Review of the PNA Purse Seine Vessel Day Scheme

Final Report

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Foreword

After 5 years of the establishment of the PNA Office, and having taken over the administration of the PNA Purse Seine Vessel Day Scheme (VDS), we wanted a review of the VDS to be undertaken by an independent group of people who have not had anything to do with its establishment. We were not sure about the direction that this review would take and even then we were also not sure about the choice of Consultants because apart from Judith Sawn whom we had been familiar with when she was Legal Officer at the Forum Fisheries Agency (FFA), we did not know Professor Ragnar and Dr. Michael Harte. Indeed very few of us knew them except perhaps for me as I had come to know Professor Ragnar though our association as Members of the World Bank Blue Ribbon Panel. I also recall seeing Dr. Michael Harte at the FAO Fish Rights Conference in Perth in 2006 but I did not know him personally.

We were keen on having an independent review of the VDS on the 5th year of the establishment of the PNA Office because it was the right thing to do. It was necessary to have an evaluation of where and how far we had come and also to identify the areas that we will need to improve. We wanted answers to questions about how the VDS was working, how we were administering it, and whether the systems we were developing to monitor the VDS were robust. We wanted to ensure that we had a Report that would help us to improve the administration and implementation of the VDS so that it continued to achieve the efficacy expected of it. We believe that we have an excellent Report. It has been considered by our Ministers who have tasked that we work on a Plan which will form the Strategic Plan for the PNA for the next 5 years. In spite of some initial issues with regards to the logistics, the Review has been highly successful and is without doubt, one of the best quality works on the Pacific Tuna fisheries in recent years.

PNA Ministers considered the draft Report at their Special Meeting in Funafuti, Tuvalu and tasked PNA Officials to develop a work plan setting out the key issues for implementation. A Working Group was convened and met in Yap in the Federated States of Micronesia in February and again in Majuro in April. The Work Plan was finalized and presented to PNA Fisheries Ministers at their 10th Annual Meeting in June which they held in Pohnpei, Federated States of Micronesia. The Review will result in improvements to compliance mechanisms and the establishment of a research programme that will help inform the PNA on the development of a bioeconomic model that is more suited to the PNA.

Funding for the Review took a circuitous journey. It was initially earmarked for funding by the FAO under the ABNJ but delays to the availability of funds and the protracted procedures of the FAO compelled me to seek alternative funding. The Review was supported by funds provided by the Forum Fisheries Agency. We are appreciative of this support that enabled the Review to be undertaken. The Review no doubt will be of immense interest to fisheries economist, practitioners, academics and others interested in the tuna fisheries of the Western and Central Pacific.

Dr. Transform Aqorau
Chief Executive Officer

July 2015

Hagrannsoknir sf

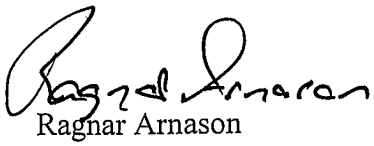
Review of the Purse Seine Vessel Day Scheme

October 30 2014

Preface

On 22 of February 2014, Hagrannsoknir sf contracted with the FFA to conduct an independent review of the PNA purse seine vessel day scheme. One of the stipulations of this contract was that an initial draft review be submitted for comments by the FFA, members of the review's Steering Committee, the staff of the PNA Office and other interested parties following which a revised review would be submitted. The first draft of the review was submitted on September 27, 2014. This report represents a revised second draft modified in response to the comments received and improved in various other ways.

Reykjavik 30.10 2014



Ragnar Arnason

For Hagrannsoknir sf

Acknowledgements

This review would not have been possible without the unstinting assistance of several members of staff at the FFA and the PNA Office, members of the review's Steering Committee, numerous fisheries administrators from PNA countries and various other experts on the PNA vessel day scheme. These people have provided us with background reports, numerical and qualitative data valuable insights and, crucially, comments on and criticisms of our work at its various stages of development. We would like to express our gratitude for all the time and effort these people have been willing to contribute in order to improve our report.

The list of individuals to which we owe gratitude is too long to recount. However, special thanks are due to Mike Batty and Chris Reid at the FFA, Wez Norris, the chairman of our Steering Committee, Transform Aqorau, Maurice Brownjohn and Sangaa Clark at the PNA Office, Mark Oats, one of the designers of the FIMS, Richard Banks at Poseidon and a PNA economist and Les Clark consultant at Ray Research. Needless to say, none of these individuals are to blame for errors and inaccuracies that may still remain in this report. That responsibility is solely ours.

Note

Because of the limited time available for preparing this second draft, some of the cross referencing between sections and chapters is imperfect. In particular, the references in chapter 3, Legal aspects, to the recommendations presented in chapter 2 have not been updated from the first draft.

Abbreviations and acronyms

DWFF	Distant Water Fishing Fleet
EEZ	Exclusive Economic Zone
EEZ	Exclusive Economic Zone
EU	European Union
FFA	Forum Fisheries Agency
FIMS	Fisheries Information Management System
FSMA	Federates States of Micronesia Arrangement
GNP	Gross National Product
IA	Implementing Arrangement
IQ	Individual Quotas
ITQ	Individual Transferable Quotas
MSY	Maximum Sustainable Yield
NA	Nauru Agreement
PA	Palau Arrangement
PAE	Party Allocated Effort
PNA	Parties to the Nauru Agreement
PSVDS	Purse Seine Vessel Day Scheme
TAC	Total Allowable Catch
TAE	Total Allocated Effort
TOR	Terms of Reference
UST	US Treaty
VD	Vessel Day
VDS	Vessel Day Scheme
VDSC	Vessel Days Scheme Committee
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific
WDFN	Distant Water Fishing Nations

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Executive Summary

This section summarizes the main results and recommendations of chapters 2 and 3 of this report. For fuller information including the analysis and arguments underpinning the recommendations the reader is referred to the corresponding subsections and appendices in the main report.

The material is organized according to specific requirements set-out in the detailed TOR (Terms of Reference) for this study (see appendix 13). Since these requirements are in various respects related, there are corresponding interdependencies in the recommendations that we try to indicate.

2.1 Governance and management

1. To allow the VDS to function more effectively, it is recommended that the broader governance of the PA, NA and the FSMA be clearly separated from the operational management of the VDS. [See also 2.6, item 1]

   To this end we suggest two specific changes:

   1.1 The formal adoption of a clear and simple objective for the VDS. Our proposed objective is to maximize fee revenues from the tuna fisheries on a sustainable basis. [See also 2.2, item 1].

   1.2 The establishment of a Board of Directors for the VDS charged with the objective of attaining this objective.

2. It is further recommended that the PNAO under the VDS Administrator be substantially strengthened in various ways.

2.2 Design objectives

1. The VDS should be operated with the single objective of maximizing net fee revenues from the tuna fisheries on an economically and ecologically sustainable basis. [See also 2.1 item 1.1]
2. The durability of VD rights held by Parties to the PA should be strengthened. In particular, there are great efficiency advantages in the Parties having a long term share in the TAE that would be unaffected by the fishing in their EEZ and their own trading in their PAE. [See also 2.3, item 2].
3. It is recommended that steps be taken to substantially increase the transferability the PAE. In particular, trades of the PAE to other Parties should not affect future years PAE. (See item 2 above).
4. It is recommended that a study be undertaken into the costs and benefits of altering VDS to a system where the fishing rights are in terms of harvest volume rather than effort. [See also 2.3 item 3].

2.3 Allocation mechanisms

1. We recommend that the current process of determining PAE be replaced with an allocation mechanism which gives long-term certainty to Parties regarding their entitlement to a share of the VDS and increased flexibility in the way in which VDs can be transferred to other Parties without a penalty in the form of reduced future PAE [See also 2.2, item 2].
2. We suggest the PA be amended or provisions made in a new integrated legal instrument allowing for both the entry of new Parties to the VDS and the mechanism for calculating their proportional share of the VDS. This has the advantages of facilitating new entry and clarifying implications for both the joining Party and existing Parties.
3. We advise that a study be initiated to evaluate the cost and benefits of transforming the VDS from an effort-based to a harvest-based system. [See also 2.2, item 4]
4. As long as an effort-based system is retained we urge the continuation of current efforts by the FFA and PNA to control, modify and/or reduce FAD use by pricing of VDs and other means.
5. As long as an effort-based system is retained, it is vital to continue the efforts by the PNAO to address fishing effort creep by more closely relating individual vessel performance to its calculated use of a standard VD. This would help align the actual fishing mortality and harvest under the VDS to target reference points and reduce the incentives for fishing companies to find ways to bypass the effort constraints.
6. We further suggest that the PA be amended or provision made in a new integrated legal instrument allowing for a range of appropriate mechanisms to be integrated into the VDS to manage effort creep.

2.4 Participation and Management of Substitutes

1. The competitive fringe constitutes a threat to the efficacy of the VDS in maximizing fishing fee revenues. It is recommended that the VDS-partners actively try to expand the VDS-coalition or at least attempt to get nations in the competitive fringe to act co-operatively with the VDS. [See also 2.3 item 3].
2. The VDS-partners should do their utmost to exclude fishing from the high seas pockets (doughnut holes) between or bordering their EEZs.
3. VDS should eliminate or minimize the effects of the internal competitive fringe by:
   - Bringing all purse seine fishing effort under the standard VDS.
   - Ensuring all purse seine fishing effort is charged at least the benchmark fee.
4. The VDS partnership should be expanded to include the long-line VDS and attempt to set a long line fee level that minimizes artificial distortions between fishing methods.[1]

[1] Different fishing fees for different fishing methods alter the relative attractiveness of these methods to the fishing companies and thus may artificially distort their choice between the methods.

2.5 Trading arrangements

1. It is strongly recommended that a study be conducted into the advantages and disadvantages of making the VD more homogeneous in the sense that they can be used in several, possibly all of the VDS-partners' EEZs (pooling).
2. It is recommended that free trading of VDs between partners be formally allowed within the VDS-structure (PA). A framework for facilitating trades should be developed e.g. under the auspices of the PNAO.
3. It is recommended that fishing companies be formally allowed to switch their VDs between EEZs subject to restrictions to be developed. However, they should not, at least not until the harvesting efficiency of different vessels is better accounted for, be allowed to switch VDs between vessels.
4. It is strongly recommended that work on designing auctions for VDs for maximizing their value be initiated. [See also 2.9, item 3].

2.6 Integrity of systems and processes

1. We suggest formally separating the management of the VDS systems and processes from broader PNA harmonization issues. The two are not completely independent, but should be dealt with separately within the PNA. (see also 2.1, item 1).
2. To promote the integrity of VDS systems and processes we recommend a clearer demarcation of roles and functions between the PNAO (under the VDS Administrator) and the Parties to the PA ensuring stronger accountabilities for different management and administrative functions. (See also 2.1,item 1)
3. The VDS Administrator operating via the PNAO as the chief executive officer of the VDS should be responsible for implementing the VDS on behalf of the VDS Board.

To improve uniformity and consistency in the application of the VDS, we further recommend:

4. The VDS Administrator be charged with the responsibility of ensuring that the VDS system be applied uniformly and consistently across the waters of the VDS-partners.
5. The VDS authority (the Board or annual meeting) adopt a clear, operational and preferably simple definition of vessel days. One such definition is simply day at sea in the EEZ of a VDS-Partner.[2]
6. The VDS Administrator be made responsible for implementing this definition in the accounting of VDs used by the Partners. In this he can of course make use of the VMS and the FIMS.[3]
7. The VDS Administrator be made responsible for developing and operating efficient market trading mechanisms including but not limited to the enforcement of minimum

[2] We note that the 2014 PA and FMSA meetings, this issue was considered and resolutions in the very direction we suggest taken. This suggests that the main issues now is implementation and compliance

[3] Again we note that this seems to be the way the role of the VDS Administrator and the PNAO is developing.

benchmark prices, operation and maintenance of VD trading exchange and the preparation for and operation of a VD auction system. (See 2.5 and 2.5 item 4).

8. The necessary system for compliance including sanctions be developed and implemented. (See 2.7 below).

2.7 Compliance with the rules

1. The VDS rules should be as clear and complete as possible to minimize the room for alternative interpretation and loopholes.
2. The rules and/or applicable legal instruments should have clear statements of the process of dealing with infringements as well as the type and level recompense for violations.
3. We further recommend the development of an adjudication process to assess whether in fact infringements have been committed and, if so, the appropriate recompense. [See also 2.6, item 8, 2.8, items 3 and 4 and 3.2, item 2].

2.8 Transparency

1. It should be clearly stipulated (possibly in an amendment to the Palau Arrangement) that all applications of the VDS by individual Parties that may negatively affect the benefits received by other members shall be common knowledge to all VDS-partners.
2. The VDS Administrator, with the help of the PNAO (see section 2.1) should be required to report annually on the application of the VDS by the Parties. The areas of reporting might be stipulated in the VDS-agreement (e.g. as an amendment to the PA).
3. A rule interpretation/arbitration process needs to be established.
   This process would (i) receive and review the VDS Administrator's report (see item 2 above) and (ii) respond to requests from members for clarification of rules and complaints about the application of the VDS by individual members. Obviously, detailed rules for the operation and powers of this process need to be worked out. [See also 2.7, item 3 above].
4. A clear system of sanctions for deviations from VDS rules designed to make deviations unattractive should be set up to. This should preferably be adopted by unanimous agreement of all Parties. [See also 2.7, item 3 and 3.2, item 2].
5. A VD-registry should be run. This registry should provide information about the VD position of every VDS-partner and every fishing-company (or vessel) that is as up-to-date as possible. The PNAO is the natural place to house and run this registry and, in fact, already does.
6. The VD-registry should be up-dated by (i) trading information and (ii) unused VD information. Both should be as close to real time as possible.
7. The VD-registry should be accessible to all VDS-partners on a confidential basis. Measures to preserve the confidentiality (this is potentially valuable information) may need to be taken.

8. Information about VD trades should only be available to VDS-partners on a confidential basis and possibly with some time delay. Steps to preserve the confidentiality (this is potentially valuable information) may need to be taken.
9. Information about prices in trades should also be collected by the VD-registry on a confidential basis. Attempts by buyers (or sellers) to stipulate in trading contracts that the registry cannot obtain such information cannot be accepted under the VDS.
10. Since information about prices in trades is potentially beneficial to VDS-partners, it may be made available to members with the permission of the VDS-partners involved in the trade or more generally on the basis of unanimous agreement to do so.
11. The VDS-registry and trading information will not be accessible to outside parties (including DWF-companies and governments). Some trading information may be made publically available after the fact (e.g. one year later) in aggregate form if so decided by Parties to the PA.
12. It appears that information about the rules and procedures of the VDS, the principles guiding decisions on the TAE, information about penalties for violations and how vessel, company and Party noncompliance are dealt with could all be public knowledge and accessible though e.g. the PNA Office public webpage

2.9 Bio-economic model: Amount of fees

The key results of the bio-economic investigation are: [4]

1. The maximum fee revenues depend strongly on:
   i. Operating conditions of the fishery including stock sizes and input and output prices.
   ii. The number of fishing days offered for sale. Too few or too many fishing days (or alternatively too high or too low daily fishing fee) will reduce attainable fee revenues.
2. The optimal (fee maximizing) number of fishing days:
   i. The optimal number of fishing days (or equivalently fees) each year depends on the operating conditions during that year as well as in the future.
   ii. This, optimal number, therefore, will generally vary over time as will maximum attainable fee revenues.
   iii. There is substantial uncertainty regarding the optimal number of fishing days (or equivalently the optimal daily fishing fee level).
      a. This uncertainty is caused predominantly by uncertainty about the true empirical parameters employed by the model not the least (a) the cost of fishing operations and (b) the landing prices of tuna.
      b. The uncertainty is to a lesser extent caused by model structure and simplicity.
3. Given recent (2011-13) operating conditions (input and output prices), it is found that there is a high probability that fishing fees can be substantially increased.
   i. A likely range for the maximum daily fishing fee is found to be 12-17 thousand US$.

[4] The key premises for these results are provided in appendix 7.

ii. A likely range for the maximum annual fees is found to be between 370 and 1150 M.US$ annually.

4. It should be noted that according to this bio-economic model, fishing fee maximizing policies leave comparatively small proportion (some 6-10%) of the total fishing profits with the fishing industry.

5. These results from the bio-economic model developed in this study are in broad agreement with those of the PNAO-model (Kirchner et al. 2014, Anonymous 2014).

6. This bio-economic study indicates that to maximize total fee revenues, the total number of vessel days may have to be increased. A likely range for fee maximizing number of vessel days is between 32 thousand and 67 thousand days. According to the bio-economic model maximum attainable fee revenues are not very sensitive to vessel days over this range.

7. Greater precision in these calculations, not to mention a proper stochastic analysis, requires a substantially more extensive bio-economic study.

8. Since the potential benefits of more precise setting of fishing days (or daily fees) are huge (easily tens of million US$ annually), setting up a special research unit expressly to investigate and recommend the optimal fishing day/fishing fee policy appears to be a good policy.

9. It is highly likely that the total fee maximizing policy will further reduce the biomass of bigeye tuna unless fishing methods (especially the particulars of FAD use) are altered.
   i. To reduce bigeye tuna mortality not to mention restoring the bigeye stock level to the neighborhood of the MSY by reducing VDS fishing days only will probably reduce attainable fishing fee revenues very substantially or by as much 2/5.
   ii. This suggests the advisability of exploring fisheries technical ways of reducing bigeye bycatch without reducing the catch rate of especially skipjack. Increased selectivity in this sense will not only be environmentally beneficial, but can increase the maximum attainable fishing fees substantially

On the basis of the bio-economic model the following is recommended:

1. It is recommended that the PNA set up a special research unit to research and recommend the optimal fishing day/fishing fee policy both for the coming fishing year and in the longer run.

   Compared to the potential benefits the costs of this unit would be miniscule. It seems appropriate to organize this research unit within the PNAO.

2. It is recommended that the PNA initiate a study and subsequently efforts to improve the species selectivity of the purse seine tuna fishery.

   The current patterns of tuna fishing in the WCPO have differential impact on the tuna stocks. In particular, it has reduced the bigeye stock precariously. The purse seine tuna fishing captures considerable amount of bigeye primarily as bycatch. Stock conservation objectives can be met and total fishing fees can be considerably increased if the species selectivity of the purse seine fishery can be increased. Such methods exist and can no doubt be made more efficient.

3. It is recommended that the PNA initiate work on a robust design of an auction or tender process to maximize fishing fee revenues. [See also 2.5, item 4]

This is a substantial piece of work involving both high level technical expertise and solid understanding of the empirical reality of the tuna fishery and fishing day trading. The potential benefits of a well-designed system, however, far outweigh the possible costs of this work.

2.10 The level of fishing effort (TAE)

It was found that:

1. There is a considerable uncertainty about both the short run and long run optimal level of vessel days
2. There are indications that the fee revenue maximizing vessel days could be somewhat higher than those today. The evidence, however, is not very conclusive. This suggests that a more careful bio-economic study should be conducted before the current vessel day policy is altered.

3.1 Role and organization of the PNA Office

This report recommend a substantially enhanced role of the PNAO with added functions including facilitating trades of VD, overseeing auctions of VDs, bio-economic research, expanded VD registry and more

1. It is recommended that the relevant legal articles and instruments applicable to the PNAO and the Administrator be strengthened or, as the case may be, amended to accommodate these enhanced duties.

3.2 Legal instruments

1. Current legal instruments affecting the VDS suffer from certain constraints, gaps and inadequacies. It is highly desirable to take steps to remedy these weaknesses.
2. Certain proposal of the report, notably, those having to do with non-compliance by Parties and enforcement of the rules require strong legal backing. This legal backing needs to be developed if it is decided go go-ahead with beefed-up compliance and enforcement.

3.3 Options for optimizing the legal mix

The legal analysis suggests the following options for optimizing the mix between existing legal instruments having a bearing on the operation of the VDS:

1. Developing and adopting a new integrated legal instrument based on and incorporating existing legal instruments (PNA, PA and FSMA). This new instrument would:
    i. Replace the existing legal instruments as appropriate or
    ii. combine issues relating to cross-cutting and/or interdependent matters and accordingly amend the existing legal instruments.
2. Amend the PA (Palau Arrangement) only. Amendments of other legal instruments may be considered separately.

3. Amend the PA (Palau Arrangement) and agree on a new separate protocol or other form of instrument applicable to the NA (Nauru Agreement) and the FSMA (FSM Arrangement) to harmonize them with the amendments.

1. Introduction

The WCPO tuna fishery is one of the largest and most valuable fisheries in the world. The biological productivity and the harvesting and marketing economics of this fishery are such that properly managed it can generate, on a sustainable basis, very substantial net economic income.

The WCPO tuna fishery is also one of the most complicated in the world. The tuna resources are spread over a huge ocean area and are found in significant volume in the EEZs (Exclusive Economic Zones) of more than 12 independent nations as well as the high seas between them. They are exploited by both local and distant water fishing nations and by very different types of fishing enterprises using a variety of fishing methods. These attributes of the fishery imply that it is also one of the world's most difficult to manage effectively.

The PNA purse seine Vessel Day Scheme (VDS) represents an attempt by eight Pacific States, whose EEZs cover a large fraction of the distribution area of the WCPO tuna resources, to install a management system for this fishery capable of conserving the resource and securing the flow of net economic benefits from the fishery on a sustainable basis. Given the complexity of the fishery and the number of nations involved, this may be the single most ambitious attempt of this kind seen in the world so far.[5]

There is overwhelming evidence that the VDS has been highly successful. Under the VDS, two of the largest tuna stocks; skipjack and yellowfin, have been maintained in a very healthy state. The main target species in the fishery, skipjack (accounting for some 70% of the total catch) is currently underexploited, while yellowfin (accounting for some 25% of the total catch) is close to fully exploited (WCPFC, 2013). Only the third stock, that of bigeye tuna (accounting for some 5% of the total tuna catch), which constitutes hard-to-avoid bycatch in the purse seine fishery, is overexploited in the sense of being below the MSY level (WCPFC, 2013). Apparently certain advances in or modifications of the application of the purse seine fishing technology are needed to bring the fishing mortality of this tuna species into line with that of skipjack and yellowfin. The net economics benefits of such efforts are unclear.

