,122,240	186,666	5,393,785
2000	0	1,639,680	17,820	647,410	984,465	1,216,967	80,524	4,586,866
2001	0	794,808	236,844	438,656	871,038	2,266,782	69,375	4,677,503
2002	0	1,080,079	17,496	541,024	1,248,770	2,080,038	54,537	5,021,944
2003	117,000	3,030,714	214,011	27,619	224,749	566,307	46,970	4,227,370
2004	139,783	2,717,660	564,900	143,995	290,054	313,073	51,214	4,220,679
2005	127,658	3,881,721	499,392	84,388	282,388	226,204	21,120	5,122,871
<i>Total</i>	<i>597,318</i>	<i>19,746,522</i>	<i>1,610,679</i>	<i>4,306,928</i>	<i>6,220,356</i>	<i>11,770,885</i>	<i>1,017,703</i>	<i>45,270,391</i>
<i>Fixed share</i>	<i>1%</i>	<i>44%</i>	<i>4%</i>	<i>10%</i>	<i>14%</i>	<i>26%</i>	<i>2%</i>	<i>100%</i>

b) Fixed shared of revenues (all values in USD)								
Year	Palau	FSM	Solomon Islands	Marshall Islands	Nauru	Kiribati	Tuvalu	Total
1997	84,155	2,782,050	226,925	606,795	876,374	1,658,378	143,382	6,378,059
1998	74,434	2,460,689	200,713	536,703	775,142	1,466,814	126,820	5,641,314
1999	71,168	2,352,719	191,906	513,153	741,130	1,402,454	121,255	5,393,785
2000	60,521	2,000,748	163,196	436,385	630,256	1,192,644	103,115	4,586,866
2001	61,717	2,040,283	166,421	445,008	642,710	1,216,211	105,153	4,677,503
2002	66,262	2,190,525	178,676	477,777	690,038	1,305,770	112,896	5,021,944
2003	55,778	1,843,939	150,406	402,183	580,860	1,099,171	95,034	4,227,370
2004	55,690	1,841,021	150,168	401,546	579,940	1,097,431	94,883	4,220,679
2005	67,593	2,234,549	182,267	487,379	703,906	1,332,012	115,165	5,122,871

2. Korea

The same application is used for the Korean fleets and the coastal states that have the bilateral agreements. The average number of pool days 6961.33 over the time period from 1997-2005 (Table 6). These pools days are to be shared by these states and it will differ according to the limited allocated days. The current revenues received (Table 8a) to the value of the day scheme and the percentage of the fixed shares for FSM, PNG, Solomon Islands, Marshall Islands, Nauru and Kiribati are 16%, 34%, 11%, 6% and 27% respectively. These fixed shares are used to estimate the fixed share revenues (Table 8b). The side-payment scheme conveys the evenly distributed revenues over time with respect to the fixed shares and there is no coastal state better of than either state in the overall years (Appendix II).

Table 8: Current and fixed share revenues for Korea with PNA states

a) Current revenue received to the value per day fished (all values in USD except the fixed share as a percentage)							
Years	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	656,60	2,702,406	642,914	6,264	24,320	4,201,770	8,234,234
1998	756,240	1,806,000	3,289,000	1,892,723	0	2,552,094	10,296,057
1999	2,461,804	111,012	18,502	401,849	470,050	263,541	3,726,758
2000	1,186,580	2,761,242	0	108,679	562,035	652,596	5,271,132
2001	1,274,154	905,024	320,005	677,120	570,768	3,151,329	6,898,400
2002	939,811	773,520	21,750	548,688	1,239,480	4,312,880	7,836,129
2003	205,450	4,648,597	335,666	10,520	43,731	168,885	5,412,849
2004	1,240,785	5,022,342	1,496,664	124,608	522,453	13,659	8,420,511
2005	2,020,403	3,649,870	976,332	102,189	233,179	2,640,400	9,622,373
<i>Total</i>	<i>10,741,787</i>	<i>22,380,013</i>	<i>7,100,833</i>	<i>3,872,640</i>	<i>3,666,016</i>	<i>17,957,154</i>	<i>65,718,443</i>
<i>Fixed shares</i>	<i>16%</i>	<i>34%</i>	<i>11%</i>	<i>6%</i>	<i>6%</i>	<i>27%</i>	<i>100%</i>
b) Fixed shared revenues (All values in USD)							
Years	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total Annual shared
1997	1,345,899	2,804,118	889,703	485,225	459,336	2,249,953	8,234,234
1998	1,682,907	3,506,259	1,112,482	606,723	574,352	2,813,333	10,296,057
1999	609,145	1,269,125	402,674	219,609	207,892	1,018,313	3,726,758
2000	861,575	1,795,052	569,542	310,616	294,043	1,440,304	5,271,132
2001	1,127,555	2,349,208	745,367	406,507	384,818	1,884,945	6,898,400
2002	1,280,828	2,668,546	846,688	461,765	437,128	2,141,173	7,836,129
2003	884,739	1,843,313	584,855	318,967	301,949	1,479,027	5,412,849
2004	1,376,346	2,867,553	909,830	496,202	469,727	2,300,852	8,420,511
2005	1,572,793	3,276,840	1,039,691	567,025	536,771	2,629,253	9,622,373

3. Taiwan

For the Taiwanese fleets, the same application (as above) is used for those states that have former bilateral agreements. The average number of pool days for this flag state is 5057.67 per year, with the time period of 1997-2005. These pool days are to be shared by these states but the division will differ in accordance to the limited allocated days. The current revenues to the value of the per days fished and the calculated fixed shares for FSM, PNG, Solomon Islands, Marshall Islands, Nauru and Kiribati are 22.7%, 39.8%, 5.8%, 2.8%, 8.8% and 20.1% respectively (Table 9a). The fixed shares are then distributed evenly over the years (Table 9b) and the perfect side-payment illustrated no net loss/gains in the overall years (Appendix II).