The economic success of the VDS has been even more impressive. Since the introduction of the Scheme, the fishing fee revenues collected by the VDS-partners have increased dramatically.[6] At the present they amount to a significant part of the landed value of the catch[7] and are still increasing. It moreover appears that a good part of these gains represents an overall improvement in the net economic benefits generated by the fishery; there are no signs that the profitability of the fishing fleets has been reduced by anything like the increase in the fishing fees.[8]

The comparative success of the VDS system raises the question of what elements of the VDS are primarily to thank. The VDS restricts the number of fishing days (referred to as vessel

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[5] The only somewhat comparable case we can think of is the attempt by the European Union to implement a common fisheries policy across the union. This attempt, however, is widely acknowledged to have been a failure at least so far.

[6] According to our data, since 2010 (2 years after the introduction of the system) the increase is close to being five-fold

[7] In 2013, fee revenues were close to 7% of the landed value of the catch from EEZs of the VDS-partners.

[8] This, however, has not been carefully researched.

days, VDs). However, it is well-known, both theoretically and empirically, that effort restrictions, since they do not curtail the common property problem, will not lead to significant sustainable economic benefits from a fishery (Clark 1990, Arnason 2007b). The reason is that fishing effort is a multidimensional variable and restricting just one component, e.g. fishing days, will only lead to and expansion in other components, e.g. vessel efficiency, as explained further in appendix 11 to this report. On the other hand, it is also well known that taxes on common property fisheries can in principle generate sustainable economic benefits equal to the tax revenue (Clark 1990, Arnason 2007b).

This is precisely what seems to be happening under the VDS. Limiting the supply of VDs and selling them at the market price amounts to a tax on the fishing activity. The tax revenues (after collection costs) are equivalent to net economic benefits from the fishery, for fishing companies that pay the tax will not be operated at a loss. The tax also reduces the profitability of fishing and thus the incentive for investing in effort components that can compensate for limited VDs. As a result, the increase in unrestricted components of fishing effort, the inherent weakness of limited effort systems, is correspondingly reduced.

Thus, the potent fisheries management component of the VDS system is not the limitation on VDs per se but the fishing fee per vessel day.[9] So, contrary to arguments sometimes made by representatives of the DWF-fleets, the fishing fee is the crucial part of the VDS. The higher this fee can be pushed, while the allowable fishing days are still being used, the more economically efficient will the tuna fishery be and the greater its net contribution to the world economy.

This draft report is organized as follows:

Chapter 2 sets out our essential analysis of the issues and resulting recommendations. It is arranged according to specific tasks in the Terms of Reference (TOR) for this work, so there is one sub-section for each task. More detailed analytical and empirical support for the material presented in the sub-sections is contained in appendices at the end of the report. Many of the issues of chapter 2 are complicated and the respective appendices are in many cases essential for fully understanding our analysis and conclusions.

Chapter 3 addresses the legal aspects of our recommendations primarily relating to governance and management, as well as others that would benefit from legal underpinning. It reviews and defines the relationship among the legal instruments to which all or most Parties to the Palau Arrangement are also party.[10] The legal aspects of the role and organization of the PNA Office are reviewed and constraints and gaps in the legal instruments affecting its administration, management and operations are identified and assessed. Options for optimizing the mix of legal instruments are presented, based on a recommended indicative framework for an integrated legal instrument. Finally, options for legal mechanisms relating to dispute prevention and resolution are set out and discussed. As is the case for chapter 2, the legal material in this chapter is supported by a number of annexes that may be consulted for added information and clarity.

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[9] It should be mentioned, however, that this does not imply total VDs (TAE) could be increased without an effect on the fee revenues. Under the present arrangement of selling VDs, the fee per VD depends (inversely) on the total VDs issued (TAE) so the two are intricately linked.

[10] Those include the Nauru Agreement (NA), the Palau Arrangement (PA), the Purse Seine VDS (PSVDS) and the Federated States of Micronesia Arrangement (FSMA).

The final part of this report consists of several appendices and, in the case of chapter 3, legal annexes complementing the main text. Much of the detailed analysis and background information is contained in these appendices/annexes.

2. Findings and recommendations

This chapter provides our analysis of the VDS issues specifically identified in the Terms of References (TOR). The chapter is organized in sub-sections in the same order as the issues are set out in the TOR. Each sub-section contains our analysis, often supplemented by additional material in appendices, followed by policy recommendations.

2.1 Governance and Management

Governance of fish resources that migrate between or straddle different national EEZs is always complicated and often contentious. Governance of the valuable tuna resources in the Western Central Pacific region, which are found in significant quantities in more than 12 national EEZs[11] as well as extensive high seas areas and exploited by both local and distant water fishing firms using a variety of fishing techniques, is among the most challenging in the world.

The PNA Vessel Day Scheme (VDS), comprising approximately 60% of the tuna resources in the WCPO, has been superimposed on this situation as well as the pre-existing regional, sub-regional and national fisheries management bodies. It is well documented (see e.g. Havice 2013 and Aqorau 2014) and generally recognized that the VDS has worked well in terms of curtailing the exploitation of the tuna resources and increasing the net economic benefits to the PNA-members. However, there are indications that a streamlined governance structure and management of the VDS may substantially facilitate further progress toward the maximization of the net benefits from these resources to the PNA on a sustainable basis.

Jointly referred to as the PNA VDS or just the VDS, the purse seine VDS and the trial long-line VDS are implemented under the Palau Arrangement (PA). The PA, however, is just one of three overlapping but separate sub-regional agreements between the PNA members that are relevant for the VDS governance.

1. The Agreement Concerning Cooperation in the Management of Fisheries of Common Interest (PNA) was established in 1982 to agree on minimum terms and conditions for foreign fishing vessels that fish in their waters. Eight Pacific Island States are Party to the Agreement.
2. The Palau Arrangement (PA), first signed in 1992 but subsequently amended a number of times, sets out a Management Scheme consisting of rules for the purse seine VDS.. The VDS was established under the PA in 2006.[12]
3. The Federated States of Micronesia Arrangement (FSMA) a reciprocal purse seine access agreement effectively requiring the commitment of vessel days to a regional pool for access by purse seine vessels flagged to participating Parties.

Although each agreement has potentially a major bearing on the governance and management of the PNA VDS, they are administered separately with differing governing bodies making different decision, hold separate meetings often attended by different staff and decisions under any one of them are not subject to the confirmation or endorsement by the others. Further

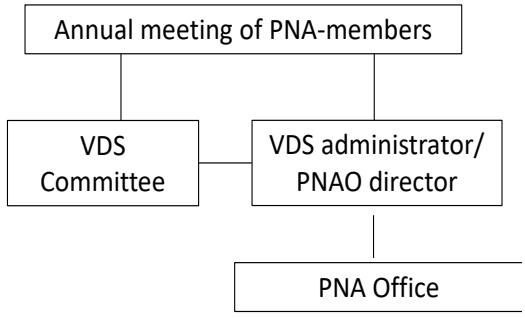
[11] The eight PNA nations and Indonesia, Philippines, Japan and Vietnam

[12] The current VDS for the purse seine fleet was agreed on February 2 2013 (http://www.pnatuna.com/Documents).

complicating the governance and management of the PNA VDS is the existence of the Treaty on Fisheries between the Governments of certain Pacific Island States and the Government of the United States of America (UST) that came into effect in 1988 providing for the access of US flagged vessels to large areas of the Pacific including the EEZs of 16 participating Pacific Island States. Two regional organizations, the Forum Fisheries Agency (FFA) and the Secretariat of the Pacific Community (SPC) advise on regional fisheries matters. This advice often has a bearing on the management of the VDS. The Western and Central Pacific Fisheries Commission (WCPFC) is the forum for collective decision making between PNA, other FFA members and DWFF, and these decisions also often impact on the operation of the VDS.

Compared to this external complexity, the internal VDS governance and management arrangements as set out in the Palau Arrangement are relatively straightforward. There are three main governance institutes: (i) the Annual Meeting of Parties to the Palau Arrangement which is the top governing body, (ii) the Vessel Days Scheme Committee (VDSC) which provides oversight of the VDS and (iii) the Administrator of the VDS which conducts the day-to day administration of the VDS. Importantly, the Administrator is also the Director of the PNA Office (PNAO) whose establishment was agreed by the Bikenibeu Declaration of 2009. The essentials of this governance structure are illustrated in figure 2.1.

Figure 2.1
The internal VDS governance structure



The Annual Meeting of the Parties to the Palau Arrangement considers, but is not required to act on, the advice of the VDSC, sets the Total Allowable Effort (TAE), the Party Allowable Effort (PAE) as well as other important parameters of the VDS such as the benchmark fishing fee rate. In practice, much of the advice to the VDSC and the Annual Meeting is coordinated by the VDS Administrator and/or presented by the PNA Office.

We don't see any fundamental difficulty with this internal governance structure of the VDS. In our opinion, there is a problem with the external governance structure of the VDS in the form of the other agreements and arrangements such as FSMA and the PNA itself and the wider regional bodies WCPFC, the SPC and the FFA. While the last two have a purely advisory role, the first three may, at least in principle, impinge on the governance of the VDS. It is therefore important to ensure that roles and functions are well defined and Parties implement decisions and agreed policies consistently.

The advantage of this governance arrangement is that it allows issues to be negotiated at a high governmental level with minimal alienation. Differences can be aired, and compromises found. Moreover in the early days of the VDS, as experience was being gathered, this proximity of the VDS operations to high level political decision making was perhaps necessary.

There are disadvantages, nevertheless, with this arrangement especially as the VDS settles down and the issues increasingly become the technical matters of maximizing fee revenues. First, as sovereign states Parties to the PA have a range of multi-lateral, bi-lateral and business

related obligations. This means, the PNA representatives attending the Annual Meeting of the PA as well as meetings in other governance bodies, which may have a bearing on the operation of the VDS, inevitably bring with them a range of concerns that may not have much to do with the basic aims and operation of the VDS as such but may interfere both with the discussions and the eventual decisions. Second, because of the disparity of the VDS-partners both in terms of their involvement in the tuna business and the nature of their economies, they are likely to want somewhat different operations of the VDS even to the point where maximization of aggregate fee revenues would not necessarily be their preference. Third, as the VDS matures, the problems that have to be solved will become increasingly more technical. This suggests an increased need for specialized technical abilities in the decision making rather than political acumen. Finally, one effect of the above is to increase the uncertainty as to annual decisions about the VDS system as well as its evolutionary direction both for parties to the NA and for businesses participating in the purse-seine fisheries. This uncertainty inevitably results in a reduction in the collective benefit of the VDS compared to what would otherwise be the case. As the value of Vessel Days continues to increase these nuances may become more serious.

Importantly, these disadvantages that we see, concern more the external bodies that may influence the operation of the VDS and the composition of the Annual Meeting of the PA, rather than the VDS governance structure itself.

Recommendations:

To allow the VDS to function more effectively in the future we recommend a clear separation of broader governance of the PA, NA, and FSMA from the operational management of the VDS under the PA. This will allow the operational management of the VDS to be much more effective and efficient because accountabilities for the delivery of VDS services will be clearer and administrative functions freed from extraneous considerations.

To this end we suggest two specific changes:

1. The formal adoption of a ***clear and simple objective for the VDS*** and an unambiguous statement of this objective. [13] As further explained in section 2.2, the objective should be to maximize the sustainable net economic benefited from the tuna fisheries to Parties to the PA. An unambiguous statement of this objective could be along the following lines:

   "*The objective of the VDS is to maximize the fishing fee collected from the tuna fisheries on sustainable basis*."

   It should be noted that this objective subsumes three objectives out of the four stated in Article 2.1 of the Palau Arrangement (as amended). It leaves out objective (iii), support for the development of a domestic purse seine industry, not because this is an unworthy objective, but because this is not fundamentally a matter for collective action and, in any case, better handled by the individual nations of the PNA.

2. The establishment of a ***Board of Directors*** charged with the responsibility of attaining the (above) objective of the VDS. This Board of Directors (number of members to be decided) would be appointed by Parties to the Palau Arrangement (for a term to be

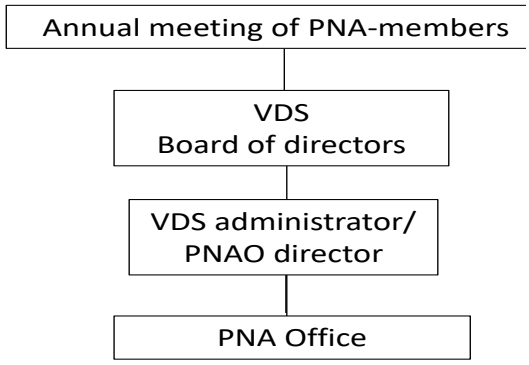
[13] This requires modification of article 2.1 in the PA.

decided). It would replace the VDSC and the VDS Administrator would be answerable to the Board.[14] This Board would carry out all the usual function of a corporate board including engaging the VDS Administrator/PNAO Director, approving budgets, setting certain parameters for the administration of the VDS (the exact mandate in this respect needs to be carefully considered), approving changes in the PNAO etc.

While the Board of Directors would be appointed by the Parties to the PA, our intention and expectation is that its membership would be more commercially professional and technical than the typical membership of the PNA-meeting. We expect this to happen because the Board is one step removed from the political level represented by the Annual Meeting and with a clear and simple commercial objective, Board Members would clearly need these abilities. The option remains to formally require certain qualifications that Board members would have to satisfy.

The essentials of our proposed governance structure may be described as in Figure 2.2. Note that the structural changes compared to the current governance structure are relatively minor. The main change in the governance of the VDS would come from (i) the restated and simplified objective and (ii) the replacement of the VDSC with a Board of Directors with presumably greater responsibilities than the current VDSC and more addressing more technical and administrative issues than the Annual Meeting of the Parties to the Palau Arrangement

Figure 2.2
The proposed VDS governance structure



We feel that by having a Board of Directors as visualized above and a clear and simple objective for the VDS, the chances are good that difficulties stemming from current weaknesses in the governance framework of the VDS will be substantially reduced and possibly all but eliminated. Most importantly the Board of Directors and a simple economic objective for the VDS serves to separate the governance the VDS from wider perspectives of the PNA and FSMA. They also serve to concentrate the internal governance of the VDS on the basic economic objective, that of maximizing the present value of fee revenues from the tuna fishery.

Overall, we feel these changes would probably be sufficient to achieve the basic objectives of the VDS as understood by us (and stated in 1 above). However, we acknowledge that this may turn out not be the case. Organizational changes that will almost certainly achieve the desired results exist. One of those is to establish the VDS as a commercial entity, i.e. a corporation with Parties to the Palau Arrangement as shareholders (see, for example, McClurg 2013). We do not think this more radical step or similar options are necessarily needed to achieve the

[14] This structural change could be implemented by a refinement of Article 11 and an amendment of article 2.3 of the Palau Arrangement.

revised objectives of the VDS. However if we turn out to be overly optimistic in this assessment, these other options remain available.

The PNA Office

The specification of functions for the PNAO needs to be clarified given the rapid evolution of the VDS and Parties' expectations of VDS performance and its management. Article 11 of the Palau Agreement defines a set of functions for the VDS Administrator. The specified functions of the VDS Administrator include Article 11.2 (vi) that states the Administrator shall *perform any function necessary for the effective administration of the management scheme.* Since the Administrator of the VDS is also the Director of the PNAO, this provision potentially provides wide latitude for the PNAO to act in support of the Administrator.

We urge that the PNAO be formally established as a joint Secretariat to the PA and FMSA in the first instance and the current functions of the Administrator to the FMSA (Article 7) and PA (Article 11) be combined.

We further suggest amending and as appropriate integrating the NA, PA and FSMA to eliminate duplication and conflicting provisions, and simplifying the VDS administration in accordance with the recommendations of this review. Options to do this include updating each agreement, merging the three agreements or establishing an implementing mechanism for creating the joint Secretariat and the establishment of the Board described above is an instrument that serves as a protocol or addendum to the PA and FSMA. This would build upon references in the PA to FSM Arrangement (Art 4) and in the FSM Arrangement to the PA (Art 2 (e)) and Nauru Agreement (Art 2(f)).

Under our proposed organization the Administrator of the VDS is responsible to the Board for the effective administration of the VDS. This can be achieved by ensuring in the new instrument that, where necessary for good governance, the Parties direct the Board while the Board directs the Administrator for matters related to the administration of the VDS.

Consensus, majority voting and dispute resolution.

The VDS is governed through consensus. There is no decision making provision or dispute resolution process within the PA, although a very basic dispute resolution provision is included in the FSMA. Decisions are taken by consensus, in accordance with regional custom. This could lead to a minority of Parties preventing important decisions being made that they disagree with. This heightens uncertainty for both Parties and harvesters and potentially reducing the ability of Parties to collectively maximise the benefits of participating in the VDS.

We hold that as a general rule, decisions of the Parties to the Palau Arrangement should be taken by consensus as currently done. However, the search for consensus should not come at the cost of undermining the fundamental objectives of the VDS. To avoid this we suggest that in regard to matters of substance situations where all efforts to reach consensus have failed, a majority voting mechanism be used. We note that various precedent exist that could be a basis for moving forward with this recommendation and these are explored in Chapter 3.

2.2 Design Objectives

The terms of reference for this study claim that the "VDS suffers from conflicting objectives with parties variously seeking":

- Increased fee revenues;
- Increased supplies for local processing;
- Improved long term sustainability of the resource;
- More equitable share of the resource.

In the Palau Arrangement (as amended), the specific objectives of the VDS are formally stated in article 2.1 as:

(i) Promoting optimal utilization and conservation of tuna resources;
(ii) Maximizing economic returns, employment generation and export earnings from sustainable harvesting of tuna resources;
(iii) Supporting the development of domestic locally based purse seine fishing industries
(iv) Promoting effective and efficient administration, management and compliance."

Although, there is considerable overlap between these two sets of objectives, taken together they amount to a fairly high number of distinguishable objectives. An amalgamated list may be written as:

(1) Optimal utilization and conservation of the tuna resources.
(2) Maximization of economic returns (including fee revenues) from sustainable harvest of tuna resources.
(3) Maximization of employment from sustainable harvest of tuna resources.
(4) Maximization of export earnings from sustainable harvest of tuna resources.
(5) Supporting the development of domestic purse seine fishing industries.
(6) More equitable share of the resources
(7) Promotion of effective administration, management and compliance.

This high number of objectives is a matter of concern. The reason is that, as established in fundamental theorem by Afriat (1967), it is logically impossible to formulate a policy unless there is one overriding objective or at least a single objective function. Note that Afriat's theorem does not reject the possibility of many objectives. The theorem only states that there must be some way to prioritize these objectives or weigh them together in order to make a decision possible. This prioritization or assigning weights to the different objectives to make them comparable is, of course, equivalent to combining them in a single objective function (Arnason 2009).

In the context of the VDS, the problem is that this prioritization or assigning weights to the different objectives has not, at least not to our knowledge, taken place. Therefore, there is no overall objective function for the VDS. All we have is a set of at least seven different objectives. Consequently, according to Afriat's theorem, there is no logically consistent way to determine the optimal VDS policy. This is not merely a technical problem. It has serious practical implications which are important to appreciate. Since it is not possible to logically determine the optimal VDS policy on the basis of the objectives, any policy that is formulated will necessarily both seem and be *ad hoc*. Exactly for this reason it will always possible to question any policy that is formulated. In fact, this questioning is likely to happen because it

will be impossible to formulate a policy that meets all the objectives and the various VDS-partners, obviously, will not rank all of them equally. Thus, it emerges that the multitude of different objectives with no weighing rule not only makes it more difficult to operate the VDS system but also undermines the coalition itself.

Fortunately, however, the problem is not as damaging as it might be. The reason is that on closer examination, it turns out that the seven objectives above are not all independent.

First, to achieve objectives (1) to (4), obviously (7) must be achieved. Thus (7) is more like a means to the attainment of the more fundamental objectives in (1) to (4) and can therefore be dropped as an independent objective.

Second, objectives (1) and (2) are not independent. As explained in appendix 10, maximization of economic returns implies both a sustainable fishery and fairly large tuna stocks that (apart from possibly bigeye) are in excess of the maximum sustainable yield level. Presumably, although this is not totally certain, this will satisfy the tuna conservation objective, i.e. (1). In that case objective (1) is subsumed by (2).[15]

Third, objectives (3), (4) and (5) are not independent of objective (2). Maximizing economic benefits from the tuna fishery implies a certain employment in the industry, a certain level of exports earnings and even a certain domestic participation in the tuna fishery (see appendix 10). Only if more (or less) of these items is desired, which may well be the case, will there be an incompatibility, in which case it might be suggested that maximization of economic returns should give way to the other objectives. Let us consider whether that could ever make sense?