Table 9: Current and fixed share revenues for Taiwan with PNA states

a) Current revenues received to the value per day fished (all values in USD except the fixed share as a percentage)							
Years	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	1,788,451	5,530,039	239,704	760	3,732	2,061,198	9,623,884
1998	1,969,	2,682,230	2,686,866	781,549	1,219,329	2,378,240	11,717,664
1999	2,371,891	1,167,812	93,280	230,184	563,958	1,263,616	5,690,741
2000	1,726,940	3,296,623	14,148	117,852	1,028,856	567,216	6,751,635
2001	2,021,990	2,196,576	218,900	418,545	678,656	2,860,957	8,395,624
2002	1,122,156	2,408,636	9,976	348,738	1,634,716	4,007,662	9,531,884
2003	1,936,368	4,925,862	104,566	53,450	178,568	561,039	7,759,853
2004	1,689,028	4,524,804	424,719	90,576	1,049,598	625,248	8,403,973
2005	2,904,600	4,033,400	724,140	87,468	417,605	1,194,095	9,361,308
<i>Total</i>	<i>17,530,874</i>	<i>30,765,982</i>	<i>4,516,299</i>	<i>2,129,122</i>	<i>6,775,018</i>	<i>15,519,271</i>	<i>77,236,566</i>
<i>Fixed shares</i>	<i>23%</i>	<i>40%</i>	<i>6%</i>	<i>3%</i>	<i>9%</i>	<i>20%</i>	<i>100%</i>
b) Fixed shared revenues (all values in USD)							
	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	
1997	2,184,394	3,833,524	562,743	265,294	844,185	1,933,743	9,623,884
1998	2,659,633	4,667,549	685,174	323,012	1,027,847	2,354,450	11,717,664
1999	1,291,664	2,266,818	332,758	156,872	499,179	1,143,450	5,690,741
2000	1,532,461	2,689,409	394,792	186,117	592,238	1,356,617	6,751,635
2001	1,905,608	3,344,266	490,922	231,436	736,445	1,686,947	8,395,624
2002	2,163,512	3,796,877	557,363	262,758	836,115	1,915,257	9,531,884
2003	1,761,303	3,091,016	453,746	213,910	680,677	1,559,200	7,759,853
2004	1,907,503	3,347,592	491,410	231,666	737,178	1,688,624	8,403,973
2005	2,124,796	3,728,931	547,389	258,056	821,153	1,880,983	9,361,308

The side-payment scheme used a fixed share (%) for each of the following flag states and the respective coastal states. The evenly distributed revenues over the nine year period provide for the opportunity for all the states to avoid any fluctuations in their annual revenues with the ENSO events. However, to further elaborate that this side-payment scheme can be flexible, in that it can take into account any future influences and planning, this is therefore demonstrated in the following section.

4.4.2 Five-year moving average

The study will illustrate the side-payment scheme by using the five-year moving average to estimate the shares (%) of the states. The premise for including a moving average in this study addresses the dynamic nature of the environment, the fish stocks and market prices. The five-year moving average estimation in this study intends to promote equity in the allocation of the fixed shares (%) over time.

The data is limited with its estimation in using the moving average. However the concept for this side-payment scheme is the principle argument. Hence the estimated moving average for the share (%) for 2002 is assumed to be equivalent for the moving average shares for the years 1997 to 2001. The current revenues received by each of the coastal states from the flag states (Japan, Korea and Taiwan) are then used to estimate the 5 year moving average shares.

1. Japan

The estimated moving average shares as a percentage for the following coastal states (Appendix III); with the estimated side-payment with the moving average indicates that there are no net gains/losses between the states annually (as shown in the previous section) (Appendix III). The concern in using a moving average is that the overall years do not show equal shares over time (Table 10).

There are negative values for Palau, FSM and Solomon Islands in this group (Table 10). As stated, the negative values represent those states that pay (or compensate) the other states within the group (Table 10). The states of Palau, FSM and Solomon Islands will pay US \$234,655, US\$ 3,962,527 and US \$856,142 respectively in the total overall years. Those states in this group who have positive values overall will stand to receive compensation payment. It is necessary to note that due to the limitations of the data used in this analysis this method needs further research.

Table 10: Side-payment (Japan) use moving average (5 years) where no state gains or loses in this scheme

Side-payments with moving average								
Year	Palau	FSM	Solomon Islands	Marshall Islands	Nauru	Kiribati	Tuvalu	Total
1997	-71,166	-35,396	75,281	800,447	- 66,551	- 904,365	201,750	0
1998	45,016	231,965	18,934	- 955,017	194,834	793,121	-328,851	0
1999	- 47,776	-900,155	51,100	21,744	277,568	613,568	- 16,050	0
2000	36,602	- 85,993	36,320	- 43,926	- 266,730	259,161	64,567	0
2001	37,325	789,580	-181,635	176,753	-139,121	- 761,485	78,584	0
2002	40,073	620,979	41,779	119,702	- 462,956	- 463,895	104,317	0
2003	- 101,838	-1,708,379	-158,521	642,216	502,912	720,594	103,016	0
2004	-103,095	- 1,080,681	- 476,852	269,575	397,658	967,271	26,124	0
2005	- 69,796	-1,794,447	-262,548	320,925	533,120	1,225,674	47,071	0
Total	-234,655	- 3,962,527	- 856,142	1,352,418	970,735	2,449,644	280,529	0

2. Korea

The data limited to the 5-year moving average represents the pattern as that of the above to the side-payment scheme. Hence the moving average with the percentage share is assumed to be the same for 1997 to 2002 (Appendix III). In this group, those states that have negative values in the overall period with the moving average are FSM, Solomon Islands and Kiribati and their compensation payments are US \$642,186, US \$358,115 and US \$280,419 respectively (Table 11). As previously mentioned this is for the total overall years, however annually no state stands to gain or lose in this group (Table 11).