Presumably, more employment, export earnings and domestic tuna industries are desirable for economic reasons. That is, these things increase economic benefits in the sense of increasing social well-being.[16] Therefore, it makes no sense to sacrifice economic benefits to achieve these benefits, unless the gains are larger than sacrifice. But in that case, the objective is still to maximize economic benefits incorporating the value of (3) to (5). Thus, it emerges that objectives (3) to (5) are actually subsumed in objective (2).[17]

Thus, on the basis of these arguments it appears, that only two independent objectives remain, namely (2) and (6). Objective (6), however, only makes sense as an equitable flow of benefits from the resources rather than, as stated, shares in the resources themselves. Thus, we are left with two fundamental objectives:

I. Maximization of economic returns from the tuna resources
II. Equitable distribution of these benefits

Regarding the 2nd objective it is important to realize that in any stable coalition, and the VDS is one, a certain degree of equity will prevail between the partners. The reason is that the

[15] If, on the other hand, the conservation objective in (1) requires even larger tuna stocks, we are faced with two independent objectives and need to weigh them together.

[16] It is important to realize that by the term economic benefits in this report we generally mean all benefits and not only monetary income. Thus, for instance social changes that would increase the wellbeing of the population would constitute economic benefits.

[17] There may still be the nagging problem of how to measure total economic gains, for instance the value of increased employment against fee revenues. These, however, are problems of measurement and not fundamental.

bargaining game equilibrium implies that each party to the coalition receives at least what he might be able to obtain on his own or in any other coalition (Nash 1953) and generally at least his contribution to the overall gains of the coalition (Shapley 1953). Thus, if one or more parties feel they are being short-shifted by the coalition they should be able to obtain an improved share by bargaining with the other VDS-partners up to the point of their contribution to the overall benefits of the VDS-coalition. If, on the other hand, they push for more than that, the stability of the coalition will be threatened.

So, the game-theoretic laws of the coalition impose certain bounds on the distribution of the benefits between partners. These bounds reflect a certain kind of fairness; the parties cannot obtain more in any other way. However, there is no particular reason to expect those bounds to be seen as fair by all parties. Therefore, it seems that there may be a real contradiction between objectives I and II. The problem, of course is that if the VDS-coalition is to survive, the distribution of benefits cannot deviate too much or too long from the game-theoretic bounds.

Thus, it emerges that objective II above is somewhat superfluous as guidance for the operation of the VDS. The very existence and stability of the VDS guarantees a certain degree of equity and attempting to alter that may undermine the coalition itself. On this basis we conclude that the overriding objective for the operation of the VDS should be objective I.

An important point to note in this context is that, provided benefits are transferable between partners,[18] game equilibrium normally implies that all partners will benefit from increasing the total benefits. Thus, they should all want the VDS operated in accordance with objective I even if the resulting distribution of the benefits is not seen as equitable. This, in fact, is what our interviews with PNA members seem to suggest; our respondents uniformly want to maximize total fee collection, although they would also like to see a host of other things.

As discussed in appendix 7, maximization of economic returns from the tuna resources to VDS members is almost the same as maximizing fee revenues. First, as demonstrated in appendix 7, there is very little difference between maximizing net proceeds from the fishery and maximizing fee revenues. Second, the difference is retained profits to the fishing companies which are predominantly foreign. Third, as the tuna harvesting industry becomes more domestic, it is straight forward to adjust the VDS operation accordingly. Note, however, that this will only be appropriate if the domestication of the tuna harvesting is approximately the same across all VDS partners.

We thus conclude that a very reasonable single objective for the VDS is:

Maximization of net[19] fee revenues on an economically and ecologically sustainable basis.

This single objective has several important advantages:

(1) It is relatively simple.
(2) It avoids the problem of multiple objectives discussed above.

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[18] Many types of benefits are transferable. Monetary benefits are the prime example of transferable benefits but so are harvesting rights, vessel days and so on. Some other benefits increased employment in one member nation are not easily transferable to another nation.

[19] I.e. fees net of the cost of collecting these fees.

(3) It is relatively easily measurable. Unlike many other economic benefits, fee revenues appear as monetary inflow.

(4) It subsumes most of the seven distinguishable objectives discussed above. In particular, it implies sustainability and a high degree of resource conservation (appendix 7), approximately maximizes total economic benefits to the VDS-partners and their export earnings from the tuna resources (appendix 7), and comes close to maximizing national employment by maximizing net national income.[20] Finally, maximizing fee revenues, will also maximize the availability of funds to those VDS-partners that want to support their domestic tuna industries or seek other structural policies. It should not be forgotten, that to the extent that such initiatives make economic sense, they will be able to purchase VDs at the going rate.

(5) The equity concern can be met by bargaining about the distribution of fishing fees (Note that in other section of this report we recommend moving away from VDs that are specific to EEZs). This distribution is, however, circumscribed by the game theoretic constraints of the VDS-coalition.

Fishing rights under the VDS

It is well established that efficiency of any production activity depends positively on the quality of the property rights in the inputs and outputs associated with the activity (Arnason 2000, Scott 2008). This applies to fisheries no less than other production activities (Arnason 2007). It follows that to assess the efficiency of the tuna fishery under the VDS it is necessary to understand the fishery property rights defined by the system and their quality.

Property rights are complicated multidimensional social arrangements. They define the rights of social agents with respect to a certain subject referred to as the property. These rights are multidimensional with several different attributes, the most important of which are (Arnason 2000, Scott 2008):

- Exclusivity (ability to keep others from using the property)
- Security (how likely is it that the owner can hold on to his property right)
- Duration (how long lasting is the property right)
- Transferability (to what extent can the property right be divided and traded to others)
- Flexibility (in what way can the property right be used)

The quality of a property right is measured by the extent to which it comprises these key properties. Thus, for instance a property right with perfect exclusivity and security, infinite duration and perfect tradability and flexibility has full quality, while a property rights of no duration or no security has the quality measure zero.

Thus, parameters of crucial importance in any rights-based system are:

- Who holds the property rights (the user or someone else).
- What is the subject of the property rights (what is the property in for example effort, harvest or the resource itself).
- How strong is the property right along the key attributes of property rights.

[20] Total employment is generally maximized by maximizing the GNP (Gross National Product).

Under the VDS, the basic property is vessel days (VDs). There are essentially two holders of these rights: (i) Parties to the Palau Arrangement; and (ii) fishing companies (mostly DWF-ones). To assess the quality of the property rights held by these parties requires an extensive study. It may be helpful at this stage, however, to provide our preliminary and extremely rough assessment of the quality of the rights held by the two parties holders. This assessment is presented in the following two tables.

Table 2.1
Quality of Property Rights: Very approximate assessment
Parties to the Palau Arrangement
Quality code: + strong; - weak; +/- medium; 0 none; (+) not very strong, (-) not very weak

	Subject of the rights		
	Fishing days	Harvest	Resource
Durability	+/-	+/-	+/-
Exclusivity	+	(+)	(-)
Security	+	+	+
Transferability	-/+	-/+	-/+
Divisibility	+	+	+
Flexibility	+	+	+
Overall quality	High [0.7,0.8]	Good [0.6-0.7]	Weak [0.3-0.4]

Table 2.2
Quality of Property Rights: Very approximate assessment
Distant water fishing (DWF) companies
Quality code: + strong; - weak; +/- medium; 0 none; (+) not very strong, (-) not very weak;

	Subject of the rights		
	Fishing days	Harvest	Resource
Durability	0	0	0
Exclusivity	+	(-)	0
Security	+	+	+
Transferability	-	-	-
Divisibility	-	-	-
Flexibility	+/-	+/-	+/-
Overall quality	Weak [0.2,0.3]	Weak [0.1-0.2]	Weak [0.-0.1]

According to our assessment, the quality of the VDS rights held by the Parties to the PA is fairly high. The main weakness of these rights is a certain lack of durability because PAE is re-calculated each year and may change radically over time. Another dimension of VDS rights quality that could be improved is the ability to transfer these days. With respect to the quantity of harvest, the rights are weaker than for the VDs as such but still fairly good (above 0.6). With respect to the resource itself the rights are considerably weaker since individual VDs confer very limited and indirect rights to the resource.

Given these fairly high quality property rights in vessel days it is clearly in the individual interest of all Parties to PA:

- Maximize the value of vessel days; and

- Sustain and conserve the resource (since this contributes to the value of vessel days)

These incentives, however, would be stronger if the rights were both more durable and transferable.

The situation is quite different as regards the actual users of fishing days (the harvesters of tuna). They have low quality, short term and mostly nontransferable fishing rights. Therefore they have very limited interest in conserving the resource, employing the least harmful fishing methods and generally following the profit maximizing fishing path. Importantly, because their exclusivity in harvests is so weak, they have strong interest in finding ways to secure more harvest per vessel day. This will lead among other things to overinvestment in harvesting capacity[21] and altered fishing behavior in many other ways, which will reduce fishery net profits compared to what would have been attainable and, therefore also lower attainable fishing fee revenues.

The DWF vessels are in effect the fishing agents of the VDS-partners. Since they do not have strong property rights in the fishery, these agents cannot be relied on to fish in accordance with the objectives of the VDS. To make them do so requires either (i) a high degree of costly monitoring and enforcement or (ii) strengthening of their fishing rights. The latter, however, while increasing the profitability of fishing would inevitably lead to a reduction in the maximum share of the PA-partners in the overall benefits and may therefore not contribute to the basic objective of the VDS.

Cognizant of the both the strengths and weaknesses of the rights embedded in the current VDS we recommend the consideration of the following:

Recommendations

1. Strengthening the durability of VD rights held by Parties to the PA. In particular, there are great advantages in the Parties having a long term share in the TAE that would be unaffected by the fishing in their EEZ and their own trading in PAE.
2. Taking steps to substantially increase the transferability the PAE. In particular, trades of the PAE to other Parties should not affect future years PAE (see 1 above).
3. Initiating a study into the costs and benefits of altering VDS to a system where the fishing rights are in terms of harvest volume rather than effort. [22]

[21] The adjustment of "effective" fishing days according to vessel length mitigates this effect only very partially.

[22] The arguments in favor of harvesting rights are discussed in appendix 12.

2.3 Allocation Mechanisms

In the preceding section about design objectives we made the case that the economic development and conservation objectives of the VDS would to a considerable extent be met by maximizing fees from the VDS. Further we explained that strong fishing property rights would contribute to increasing the attainable fees to the Parties to the Palau Agreement. We identified the durability of rights and inadequate transferability of VDs as attributes of the existing rights in particular need of strengthening. In this section we further elaborate on these aspects with a special reference to the allocation of VDs to VDS-partners.

Annual Determination of the PAE

Under the current arrangement, the Party Allowable Effort (PAE) is an average of the actual vessel days applied in their EEZs (actual fishing effort) and the moving average of the biomass in the Parties' waters (article 12.5 of the Palau Arrangement with subsequent modifications).[23] This means that the PAE in future years will be affected by the current fishing activity in their waters and, consequently, their sales of VDs. This, obviously, creates an added incentive for VDS-partners for selling VDs in their EEZs to fishing companies and a disincentive to trade VDs to other VDS-partners. Both are damaging in the sense of reducing the amount of fishing fees to the VDS-coalition as a whole. The former is likely to result in VD price competition and lower average price per VD than necessary as each party attempts to sell all their PAE. The second prevents the VDs to be used in the most productive parts of the VDS-region and thus reduces the overall profitability of the fishery and, consequently the total market value of VDs. Combined the negative impact of these two factors on the attainable fishing fees to the VDS-coalition can be very substantial.[24]

In addition to this, it seems to us that the application of the current PAE allocation rule and how VDs are to be allocated to meet the US Treaty and FMSA obligations has been until very recently subject to annual debates the outcomes of which can have profound financial consequences for each Party. This creates considerable uncertainty for Parties and reduces both the security and overall quality of fishing rights provided by being a participant in the VDS.

Recommendations:

2. We recommend that the current process of determining PAE should be replaced with an allocation mechanism which gives long-term certainty to Parties regarding their entitlement to a share of the VDS and increased flexibility in the way in which VDs can be transferred to other Parties without a penalty in the form of reduced future PAE.

   There are many ways of setting up this kind of arrangement all of which we presume would be subject to negotiation between VDS-partners. One simple way is as follows:

[23] Our understanding is that the current rule is 60% on the basis of actual effort and 40% on the basis of biomass share.

[24] We have been informed that an important motivation for the current PAE rule is to allow gradual adjustment of PAE to real fishing opportunities in the EEZs. This does not alter the disadvantages with the arrangement discussed in the main text., but can be seen as a benefit that can be set against the disadvantages.

(i) Each Party should receive its current (or most recent) share in the TAE as a long lasting share (measured as a percentage) in the TAE as it is determined every year. This share may be referred to as the TAE-share. It would be constant from year to year and independent of the actual pattern of fishing. It might be reviewed periodically in response to changed conditions, e.g. every 5 or 10 years.

(ii) Given the TAE-share, the annual PAE would be a simple multiple of this share and the TAE pretty much as it is today.

(iii) The resulting PAE would be freely transferable to all VDS-partners (see section 2.5)

(iv) Allocations to UST and FSMA would be out of each PAE to the extent the Parties choose and subject to their negotiations of those instruments.

(v) Beyond the remit of the current review, we recommend that a model (or models) be developed to show both the collective benefit to Parties and the individual benefit of different allocation formulas under different trading scenarios for VDS.

Accommodating new participants in the VDS

We argue in section 2.4 that substitutes to fishing in the VDS should be minimized. One way to do this is to bring nations with potential substitute EEZs into the VDS-coalition as new partners. This raises two questions. One is how many VD or PAE the new partner would have Another is how to adjust the existing partners' TAE-shares.

The number of VD or TAE-share that the new partner would have is fundamentally a distributional matter and subject for negotiation between the VDS-coalition and the prospective new partner. While a natural way to set it is in the same way as that of existing partners, i.e. on the basis of the biomass in his EEZ and historical fishing effort, the outcome of this negotiation will depend on the relative bargaining position of the two parties. Needless to say, the VDS-coalition will of course not accept anything that does not increase their expected benefits.

While there are many ways to adjust existing partners' TAE-shares to the entrance of a new partner a seemingly natural way is to stipulate that each existing partners' PAE (measured in VDs) should not be reduced by the entry of a new member. This essentially means that the new partner's PAE would not exceed the additional TAE he brings to the VDS-coalition.[25]

Recommendation:

3. We suggest the PA be amended or provision made in a new integrated instrument allowing for both the entry of new Parties to the VDS and the mechanism for calculating their proportional share of the VDS be made explicit so the implications for both the joining Party and existing Parties are clear.

[25] The formula for the new TAE-share of existing partners would be: $a(1) \geq a(0) \cdot TAE(0) / TAE(1)$, where $a(1)$ is the new TAE-share, $a(0)$ the old one, $TAE(0)$ the total allowable effort before the entry of the new partner and $TAE(1)$ the total allowable effort after the entry of the new partner.

Effort vs. harvest-based systems

Limited effort systems, as the VDS is, suffer from a fundamental weakness that prevents them from generating economic benefits to the participants in the long-term. This fundamental weakness stems from the fact that fishing effort is a multidimensional phenomenon and fishers constrained by effort limitation will have a strong incentive to expand those dimensions of fishing effort that are not limited (Arnason 2007b). The essence of the theoretical analysis is presented in appendix 11 to this report. Experience from numerous fisheries around the world shows that this incentive is strong enough to wipe out all net economic gains from even the richest of fisheries (Arnason 2007b, Anderson and Sejio 2010).

Harvest-based systems, where the volume of harvest by individual fishers is constrained, do not suffer from this weakness. It is well established both theoretically and empirically that such systems are capable of generating the highest possible flow of economic benefits from fisheries on a sustainable basis (Arnason 2007b). As a tool to maximize the flow of economic benefits from the PNA tuna fisheries, harvest- based systems, therefore, are in principle superior to the current effort-based system. The only serious question is whether a harvest based system, presumably some variant of ITQs (Individual Transferable Quotas) could be effectively enforced in the PNA tuna fisheries. Given the obvious superiority of such a system, it seems highly advisable for the Parties to the PA to initiate a study about the feasibility of transforming the current VDS to a system based on individual harvest restrictions.

The question may be asked why in spite of this inherent weakness of effort restrictions, the VDS has managed to generate a substantial and growing amount of fishing fee revenues. The answer is that the effective fisheries management of the VDS is not the VD-restrictions as /such but the fee charged for the VD (see appendix 11) This fee amounts to a tax on fishing effort and it is well-known that taxes on fishing activity are capable of generating and maintaining net economic benefits from fisheries amounting to exactly the net tax revenues (Arnason 2007b). So, it is precisely the fishing fee that is the potent ingredient of the fisheries management contained in the VD.[26] It is the fishing fee that secures and sustains the economic benefits coming from the scheme. So, contrary to arguments sometimes made by representatives of the DWFN, the fishing fee is the redeeming part of the VDS. It follows that the higher the fishing fee can be pushed while still selling the allowable fishing days (assuming they are optimally determined), the better for the world economy.

Effort measurements

The need for Parties to agree and implement a consistent definition of a vessel day is discussed in section 2.7. However, this does not solve the problem of effort creep inherent in limited effort-based systems. Vessels participating in the VDS become better at catching fish so the fishing mortality per VD increases. This occurs via investment in human and physical capital and technology. Because of this and the accumulation of fishing knowledge vessels become more powerful, catching more fish yet often being cheaper to operate.

[26] Of course, since the fishing fee is currently determined by the demand for and the limited supply of fishing days, it may appear that it is the limited supply that generates the fee. However, since it is obvious that the same effect could be generated by simply setting the fishing fee and letting the demand determine the number of fishing days, it should be clear that it is the fee and not the limited fishing days that is instrumental here. This is further explained in appendix 11.

Currently the PA uses a relatively crude rule based on vessel length to account for a vessel's fishing power. Somewhat arbitrary vessel size classes (<50 m, 50-80m, 80m +) are combined with vessel day ratings (0.5, 1 and 1.5) to calculate "equivalent" fishing days. This simple rule cannot, of course, reflect actual fishing power of the vessels and therefore the resulting "equivalent" fishing days are not really equivalent and probably quite far from being so. Even more seriously, this rule, as would others like it, inevitably leads to distortion in the capital structure of the fishing fleet (as vessel owners adjust to the rules) that can only reduce the economic efficiency of the fleet and therefore reduce the maximum fishing fee revenues that can be collected. Thus, for instance, according to our information new tuna vessels just shy of 80m. are being built.

Effort creep also occurs as vessels use more efficient fishing techniques such as the use of Fish Aggregating Devices (FADs). The use of FADs is a major contributor to the decline in bigeye tuna stocks which if required to be rebuilt to MSY levels or better without a change to current fishing methods require a precipitous reduction in TAE and a reduction in the economic return to Parties by some 35% as discussed in section 2.10.

Recommendations:

7. We advise that a study be initiated to evaluate the cost and benefits of transforming the VDS from an effort-based to a harvest-based system.
8. As long as an effort-based system is retained we urge the continuation of current efforts by the FFA and PNA to control, modify and/or reduce FAD use by pricing of VDs and other means.
9. As long as an effort-based system is retained, it is vital to continue the efforts by the PNAO to look at ways of addressing effort creep by more closely aligning individual vessel performance to its use of a standard VD. With respect to the latter, ideally each vessel in the fishery should be assigned individual efficiency value that would that allows a more precise calculation of "equivalent" fishing days for that vessel and could be revised annually on the basis of the vessel's catch and effort record. This would help align the actual fishing mortality and harvest with the VDS and the target reference points.
10. We further suggest that the PA be amended or provision made in a new integrated instrument allowing for a range of appropriate mechanisms to be integrated into the VDS to manage effort creep. This amendment accommodates the outcomes of the studies supported in recommendation 2 above.

2.4 Participation and management of substitutes

Maximizing fee revenues to the VDS-coalition may be hampered by alternative or substitute fishing opportunities open to fishing companies. These substitutes may be external to the VDS-region or they may exist within the EEZs of the VDS-partners. It is convenient to discuss these in turn.

External opportunities

The PNA VDS comprises a substantial part of the WCPO tuna fisheries. More precisely, in recent years the EEZs of its members combined with the high seas areas (doughnut holes) enclosed by their EEZs have accounted for some 60% of total tuna catches in the region.[27] Other EEZs accounting for a significant portion of the tuna harvest in the region are those of Indonesia, the Philippines and Japan with a combined share of some 25%. The high seas tuna catches excluding the doughnut holes referred to above account for some 8%. Presumably, the geographical distribution of fishable tuna stocks is in accordance with these catches.

The share of the VDS in the purse seine fishery, presumably the most mobile and commercial sector of the tuna fishery in the WCPO, is considerably higher or close to 80%. Nevertheless, it should be recognized that significant tuna fishing opportunities exist in the WCPO outside the current coverage of the VDS. As a result, the VDS is faced with external competition of two kinds; one is competition for harvest from common tuna stocks, the other is competition for DWF activities to harvest from these stocks. The latter type of competition is often referred to as the ***competitive fringe*** in competition theory (MacDonald 1986). In this presentation we use the term to refer to both kinds of competitions.

The competitive fringe affects the opportunities available to the VDS-partners in at least two ways: First, harvesting outside the VDS will affect tuna availability inside the VDS region. Tuna concentrations generally migrate toward locations of higher prey availability at some positive rate. As a result, the VDS applying their vessel day policy can only control the abundance of tuna stock in its partners' EEZs to a limited extent. More specifically, if the VDS follows a more stock conservation minded policy than its neighbors, at least a part, perhaps most, of the increased stock volume will spill over to the neighboring EEZs and vice versa.

Second, the availability of fishing opportunities outside the PNA-area undermines the ability of the VDS-partners to increase their fee revenues from the DWFF. The DWFF will, of course, seek to harvest in the most profitable areas taking fish abundance and catchability into account as well as travel costs and fishing fees. Thus, as further explained in appendix 4, at a certain level of fishing fees (given other relevant factors) they will elect to move their fishing activities elsewhere. Even more seriously, as fishing fees increase, the benefits of developing fishing methods and technologies to improve the profitability of fishing outside the VDS-region, in the high seas areas and other nations ' EEZs under contract will also increase. This may lead to investments making the economics of fishing these alternative regions more attractive than before. This change in relative competitiveness is not easily reversible, even if fishing fees are subsequently reduced.