Table 11: Side-payment (Korea) use moving average (5 years) where no state gains or loses in this scheme

Side-payment with moving average							
Year	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	858,742	- 720,616	378,496	732,005	364,871	- 1,613,498	0
1998	1,138,488	672,023	-2,011,833	-969,594	486,643	684,272	0
1999	- 1,775,989	785,933	443,781	- 67,714	-293,905	907,893	0
2000	-216,562	- 1,492,602	653,854	363,923	- 312,895	1,004,282	0
2001	- 4,679	755,262	535,702	- 58,620	- 244,715	- 982,950	0
2002	502,230	1,112,456	950,277	153,887	-869,105	- 1,849,744	0
2003	847,357	-3,637,432	244,815	566,748	408,394	1,570,119	0
2004	512,294	- 2,364,497	- 1,295,601	380,085	311,375	2,456,344	0
2005	-642,186	362,618	- 358,115	315,707	602,396	- 280,419	0
Total	1,219,695	- 4,526,856	- 458,624	1,416,427	453,059	1,896,299	0

3. Taiwan

The same underlying principles are used (previously) with the moving average scheme (Appendix III). In this group, PNG is identified as having the negative values for the overall years, at the value of US \$3,302,932 (Table 12). This would be an issue for further discussion if PNG would enter such a scheme in this group.

Table 12: Side-payment (Taiwan) use moving average (5 years) where no state gains or loses in this scheme

Side payments with moving average							
Years	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	465,525	- 2,136,482	502,493	352,642	793,597	22,226	0
1998	774,902	1,449,633	-1,783,197	- 351,261	-248,533	158,455	0
1999	- 1,039,083	838,847	345,591	- 21,212	- 92,486	- 31,658	0
2000	- 145,664	-915,873	506,540	130,077	-469,490	894,410	0
2001	-55,681	763,875	428,573	- 110,246	16,913	-1,043,433	0
2002	1,110,273	952,481	725,125	1,286	-845,009	- 1,944,155	0
2003	-237,835	- 2,759,120	452,828	296,283	766,444	1,481,400	0
2004	334,143	- 1,440,128	- 327,549	167,026	-149,299	1,415,807	0
2005	-957,186	- 56,164	- 547,125	148,418	629,940	782,116	0
Total	249,395	- 3,302,932	303,280	613,013	402,076	1,735,169	0

The moving average share highlights that the side-payment scheme can provide an even share scheme annually. However, the moving average scheme using five years has been identified to have a negative overall value for individual states with respect to each of the flag states. This second example represents the relevance to address the dynamic environment of the fisheries resources and its externalities; the issue of equity is not favourable for all the coastal states. However, this method can be further studied with more data to work with and be improved.

4.5 Side-payment scheme (VDS-s) for Nauru

I will now illustrate the example of Nauru and its implications for the following current bilateral license and access fee arrangements compared with the fixed share side-payment scheme (VDS-s) and the moving average side-payment scheme. In the current arrangement for the VDS without side-payment the fluctuations from 1997-99 are from US \$1 to 1.9 million increased with the El Niño. In 2000-2 the sharp increase from \$2 million to \$4 million corresponds to the El Niño. In 2003 the sharp decline to \$0.45 million (La Niña) and the following year in 2004 to \$1.8 million and then slight decline to \$0.9 million in 2005.

These sudden fluctuations that correspond with the ENSO events are significant for Nauru with respect to its economic situation. Nauru's position improved in the fixed shares of the side-payment scheme in 1997-8 increased substantially from about \$2 million, 1999-2001 they dropped to about \$1.4 million, then an increase to \$1.8 million in 2002-3 a slight decrease to about \$1.5 million and then in 2004-5 a gradual increase to about \$1.8 to \$2 million (Figure 17). The moving average shows the similar patterns to that of the fixed shares from the years 1997 to 2002. This is correct with the assumption of the fixed shares. From 2003 to 2005, the moving average increases with an increment per annum of \$0.3 million. The fixed shares and the moving average showed less fluctuation than that of the current revenues. In Nauru's case it would be then highlighted that overall the side-payment that is optimal, to ensure that there are no shocks to its revenue with respect to the ENSO events. However, from the fluctuations of the ENSO events it is perceived that Nauru stands to benefit from the moving average side-payment scheme.

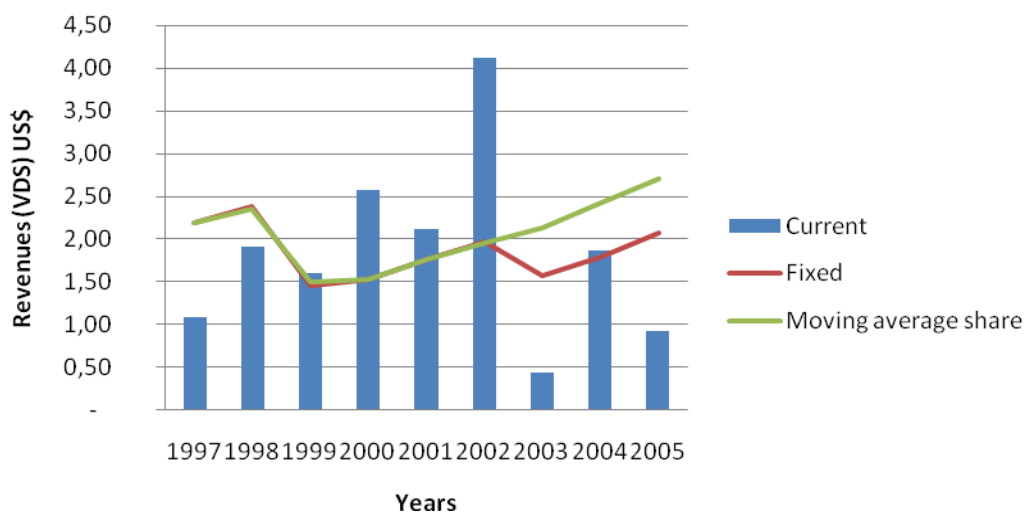


Figure 18: Annual income from Japan, Korea and Taiwan vs. fixed and moving average side-payment scheme (Reid 2006)

This side-payment scheme (VDS-s) in Nauru's case was illustrated as a case example. However, the analysis for most of the PNA states that are highly reliant on these access fees and its contribution to their gross domestic product (GDP) overall improved their income with respect to any sudden fluctuations of the ENSO events.