[27] And about 97% of the total tuna catches of the FFA members.

So, the VDS-coalition, in attempting to maximize its tuna fee revenues is hampered by the existence of the competitive fringe. This inevitably gives rise to a competitive game between the PNA and the competitive fringe. This game may evolve in various ways. Three special cases are of particular interest:

1. First, it may well be the case that the competitive fringe plays passively, i.e. does not respond in any particular way to VDS moves. In this case, as fishing fees are increased within the VDS the DWFF would simply spend increasingly fewer fishing days in PNA waters and more in the waters of the competitive fringe. This would then merely show up as an increased (negative) slope (higher elasticity) of the demand function for fishing days. The implications may, however, be economically serious for the PNA as discussed below.

2. Alternatively, the competitive fringe may actively react to the VDS policy (possibly encouraged by the DWFF) by taking steps to make it more profitable for the DWFF to fish in its waters. In this case, the VDS-partners would have to adjust their operation of VDS to protect their interests instigating further moves by the competitive fringe and so on. This game playing could evolve in various ways. It might converge to a stable competitive equilibrium with both parties collecting significant fees. This particular case will be discussed below. However, in an extreme case the game could devolve into a vicious circle with the competitive fringe offering increasingly better deals to the DWFF and the VDS-coalition counteracting by reducing fees to keep them fishing within its EEZs. This course of events, akin to price wars in retail commerce, could be very costly to both parties (and equally beneficial to the DWFF). Fortunately, however, this outcome is not very likely because the competitive fringe is (i) not currently acting as a co-ordinated entity, (ii) composed of several heterogeneous nations which will find it difficult to co-ordinate and (iii) is already, for the most part, harvesting the tuna in its EEZs. Nevertheless, the probability of this happening is not negligible, especially as this course of events may be encouraged by the DWFFs as a part of their strategy to undermine the VDS. Therefore, the PNA-nations would be well advised to be at least aware of this eventuality in their strategic planning.

3. The third special case occurs when the two parties, the VDS and the competitive fringe, recognizing the game-theoretic situation and their common interests, elect to transform the game into a co-operative game under which they would seek to reach an agreement to act co-operatively with respect to the DWFFs. Since the parties can maximize joint benefits by doing this, there are considerable incentives for electing to follow this route.

A somewhat detailed analysis of the outcomes under alternatives 1 and the stable version of alternative 2 is presented in appendix 5. The most pertinent findings of that analysis are as follows:

- Even when the competitive fringe pays passively (case 1), its presence will reduce the maximum fee revenues attainable by the coalition.
- The reduction in attainable profits will be greater if the competitive fringe plays competitively (actively reacting to the moves of the coalition).
- If the coalition and competitive fringe do not coordinate their actions, both parties will have to accept lower unit fees and collect less fee revenues than if they act in a coordinated fashion.

- The coalition and the competitive fringe can maximize their total fee revenues by acting co-operatively.

An assessment of the potentially lost fee revenues because of the competitive fringe requires an extensive empirical study. This loss can in principle be quite large. Consequently, this kind of study may well be worth the cost. A priori, it seems that given the nature of the competitive fringe in the WCPO tuna fisheries, and the way it has acted until now, this loss seems unlikely to amount to a large percentage of the attainable fee revenues.

Given the above findings, it will obviously strengthen the VDS coalition and potentially increase fee revenues substantially if the competitive fringe or large sectors of it would either join the VDS coalition or be persuaded to act co-operatively with VDS system. Both parties would gain from this kind of a co-operation.

Internal opportunities

There is substantial fishing for tuna within the VDS area that is not subject to the purse seine VDS or even VD restriction at all. The most important of this is the long-line fishery. While this usually targets larger yellowfin and bigeye it also catches smaller individuals and skipjack tuna. In any case this activity affects the tuna stock available to the purse seine fishery and constitutes an alternative tuna fishing opportunity although clearly not a close substitute to purse seine fishing. It should be noted that this fishery has now been put on VD restrictions as a part of an extended VDS. For economic efficiency, the appropriate co-ordination of these two VDSs, e.g. in the form of VD-trades between the two is needed. This, however, is technically very difficult because to the different technology and catches of the two types of fisheries.[28]

Considerable number of VDs are set aside to meet obligations under the US Treaty (UST) and Federated States of Micronesia Arrangement (FSMA). Both cover several EEZs, so they are different commodities than normal VDs, and are marketed differently than the normal VDs. To a certain extent these two arrangements offer purse seiners alternative routes into the VDS area that then obviously competes with the standard VDS and can only reduce overall fee revenues to the VDS-coalition. Indeed, it appears that the VDs allocated under these two treaties have fetched lower prices in past years than the normal VDs (see anonymous (2014c) for the FMSA) in past years although steps have been taken to bring at least the UST VDs to the minimum benchmark price.

There is significant fishing for tuna in the archipelagic waters of some VDS-parties that has been exempt from VD restrictions.[29] This fishery has both DWFF, domestic and other Pacific Island state participation. It reduces the tuna stocks and represents an alternative (approximately 15 percent of total PNA fishing days in 2011), to purse seine fishing within the VDS. The danger, of course is that this sector of the fishery will expand and become substantial. This may happen, if tuna stocks or tuna landings prices increase, both of which could easily happen as a result of the VDS-partners pressure to increase fishing fee revenues.

[28] This is merely an aspect of the fundamental difficulties with controlling fisheries by effort restrictions.

[29] We understand, however, but limits on fishing days in these waters are being established.

Internal alternatives to the standard VDS, although established for the best of intentions, are likely to reduce overall gains from the tuna resources to the VDS-partners. The fundamental reason is the economic principle that separation of markets and special deals that do not reflect real economic constraints (i.e. are artificial) generally reduce economic efficiency and are therefore counterproductive (see e.g. Varian 1992). While it is possible that such man-made restrictions may be beneficial because they correct another imperfection according to the theory of second best (Lipsey and Lancaster 1956), the likelihood of that is low. That kind of an argument, therefore, needs careful substantiation. In the absence of such evidence, the prudent course of action is to remove such artificial constraints and exceptions to the extent possible.

Recommendations

The above discussion suggests the following recommendations:

5. The VDS-partners should actively try to expand the VDS-coalition or at least attempt to get nations in the competitive fringe to act co-operatively with the VDS.
6. The VDS-partners should do their utmost to exclude fishing from the high seas pockets (doughnut holes) between or bordering their EEZs
7. VDS should to eliminate or minimize the effects of the internal competitive fringe by:
   - Bringing all purse seine effort under the standard VDS.
   - Ensuring all purse seine effort is charged at least the benchmark fee
8. The VDS partnership should expand and consolidate the long line VDS and endeavor to set the long line fee level that minimizes artificial distortions between fishing methods.

2.5 Trading arrangements

Under the VDS a certain number of allowable vessel days (VDs) called TAE is determined and allocated to Parties to the Palau Arrangement (PA) as PAE. A PAE allocated to a Party can be applied in that Party's EEZ.[30] As explained in some detail in appendix 9, the VDs are widely heterogeneous commodities depending on the EEZ to which they apply and who holds them.

A VD in a given EEZ will generally not yield the same harvest as a VD in another EEZ. The PAEs are therefore, heterogeneous commodities, from the perspective of the DWFF and will generally fetch different prices.

The geographical pattern of the PAE will, moreover, generally not be in accordance with the geographical pattern of tuna stocks and their catchability, and therefore fishing company demand for VDs. This has important implications.

(i) The geographical pattern of PAE is generally not in accordance with the fee maximizing one as explained in appendices 3 and 4.

(ii) The market clearing price of the vessel days (fishing fee per day) allocated to the various PNA-partners will generally be different, even widely different. It might even turn out that some partners would find themselves unable to sell all their allocated fishing days. This will inevitably put a strain on the VDS-coalition.

Trading of VDs between VDS-partners will render the various VD prices more equal. If trading is costless, these prices might even become completely equal (see appendix 6). Moreover, as shown in appendix 6, the more equal the VD prices the closer is the geographical pattern of fishing to the optimal one. Therefore, free trading of VDs between partners is conducive to more optimal geographical distribution of the fishing effort.

As shown in appendix 2, the more profitable the tuna fishery is the higher are the maximum attainable fishing fees. Therefore, free trading of VD between partners contributes to increasing total fishing fees collected by the VDS-partners.

It is important to realize that trading of VDs will normally be from those EEZs that are less profitable for fishing to those that are more profitable. This, however, does not mean that those VDS-partners from which VDs are traded will be disadvantaged by this. On the contrary. Those VDS-partners who elect to sell some or all of their VDs will only do so if they receive a higher price that they can obtain from the fishing companies. Thus, they share in the higher profitability of the other EEZ to which they sell. In fact, both parties gain because the purchasing partner will only buy at a price that is lower than what he can obtain from the fishing companies in his EEZ. So, both trading partners gain and, therefore, so will the VDS coalition as a whole.

It should be noted, however, that the trading of allocated VDs to the most profitable EEZs will increase the efficiency of the TAE for fishing and, thus, result in a higher fishing mortality of the tuna stocks. This may require an adjustment in the TAE in order to ensure dynamic efficiency of the fishery, i.e. that the evolution of the tuna stock remains as close to optimal path as possible. This adjustment, however, does not imply that the VDS-partners' gain from trading will be reduced. It only means that it will be less than it might appear on the

/[30] Some VDs have been assigned to a pooling arrangement applicable to many EEZs.

basis of static analysis and the adjustment in TAE to account for this greater efficiency will increase it further.

There are essentially[31] two sets holders of VDs: (1) VDS-partners and (2) fishing companies. The VDs of partners are in practice tradable between partners, although the VDS does not formally define procedures for inter-party trading. Therefore, the VD trading that has occurred between partners has been on a somewhat ad hoc basis.

Because of the formula used to determine the annual PAE[32], trading VDs between VDS-partners may entail an alteration in future PAE to the trading partners, namely a reduction for the seller and an increase to the buyer. This by itself does not distort the trading pattern as the trading price can reflect the amount of future PAEs involved. However, the uncertainty and its asymmetric distribution between the buyer and the seller does. The seller runs the risk of being penalized by a lower PAE in the future, the buyer gains the chance of a higher PAE in the future. This will generally distort trades toward less trades than would be optimal.

This suggests that current trading of VDs between partners is some distance away from being free and unhampered. The current arrangement, in effect, imposes non-trivial costs on such trades restricting their extent and, consequently, total benefits to the VDS-coalition. Eliminating the uncertainty about the implications of these trades for future PAE and facilitating them in other ways, therefore, seems a very good idea.

The VDs held by fishing companies are not very transferable. They cannot be traded to other companies at all and they can only be used in the EEZs of the selling nations. However, there are no restrictions on transfers of VDs between the vessels within the company, so the company can freely transfer its VDs, usually purchased in bulk, between any of its vessels albeit not across EEZ.[33] Also, it should be noted that companies have an indirect way of transferring VDs between EEZs. It may request the Party that it initially bought the VSs from to transfer the VSs to another Party. A significant part of the trading of VD between the Various VDS-partners is believed to reflect this kind of an initiative from the fishing companies holding VDs which generally pay a premium for this kind of transfers.

This limited transferability of the VDs held by fishing companies can only reduce the potential benefits to the fishing companies of purchasing VDs. For this reason, the fishing companies are bound to offer lower fees for the VDs than would otherwise be the case. This applies to VDs of all partners although the reduction in VD-price will tend to be largest in EEZs where the uncertainty of stocks and catchability is greatest. Thus, the aggregate fee revenues of the VDS will also suffer.

This suggests that it may be a good idea to formally allow some switching of VDs held by fishing companies between EEZs and possibly even switching or trading between of different vessels. It is useful to distinguish between switching VDs between EEZs and between vessels. The former seems generally beneficial for pretty much the same reasons as described above.

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[31] Under the current VDS, it is conceivable that other parties, e.g. financiers, speculators etc., would be owners of VDs.

[32] This formula has been altered over time. Initially it was 50% on the basis of relative biomass and 50% on the basis of actual fishing effort in their EEZs. Now it is a choice between 40% on the basis of relative biomass and 60% on the basis of actual fishing effort or 0% on biomass and 100% on fishing effort.

[33] Obviously this opens the door to transfer to other companies via a pro forma vessel rental agreement.

Note, however, if the fishing companies, can switch VDs between EEZs they will probably be able reap some of the benefits of more optimal allocation of fishing effort to EEZs that would otherwise be captured by VDS-partners trading between themselves and then selling to fishing companies.[34] Note, however, although those benefits would initially primarily befall the fishing companies, a good part of the expected gain would be reflected in the price for VDs.

A more serious problem is caused by the heterogeneity of fishing vessels. No two fishing vessels are identical. Trading of VDs between vessels will inevitably be from less efficient vessels to more efficient ones. This implies that any given number of VDs can be translated into more effective fishing effort by trading of fishing days between vessels. This has two implications. First the management of the tuna stocks becomes more imprecise because the relationship between any given number of VDs and fishing mortality will become more uncertain. Second, the fishing companies will reap the surplus from these trading gains. The latter's gain, however, will, at least partially and in the long run, reflected in higher market value of VDs to the VDS-partners.

Auctioning fishing days

The market for VDs is far from being perfect. It is characterized by bilateral monopolies/oligopolies and bargaining. The equilibrium (market clearing) price is unknown. Under those circumstances, i.e. in imperfect markets with unknown equilibrium prices, it is well-established (see e.g. Klemperer 2002, 2004) that auctions are well-suited to maximize selling revenues.[35] Therefore, if the intention is to maximize fishing fee revenues to the VDS-partners auctioning of the VDs appears a promising way to go.

It is important to realize, however, that applying auctions successfully is not an easy matter. First, for auctions to be effective they must be carefully designed to fit the empirical situation at hand (Klemperer 2002, 2004, Milgrom 2004). There are many cases of auctions failing because of poor design relative to the empirical situation (see e.g. Hazlett 1998, Klemperer 2002, 2004, Milgrom 2004). In particular, in the VDS situation, auction design will have to deal with the very real possibility that the potential bidders co-ordinate their bids to reduce prices. Careful design of auctions requires deep empirical knowledge and solid understanding of auction theory and, consequently, experts, significant costs and, not the least, time.

Second, the likelihood that auctions will be successful would be greatly increased if the VDs were made more homogeneous along the lines discussed above. If they are not, there would have to be a high number of auctions, one for each type of VD, and the design difficulties discussed in the previous paragraph would be multiplied.

In spite of these hurdles, it is our opinion that auctions constitute a very promising way toward maximizing fishing fee revenues to VDS-partners. However, we strongly recommend that before steps in this direction are taken, careful preparations along the above lines be made. We also recommend that initially, to minimize risk, only a relatively small proportion of fishing days be auctioned. The question of auctions is re-visited in section 2.9 where it is discussed more thoroughly and in appendix 8

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[34] This, however, is more apparent than real because once the VDs have been sold to the fishing companies the VDS-partners can no longer trade them between themselves.

[35] The basic theory and experience of auctions is discussed in appendix 8.

Recommendations:

a. It is strongly recommended that a study be conducted into the advantages and disadvantages of making the VD more homogeneous in the sense that they can be used in several, possibly all of the VDS-partners' EEZs (pooling).

b. It is recommended that free trading of VDs between partners be formally allowed for in the VDS-structure (PA). A framework for facilitating trades be developed e.g. under the auspices of the PNAO and the implications of trading for future PAE be made crystal clear. In fact, we see no reason why PAE should be altered because of trades to another VDS-partner. It may be noted that if VDs become homogenous (applicable in any EEZ), the economic gain from this trading between partners would largely disappear.

c. It is recommended that fishing companies be formally allowed to switch their VDs between EEZs subject to restrictions to be developed. However, they will not, at least not for the time being, be allowed to switch VDs between vessels

d. It is strongly recommended that work on designing auctions for VDs for maximizing their value be initiated.

2.6 Integrity of systems and processes

While under the VDS the TAE and PAE are set centrally and the VDS managing office, the PNAO, provides various services to the partners including information provision via the FIMS, the management of the PAE days and the enforcement of the associated rules are the responsibility of individual VDS-partners.

This arrangement is a matter of considerable concern. Most fisheries management systems around the world are run by one national state guaranteeing a certain uniformity of operation. A prominent example of where this is not the case is the European Union common fisheries policy (CFP). Under this system national governments were entrusted with monitoring and enforcing the common fisheries management rules leading to serious problems of monitoring heterogeneity, lack of data standardization, and differential enforcement and handling of violations (Rocha et al. 2012). As a result, the EU has belatedly taken measures to attempt to unify the monitoring and enforcement of its fisheries management rules by establishing a common EU enforcement agency (see European Fisheries Control Agency 2014 and European Union 2014).

The operation of the VDS system is subject to similar problems. The decentralized arrangement of the monitoring and enforcement may easily lead to inconsistency in the application of the rules across different EEZs. In fact, according to verbal communications we have received, this seems to have been the case although we are told the situation has improved significantly this year (2014).

In the VDS context, inconsistent application of the rules might in particular apply to two items; (i) how vessel days are priced by the partners and (ii) how fishing days are calculated by the partners. The first item is really a variant of internal price competition which has been extensively discussed in sections 2.4 and 2.5 above. As pointed out there, un-coordinated price setting can only reduce overall fees revenues to the VDS-partners.

The second item has to do with counting the number of the vessels' fishing days. There are of course various reasonable options for this ranging from (i) days at sea to (ii) days of actual fishing which is a significantly smaller number because of travel time, fish search time and time of idleness e.g. due to bad weather, mechanical breakdowns etc. What option for measuring fishing days is selected is not of any great consequence. What is important is that all the VDS-partners adopt the same definition and employ it consistently. For a more accommodating definition of fishing days adopted by a VDS-member really amounts to an increase in the member's allocated fishing days (effort). If for instance a VDS-partner that receives a PAE of 100 days that are supposed to be days at sea, allows the fishing vessels in its EEZ 100 actual fishing days, the corresponding days at sea would be much higher. Total exerted effort and catches would be correspondingly higher and, of course, the fishing vessels would be willing to pay a higher fee for days counted in this way.

Thus, each individual VDS member has an individual incentive to interpret the VDS rules liberally to increase his own benefits from the system. This kind of inconsistent application of the rules improves the bargaining position of the DWF-companies, reduces overall fee revenues and is therefore detrimental for the coalition as a whole. The task, therefore, is to remove this temptation to the extent possible. We note that the VDS-partners have already taken steps in this direction (Honiara meeting 2014).

Inconsistent application of the rules is likely to affect the configuration of fishing effort across the VDS-area; vessels will naturally prefer the EEZs where the application of the rules is most favorable to them. This, to the extent that it actually happens, will have several detrimental consequences:

1. It will reduce total fee revenues to the VDS-nations, although it may increase revenues to the nations having the most liberal interpretation of the rules. The reason is that a more liberal interpretation of the rules, e.g. how fishing days are counted, really amounts to a reduction in fishing fees.
2. It will also reduce the total net benefits generated by the fishery because it distorts the geographical configuration of fishing effort. All of this loss will be borne by the VDS-countries because the DWFF will be compensated by what amounts to a reduction in fishing fees.
3. Finally, this inconsistent application of the rules will weaken the VDS-coalition as the nations that conscientiously apply the rules will suffer a reduction in fee revenues, so their net gains from staying in the coalition are correspondingly reduced.

This above strongly suggests that VDS fee revenues could be increased, even substantially, by (i) a better co-ordinated VD selling effort, (ii) a uniform measurement of VDs and, (iii) generally more consistent and application of VDS-rules across the EEZs of the partners. It follows that it would be a good idea for the VDS-coalition to take steps in this direction. Improved trading arrangements are discussed in section 2.5 above. At the end of this section we suggest measures to further the uniform measurement of VDs and consistent application of VDS-rules in general.

Assessment of the FIMS

Although we have not explored the Fisheries Information Management System (FIMS) in depth, it is our assessment that the FIMS is a well-designed information system capable of providing timely information to the VDS-members about the central parameters and operation of the VDS. There is no doubt in our minds that the development of this system has greatly increased the transparency of the VDS operation, including vessel location, fishing day use and trade, catches etc., to all its members. In our opinion the FIMS, and its industry-oriented counterpart IFIMs, is well suited to be the basic informational system of the VDS and judiciously employed could serve to provide the transparency into VDS operation that is needed for optimal operation of the system as discussed in section 2.8.

FIMS is somewhat intricate with a substantial number of capabilities and not all members appear equally knowledgeable about and proficient in using the system. To remedy this, a comprehensive training programme to use FIMS effectively is currently being offered to all members. We understand that this will be completed this year. In addition, the PNAO offer on-line and telephone assistance to all members that run into difficulties in using this programme. Given the importance of the FIMS for the understanding and transparency of VDS operations and therefore the stability of the VDS as a consortium, it seems to us that support for training to ensure all Parties to the Palau Arrangement can use FIMS are resources well spent.[36]

[36] It might be mentioned that the World Bank grants and other development agencies routinely support this kind of training around the world.