5 DISCUSSION

This study and its analysis, although limited to the three flag states of Japan, Korea and Taiwan, does not eliminate its significance and the implications to the recently introduced management strategy (VDS) for the PNA coalition. The study has highlighted and proposed management options that these coastal states should consider to implement the VDS successfully. The free-riding option, although it can be a low risk venture, is not favourable to the cooperative management regime. The realities of free-riding for some of these states may perhaps be optimal in that their expected rate of returns is known. The challenge for these governments is to consider implementing the VDS strategy as one opportunity to further improve net benefits from the fishery and/or ensure the sustainability of its tuna stocks.

The implementation of the VDS strategy with the effects of the ENSO fluctuations is the main challenge addressed in this study. The coastal states that rely heavily on the revenues from fishing licenses are therefore affected by this phenomenon. The states may consider a system that evens out these fluctuations as preferable to the current one. The understanding that the VDS was developed with a degree of flexibility where one can borrow from future days (in a 3-year rolling period), still does not assure the states that it ensures increased net returns from its current situation with these ENSO events.

The risk and fear that the price of the day is not the best over time is a cause of reserve for many of these states without the experience to undertake this method effectively. The states that are most at risk to the ENSO events may not be inclined to take risks with this option. Although the days at sea are limited and the economic theory of scarcity suggests that the demand will be high for the natural rich tuna resources and of course this will raise the price of the days and in effect, the market value. It should be identified that the target species, skipjack tuna is a low value species as compared to the other principle market tunas in a purse seine fishery. The increase in its market value raises contentious issues for the states. However, it has been stipulated that attempts to make fishers pay more without improving their productivity, adds to their costs, thereby limiting their capacity and willingness to pay (Gillet 2007). In essence the advice by the ADB with this strategy is not favourable to raise the market prices and value of the skipjack tunas in the purse seine fishery.

This study has identified a supplementary side-payment with the VDS, known as the VDS-s for the parties in this coalition and thereby addressing the issues of risk in implementing the VDS for the individual coastal states. It would be fair to assume then that all the coastal states in this coalition with the exception of PNG and Palau place a higher significance and reliance on these foreign license and access fees to either their GDP or national income. These coastal states would be considered therefore to have similar discount rates placed on their tuna resources (or management priorities) which should ensure that a side-payment can then be induced in this coalition.

The VDS-s concept in the study identified two ways that this side-payment scheme can be undertaken. Firstly, a fixed share scheme where the percentages represent the catches over the respective years from 1997 to 2005 in the each of the states' EEZs. The fixed share scheme has been successful to illustrate a fair side-payment scheme

where the situation is not possible to make one state better off, except at the expense of the other states known as the concept of Pareto Optimality. (Munro *et al.* 2004). The fixed share is successful in that it assures the states a stable income in lieu of the fluctuations to the ENSO events. However, it is rigid in that the shares remain the same regardless of longer-term developments in the distribution of the catches within the region. Some type of system where the shares are updated is another possibility.

The second side-payment scheme illustrates that the VDS-s can be a flexible method and therefore be further developed and enhanced to reach an optimal strategy. This option thereby acknowledges that some adaptive management is necessary for any renewable resource in lieu of the environmental influences is a qualitative option. It suffices to say, that due to the limited data available for this study it can only demonstrate certain constraints to this method as it stands, but it needs further research with a longer time-period. The moving average shares overtime can be changed with further development. The scheme identified that there are no net gains on an annual basis with respect to the compensation payments. For Nauru's case the five-year moving average increased its revenues which are favourable compared to those of the fixed share scheme.

However, the real concern to using the second side-payment scheme as opposed to the fixed share scheme is that it has identified in the overall years that some states within the coalition incurred net losses as opposed to those gained from this scheme. These losses or gains are of course unknown in advance and only reflect long term changes in catches. Therefore, it has identified for the three flag states of Japan, Korea and Taiwan the following:

- Japan- Palau, FSM and Solomon Islands identified value of loss overall is about \$5 million
- Korea- FSM, PNG and Kiribati identified value of loss overall is about \$1.2 million
- Taiwan- PNG identified value of loss overall is about \$3.3 million

The concern for these above-mentioned states then to enter into the second method of the side-payment scheme is addressed. There are measures that can be used to enhance this side-payment scheme in that it can be a non-monetary form among these states. For PNG, FSM and Solomon Islands are known to participate in the fishery with their own regional fleets that operate under the FSM arrangements and thus have been granted preferential treatment. Thereby removing the FSM arrangements this side-payment scheme can further develop and ensure that a Pareto improvement does occur between and among these states.

Kiribati and Palau are two polar extremes, Kiribati has a high reliance on its access fees as opposed to Palau where the access fees are not a significant contribution to its GDP. Kiribati's situation has improved with the fluctuations with the ENSO events it gained from the other flag states of Japan and Taiwan in the analysis the gains are higher overall to its loss. Palau with its case stands to lose, however this stands to be corrected with further research and development of this method.

The states that have been identified to incur overall losses rather than gains to the second side-payment strategy should note that this method is flexible. This study is

limited to only three flag states as it stands but these states have bilateral agreements with other flag states that can be used to identify their overall gains or losses with this method. For example, PNG has been identified to have bilateral agreements with the Philippines flag states exclusively. Therefore, this is not subject to the side-payment strategy and is under PNG sole management under the VDS strategy.

The argument is that the PICs and PNA coalition in this cooperative management regime should undertake a principle goal or identify its “core” in this game as one to extend their management in the high seas enclave. For this to occur it is essential then that these states cooperate in the management and conservation of its tuna stocks now and thus ensure the cooperation with the VDS strategy. The first step is to incorporate a side-payment scheme to the VDS. This then makes it favourable for all the coastal states to participate with respect to their economic situation. This side-payment strategy can address the issues of the natural phenomenal fluctuations in the distribution of the stocks, its catches and the issue of equity to an extent and should be successful can thus be extended to the high-seas (international waters).