Recommendations:

To achieve the necessary integrity and consistency in the operation of the VDS, the appropriate organizational structures have to be in place. Our proposed VDS organizational structure was discussed in section 2.1. The recommendations particularly pertinent to the subject of this section are:

9. We suggest formally separating the management of the VDS systems and processes from broader PNA harmonization issues. The two are not completely independent – but should be dealt with separately within the PNA (see section 2.1).
10. To promote the integrity of VDS systems and processes we recommend a clearer demarcation of roles and functions between the PNAO (under the VDS Administrator) and Parties ensuring stronger accountabilities for different management and administrative functions as further explained in section 2.1.
11. The VDS Administrator operating via the PNAO as the chief executive officer of the VDS should be responsible for implementing the VDS on behalf of the VDS Board (see section 2.1)

To improve uniformity and consistency in the application of the VDS, we recommend:

12. The VDS Administrator be charged with the responsibility of ensuring that the VDS system be applied uniformly and consistently across the waters of the VDS-partners.
13. The VDS authority (the Board or annual meeting) adopt a clear, operational and preferably simple definition of vessel days. One such definition is simply day at sea in the EEZ of a VDS-Partner.[37]
14. The VDS Administrator be made responsible for implementing this definition in the accounting of VDs used by the Partners. In this he can of course make use of the VMS and the FIMS.[38]
15. The VDS Administrator be made responsible for developing and operating efficient market trading mechanisms including but not limited to the enforcement of minimum benchmark prices, operation and maintenance of VD trading exchange and the preparation for and operation of a VD auction system (see 2.5).
16. The necessary system for compliance including sanctions be developed and implemented (see 2.7).

[37] We note that the 2014 PA and FMSA meetings, this issue was considered and resolutions in the very direction we suggest taken. This suggests that the main issues now is implementation and compliance

[38] Again we note that this seems to be the way the role of the VDS Administrator and the PNAO is developing.

2.7 Compliance with the rules

As described in previous sections, co-ordinated supply of tuna fishing access is necessary for maximizing the PNA-members total benefits from their tuna resources. The Palau-arrangement and the VDS are instruments for this co-ordination. It follows that violations of the rules set under the VDS will weaken the co-ordination of supply and, therefore, will almost surely lead to losses of aggregate benefits to the VDS-partners.

In the neighborhood of the optimal VD-policy such aggregate losses are unlikely to be high however, provided the extent of non-compliance is modest. Calculations that we have carried out on the basis of the bio-economic model explained in section 2.9 and appendix 7 indicate that the cost of, say 5% overrun in fishing days from the optimal equilibrium would reduce annual aggregate fee revenues by just about 1.5 M.US$. The cost of a 10% overrun, however, would be US$ 13.1 M. per annum and so on. Interestingly, because of the losses due to divergence from the optimal management policy, the violating partner may not even benefit from his violations in the long run.

The impact of non-compliance on the solidity and stability of the VDS-coalition is likely to be much more costly. The presence of non-compliance to the rules will almost surely make it more difficult to reach optimal decisions within the coalition and thus reduce the fee revenues that can be attained. If non-compliance is persistent or seen as excessive by other partners, it could even lead to breakdown of the VDS-coalition with much greater losses.

Our investigations including interviews with PNA-partners indicate concerns about the lack of compliance with VDS rules by individual partners. These concerns most often mentioned are: (i) The way certain partners define "so-called" non-fishing days, i.e. subtract them from their PAEs (ii) the failure of some partners to actually close the fishery in their EEZs when their PAE has been exhausted and (iii), the willingness of certain partners to undercut the minimum benchmark price in their sales of days.

Official VDS documentation (e.g. Anonymous 2013b) gives substance to these concerns. Anonymous (2013b) explicitly documents imperfect implementation of VDS rules during 2012 including (i) an overly liberal interpretation of non-fishing days by some partners and (ii) the failure by some parties to close their EEZs to fishing when their PAEs had been reached. As pointed out by Anonymous (2013b), the first type of violation leads to the DWFFs having more effective fishing days than they bought, thus, in effect reducing the fishing fee per real fishing day. Both types of violations, of course, lead to higher total fishing effort than would otherwise be the case.

According to our interviews, however, there seems to be a general perception that compliance improved considerably in 2013 and continued to improve in 2014. This perception is partially supported by official documentation. According to Anonymous (2014b), overruns of national PAE were relatively minor in 2013 (suggesting partners generally closed their EEZs to fishing when their PAE was reached) and the minimum benchmark price of 5000 US$ per fishing day was largely adhered to. However, according to Anonymous (2014b), problems concerning the appropriate interpretation of non-fishing days continued to be an issue in 2013. Measures agreed at the 2014 Meeting of Parties to the PA, if implemented by Parties, should strengthen the VDS in this matter.

The economic theory of enforcement has established certain basic principles of violations and compliance to rules (Becker 1968, Polinski and Shavell 2000, COBECOS 2009 and Arnason 2013). The following are of great relevance in the VDS context:

(i) Social actors (fishers, nations and other parties) will violate when the expected benefits of violations exceed the expected costs. Note that costs and benefits include psychological, social and political costs and benefits as well as monetary ones.

(ii) The expected penalty is the multiple of the probability of having to suffer the penalty if one violates and the size of the penalty.

(iii) Therefore, compliance can be increased by increasing either the enforcement (monitoring and penalty assessment process) or the penalty itself.

Fisheries enforcement is in general expensive. Therefore, the practical suggestion of the theory of enforcement is that penalties should be as heavy and the penalty issue process as expedient as possible. This, obviously, has practical implications for the VDS compliance. It should be noted, however, that certain violations of VDS-rules such as countries exceeding their PAE are fairly obvious and the enforcement of those therefore not inherently expensive.

The existence of non-compliance is related to the issue of transparency and trust within the VDS-coalition that is discussed in section 2.8. Therefore, not surprisingly, our suggested remedies are similar.

Recommendations:

1. The VDS rules should be as clear and complete as possible, so there can be no doubt and little room for alternative interpretation and gaps and loopholes are minimized.
2. The rules and/or applicable instruments should have clear statements of the process of dealing with infringements as well as the recompense for violations which needs to be high enough to remove incentives for breaches of the rules.
3. Some form of an adjudication process to assess whether in fact infringements have been committed and, if so, the appropriate recompense.

2.8 Transparency

It appears convenient to divide the issue of transparency into internal and external transparency. Internal transparency relates to the access of VDS-partners to information about the operation of the VDS system. External transparency relates to the ability of parties external to the VDS to obtain this kind of information.

Internal transparency

Our interviews with representatives of VDS-partners suggest some concerns about lack of transparency. However, our impression also is that by mid- 2014 many of these concerns had been allayed compared to 2013 partly because of the greater transparency provided by the operation of and improvements in the FIMS (Fisheries Information Management System).

It appears to us that the demand for greater transparency primarily concerns the application of the VDS by individual partners and their trading of vessel days (VDs). The following are some of the more frequently expressed concerns:

1. How are VDs measured and reported by individual VDS-partners?
2. What are the trades of VDs between VDS-partners?
3. Where (in what EEZs) are the VDs ultimately applied?
4. What are the prices in trades both between VDS-partners and from Partners to fishing companies?
5. To what extent do the prices in the latter class of trades reflect the real payment in the sense of trades being supplemented with non-price valuables such as on-shore investments and other supports?
6. Do individual VDS-partners exceed their VD allotments and, if so, by how much and how are such overages dealt with at the end of the fishing year?
7. What is the relationship between the VDS and the VDS-partners' domestic tuna fisheries especially the archipelagic and to a lesser extent small scale ones?

It is useful to divide these concerns into two categories; (i) those that affect the distribution of benefits from the VDS system and are thus related to the fairness in the application of the scheme and (ii) those that are of more general informational nature. Concerns 1, 6 and 7 relate to the first category and the other four to the second.

Fairness in the application of the VDS

It seems beyond dispute that any aspects of VDS-partners' application of the VDS that impinge on the benefits to other partners should be scrupulously reported and the information reports accessible and transparent to all VDS-partners. The VDS is a co-operative arrangement by independent parties supported by a formal contractual agreement. The arrangement generates certain aggregate benefits that are divided amongst the members according to agreed rules. Any perceived deviation from what was agreed or believed to have been agreed undermines the co-operation with possibly very detrimental consequences for the VDS-partners as a group. Suspicion of deviations, even when unfounded, may have qualitatively similar consequences. Consequently, there is a very good reason to avoid such situations to the extent possible.

This suggests the following:

- There should be as much transparency in how individual Parties apply the VDS within their jurisdiction as possible.
  This serves to reduce unfounded suspicion.
- There should be as clear rules about how the VDS can be applied as possible.
  This serves to reduce ambiguity and different interpretation of the rules.
- There should be uniform enforcement of these rules.
  Anything else undermines the VDS arrangement.
- There should be total transparency in how the rules are enforced in each particular case.
  This also serves to reduce unfounded suspicion and uncertainty.

Recommendations:

We recommend that arrangements should be set up within the VDS structure to ensure to the extent possible that the above is adhered to. As all arrangements, this one should be as automatic and incentive compatible as possible. The following are suggestions along these lines.

1. It should be clearly stipulated (possibly in an amendment to the Palau Arrangement) that all applications of the VDS by individual Parties that may negatively affect the benefits received by other members shall be common knowledge to all VDS-partners.
2. The VDS Administrator, with the help of the PNAO (see section 2.1) should be required to report annually on the application of the VDS by the Parties. The areas of reporting might be stipulated in the VDS-agreement (e.g. as an amendment to the PA).
3. A rule interpretation/arbitration process needs to be established.
   This process would (i) receive and review the VDS Administrator's report (see above) and (ii) respond to requests from members for clarification of rules and complaints about the application of the VDS by individual members. Obviously, detailed rules for the operation and powers of this process board need to be worked out.
4. A clear system of sanctions for deviations from VDS rules designed to make deviations unattractive should be set up to. This should preferably be adopted by unanimous agreement of all Parties.

General information

It is not as obvious that the aspects of the operation of the VDS that do not directly affect the benefits to individual VDS-partners should be common knowledge. The question may be legitimately asked; why should VDS-partners be privy to particulars of VDs trades made by other Partners, if these do not reduce the opportunities of those VDS-partners?

There are certain possible reasons for transparency in this context. Information is generally helpful. The VDS is a partnership to maximize joint benefits and divide them fairly. Therefore, it does not make sense to keep information from Partners unless the transmission of that information is somehow detrimental to other partners. How likely is that?

The VDS-partners compete to a certain extent for buyers of their VDs.[39] Obviously information about trades, especially information that is provided close to real time, can influence other trades. Whether this would be beneficial or detrimental to the interests of VDS-partners individually and as a group is not entirely clear. It could for instance help the group but be detrimental to certain individual members. The impact also depends on who exactly would become privy to the information, i.e. individual members or the VDS as an entity in the form of the VDS Administrator.

Another, more practical, consideration is what information can be reliably obtained. The quantity of trades (i.e. number of fishing days) can normally be reliably obtained because these are valuable assets and the buyer needs to prove he has acquired these rights (otherwise he may be sanctioned for poaching) and the seller will not accept him overstating his purchase. In any case, this information is absolutely necessary to run the VDS system and must therefore be carefully monitored. The price at which trades take place is another matter. This is unnecessary for running the VDS system. The price, moreover, is pure information, not an asset. Hence, there is no particular incentive for either party to VD-trades to report the price accurately, if at all. Therefore, if reliable trading price information is to be collected, a special information collection and verification system will probably have to be set up.

External transparency

It is clear that potential users of fishing days, i.e. the fishing companies including DWF-companies, could benefit from information about trades and prices. The trading of fishing days cannot be described as perfect competition. It is more like a bilateral oligopoly. Individual VDS-partners generally approach several potential buyers and DWF-companies several VDS-partners with trades in mind. Therefore, the trading proceeds much like a multilateral bargaining with each party jostling to gain an advantage. Moreover, potential buyers have an incentive to pit one VDS-partner against another to the extent they can. They could even collude to improve their position. Clearly in this situation, the DWF-companies and other fishing companies could improve their bargaining position if information about trades were freely available. On the other hand, the potential benefits to VDS-partners of this information being accessible to the DWF companies are not obvious. Thus, it appears that VDS-partners have little if anything to gain by making trade information available to the DWF-companies and nations, especially not current or recent trade information.

In addition to information about VD trading and prices there is external demand for information about processes followed by the PNA, how the TAE is set, actions taken against improper fishing practices, how violations are dealt with. In fact, some nation states of DWF-companies, notably the EU (European Union), have publically complained about the lack of transparency in this respect (as well as lack of management efficacy) of the VDS and formulated a policy calling for transparent operation of the VDS and other things[40] (European Parliament 2013). We see this as primarily another manifestation of the DWF-companies attempts to promote their commercial interests in the region. The EU has a long history of using its powers to protect the commercial interests of its fishing industry in distant waters worldwide. The call for transparency serves to strengthen the EU fishing companies' price bargaining position as well as EU's bargaining position with the Parties to PA more generally.

[39] Note that this competition will be largely eliminated if vessel days apply to all PNA-EEZs equally as suggested in section 2.5.

[40] Such as bilateral fishing agreements with individual Pacific nations, thus bypassing the VDS.

Nevertheless, it must be recognized that the EU constitutes an important market for tuna products and has a history of restricting market access to back up its demands. Therefore, it might be a good policy to generally provide information about aspects of the VDS that are unlikely to damage its commercial purpose. It appears that information about the rules and procedures of the VDS, the principles guiding decisions on the TAE, information about how penalties for violations and how vessel, company and Party noncompliance to the rules are dealt with could all fall into this category of non-damaging information. It might even help the enforcement of the VDS. A natural way to provide access to this kind of information would be via the web-page of the PNAO.

It should be noted that if the Parties to the PA decide to move to international auctions of VDs as recommended in section 2.5 above, the transparency of trading and trading prices would be substantially increased. At the same time it is important to realize that trading transparency would not become perfect. This is because of the difficulties in determining who the "real buyers/bidders" are inherent in modern day business and because of secondary trades of VDs that might be quite substantial. Moreover, as discussed in section 2.5, to the extent that the potential bidders for VDs are in a position to collude and, thus, sabotage the fundamental purpose of the auctions (maximizing fee revenues), there would be a limit to which auctions should be employed.

Recommendations:

The above deliberations suggest the following:

5. A VD-registry should be run. This registry should provide information about the VD position of every VDS-partner and every fishing-company (or vessel) that is as up-to-date as possible. The PNAO is the natural place to house and run this registry and, in fact, already does.
6. The VD-registry should be up-dated by (i) trading information and (ii) unused VD information. Both should be as close to real time as possible.
7. The VD-registry should be accessible to all VDS-partners on a confidential basis. Measures to preserve the confidentiality (this is potentially valuable information) may need to be taken.
8. Information about VD trades should only be available to VDS-partners on a confidential basis and possibly with some time delay. Steps to preserve the confidentiality (this is potentially valuable information) may need to be taken.
9. Information about prices in trades should also be collected by the VD-registry on a confidential basis. Attempts by buyers (or sellers) to stipulate in trading contracts that the registry cannot obtain such information cannot be accepted under the VDS.
10. Since information about prices in trades is potentially beneficial to VDS-partners, it may be made available to members with the permission of the VDS-partners involved in the trade or more generally on the basis of unanimous agreement to do so.
11. The VDS-registry and trading information will not be accessible to outside parties (including DWF-companies and governments). Some trading information may be made publically available after the fact (e.g. one year later) in aggregate form if so decided by Parties to the PA.

12. It appears that information about the rules and procedures of the VDS, the principles guiding decisions on the TAE, information about how penalties for violations and how vessel, company and Party noncompliance are dealt with could all be public knowledge and accessible though e.g. the PNA Office public webpage

2.9 Bio-economic model: Amount of fees

The WCPO tuna fishery is very complicated. It is a multispecies, multi-fleet and multi-national fishery. It comprises four tuna species in addition to several species of billfish and tuna-like species. It is pursued by a large number of (at least 20)[41] fishing nations employing several types of fishing gear the most important of which are purse seine, long line and pole and line complemented by various types of fish aggregating devices (FADs). The fishery is conducted over a very large area containing many national EEZs as well as the adjacent high seas areas and the tuna harvested enters several processing and marketing lines in different countries.

In spite of its complexity, various attempts have been made to model this fishery. Prominent early examples are Bertignac et al. (2000), Chand et al. (2002) and Hannesson and Kennedy (2007). None of these models, however, can be described as reasonably bio-economically complete or even practical in the sense of offering the possibility of systematically investigating the maximization of fishing fees. The most advanced and detailed bio-economic model of this fishery that we have seen is the one by Kirchner et al. (2014) which is explicitly a work in progress.

Within the time and resource limits set for this project, it is not possible to develop a bio-economic model that can significantly add to the empirical part of the bio-economic model in Kirchner et al. (2014) or even come close to the details and precision of that model. What is possible to do is to develop a much more aggregative and simplistic model that has the ability to systematically investigate fee maximizing policy for the PNA-nations.

A bio-economic model of this kind has been developed. This model is based on standard bio-economic theory (Arnason 1990, World Bank and FAO 2009, Anderson and Seijo 2010) with the added component of fishing fee collection. While the model attempts to reflect certain key aspects of the PNA purse seine fishery especially as pertains to fishing fee collection, it is empirically very simple and its numerical results should be regarded as primarily indicative.

The model's basic structure, as well as empirical specifications, is set out in appendix 7. For full understanding of the status and premises of the bio-economic results to be reported below, it is necessary to carefully read this appendix. The description in this appendix is detailed enough for easy replication and testing of the model results and, perhaps more importantly, improvement of the model's numerical results at a later date by providing it with more accurate and up-to-date empirical data.

The key results of the bio-economic investigation are: [42]

10. The maximum fee revenues depend strongly on:
    iii. The operating conditions of the fishery including stock sizes and input and output prices.
    iv. The number of vessel days (PAE) offered for sale. Too few or too many vessel days (or alternatively too high or too low daily fishing fee) will reduce attainable fee revenues. Fortunately, however, attainable fee revenues are not

[41] Including Japan, Korea, Taiwan, China, Spain, US, Ecuador, El Salavador, PNG, Solomon Islands, RMI, FSM, Kiribati, Vanuatu, Fiji, Samoa, NZ, Indonesia, Philippines and Vietnam.

[42] The key premises for these results are provided in appendix 7.

very sensitive to the exact number of vessel days provided they are not far away from the optimal level.

11. The optimal (fee maximizing) number of vessel days:
    iv. The optimal number of vessel days (or equivalently fees) each year depends on the operating conditions during that year as well as in the future.
    v. This, optimal number, therefore, will generally vary over time as will maximum attainable fee revenues.
    vi. There is substantial uncertainty regarding the optimal number of vessel days (or equivalently the optimal daily fishing fee level).
        a. This uncertainty is caused predominantly by uncertainty about the true empirical parameters employed by the model especially (i) the cost of fishing operations and (ii) landing prices of tuna.
        b. The uncertainty is to a lesser extent caused by model structure and simplicity.

12. Given recent (2011-13) operating conditions (input and output prices), it is found that there is a high probability that fishing fees can be substantially increased.
    iii. A likely range for the maximum daily fishing fee is found to be 12-17 thousand US$.
    iv. A likely range for the maximum annual fees is found to be between 370 and 1150 M.US$ annually.

13. It should be noted that according to this bio-economic model, fishing fee maximizing policies leave comparatively small proportion (some 6-10%) of the total fishing profits with the fishing industry.

14. These results from the bio-economic model developed in this study are in broad agreement with those of the PNAO-model (Kirchner et al. 2014, Anonymous 2014).

15. This bio-economic study indicates that to maximize total fee revenues, the total number of vessel days may have to be increased. A likely range for fee maximizing fishing days is between 32 thousand and 67 thousand days.

16. Greater precision in these calculations, not to mention a proper stochastic analysis, requires a substantially more extensive bio-economic study.

17. Since the potential benefits of more precise setting of vessel days (or daily fees) are huge (tens of million US$ annually), setting up a special research unit expressly to investigate and recommend the optimal vessel day/fishing fee policy appears to be a good policy.

18. It is highly likely that the total fee maximizing policy will further reduce the biomass of bigeye tuna unless fishing methods (especially the use of FADs) are altered.
    i. To reduce bigeye tuna mortality not to mention restoring the bigeye stock level to the neighborhood of the MSY only by reducing VDS fishing days will probably reduce attainable fishing fee revenues very substantially or by as much 2/5.

ii. This suggests the advisability of exploring fisheries technical ways of reducing bigeye bycatch without reducing the catch rate of especially skipjack. Increased selectivity in this sense will not only be environmentally beneficial, but can increase the maximum attainable fishing fees substantially

As stated above (point 3), our bio-economic investigations strongly indicate that the actual fishing fees collected have been significantly below what has been attainable. It is, of course, possible that our bio-economic model is wrong and the fees have indeed been maximized. In our opinion, however, this possibility is quite remote. First, benchmark daily fees have increased drastically over the past few years while the operating conditions in the fishery have remained comparatively stable. This suggests that, at least until the current year, the fees have not been maximized. Second, our investigations of the sensitivity of model results to model assumptions (see appendix 7) indicate that the fundamental basic result, that actual fee revenues are substantially below the attainable ones, is quite robust. Third, our findings regarding maximum fees are in accordance with other recent bio-economic studies that we have seen, most notably Kirchner et al. (2014) and Anonymous (2014). Given this, we believe that our finding that fee revenues can be substantially increased is very likely to be correct.

Why have fishing fees not been maximized?

This raises the question why the fee revenues have not been maximized. To provide a definitive answer to this question requires an extensive study of the trading process and the actual pricing of fishing days in individual trades that is beyond the capabilities of this study. Our, admittedly superficial, investigations into this matter, however, suggest several possible reasons operating at different levels.