The ultimate goal or target that this study has alluded to is that the coalition remains steadfast in its cooperative regime to exacerbate the opportunities of the recent establishment of the Tuna Convention. The PICs cooperative regime can be proactive in its approach to extend its management to the high seas enclave areas. For PNG and Palau they share one area that is a high seas enclave area and this target would clearly be ideal for these states. Solomon Islands, Kiribati, PNG and FSM share another high seas enclave with that of Nauru (Figure 6). The goal for all these states especially the PNA coalition to remain in this cooperative should be their continued effort for effective management and is highly constructive to achieve changes to the current governance frameworks.

The case example is that of Pacific salmon, a transboundary stock due to part of its life-cycle moving into the high seas in Article 66 of the 1982 UN Convention was included due to the joint efforts of Canada and the United States resulting in direct high seas management of the Pacific salmon (Munro *et al.* 2004). Thereby if this is the core of the game, then preference for a side-payment scheme is necessary to enhance the unity and cooperation between the states.

The optimal management option for the PNA coalition in developing a form of side-payment scheme to supplement the current VDS should include the FSM arrangements prior to that of the US Multilateral Treaty arrangements. The US Treaty is successful in ensuring that the core of the game is to cooperate with management of the tunas in a cooperative and that should be the last to be changed (should it be necessary). The challenge presents itself then for the FSM arrangements to change to the VDS-s strategy and allow for further development of the side-payment scheme to develop more effectively.

The study has not addressed the issues or concerns regarding the sustainability of the tuna catches in the region. The VDS is a strategy that is implemented to limit effort; however in attempting to limiting days or effort this method has been proven to have failed as a management measure. The clear indication of this is that our marine resources are in a global decline (Grafton *et al.* 2005). The concept of this failure is

that in most cases, fisheries management has failed to provide incentives for fishers to cooperate with the control measures as to their lack of ownership or property rights.

The findings of this study can simply state that further improvement of the VDS strategy is needed to address both the needs of these coastal states, the fishers and the tuna resources in the region. A recommendation to ensure the sustainability is to include a taxation system that tax fishers in targeting the tuna species. It has been identified that tax on catch seems to be capable of delivering the full potential economic benefits of fisheries (Arnason 1993). This argument then confirms that fishers (with purse seine gears) have been identified to be able to selectively target the yellowfin tuna stocks (Campbell and Nicholl 1994) so implementing a tax system ensures the robustness of the VDS-s strategy.

6 CONCLUSIONS AND RECOMMENDATIONS

Nauru can expect a stable income from the US Treaty and FSM arrangements from its foreign fishing licenses and access fees at this time. However, with the newly introduced VDS strategy the risks are high in lieu of its current economic situation. The implications, therefore, present themselves that Nauru's options are one of free-riding, auctioning of the days or using its political will to set in motion a side-payment scheme to the VDS strategy at this time (and perhaps a taxation system later).

The first management option to free-ride is assumed to be favourable to the risks with auctioning of the days option, as this has been well established with built-in relationships and alliances to flag states. The latter option would entail the Fisheries Authority to have personnel training and set-up an auctioning system. This is a costly approach and the fear of not gaining the best price for the day overtime ensures a greater amount of uncertainty (gambling) that is not optimum for Nauru at this time.

Nauru's option with the VDS including a side-payment scheme with the fixed shares shows that its national income is regular without the undulating fluctuations than the current situation with the ENSO events. The implications of the side-payment scheme increase the opportunity for the economy to adjust to the post-phosphate situation without the business cycle effect. The second side-payment scheme is the best option for Nauru to undertake as the study has highlighted the opportunity to increase its national income with respect to the current revenues over time.

Nauru's option would entail it to comply within the cooperative and coalition as stated to clearly extend its interests into the high seas enclave. This option ensures further income from its fisheries and maintains Nauru's interests to ensure sustainable management practices with respect to its fisheries management.

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For those contemplating to undertake this UNU-FTP course, all I can say is that if "sweating" in Iceland is part of your endeavours then this is for you.

Have a great day!

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Appendix 1: Value of the per day fished for PNA states (Source: Reid, 2006)

Gross value of a fishing day

1. In the Table below the prices used to calculate the gross value of a fishing day are provided. For the Japanese fleet the price is based on the Yaizu purse caught prices (ex-vessel) while for Korean and Taiwan they are based on Thai import prices (c&f). In the calculation bigeye is assumed to attract the same price as yellowfin. The CPUE data are estimates obtained from OFP-SPC and based on raised 1° x 1° data approximated to the relevant country's national waters.

	<u>Korea, Taiwan</u>		<u>Japan</u>	
	Skipjack	Yellowfin	Skipjack	Yellowfin
1997	1,130	1,130	1,454	1,454
1998	993	993	1,408	1,408
1999	652	652	935	935
2000	536	536	863	863
2001	788	788	960	960
2002	751	751	1,074	1,074
2003	700	700	1,093	1,093
2004	889	889	1,080	1,080
2005	873	873	1,278	1,278

Prices to estimate gross value of catch per day by fleet

- Federated States of Micronesia

Japanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	5 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	1,853	12.70	5.61	0.92	23,701	1185
1998	955	26.55	4.41	0.29	35,168	1758
1999	1,995	19.77	5.61	0.23	27,342	1367
2000	1,464	23.51	4.16	0.56	22,408	1120
2001	684	20.76	4.46	0.69	23,234	1162
2002	913	21.37	4.40	0.54	23,655	1183
2003	2,466	29.06	2.82	0.48	24,576	1229
2004	2,420	20.74	3.48	0.49	22,453	1123
2005	2,593	26.00	4.26	0.42	29,947	1497

Korean purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	580	14.61	1.62	0.17	18,864	1132
1998	411	15.97	10.51	0.53	30,660	1840
1999	2,788	16.99	3.89	0.14	14,719	883
2000	1,502	19.20	3.33	0.09	13,160	790
2001	1,319	17.96	2.03	0.12	16,104	966
2002	937	19.04	2.25	0.13	16,722	1003
2003	1,750	25.36	1.66	0.02	19,559	1174
2004	1,313	14.06	3.02	0.19	15,758	945
2005	1,381	20.45	5.11	0.35	24,391	1463

Taiwanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	1,921	8.93	3.73	0.77	15,514	931
1998	1,190	24.85	2.06	0.15	27,590	1655
1999	3,403	14.19	2.53	0.16	11,621	697
2000	2,186	21.53	1.90	0.09	13,172	790
2001	1,678	22.36	2.56	0.32	20,075	1205
2002	1,022	19.56	3.36	0.31	18,307	1098
2003	1,904	19.94	2.74	0.11	16,946	1017
2004	1,669	16.08	2.38	0.25	16,864	1012
2005	2,472	18.43	2.73	0.42	19,586	1175

- Kiribati**Japanese purse seine fleet**

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	5 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	1,777	14.26	11.23	1.21	33,285	1664
1998	663	23.33	3.83	0.35	30,835	1542
1999	960	13.91	6.80	0.62	23,379	1169
2000	1,061	21.90	5.22	0.76	22,941	1147
2001	1,741	20.13	7.25	0.76	26,042	1302
2002	1,643	27.58	1.79	0.50	25,327	1266
2003	801	12.30	3.82	0.82	14,136	707
2004	337	17.25	2.83	0.71	18,588	929
2005	212	18.54	3.03	0.89	21,341	1067

Korean purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	2,270	18.67	6.71	0.81	30,854	1851
1998	1,002	33.69	6.38	0.34	42,453	2547
1999	321	12.22	6.12	0.73	13,690	821
2000	476	31.71	6.80	0.15	22,856	1371
2001	1,857	24.69	9.20	0.37	28,286	1697
2002	2,704	31.50	2.72	0.13	26,589	1595
2003	243	13.79	1.77	0.15	11,581	695
2004	87	2.83	0.10	0.03	2,620	157
2005	1,400	30.69	3.64	0.23	31,440	1886

Taiwanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	1,119	13.87	10.33	0.68	30,694	1842
1998	1,280	22.40	6.20	0.23	30,974	1858
1999	1,234	17.47	6.08	1.06	17,073	1024
2000	468	30.17	4.69	0.28	20,208	1212
2001	1,969	21.59	7.51	0.38	24,215	1453
2002	2,762	28.83	2.35	0.22	24,186	1451
2003	519	20.19	3.55	0.42	18,011	1081
2004	468	23.91	0.94	0.25	22,263	1336
2005	763	24.30	3.81	0.34	26,086	1565

- Marshall Islands**Japanese purse seine fleet**

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	5 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	45	7.42	5.76	0.89	17,203	860
1998	912	24.45	7.37	0.18	37,213	1861
1999	581	17.58	4.55	0.54	23,675	1184
2000	641	24.65	2.20	0.45	20,199	1010
2001	368	22.49	3.73	1.22	23,840	1192
2002	464	23.99	2.53	0.62	23,328	1166
2003	71	7.87	1.56	0.64	7,789	389
2004	155	18.78	1.83	0.29	18,589	929
2005	68	23.15	2.64	1.67	24,830	1241

Korean purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	6	15.40	0.00	0.00	17,400	1044
1998	749	26.87	10.95	0.52	42,114	2527
1999	413	20.93	2.74	0.25	16,211	973
2000	191	14.82	1.80	0.07	9,486	569
2001	529	25.73	1.11	0.05	21,338	1280
2002	497	23.67	0.58	0.07	18,404	1104
2003	40	1.47	3.08	0.01	4,390	263
2004	96	22.61	1.43	0.05	21,640	1298
2005	69	27.99	0.19	0.03	24,684	1481

Taiwanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	5	1.00	0.97	0.03	2,534	152
1998	401	14.65	12.74	0.31	32,490	1949
1999	417	11.26	1.98	0.32	9,197	552
2000	276	12.25	0.65	0.08	7,123	427
2001	655	10.79	2.24	0.13	10,653	639
2002	442	16.45	0.74	0.07	13,155	789
2003	50	24.04	0.91	0.11	17,817	1069
2004	148	11.29	0.16	0.04	10,208	612
2005	111	14.67	0.25	0.08	13,126	788

- Nauru**Japanese purse seine fleet**

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	5 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	615	13.94	12.53	1.81	34,626	1731
1998	427	18.18	8.60	0.58	32,215	1611
1999	478	11.82	8.42	0.72	23,699	1185
2000	835	16.14	8.21	0.60	23,572	1179
2001	651	19.96	7.97	1.13	26,762	1338
2002	827	30.45	3.66	1.02	30,204	1510
2003	331	13.07	3.04	0.75	13,576	679
2004	323	17.86	1.95	0.35	17,963	898
2005	227	21.71	3.48	0.83	24,884	1244

Korean purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	20	15.92	1.56	0.06	20,262	1216
1998	14	0.00	0.00	0.00	0	0
1999	425	15.01	9.24	0.61	18,427	1106
2000	421	23.24	11.36	0.17	22,253	1335
2001	506	14.17	7.95	0.29	18,792	1128
2002	660	37.13	3.17	0.48	31,302	1878
2003	113	6.41	1.80	0.09	6,451	387
2004	349	26.16	1.56	0.10	24,946	1497
2005	251	10.85	4.71	0.32	15,487	929

Taiwanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	12	1.25	2.59	0.33	5,177	311
1998	549	16.55	14.62	0.38	37,024	2221
1999	873	10.15	4.43	0.65	10,760	646
2000	1,052	20.67	6.06	0.16	16,299	978
2001	704	13.16	5.93	0.30	16,063	964
2002	1,171	27.77	2.23	0.35	23,266	1396
2003	202	14.16	4.41	0.21	14,727	884
2004	627	29.56	1.50	0.21	27,897	1674
2005	289	23.78	2.60	0.38	24,084	1445