The first main (and necessarily true[43]) explanation is that the fee pricing policy has simply not been aggressive enough. There are many possible reasons for this. First, it should not be forgotten that the VDS inherited a regime of low fishing fees.[44] In fact, it might be said that in raising fishing fees, the VDS has been struggling against convention and tradition. Second, the DWFFs of course oppose raising the fees. In this opposition they have many means at their disposal. Most importantly, the situation is one of bilateral oligopolies with a number of DWF companies dealing with a fairly loose consortium of eight VDS-partner nations. Therefore there is a wide space for bargaining and negotiations. In this bargaining process, the DWF companies have several strong cards. They know much more about the profitability of their operations and the tuna industry in general than the VDS-partners. No doubt they exploit this informational advantage to the extent possible. They can, at least to an extent, play different VDS-partners against each other and probably do. They can enlist the support of their national governments and they can threaten to and even take steps to concentrate their tuna fishing outside the PNA area. All of this means that it is not at all easy for the VDS-partners to aggressively raise fishing fees, especially not when their selling of fishing days is somewhat disjointed and uncoordinated.

The other main reason is that the PNA-nations have not so far endowed their VDS with fishing day selling methods designed to maximize fee revenues. They have set the total

[43] If the fees could have been higher a more aggressive pricing policy would have increased them.

[44] DWFN purse seiners have been paying access fees in the area since the late 1970s. These fees, however, were generally low compared to the VDS fees.

number of vessel days apparently primarily on biological grounds with little or no regard for the demand while fee maximization requires that the supply of vessel days be determined both on economic and biological grounds with a firm eye on the profit functions of the fishing vessels (see e.g. Varian 1992). In operating the VDS, the PNA nations have apparently not even adopted market clearing methods (a prerequisite for fee maximization). They have, as mentioned, decided on the total number of fishing days and in recent years set benchmark prices. The benchmark prices are intended as suggested minimum price to assist individual VDS-partners in their negotiations with potential buyers of VDs. However, under certain conditions and in certain EEZs they may actually become binding. To the extent that this happens, it is important to keep that setting both price and the quantity is not conducive to clearing fishing day markets and definitely not compatible with maximizing fee revenues (Varian 1992).

While economic theory strongly suggests that the most effective way to maximize selling revenues in imperfect markets is some form of auctions or tenders (see e.g. Klemperer 2004), these methods have not been employed. Instead, as discussed in previous sections, the VDS system has to a large extent been based on vessel days specific to certain EEZs, with the EEZ-nations marketing these days individually thus greatly enhancing the bargaining position of the DWFFs.

How to maximize fee collection?

As already pointed out, economic price theory has established fairly conclusively that, generally speaking, some form of auctions constitute the most effective way to maximize selling revenues in imperfect markets with unknown equilibrium prices (Klemperer 2004, Milgrom 2004, Zhen 2008). The market for VDS vessel days fits this bill. It is an imperfect market (bilateral monopolies/oligopolies) and the equilibrium (market clearing) price is unknown. Therefore, to maximize fishing fee revenues to the VDS-partners auctions seem promising.

However, as further explained in appendix 8, auctions are not a magic potion. There is a great number, possibly infinite types of auctions. To maximize selling revenues in a particular marketing situation, the auction needs to be designed for that situation. Note that this is not intended to deny that there are types of auctions that work pretty well for a fairly wide range of situations. However, if the auction is inappropriate for the situation at hand it may produce inferior and even very poor results. In fact, there are many cases of auctions failing miserably (see appendix 8). So, for auctions to achieve their objectives they have to be carefully designed taking due account of the pertinent aspects of the empirical situation (Klemperer 2002, 2004, Milgrom 2004). In particular, they will have to respond to the very real, in the case of the VDS, possibility of bidders' colluding to reduce prices.

On this basis, it is our view that to employ auctions to maximize fishing fees in the VDS context, it is necessary to conduct first a careful study of the relevant aspects of situation and design the auction mechanism accordingly. This is significant work, requiring both solid knowledge of the empirical situation and the theory and practical aspects of auctions.

While, as argued above, it would be premature to propose a particular auctioning system for fishing days and to do so with confidence requires a careful study, it might be helpful at this stage to indicate what to use appears to be sensible attributes of an auctioning system:

Auctioning system: Apparently sensible attributes

- The auctions should be international
  To attract as many bidders as possible and thus reduce the danger of bidders colluding.
- The auctions should be sealed bid ones stating quantity and bid price.
  Sealed bid auctions are normally more effective. By the nature of the commodity being sold they have to state both bid price and the quantity (number) of days.
- The 2nd highest bid price should apply as appropriate
  This is just a well-known principle of efficient auctions (Klemperer 1999, 2004) .
- At the outset (first 1 to 3 years) only a part of fishing days should be auctioned.
  This is to minimize the cost of possible mistakes. An appropriate portion put up for auction at the outset might be 10-20%.
- The PNA should reserve the right to accept or reject bids.
  This is another safety measure. If the auction is a failure no selling needs to take place.
- Auctions may be repeated during the course of the year
  Yet another safety measure to respond to earlier mistakes or, possibly, unexpected success.
- Indicative minimum price may be published
  This would reduce uncertainty and help the bidders to make an acceptable bid
- The auctions should be carefully designed, legally solid, well advertised and supported by the necessary documentation
  This is to avoid mistakes, possible disputes and to maximize informed participation in the auction.

Certain modifications of the current VDS would help auctions to maximize fee revenues. An important one is to take steps to render vessel days as homogeneous assets as possible (e.g. along the lines discussed in chapter 2.5 above). This means that to the extent possible, the fishing days should apply to all PNA EEZs. Auctions work best for homogeneous commodities. Making fishing days more homogeneous also has the added benefits of reducing the risk facing the fishing firms (discussed in 2.5) which can only increase the price they are willing to offer for the fishing days.

Recommendations:

4. It is recommended that the PNA set up a special research unit to research and recommend the optimal fishing day/fishing fee policy both for the coming fishing year and in the longer run.
   Compared to the potential benefits the costs of this unit would be miniscule. It seems appropriate to organize this research unit within the PNAO.
5. It is recommended that the PNA initiate a study and subsequently efforts to improve the species selectivity of the purse seine tuna fishery.
   The current patterns of tuna fishing in the WCPO have differential impact on the tuna stocks. In particular, it has reduced the bigeye stock precariously. The purse seine tuna fishing captures considerable amount of bigeye primarily as bycatch. Stock conservation objectives can be met and total fishing fees can be considerably

increased if the species selectivity of the purse seine fishery can be increased. Such methods exist and can no doubt be made more efficient.

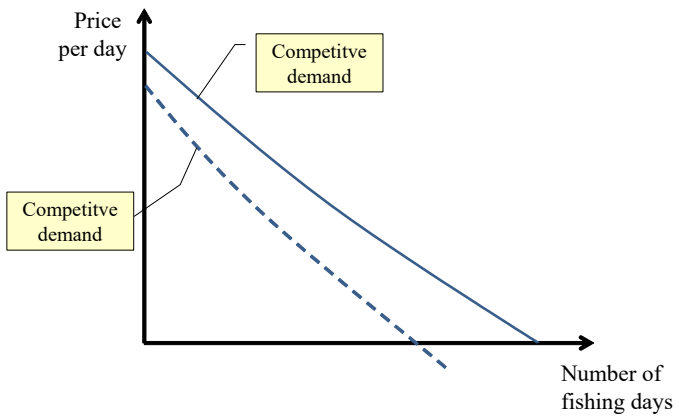
6. It is recommended that the PNA initiate work on a robust design of an auction or tender process to maximize fishing fee revenues.

   This, as explained above, is a substantial piece of work involving both high level technical expertise and solid understanding of the empirical reality of the tuna fishery and fishing day trading. The potential benefits of a well-designed system, however, far outweigh the possible costs of this work.

2.10 Level of fishing effort

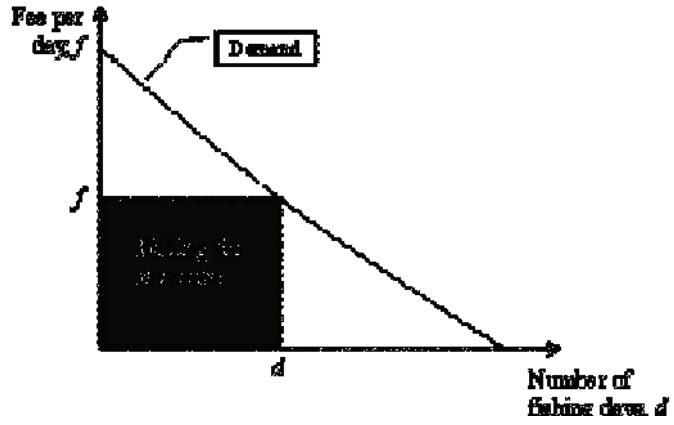
Fishing fees revenues are the multiple of fishing days and the average daily fishing fee. Given any number of fishing days, the maximum daily fishing fee is determined by the demand function for fishing days. This demand function equals marginal profits of fishing days unless the DWFFs can jointly curtail their demand by monopsonistic behavior (i.e. colluding) as illustrated in figure 2.3.

Figure 2.3
Demand for fishing days



If the PNA nations want to maximize their fee revenues they will have to operate on the demand curve for fishing days. In that case they cannot set both the number of fishing days and the fishing fee. Once fishing days are set, the fishing fee will be determined by the demand and vice versa (see figure 2.4). Given a certain number of fishing days, *d*, in the figure, the maximum fishing fee per day is determined by the demand curve as *f* in the figure and consequently the maximum fishing fee revenues. So, provided the PNA seeks to maximize fishing fee revenues, it has only one control variable, either fishing days or fishing fee per day. Either would do, but in what follows we will assume the control variable is fishing days.

Figure 2.4
Maximum fishing fee revenues for fishing days *d*

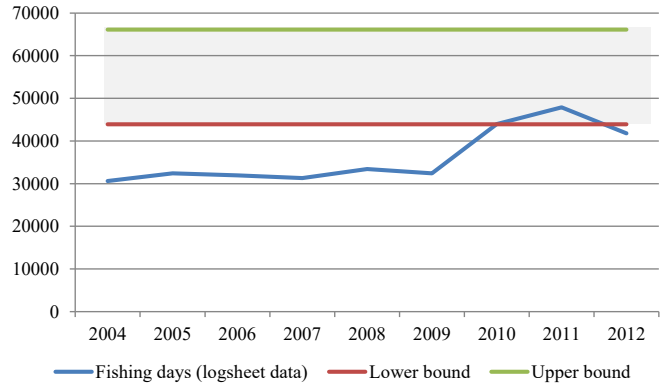


The optimal number of fishing days each year is that which maximizes the present value of current and future fishing fee revenues to the PNA-nations. Importantly, this is not the same as maximizing fee revenues each year. There is a difference because (i) the number of fishing days selected affects the evolution of the tuna stocks and thus influences future fishing fee revenues, (ii) the number of fishing days affects the evolution of the harvesting industry and thus also affect fishing fee revenues in the future and (iii) the PNA's adopted rate of discount affects the optimal number of fishing days in any given year.

A bio-economic model to estimate optimal fishing days has been developed as a part of this study (appendix 7). This model takes account of factors (i) and (iii) above. Factor (ii), the dynamics of the harvesting industry is difficult to model appropriately and is not included in the model. This bio-economic model, moreover, is highly aggregate and relies on imprecisely measured empirical data. As a result, it is not very accurate in its estimates of fee maximizing policies including optimal fishing days.

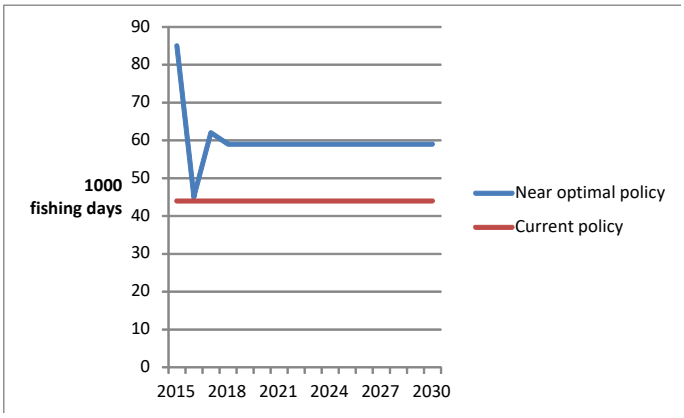
The results of this model suggest that optimal long run fishing effort (measured as standardized fishing days) might be considerably higher than what it has been in the past. The confidence interval for this prediction is wide however. Recent fishing effort (according to vessel logsheets (Anonymous 2014b)) seems to have been close to the lower bound of this interval. This is illustrated in figure 2.5. The shaded area in this figure indicates a confidence bound for optimal long run fishing days. As may be read from this diagram, actual fishing effort as measured by the logsheet reports was well below estimated long run one until 2010. Since then it has hovered around the lower bound of this confidence interval.

Figure 2.5
Recent and optimal long run fishing effort



Full dynamic maximization of the present value of fishing fees does not imply a constant fishing effort from year to year. Even if operating conditions remain constant, dynamic maximization implies an adjustment path of fishing effort toward a long run equilibrium that may take a few years. One such adjustment path, illustrated in figure 2.6, suggests a significant initial increase in fishing effort which subsequently falls down to the long run level of some 58 thousand fishing days.

Figure 2.6
Dynamic fishing effort (days) paths



Also drawn in figure 2.6 is the current fishing day policy interpreted as the average fishing days 2010-12. As shown in the diagram, this policy involves considerably (about 20%) fewer fishing days. The difference in fee revenues is about 90 M.US$ per annum on average.

3. Legal aspects

The purpose of this chapter is to make recommendations and provide options on the legal aspects of recommendations made in the Report. It reviews and defines the relationship among the legal instruments to which all or most Parties of the Palau Arrangement (PA) are also party: the Nauru Agreement (NA) and its Implementing Arrangements (IAs) the PA and the Purse Seine VDS (PSVDS) concluded under its ambit, and the Federated States of Micronesia Arrangement (FSMA) (hereafter "legal instruments"),[45] including decisions taken thereunder.

The Pacific region pioneered the concept of legal harmonization of terms and conditions for fisheries access by adopting the NA over three decades ago; the objective was to strengthen the collective legal authority of countries to manage a valuable resource. Since then the other interrelated legal instruments have been developed separately – the IAs, PA, PSVDS and FSMA – and the point has been reached once again where legal harmonization and streamlining is needed to strengthen the collective position of countries both to manage the fisheries resources and maximize economic benefits.

Now the focus is on harmonizing existing legal instruments, which in turn will provide a robust basis for the adoption of national laws and procedures. The legal instruments should also be updated to reflect recent developments and incorporate the Ministerial decisions relating to the Report. This chapter shows why, and provides recommendations on how harmonization and updating are needed.

It is based on best legal practices for international legal instruments, which aim to provide a solid foundation for clear and effective cooperation among countries and increased potential for future benefits.

In section 2.1 of the Report relating to governance and management, it is:

- recommended to amend and as appropriate integrate the Nauru Agreement (NA), Palau Arrangement (PA) and FSM Arrangement (FSMA) to eliminate duplication and conflicting provisions, and simplify the VDS administration in accordance with the recommendations of the review; and

- further urged that the PNA Office be formally established as a joint Secretariat to the PA and FSMA in the first instance and that the current functions of the Administrator for the PA and FSMA be combined.

This chapter primarily addresses legal aspects of the above, as well as of other related recommendations in the Report.[46]

The current role and organization of the PNA Office is reviewed, including legal arrangements and relations with other organizations and stakeholders. A wide range of

[45] The PA formed the legal basis for conclusion of the PSVDS and a longline VDS, but the latter, while in trial a phase, had not yet entered into force at the time of writing.

[46] Including the following: Section 2.1 items 1-4; section 2.3 items 4 and 7; section 2.4 item 3; section 2.5 items 1-4; section 2.6 items 1-7; and section 2.8 items 1-10.

constraints, inconsistencies and gaps in the legal instruments affect the administration, management and operations of the Office, and these are described and assessed.

Options for optimizing the mix among legal instruments are presented that would underpin the Report's various recommendations, including an indicative framework for an integrated legal instrument. Based on decisions taken on the various recommendations on the Report, the indicative framework could be reviewed, further developed and as appropriate implemented incrementally on a piecemeal basis through separate protocols or other mechanisms.

The general aim of the indicative framework is to provide a streamlined and robust legal basis that promotes effective and efficient administration and management for current and future needs and contributes to the maximization of economic benefits to Parties and the sustainability of the resource. It address, *inter alia*:

- Governance and management, including:
  - definition of the current role and organization of the PNA Office;
  - establishment of a VDS Board of Directors;
  - accountabilities for different management and administrative functions;
  - the relationship between the legal instruments to which all or most PNA Parties are party.
- Legal aspects of:
  - allocation mechanisms;
  - institutional arrangements for trading VDs;
  - information systems and processes;
  - compliance;
  - transparency.
- Improved dispute prevention and settlement mechanisms.

This chapter also sets out options for mechanisms relating to dispute prevention and resolution.

3.1. Current role and organization of the PNA office

The PNA Office currently administers several legal instruments: the 1982 Nauru Agreement and its three Implementing Arrangements, the 1992 Palau Arrangement and the 1994 Federated States of Micronesia Arrangement, as well as the purse seine and longline VDS schemes. This entails activities of a *commercial* nature, such as administration of the VDS, as well as those relating to *conservation and management* of the fish stocks[47] and *policy implementation* of the VDS, FSMA, VMS, PNA Observer Agency and other initiatives.

However, these instruments do not address the full scope of current or planned activities individually or in an integrated manner. An assessment of the instruments, and decisions taken under them, is provided below in section 3. An understanding of the current operational

[47] For example, those prohibiting fishing in the two western pockets of high seas in the Western and Central Pacific, prohibiting setting on whale sharks, prohibiting fishing on fish aggregating devices (FADs) for 3 months of the year, retaining all tuna species on board purse vessels, 100% observer coverage on all purse seine vessels, and minimum mesh size for purse seine nets.

functions, activities, organization, financing, future priorities and constraints of the PNA Office, provided below in sections 2.1 to 2.4, is necessary to inform the assessment.[48]

3.1.1 Functions and activities

Current functions of the PNA Office include the following:

- Develop and coordinate commercial programmes and activities which a Party may enter as it decides;
- Coordinate implementation of the provisions of the Nauru Agreement, Palau Arrangement and FSM Arrangement;
- Develop strategic fisheries conservation and management initiatives for the Parties;
- Formulate initiatives to maximize the sustained direct and indirect economic benefits to the Parties;
- Administer management initiatives agreed by Parties and undertake such other functions as they may decide;
- Administer the Purse Seine and Longline VDS;
- Administer the FSMA;
- Strengthening of the PNA FIMS;
- Administer the VDS Register.

The PNA also runs the PNA Observer Agency which is contracted to MRAG Asia-Pacific and is involved in a crewing initiative. It will be embarking on FAD tracking and other measures to maximize economic returns to the Parties and ensure control of their tuna fisheries.

It works closely with existing regional and international organizations such as the Pacific Islands Forum Fisheries Agency (FFA), Western and Central Pacific Fisheries Commission (WCPFC), and Oceanic Fisheries Programme of the Secretariat of the Pacific Community (SPC), and has relations with appropriate government and private enterprise organizations involved in the tuna fishery and other stakeholders, including Pacifical and the Marine Stewardship Council. It engages blue ribbon consulting companies to provide advice on policy and economics.

PNA countries form a bloc within WCPFC and where the latter fails to agree on conservation and management measures they may respond by agreeing on measures among themselves, for example as done in the adoption of the Third Implementing Arrangement under the Nauru Agreement. Reports on the VDS operations are provided annually to WCPFC, which serves as a forum where some WCPFC members with foreign fishing fleets may express their views.

As noted below, the role of the PNAO vis-à-vis FFA is becoming better defined and there is currently good cooperation, but further clarification could benefit Parties, especially mindful of the commercial activities of countries through PNA, future developments and the need for some consistency where there may be changes in personnel.

[48] Information is sourced, inter alia, from the PNA website: http://www.pnatuna.com/sites/default/files/INFORMATION%20PACKAGE%20-%20PNA%20CEO%20Sep%2030.pdf.

3.1.2 Organizational/institutional arrangements/decisionmaking

The organisational structure and scope of the work of the PNA Office has been guided by the PNA Office Business Plan adopted by the Parties in 2012.

The CEO is answerable to a Board consisting of the Heads of Fisheries of the PNA Governments, and to the Chair of the PNA. He/she provides advice to the Chair of the PNA and Government Ministers on policies and issues related to the PNA, and is the administrator of regional treaties, agreements and arrangements.

Annual meetings for each legal instrument (NA, PA, FSMA) are held separately, but often in tandem. The same countries (although not always the same people/officials) participate in the different meetings under the various instruments. This has the potential of leading to some inconsistent decisions.

Decisionmaking has been effected at annual meetings held pursuant to the various agreements as well as by Resolution, Declaration or other instrument of PNA Members' Ministers or political leaders.

A table of decisions taken by Resolutions and Declarations concerning fisheries conservation and management as well as commercial aspects, is in Annex 1.

They were taken under the name of "PNA" but variously related to all instruments - the NA, PA, PSVDS and FSMA - and were not always underpinned by the provisions of a potentially relevant instrument (e.g. the FSMA applies only to purse seiners yet guidance was given by "PNA" on a new longline VDS). More generally, the legal instruments and associated processes should be reviewed for strengthening in terms of accountability for decisionmaking and requirements for transparency as appropriate.

3.1.3 Financial arrangements

The PNA Office is fully self-funded from levies surcharged on the VDS Register and a conservation levy charged on all vessels registered on the VDS Register. It charges 7.5% administrative fee on the FSMA. Surplus funds generated at the end of the Financial Year are paid to PNA Governments as dividends. From the last quarter of 2014, it is expected that the PNA Office will receive US$2 million to be used over the next 4 years from UNDP-GEF. This will not be administered by the PNA Office, but will be used to support the PNA.