- Papua New Guinea**Korean purse seine fleet**

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	1,554	21.22	3.44	0.48	28,976	1739
1998	1,075	22.42	4.07	0.27	28,006	1680
1999	87	27.01	3.90	0.25	21,260	1276
2000	2,346	27.97	5.37	0.24	19,617	1177
2001	716	17.28	7.77	0.55	21,071	1264
2002	660	19.41	4.61	0.45	19,530	1172
2003	3,097	22.25	8.64	0.10	25,011	1501
2004	3,302	24.86	3.02	0.23	25,356	1521
2005	2,267	22.27	5.77	0.45	26,829	1610

Taiwanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	4,651	14.12	2.66	0.46	19,825	1189
1998	1,805	16.85	5.71	0.43	24,774	1486
1999	724	35.42	4.04	0.55	26,881	1613
2000	3,179	24.65	4.73	0.14	17,290	1037
2001	1,392	26.01	6.05	0.60	26,306	1578
2002	1,718	25.33	4.04	0.51	23,364	1402
2003	4,178	20.90	4.60	0.15	19,654	1179
2004	2,923	26.85	1.79	0.20	25,805	1548
2005	3,010	20.11	3.74	0.67	22,337	1340

- Palau

Japanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	5 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	61	20.05	10.79	1.95	40,025	2001
1998						
1999	86	15.23	4.36	0.17	21,117	1056
2000						
2001						
2002						
2003	90	13.10	11.77	0.51	26,002	1300
2004	133	18.08	4.14	0.68	21,028	1051
2005	62	20.10	14.58	0.56	41,188	2059

- Solomon Islands

Japanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	5 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997						
1998	19	43.04	2.43	0.57	50,154	2508
1999	4	53.50	7.50	1.50	62,816	3141
2000	10	39.20	5.80	3.50	35,634	1782
2001	172	28.58	2.45	0.79	27,541	1377
2002	36	7.72	2.48	0.37	9,729	486
2003	237	14.23	5.62	0.43	18,058	903
2004	538	20.59	2.48	0.45	21,007	1050
2005	408	22.84	2.60	1.54	24,477	1224

Korean purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	521	7.66	8.19	0.87	20,572	1234
1998	1,625	17.39	11.69	0.50	33,741	2024
1999	58	7.72	0.30	0.05	5,315	319
2000						
2001	223	22.18	6.72	0.34	23,925	1435
2002	29	13.30	2.34	0.43	12,501	750
2003	314	16.31	5.86	0.14	17,821	1069
2004	936	23.99	4.93	0.31	26,647	1599
2005	591	22.14	6.42	0.52	27,529	1652

Taiwanese purse seine fleet

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	6 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997	166	6.51	11.49	0.61	24,062	1444
1998	1,482	19.72	7.55	0.31	30,221	1813
1999	110	20.12	1.09	0.14	14,137	848
2000	12	31.32	3.34	0.29	19,654	1179
2001	199	19.00	3.51	0.16	18,339	1100
2002	29	7.24	0.27	0.07	5,736	344
2003	154	13.08	1.99	0.11	11,324	679
2004	369	18.09	2.87	0.27	19,175	1151
2005	540	21.61	2.72	0.55	22,351	1341

- Tuvalu**Japanese purse seine fleet**

	Days fished	CPUE (Mt/day)			Gross value of catch per day fished (US\$)	5 per cent of gross value (US\$)
		SKJ	YFN	BET		
1997						
1998	343	23.60	2.76	0.41	29,585	1479
1999	159	17.74	4.32	0.22	23,480	1174
2000	82	20.23	3.80	0.32	19,630	982
2001	75	19.24	1.61	0.77	18,498	925
2002	53	22.42	1.45	0.42	20,572	1029
2003	70	10.47	4.23	0.53	13,423	671
2004	58	16.98	2.29	0.90	17,657	883
2005	24	14.92	2.71	1.13	17,604	880

Appendix 2: Side-payment scheme for Japan, Korea and Taiwan

Japan

Side-payments								
Years	Palau	FSM	Solomon Islands	Marshall Islands	Nauru	Kiribati	Tuvalu	Total
1997	- 37.906	586.245	226.925	568.095	-188.191	-1.298.550	143.382	0
1998	74.434	781.799	153.061	-1.160.529	87.245	444.468	-380.477	0
1999	- 19.648	- 374.446	179.342	- 174.751	174.700	280.214	-65.411	0
2000	60.521	361.068	145.376	- 211.025	- 354.209	- 24.323	22.591	0
2001	61.717	1.245.475	- 70.423	6.352	-228.328	-1.050.571	35.778	0
2002	66.262	1.110.446	161.180	- 63.247	- 558.732	- 774.268	58.359	0
2003	- 61.222	-1.186.775	- 63.605	374.564	356.111	532.864	48.064	0
2004	- 84.093	-876.639	- 414.732	257.551	289.886	784.358	43.669	0
2005	-60.065	- 1.647.172	- 317.125	402.991	421.518	1.105.808	94.045	0
Total	0	0	0	0	0	0	0	0

Korea

Side-payments							
Year	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	689.339	101.712	246.789	478.961	435.016	- 1.951.817	0
1998	926.667	1.700.259	-2.176.518	-1.286.000	574.352	261.239	0
1999	-1.852.659	1.158.113	384.172	- 182.240	- 262.158	754.772	0
2000	- 325.005	- 966.190	569.542	201.937	-267.992	787.708	0
2001	- 146.599	1.444.184	425.362	- 270.613	- 185.950	-1.266.384	0
2002	341.017	1.895.026	824.938	- 86.923	- 802.352	- 2.171.707	0
2003	679.289	- 2.805.284	249.189	308.447	258.218	1.310.142	0
2004	135.561	- 2.154.789	- 586.834	371.594	- 52.726	2.287.193	0
2005	- 447.610	- 373.030	63.359	464.836	303.592	- 11.147	0
Total	0	0	0	0	0	0	0

Taiwan

Side payments							
Year	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	395.943	- 1.696.515	323.039	264.534	840.453	- 127.455	0
1998	690.183	1.985.319	- 2.001.692	-458.537	- 191.482	-23.790	0
1999	-1.080.227	1.099.006	239.478	-73.312	- 64.779	-120.166	0
2000	- 194.479	- 607.214	380.644	68.265	-436.618	789.401	0
2001	- 116.382	1.147.690	272.022	-187.109	57.789	-1.174.010	0
2002	1.041.356	1.388.241	547.387	- 85.980	- 798.601	- 2.092.405	0
2003	-175.065	-1.834.846	349.180	160.460	502.109	998.161	0
2004	218.475	-1.177.212	66.691	141.090	- 312.420	1.063.376	0
2005	- 779.804	- 304.469	- 176.751	170.588	403.548	686.888	0
Total	0	0	0	0	0	0	0

Appendix 3: Five-year moving average side-payment scheme

Japan

5-year moving average								
Year	Palau	FSM	Solomon Islands	Marshall Islands	Nauru	Kiribati	Tuvalu	Total
1997	1%	34%	1%	13%	16%	32%	3%	100%
1998	1%	34%	1%	13%	16%	32%	3%	100%
1999	1%	34%	1%	13%	16%	32%	3%	100%
2000	1%	34%	1%	13%	16%	32%	3%	100%
2001	1%	34%	1%	13%	16%	32%	3%	100%
2002	1%	34%	1%	13%	16%	32%	3%	100%
2003	0%	31%	1%	16%	17%	30%	4%	100%
2004	1%	39%	2%	10%	16%	30%	2%	100%
2005	1%	41%	5%	8%	16%	28%	1%	100%
Evenly shared with moving average								
Year	Palau	FSM	Solomon Islands	Marshall Islands	Nauru	Kiribati	Tuvalu	Total
1997	50.895	2.160.409	75.281	839.147	998.014	2.052.563	201.750	6.378.059
1998	45.016	1.910.855	66.586	742.215	882.731	1.815.467	178.446	5.641.314
1999	43.040	1.827.010	63.664	709.648	843.998	1.735.808	170.616	5.393.785
2000	36.602	1.553.687	54.140	603.484	717.735	1.476.128	145.091	4.586.866
2001	37.325	1.584.388	55.209	615.409	731.917	1.505.297	147.959	4.677.503
2002	40.073	1.701.058	59.275	660.726	785.814	1.616.143	158.854	5.021.944
2003	15.162	1.322.335	55.490	669.835	727.661	1.286.901	149.986	4.227.370
2004	36.688	1.636.979	88.048	413.570	687.712	1.280.344	77.338	4.220.679
2005	57.862	2.087.274	236.844	405.313	815.508	1.451.878	68.191	5.122.871

Korea

5-year moving average							
Year	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	18%	24%	12%	9%	5%	31%	100%
1998	18%	24%	12%	9%	5%	31%	100%
1999	18%	24%	12%	9%	5%	31%	100%
2000	18%	24%	12%	9%	5%	31%	100%
2001	18%	24%	12%	9%	5%	31%	100%
2002	18%	24%	12%	9%	5%	31%	100%
2003	19%	19%	11%	11%	8%	32%	100%
2004	21%	32%	2%	6%	10%	29%	100%
2005	14%	42%	6%	4%	9%	25%	100%
Evenly shared with moving average							
Year	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	1.515.302	1.981.790	1.021.410	738.269	389.191	2.588.272	8.234.234
1998	1.894.728	2.478.023	1.277.167	923.129	486.643	3.236.366	10.296.057
1999	685.815	896.945	462.283	334.135	176.145	1.171.434	3.726.758
2000	970.018	1.268.640	653.854	472.602	249.140	1.656.878	5.271.132
2001	1.269.475	1.660.286	855.707	618.500	326.053	2.168.379	6.898.400
2002	1.442.041	1.885.976	972.027	702.575	370.375	2.463.136	7.836.129
2003	1.052.807	1.011.165	580.481	577.268	452.125	1.739.004	5.412.849
2004	1.753.079	2.657.845	201.063	504.693	833.828	2.470.003	8.420.511
2005	1.378.217	4.012.488	618.217	417.896	835.575	2.359.981	9.622.373

Taiwan

5 year moving average							
Year	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	23%	35%	8%	4%	8%	22%	100%
1998	23%	35%	8%	4%	8%	22%	100%
1999	23%	35%	8%	4%	8%	22%	100%
2000	23%	35%	8%	4%	8%	22%	100%
2001	23%	35%	8%	4%	8%	22%	100%
2002	23%	35%	8%	4%	8%	22%	100%
2003	22%	28%	7%	5%	12%	26%	100%
2004	24%	37%	1%	3%	11%	24%	100%
2005	21%	42%	2%	3%	11%	21%	100%
Evenly shared with moving average							
Year	FSM	PNG	Solomon Islands	Marshall Islands	Nauru	Kiribati	Total
1997	2.253.976	3.393.557	742.197	353.402	797.329	2.083.424	9.623.884
1998	2.744.352	4.131.863	903.669	430.288	970.796	2.536.695	11.717.664
1999	1.332.808	2.006.659	438.871	208.972	471.472	1.231.958	5.690.741
2000	1.581.276	2.380.750	520.688	247.929	559.366	1.461.626	6.751.635
2001	1.966.309	2.960.451	647.473	308.299	695.569	1.817.524	8.395.624
2002	2.232.429	3.361.117	735.101	350.024	789.707	2.063.507	9.531.884
2003	1.698.533	2.166.742	557.394	349.733	945.012	2.042.439	7.759.853
2004	2.023.171	3.084.676	97.170	257.602	900.299	2.041.055	8.403.973
2005	1.947.414	3.977.236	177.015	235.886	1.047.545	1.976.211	9.361.308