3.1.4 Future priorities

The PNA Office, in its VDS role, is expected to evolve to include the establishment of a trading house through which days may be sold through an auction or trading house. The PNA Office could, in this respect, evolve into a broker of days amongst the various fishing companies., in accordance with the Recommendation 2.5, item 2 of the Report: "A framework for facilitating trades be developed e.g. under the auspices of the PNAO" and generally in accordance with the recommendations addressed in section 2.6 of the Report relating to the integrity of systems and processes. This will address the situation where countries are trading bilaterally and developing auction schemes individually or in groups.

It will require clear institutional arrangements under a legal instrument , which could as appropriate initially simply focus on the framework for a trading house or more broadly integrate the various provisions of the four legal instruments – NA, PA PSVDS and FSMA – as described in section 4, below and Annex III.

The recommendations in this chapter aim to build upon existing arrangements and strengthen the organization and institutional arrangements in accordance with the recommendations of the Report, including section 2 and other relevant those summarized in the Executive Summary, including through:

- establishment of a VDS Board of Directors to maximize the sustainable net economic benefits from the tuna fisheries to Parties to the PA. and a trading mechanism, with outcome-based reporting to Ministers; and

- providing options to integrate the legal instruments to which all or most PNA Parties are party, and to strengthen certain aspects including:
    - improved definition of the role of the PNA Office and meetings of officials; and
    - decisionmaking and accountabilities for different management and administrative functions.

The above will require strengthening of the legal instruments as described below.

3.2 Legal instruments

The relationship among the legal instruments is complex and understandably includes a number of gaps, inconsistencies and other weaknesses, given that the objectives of each – although interrelated – are different. A consolidated comparative table of the text of the legal instruments, together with commentary as appropriate, is attached as Annex II.

The relationship among the instruments is characterized by the constraints and gaps affecting administration, management and operations, as shown below. These concerns reflect the separate development and various administrative arrangements for each instrument, the somewhat *ad hoc* basis for initial establishment of the PNA Office, and the relatively rapid development of successful initiatives that have affected the focus and organization of the Office. It is vital for the overall maximization of economic benefits to Parties that there is an across-the-board common understanding and legal underpinning of priorities and initiatives.

3.2.1 Constraints and gaps in the instruments affecting administration, management and operations

Some key constraints, gaps and inadequacies in the implementation of the instruments and operation of the PNA Office are briefly described below.

Application

- Legal instruments should explain the geographical area, fisheries and/or other aspect to which they apply. Areas of application are described differently by the instruments, and there is some inconsistency in referring to Fisheries Zones and exclusive economic zones:

- The NA applies to common stocks of fisheries within the Parties' "Fisheries Zones";
- The PSVDS applies to fishing within the "waters of the Parties";
- The PA Area includes adjacent high seas areas in the Western Pacific within which fishing vessels operate, and refers to the "exclusive economic zones or fisheries zones" of the Parties, and the PA applies to all species of tuna and tuna-like species (including billfish and other incidental by-catch) taken by fishing vessels, wherever they may occur in the Area.
- The FSMA applies to "exclusive economic or fisheries zones of the Parties…except for waters closed to fishing in accordance with Schedule 2 of Annex V."

- The NA and PA apply to all fisheries, and the PSVDS and the FSMA are applicable to fishing by purse seiners only. A longline VDS has been developed and trialed and is awaiting entry into force.

Objectives

- The legal instruments have some commonality in relation to their objectives, although they necessarily do not have identical objectives. Dominant themes include fisheries management and maximising economic benefits. The FSMA is the only instrument that has as objectives consistency with other instruments, including allowing access consistent with the Palau Arrangement and furthering the objectives of the Nauru Agreement.

- The PA does not specifically state any formal objectives and the NA refers to coordination and harmonization of fisheries management.

- The objectives stated in the PSVDS include promoting optimum utilization to maximizing economic returns, development of domestic industry and, importantly, providing for effective and efficient management, administration and compliance.

- There is a wide range of objectives stated in the FSMA, including securing maximum sustainable economic benefits, promoting the development of the domestic industry, establishing a licensing regime, establishing and enforcing criteria to ensure that licenses are only issued for operations that provide quantifiable economic benefits to Parties.

Institutional arrangements

- Clear identification of institutional arrangements in legal instruments has implications for accountability,[49] reporting and decisionmaking. It provides the ground rules for smooth operation of the entity and responsible administration.

- The legal instruments do not address institutional aspects of commercial activities (e.g. trading), programmes (e.g. the Observer Programme) or relations with industry (e.g. Pacifical, MSC).

[49] Including requirements to report and take responsibility for designated activities.

- Apart from the reference to the establishment of Special Working Groups in the PA and the VDS Committee in the PSVDS, establishment of subsidiary bodies are not addressed in the instruments. If such bodies, such as a VDS Board of Directors, Working Groups or ad hoc Committees are thought useful, a basic provision for their establishment and mandate (e.g. reporting to the annual meeting or other) would be a useful tool.

- Institutional arrangements would include

Administration – PNA Office

- The PNA Office was established pursuant to the 2009 Bikenibeu Declaration but administrative arrangements and accountabilities proceeded less formally, based on a document submitted at the time by Kiribati. As noted above, the arrangements are currently based on the PNA Office Business Plan.

- In establishing the PNA Office, there was a general intention that it should be seen more as a business entity dealing with obtaining maximum benefit for Parties-as-shareholders from the operation of the VDS.

- The PNA Office also performs Secretariat duties, and the Chief Executive Officer (CEO) currently has a number of responsibilities, both *de facto* and *de jure*, which span implementation of the NA, PA, PSVDS and FSMA, as noted in section 2.1 above.

- The legal instruments vary in their reference to the functions and duties of the PNA Office and the CEO, as well as the title of the CEO. The NA[50] and its implementing arrangements do not refer to the functions and duties of the CEO, the PA provides that all secretariat services and arrangements for management meetings will be performed by the "PNA Office" and assigns specific tasks to the "Director" (e.g. coordinate the licensing, management mechanism and other mechanisms) and the PSVDS and FSMA both set out the duties of an "Administrator" in a dedicated Article as well as in various Articles throughout the respective Agreements.

- Functions are provided for a Secretariat in the PA and an Administrator in the PSVDS and FSMA, but none of the legal instruments provides functions of the PNA Office itself as a whole, taking into account its existing *de facto* duties, including those identified in the 2012 Business Plan[51] and various Resolutions and other decisions shown in Annex I.

- Accountabilities for different management and administrative functions should be more clearly defined, particularly as they relate to either commercial or conservation and management matters. For example, under the PSVDS the Administrator is currently the sole and apparently final decisionmaker as to whether a vessel meets the requirements of a Management Scheme (without

[50] Reference has been made in literature to the establishment of the PNA Office in Article V of the Nauru Agreement as amended, but the version on the PNA website and elsewhere does not show the amendment.

[51] Approved in the 2012 Resolution on Marine Animals; see Annex I.

criteria on which to base the judgment), or should be deleted from the VDS Register.[52]

- Identification of clear functions for the Secretariat would provide a robust framework for the annual workplan.

- In addition to the general intention that the PNA Office should be seen more as a business entity, noted above, another reason for not describing the functions of the PNA Office in a consolidated manner may lie in the intention not to create a fisheries body which has a mandate (either advisory or management) separate from the Parties. This is an issue which has been discussed in the past[53] but should continue to be addressed in efforts to strengthen the governance by the PNA Office through clearly integrating and streamlining the functions specified in the instruments and decisions, and in commercializing its operations as recommended in the Report.

Meetings of the Parties

- The meetings of Parties of the various instruments are held separately, and although the meetings of officials may be held in tandem, their agendas, participants and/or decisionmaking may not always be integrated or consistent.

- The instruments generally would benefit from further clarity and consistent "best practices" provisions governing the meetings of the Parties, as noted in Annex III, e.g. requirements to review and approve a Programme of Work,[54] assess compliance by Parties or others, relations with other organizations and financial reporting. This would guide the PNA Office and guarantee that certain core issues are prepared for review at each meeting, enhancing transparency and accountability.

- Concerning financial responsibility, only the FSMA requires Parties to review an auditor's report at annual meetings, and no instrument requires financial regulations.

- There is a need for better integration between the meetings of the parties and other bodies established under the instruments. For example, in the PA the VDS Committee can decide matters "delegated by Parties" but there is no requirement to consider matters referred by the Annual Meeting of Parties as such.

- The FSMA is the only instrument that makes a provision for adopting Rules of Procedure for annual meetings or other situations as appropriate. The Rules govern issues such as quorums, decisionmaking, appointment of Chair and Vice Chairs and other procedural matters to ensure a smooth process.

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[52] For example, the EU has used this as a basis for criticising the scheme. The position of PNA Parties is that the term 'satisfaction' refers to satisfaction of legal action by the Party.

[53] It was addressed in the discussion surrounding the Business Plan in 2011/12.

[54] Although not required by the instruments in accordance with best practices, the PNA Office prepares a workplan annually for consideration by the Parties.

Decisionmaking

- The legal instruments – NA, PA, PSVDS and FSMA - generally do not provide clear decisionmaking procedures or an integrated legal basis for taking decisions.[55]

- Agreement is forged at annual meetings, including through Declarations, Resolutions or MOUs of PNA Parties at a high political level in relation to specified activities to be implemented by the PNA Office and Parties, resulting in a patchwork of decisionmaking – as well as instruments used for such decisions - which in turn may impact on effective implementation.

- Decisions or guidance given in the Resolutions and Declarations are under the umbrella of the "PNA Ministers", even if they affect activities under the PA or FSMA.

- Decisions of PNA Ministers may reinforce the recommendations of earlier meetings, but they may also seek to overturn the decisions.

- Commercial decisions are taken by consensus and may be politically motivated or weakly implemented, which is an issue addressed by the recommendation to establish a professional VDS Board of Directors with clear voting powers.

Non-compliance by Parties and dispute prevention and resolution

- *Obligations of Parties*: Although Parties are required to take certain actions in the various instruments (e.g. ensure compliance by their nationals, provide information) There is no consolidated provision in the instruments setting out clearly a range of obligations of the parties (e.g. WCPFC Article 23) which, if not implemented, could give rise to dispute prevention and resolution procedures or penalties. This is especially important for commercial activities.

- *Non-compliance*: Non-compliance with decisions or instruments: Parties do not always implement the decisions or provisions of the instruments; e.g. initially, implementation of the NA Third Implementing Arrangement has been described as wobbly,[56] and parties do not always comply with the PAE requirements.

- *Dispute prevention and resolution*: Except for basic provisions in the PA and FSMA, the instruments do not provide for dispute resolution or arbitration, including situations where there are technical disputes or the Parties do not implement agreed measures.

- *Penalties for non-compliance*: Penalties are prescribed under the PS VDS for non-compliance, e.g. deletion from VDS Register for vessels and reduction in PAE for countries, but the process for imposing them is subject to a decision at the political level and may not be effective.

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[55] Except that the PA provides that the decisions of the Management Meeting must be arrived at by consensus and will be binding on the Parties. NA and FSMA require unanimity for amendments to the instrument. None of the instruments defines a quorum for decisionmaking

[56] http://www.fm/news/kp/2011/april11_1.htm.

Financial processes

- Oversight should be clear and consolidated for relevant financial processes, including end-of-year payment of surplus funds and distribution of licence fees. FSMA is the only instrument requiring the Administrator to arrange for auditing accounts.

- Financial Regulations should be required under the instruments and adopted, particularly considering the commercial activities of the PNA Office.

Relations with other organizations

- The PA recognises the need for Parties to cooperate with other states or international organisations having an interest in the tuna resources within the Area through informal consultations, but the NA, PSVDS and FSMA do not have similar requirements.

- Currently there is an FFA/SPC colloquium and MOU and a PNA/SPC MOU, and good collaboration between FFA and PNA. It would be useful to define more formally the latter relationship for the purpose of avoiding doubt and ensuring future clarity throughout possible changes in circumstances and personnel.

- It could be useful to enhance relations by more clearly defining the role and functions to be carried out by the PNA Office in cooperation with other States or organizations pursuant to the NA, PA, PSVDS and FSMA.

- If it is decided to develop an integrated instrument, the other regional bodies should be consulted in the process.

Inconsistencies among the various legal instruments

The various legal instruments were developed separately and inconsistencies exist among them, and other regional instruments as seen in Annex II, including in the definition of key terms which leads to uneven enforcement. An example is inconsistency in the definition of terms and requirements for ALCs.

Parties/Membership

- Except for the PA, the legal instruments do not have criteria to identify non-PNA countries that may accede to them.

- The PA (as amended) opens the Agreement for signature by PNA countries, and is subject to ratification (Article 9.1), and after entry into force the PA was open for accession by other members of the Pacific Islands Forum Fisheries Agency not Parties to the Nauru Agreement (Article 9.4). The VDS's under the PA are open to Parties to the Palau Arrangement.

- The FSMA provides that FFA members may be observers at meetings.

Because of the importance of building on the strengths of these instruments and the acknowledged need to update them and ensure consistency, options for integration are recommended below in section 4 which include including additional considerations for optimizing the mix described in section 3.2.

3.2.2 Optimising the mix of existing instruments: an indicative integrated instrument

The Report makes a number of recommendations in section 2 that, if accepted, require legal underpinning and should be integrated into the legal instruments. The recommendations relate to a wide range of matters and activities, including governance and management, trading, integrity of systems, compliance, and transparency.

However, in addition to the weaknesses, gaps and inconsistencies among existing instruments, the assessments in section 3.1, above and Annex II show that no single instrument contains the appropriate foundation or scope to accommodate the recommendations of the Report in a robust, integrated manner.

It should be recalled that the recommendations of the Report include:

> "amending and as appropriate integrating the Nauru Agreement (NA), Palau Agreement (PA) and FSM Agreement (FSMA)" to eliminate duplication and conflicting provisions, and simplifying the VDS administration in accordance with the recommendations of the review.

It is further urged that the PNA Office be:

> "formally established as a joint Secretariat to the PA and FSMA in the first instance" and that the current functions of the Administrator for the PA and FSMA be combined.

To address the recommendation to amend and as appropriate integrating the legal instruments, it was considered useful to develop an indicative framework for an integrated instrument , which is appended as Annex III. It provides an example of a robust instrument – and provisions – consistent with:

- the Nauru Agreement and Implementing Arrangements, the Palau Arrangement, the Purse Seine Vessel Day Scheme and the FSM Arrangement;
- the recommendations of the Report; and
- best legal practices.

Some elements of the indicative framework are new and do not appear in any of the legal instruments. They are to be considered as possible amendments.

In Annex III, explanations are given for each element of the indicative framework which encompass the legal instruments, the recommendations of the Report and best legal practices (to be considered as possible amendments. Relevant Articles in the existing instruments are referenced in footnotes, the relevant recommendations of the Report are clearly stated and best legal practices flagged.

Consistent with a "framework" approach, Annex III also indicates issues to be decided and rules to be developed by Parties if the framework , or any of its parts, is considered acceptable.

Annex IV shows the framework of the consolidated table of provisions in the existing instruments (Annex II) together with the framework of the indicative integrated instrument (Annex III). New provisions in the later include the following:

- Principles
- The Organisation
  (a) PNA Committee
  (b) Commercial arm/VDS Board of Directors
  (c) Trading/auction mechanism
  (d) Compliance Committee
  (e) Finance and Administration Committee
  (f) Secretariat
- Institutional functions and responsibilities
- Financial arrangements
- Obligations of parties
- Information
- Cooperation with non-Parties

Key to the governance is formal establishment of an Organisation (e.g. "PNA Organisation") which would have a governing Committee that holds annual meetings to consider issues in an integrated manner and a Secretariat with defined functions, including those that are currently exercised by the PNA Office. Consistent with recommendations of the Report, establishment of a commercial arm – which could also include a trading or auction mechanism – is foreshadowed. Oversight on matters of compliance and finance and administration, consistent with best legal practices, would be provided.

The current patchwork approach to decisionmaking would be discarded, and as appropriate procedures for commercial decisionmaking developed. Decisionmaking and administration of financial matters would be consolidated, transparent and accountable.

It is standard best practices to agree on principles underlying the legal obligations, and the area/parties to which the instrument applies. Institutional functions and responsibilities would be clearly described and the procedures for the handling of information addressed. Cooperation with non-parties would be clear.

It is also recommended in Annex III that other regional organizations be consulted in the development of an integrated instrument, in order to enhance complementarities and promote positive synergies.

Dispute settlement and arbitration

Section 2.7 of the Report address compliance with the rules, and note that improved mechanisms to resolve disputes, including a formal arbitration system, would be elaborated in this chapter. Currently the FSMA is the only instrument that provides for dispute settlement in a very basic manner by requiring parties to undertake consultations and proceed to dispute settlement through means of their own choice.

In international instruments, dispute prevention and settlement provisions generally fall into three categories: (a) general requirements for dispute prevention and settlement; (b)

requirements for technical disputes;[57] and (c) possible legally binding dispute resolution mechanisms, including arbitration.

(a) General requirements for dispute prevention and settlement

As general requirements, Parties should be obligated to cooperate to prevent disputes. Where the interpretation or implementation of the instrument is the subject of dispute among two or more Parties, the instrument should encourage them to consult among themselves with a view to resolving the dispute, or to having the dispute resolved by negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement or other peaceful means of their own choice.

(b) Technical disputes

In addition, where Parties cannot resolve technical disputes between themselves, procedures for establishment of an *ad hoc* expert panel or use of a *sole expert* should be agreed by the Organisation. The panel should be required to confer with the Contracting Parties concerned and endeavour to resolve the dispute expeditiously without recourse to binding procedures for the settlement of disputes.

Examples of procedures to establish an *ad hoc* panel could involve a process for designation of panel members (e.g. each Party to the dispute to nominate an expert, and the experts nominated could in turn agree on another or other experts to sit on the panel; or certain institutions specified in the procedures e.g. SPC, FFA, FAO, could each nominate an expert), as well as agreement on the terms of reference, the number of panelists, timeline, various notifications and submissions, oral/written procedures, venue, costs and the non-legally binding nature of the process.

Examples of procedures to designate a *sole expert* could involve designation by mutual agreement or appointment by a specified institution or institutions, and others similar to those used for the *ad hoc* panel.

(c) Legally binding dispute resolution mechanisms

Where a dispute is not referred for settlement or resolved within a reasonable time, legally binding dispute resolution mechanisms may be required. They may take the form of mechanisms stated in UN Conventions (1982 Convention on the Law of the Sea, 1995 Fish Stocks Agreement) and establishment of an arbitration panel. Typical provisions are shown below:

(i) Dispute resolution under UN Conventions

At the request of any party to the dispute, the dispute is to be submitted for binding decision in accordance with procedures for the settlement of disputes provided in Part XV of the 1982 Convention or, where the dispute concerns one or more straddling stocks, by provisions set out in Part VIII of the 1995 Agreement.

[57] Technical disputes are, as the name suggests, those of a technical nature rather than matters of a legal nature for example involving interpretation of the legal instrument or its implementation.

The relevant part of the 1982 Convention and the 1995 Agreement applies whether or not the parties to the dispute are also Parties to these instruments. The court, tribunal or panel to which any dispute has been submitted should be required to apply the various international instruments and other relevant rules of international law.

(ii) Dispute resolution by arbitration

A key consideration in designing an arbitration mechanism is the identification of relevant arbitration rules. It is standard for Parties to be given the option to agree on the rules (e.g those adopted under the national law of a designated country), but where agreement is not reached applicable international rules should be specified. There are two main choices: the Rules of the Permanent Court of Arbitration (PCA) or those of the United Nations Commission on Trade Law (UNCITRAL).

The 1982 Convention, Annex VII, which addresses *ad hoc* arbitration, requires the PCA Rules. The PCA has acted as registry in eleven of the twelve cases that have been arbitrated since the Convention entered into force. The PCA Rules are a set of procedural rules for the arbitration of disputes involving at least one State, State-controlled entity, or international organization. The UNCITRAL Rules aim more at commercially-related disputes. [58]

The convention establishing the SPRFMO requires the PCA Rules[59] and the US Treaty requires the UNCITRAL Rules[60]. If it is anticipated that the disputes will be more commercially-oriented, the UNCITRAL Rules could be the better option.

An arbitration mechanism should include the rules described in Annex III.

In agreeing on basic rules for arbitration, the principle of cost effectiveness should guide decisions. For example, the place of arbitration should preferably be within the region, the number of arbitrators kept lean and the arbitration rules identified should be well understood by practitioners.

3.3. Options for optimizing the mix

Three options are proposed for optimizing the mix among the legal instruments, taking into account the need for complementarity with other regional organizations, treaties and agreements. The options are based on the recommendations of the Report and elements of the indicative framework presented in Annex III.

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[58] They provide a comprehensive set of procedural rules upon which parties may agree for the conduct of arbitral proceedings arising out of their commercial relationship and are widely used in ad hoc arbitrations as well as administered arbitrations. The Rules cover all aspects of the arbitral process, providing a model arbitration clause, setting out procedural rules regarding the appointment of arbitrators and the conduct of arbitral proceedings, and establishing rules in relation to the form, effect and interpretation of the award.
The Rules have been used for the settlement of a broad range of disputes, including disputes between private commercial parties where no arbitral institution is involved, investor-State disputes, State-to-State disputes and commercial disputes administered by arbitral institutions.

[59] Annex II and Annex IV.

[60] Article 6.

- The options *should be reviewed in light of the PNA Ministers' decisions on the other recommendations in this Report.*

- The options are *not mutually exclusive* and *short and/or long term goals could be identified and as appropriate pursued in parallel*.

For example, short-term goals could include institutional changes such as establishing a VDS Board Directors and trading arrangements and otherwise consolidating the functions and responsibilities of the PNA Office and Administrator. Long term goals could include developing an integrated legal instrument (either generally or for cross-cutting issues to be identified) or amending and harmonizing existing instruments to eliminate all gaps and inconsistencies and allow for a streamlined and effective way forward.

1. Develop and adopt an integrated legal instrument, based *inter alia* on existing legal instruments and the decisions by Ministers related to this report. Such an instrument could aim to:

(a) replace the legal instruments as appropriate; or

(b) combine issues relating to cross-cutting and/or interdependent matters to be identified[61] and include consequential amendments to the existing legal instruments, either as a:

(i) final solution; or

(ii) short term solution while option (a) is being investigated in parallel.

Advantages of proceeding towards an integrated instrument include:

(a) eliminating the weaknesses, gaps and inconsistencies in existing instruments generally and as they impact VDS and management, operation and administration of the PNA Office;
(b) forging an updated, robust, coordinated and consolidated way forward for Parties in a region already full of other regional fisheries-related organizations and instruments;
(c) saving time and expense involved in amending three separate, but interrelated instruments, and ensuring a more coordinated and streamlined outcome;
(d) addressing the entire range of relevant and interlinked legal issues across-the-board rather than amending the instruments separately or adopting protocols or additional agreements that would add to the already-high number of diverse fisheries agreements and organizations in the region;
(e) maximizing economic benefits for countries through strong, well-defined governance and decisionmaking and clear rules and processes for commercial activities;
(f) clarifying relations and responsibilities with other organizations, treaties and arrangements in the region; and
(g) promoting a deeper understanding and consistent application of the VDS among all Parties.

Possible disadvantages of this option include:

(a) initiating a long-term process that could take some time to complete successfully;

[61] Such as use of terms, institutional aspects, obligations of Parties, decisionmaking, relationship with other agreements and organizations, dispute resolution, non-members and others.

(b) resistance or obstruction from non-Parties and DWFNs;
(c) disagreement among Parties on various provisions based on their national priorities; and
(d) a perceived loss of control by some members if the organization were to become bound by rules and procedures that they feel may impact on responses to the decisions – notwithstanding that they will have agreed to the rules to streamline operations;
(e) preliminary concerns by members that the result could be unwieldy and require more responsibilities and obligations of them;
(f) processes would need to be initiated to amend or otherwise the existing legal instruments.

2. Amend the Palau Arrangement only (including the VDS instruments for purse seine and longline fishing). Amendment of other instruments may be considered separately.

Advantages of amending only the Palau Arrangement together with the VDS instruments include:

(a) Updating and consolidating provisions in the existing instruments;
(b) Clearly agreeing on the role of the PNA Office, the Administrator/CEO and any commercial arm that may be agreed such as a VDS Board of Directors or trading arrangements;
(c) Providing for improved governance, integrity and implementation of the VDS, and other areas as may be decided;

Possible disadvantages of this option include:

(a) This approach would not affect the inconsistencies and gaps in relation to the NA and FSMA;
(b) An amended Palau Arrangement may not be able to integrate as well with the FSM Arrangement or the Nauru Agreement and Implementing Arrangements where consequential amendments are not agreed for to the other legal instruments;
(c) Decisionmaking processes and outcomes pursuant to the relevant instruments on issues of mutual interest would not necessarily be strengthened or better coordinated.

3. Amend the Palau Arrangement only (including the VDS instruments for purse seine and longline fishing) and agree on a new separate protocol or other form of instrument applicable to the Nauru Agreement and FSM Arrangement that would be harmonized with such amendments.

Advantages of amending the Palau Arrangement and developing a Protocol to be applied to the other instruments include:

(a) Updating and consolidating provisions of the Palau Arrangement;
(b) Providing for improved governance, integrity and implementation of the VDS, and other areas as may be decided from the indicative framework of an integrated instrument;
(c) Possibly strengthening of coordination with the other instruments;
(d) The possibility of applying dispute prevention and resolution to all situations governed by the instruments.

Possible disadvantages of this option include:

(a) The "patchwork" approach towards decisionmaking would be unlikely to improve.
(b) A separate protocol could take as long to develop as a single, integrated instrument without the benefits of integration.

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Appendix 1
Game-theoretic essentials

The following describes the essential game-theoretic aspects of the utilization of the WCP tuna stocks. These aspects are important because they delineate certain conditions for the PNA co-operation and constrain to what extent VDS fishing fees can be increased.

- The WCP tuna stocks represent valuable resources straddling several national EEZs as well as the high seas. [62] These resources are common property in the sense that harvesting in one EEZ will soon have an effect on stock abundance in adjacent EEZs and eventually all EEZs and the high seas.
- There are essentially two sets of players attempting to reap benefits from these resources:
  (i) The nations having EEZ in the region comprising the tuna resources. These may be referred to as the EEZ-nations. [63]
  (ii) The distant water fishing fleets (DWFF) which are the main exploiters of the resources.[64]
- Both sets of players are composed of a number of individual members or players.
- It may be taken for granted that all players want to maximize their net economic benefits from the resources.
- However, they cannot do this independently of each other because of the common property nature of the resources.
- This situation inevitably leads to strategic interaction between the players which is can be described and analysed game-theoretic terms.
- For the game analysis, it is important to realize that the game-playing position of the two sets of players is very different. The EEZ-nations have strong property rights over their EEZs which they can utilize unilaterally or combine in which case they could control the utilization of the resources. The DWFF, on the other hand, need co-operation with one or more EEZ-nation to exploit the resources.[65]
- A further complication is that neither set of players is composed of the homogeneous members. The EEZ are of very unequal size and level of economic development. The economic importance of the tuna resources therefore differs greatly between them. Moreover, some of them have significant domestic tuna fishing sector and even tuna processing while others do not. The DWFF are also nonhomogeneous. The vessels are of different sizes, employ different fishing gear and techniques and to a certain extent supply different markets.

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[62] It should be noted that the high seas regions are relatively small compared to the areas covered by the EEZs.

[63] The main EEZ-countries are following 12: Indonesia, Philippines, Papua New Guinea, Palau, Solomon Islands, Federated States of Micronesia, Marshall Islands, Nauru, Kiribati, Tuvalu, Tokelau and Cook Islands.

[64] The key ones are China (Taipai), Korea, Japan, the USA and the EU.

[65] Assuming fishing the high seas exclusively is not profitable.

- A yet further complication is that the DWFF are in a position to enlist the support of their national governments for furthering their interests. This may lead to widening the scope of the game to include other valuables such as access to markets, trading relationships more generally, military co-operation and so on.
- Since the players can communicate and form more or less binding agreement, this game may be characterized as a bargaining game (Nash 1953, Myerson 2001). Moreover, since the conditions under which the game is played change over time (biomasses, distribution of stocks, prices etc.), the bargaining game is also dynamic.
- Like all bargaining games, this one can proceed in various ways. One possible outcome is no agreement between the players which would lead to the well-known common property outcome of very little net economic benefits and overexploited biomass.[66] The other extreme is an overall agreement by all the players, usually referred to as the grand coalition, which would maximize total economic benefits from the resources and share them in a mutually acceptable way.
- There is a high number of possible other arrangements in between these extremes involving many possible combinations of sub-coalitions. The PNA VDS system comprising 9 of the 12 major EEZ-nations is one such coalition.
- An important feature of all sub-coalitions is that they can not maximize the net economic benefits from the resources. Only the grand coalition is capable of this. (Myerson 2001).
- A necessary feature of all coalitions that can be sustained (are stable) is that all the members of such coalitions must believe that they are getting at least as much net benefits from their participation in the coalition as under any other option they have. Moreover, in dynamic games as this one, the members must believe this at all points of time. If they did not they would leave the coalition
- It follows from this that not all coalitions, including the grand coalition, can be sustained. Sustaining coalitions will be facilitated if
  (i) Benefits are transferable (like financial benefits)
  (ii) Renegotiation of benefit distribution as conditions change is easy

The game from the perspective of the PNA

- The PNA nations have formed a coalition to extract fees from the DWFN under the VDS system. This coalition comprises a substantial part of the WCP tuna resources. With Tokelau this coalition includes nine of the 12 most important EEZ nations owning the tuna resources.[67] About 60% of recent catches and presumably a similar proportion of the fishable tuna biomass occurs within their EEZs or the high seas surrounded by their EEZs.
- Importantly the share of the global fishery controlled by the PNA nations is large enough to endow them with substantial market power in global tuna markets especially

[66] Since the resources are to a large extent straddling some net benefits would be retained if some of the individual EEZ-nations, especially those with large EEZs would maintain good internal fisheries management.

[67] The key non-members with significant tuna resources are: Indonesia, Phillipines and Cook Islands..

those for skipjack. Thus, the skipjack catches under the VDS system account for some 50% of the global catch of skipjack. [68]

- The PNA-coalition, thus, is in a strong position to increase the net economic benefits from the tuna fishery and extract a larger share of these benefits for its members. In fact it has been quite successful in doing this. It has imposed the VDS system to control fishing effort and it has increased the daily fee rate dramatically.
- The PNA-coalition however faces significant challenges including
  (i) Keeping the coalition together
  (ii) Withstand challenges from DWFF and their governments
  (iii) Deal with the threat from non-VDS nations
  (iv) Extract maximum fees
- ***Maintaining the coalition***: The PNA-coalition, as any coalition, can only be maintained if the members believe that continuing membership is at least as beneficial to them as the alternatives. This means that the controls of VDS-system – the (i) TAE, (ii) PAE, (iii) other sharing mechanisms and other services provided – have to be set in such a way that each member feels he is getting more (or at least not less) than under any other alternative open to him. This is a particular challenge because, as explained above, the members are not identical and extract benefits from the tuna resources in different ways and, moreover, the conditions of the game are continuously changing over time as stock sizes, locations of the fishable stock, prices and harvesting technologies evolve over time. This suggests the importance of well-defined procedures for adjustment of the above controls to meet altered conditions as well as methods of providing benefits to members that are independent of their own fishing and processing activities (i.e. in more liquid form).
- ***Withstanding challenges from DWFFs***: Although the interests of the DWFF and the PNA-coalition coincide to a certain extent; both would like to maintain the resource and maximize the net economic returns from the fishery, they are diametrically opposite when it comes to fishing fees. For this reason, the DWFF may be expected to do whatever they can to avoid paying the VDS- fees and even take steps to undermine the VDS –system altogether. For this, they have many means at their disposal. The can for instance enlist the support of their national governments, which they have done, and they can attempt to break the coalition by offering attractive deals to individual members, especially the more crucial ones.[69] As the fees increase, these efforts may be expected to intensify. The DWFF are more disparate than the PNA-nations. Possibly for that reason they have not yet managed to form a co-ordinated coalition to challenge the VDS-fee system. This, however, may change in the future, especially as the PNA-nations claim more and more of the net benefits of the fishery.
- ***Threats from non-VDS nations*****:** Significant fraction of the WCP tuna resources reside within the EEZs of non-VDS nations. This has two obvious but related effects: First, the fishery in these waters could conceivably expand at the expense of the concentrations in the VDS-region. This is especially likely as higher fishing fees within the PNA-waters

[68] By comparison, OPEC countries who have at times had a great impact on the global price of oil currently (2013) produce about 43% of the global production of crude oil. This is down from about 50% in the early 2000 to 2007.

[69] Note that these individual deals then constitute an alternative to the coalition to these members in the sense discussed above.

makes these fishing grounds relatively more attractive to DWFFs. Second, since these waters are outside PNA control, it subtracts from the ability of the PNA-coalition to maximize total economic benefits from the tuna resources and thus allow the maximization of fee benefits. This, obviously suggests the desirability of bringing the EEZ-nations currently outside the VDS system into the coalition.

- ***Extract maximum fees***: To extract the maximum fees requires (i) setting the appropriate number of vessel days, TAE, and (ii) sell these days in the most effective manner. These two tasks are always technical. The optimal number of vessel days depends on the state of the resources, the economics of the harvesting process and the fee setting process.[70] In this particular situation, these tasks also have to take due account of the conditions of the game and the moves and countermoves the various players without the PNA-coalition, both the DWFF and the non-VDS EEZ-nations might make. Thus, for instance, if the fees exceed a certain level, fishing from the EEZs of non-VDS nations might dramatically increase (see appendices 3 and 4). This applies in particular if, as a part of the fee maximizing strategy, stocks improve. Also, the higher fraction of potential DWFF profits the fees amount to the greater is their incentive to take countermeasures, collude and think up clever game strategies.

[70] Note that to maximize fee revenue is generally not the same as maximizing fishery profits before payment of fees.

Appendix 2
Optimal fishing fees

To avoid unhelpful algebraic complexity, this analysis proceeds in terms of a generic fishing fee situation that ignores most of the empirical complications of the actual PNA VDS. The results, however, throw light on certain fundamental aspects of the PNA fee setting problem.

Consider a fishery with the net benefit function:

$$(1) \qquad \Pi(d,x) = p \cdot Y(d,x) - C(d),$$

where $\Pi(d,x)$ denotes the benefit function depending on fishing effort, d, and biomass, x. The function $Y(d,x)$ is the harvesting function which in accordance with standard theory and empirical measurement is taken to be increasing in both arguments and at least weakly concave (the second derivatives Y_{dd} and $Y_{xx} \leq 0$). p is the unit price of harvest and $C(d)$ an increasing and at least weakly convex ($C_{dd} \geq 0$) function. Obviously, in the context of the VDS, it is convenient to regard the variable d as fishing days.

Again in accordance with standard theory, let biomass growth function be represented by:

$$(2) \qquad \dot{x} = G(x) - Y(d,x),$$

where the function $G(x)$ represents natural biomass growth which is assumed to be concave and have the usual dome-shaped properties.

The fee revenue of course is:

$$F = f \cdot d,$$

where f is the fee per unit effort.

If the owner sets the allowable effort (as under the VDS), it is easy to show that, unless the fishers manage to collude, the unit fee will be determined by the marginal profits of fishing:

$$f = \Pi_d(d,x) \equiv f(d,x),$$

where the last term is merely a shorthand for the marginal profits of fishing, $\Pi_d(d,x)$. Since the profit function is concave, the first derivative of unit fees with respect to days, $f_d(d,x) \equiv \Pi_{dd}(d,x)$, is less or equal to zero.

It is now straight-forward to verify that maximizing the present value of fees subject to the stock growth constraint, (2), yields the equilibrium conditions:

$$(3) \qquad G_x(x) - Y_x(d,x) + \frac{f_x(d,x) \cdot d \cdot Y_d(d,x)}{f_d(d,x) + f(d,x)} = r,$$

$$(4) \qquad G(x) = Y(d,x),$$

where r is the rate of discount appropriate to the present value calculations. Solving these two equations yields the fishing fee maximizing equilibrium value of effort and biomass, say, d^* and x^*. It should be noted that the fee maximizing biomass, x^*, is normally[71] larger than the biomass corresponding to the maximum sustainable yield, x_{MSY}, and the fee maximizing effort, d^*, less than that corresponding to the maximum sustainable yield.

Note 1: To obtain the fee maximizing equilibrium effort and biomass levels only requires knowledge of the net benefit function of the fishing industry and the biomass growth function as well the appropriate discount rate.

Note 2: With d^* and x^* in hand the corresponding harvest level may be inferred from the harvesting function, $Y(d^*,x^*)$. The same applies to other interesting variables such as costs, revenues etc. Thus, in this simple framework, setting the allowable fishing effort is equivalent to determining the fishery policy.[72]

Note 3: The fee maximizing path of d and x over time can also be obtained from the present value maximization.

Note 4: The various tuna fishery models employed by the FFA and the PNAO are empirical variants of the above fisheries model (equations (1) and (2)) attempting to describe in much greater detail the empirical realities of the WCP tuna fishery as well as identifying the fee maximizing policy.

It is of considerable interest to compare the fee maximizing fishery policy with the one that maximizes net benefits from the fishery.

Maximizing the present value of net benefits, i.e. (1), subject to (2) yields the optimal equilibrium conditions:

$$(5) \qquad G_x(x) - Y_x(d,x) + \frac{p \cdot Y_x(d,x) \cdot Y_d(d,x)}{\Pi_d(d,x)} = r,$$

$$(6) \qquad G(x) = Y(d,x),$$

where, as before, r is the rate of discount appropriate to the present value calculations. Solving these two equations yields the optimal equilibrium values of effort and biomass, d° and x°, say. The question is, how do these optimal values compare to the fee maximizing ones, d^* and x^*.

The two sets of equilibrium conditions are identical apart from the third term on the left hand side of (3) and (5), namely $\frac{f_x(d,x) \cdot d \cdot Y_d(d,x)}{f_d(d,x) + f(d,x)}$ and $\frac{p \cdot Y_x(d,x) \cdot Y_d(d,x)}{\Pi_d(d,x)}$. Careful investigation of these two terms shows that they are identical if only if the harvesting function is linear in effort, d. This is rather unlikely. Both theory and empirical measurements suggest that the harvesting function is generally strictly concave in effort. We thus have the first result:

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[71] An exception occurs if the rate of discount, r, is high enough

[72] In a more realistic framework, fishing effort is multidimensional and adjusting just one, e.g. fishing days, is not going to control the fishery. Fishers will, at least to a certain extent, substitute other effort variables for the one restricted.

Result 1: The fishing fee revenue maximizing policy is generally not the same as the net benefit maximizing policy.

What is the difference? The same careful analysis suggests the difference can in principle go either way; the equilibrium fee maximizing biomass may either smaller or larger than the net benefit maximizing biomass. However, reasonable specification of functional forms and parameters suggests that the fee maximizing biomass is very likely to be greater ($x^* > x^\circ$)and, consequently the fee maximizing fishing effort smaller ($d^* < d^\circ$) than the net benefit maximizing ones. Thus the fee maximizing policy is generally more conservative and environmentally more friendly than the benefit maximizing policy (to the fishers). This can be formulated as the second result:

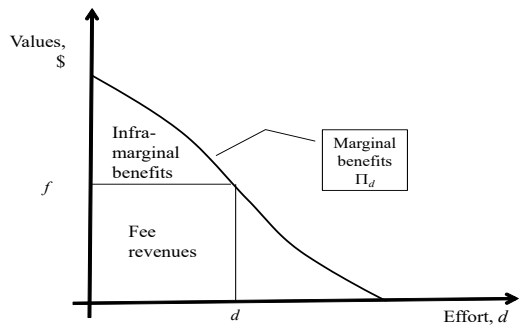
Result 2: The fishing fee maximizing policy typically generates a higher biomass and lower fishing effort than the benefit maximizing policy.

This is not surprising. The owner of the resource being faced with a downward sloping demand for fishing days is in a similar position to a monopolist. The monopolist, it is well known, maximizes his profits by reducing quantity (here fishing days) to increase his revenue.

The final question is how the fee revenues compare to the amount of net benefits. Which is higher? It is possible to provide a fairly unambiguous answer to this question. First, fee revenues can never be greater than net benefits. Otherwise the fishers would not operate in the fishery. Second, it is easy to show that unless the profit function is linear in fishing effort, fee revenues will always be less than the net benefits of the fishery.

To see this quickly, consider the diagram in figure A.1. This diagram illustrates a downward sloping marginal benefit function as a function of fishing days. This function is downward sloping if net benefits are concave in fishing days as is normally observed. Note that the function is drawn for a given level of biomass. There will be other downward sloping marginal profit curves for other levels of biomass, closer to the origin if biomass is low and vice versa.

Figure A.1
Net benefits and fishing fee revenues



Now, the area under the marginal profit curve up to any given level of fishing days, d represents net benefits. Fishing fee revenues on the other are the multiple of fishing fees and allowable fishing days. This is represented in the diagram by the area of the square formed by the allowable number of fishing days, d', and the corresponding unit fishing fee, f', on the vertical axis. It is obvious from the graph that the area of the square is less than the area under the marginal benefit curve up to d'. The only case where the two would be equal is when the marginal profit curve is horizontal, i.e. linear in fishing days.

So, even if fee revenues are maximized, the fishers will generally retain a portion of the net benefits generated. The difference between total net benefits and the fee revenues is often referred to as inframarginal rents in the economic literature.

We summarize this in the following result:

Result 3: Fishing fees collected from the fishery are always less or equal to the net benefits generated by the fishery.

Appendix 3
Location of fishing: Simplified analysis

Consider I discrete (for simplicity) locations for fishing. For easy reference index them by i, i=1,2,…I.

At any given point of time, the fish stocks and their catchability will be distributed across these locations. This distribution gives rise to different profit functions per unit of fishing effort over locations. Let us refer to these profit functions per unit effort (hereafter called just profit functions) by:

$$\Pi(i, x(i,t), t), \text{ all } t \text{ and } i,$$

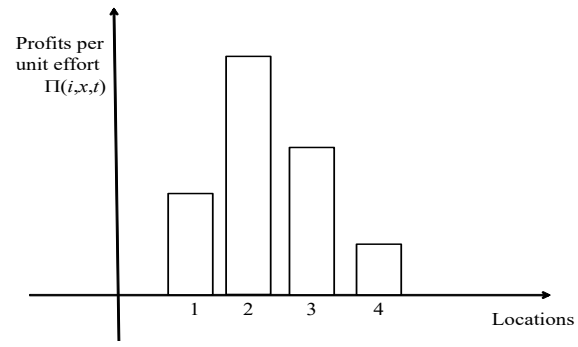
where t refers to time and $x(i,t)$ to catchable biomass at location i at time t. The independent role of t in the profit function reflects the empirical fact of fish migrations and alterations in catchability.

Note 1: This profit function naturally refers to any given vessel. However, in this simple analysis, we omit references to particular vessels.

Note 2: The profit function of any fishing location also depends on the vessel's current location (a location far away requires travel time and is, therefore, less profitable than a location close by) giving rise to complicated stochastic dynamic problems of location selection. These complications are not essential for the purpose of this appendix and will therefore be ignored.

The different profitability (profits per unit effort) of locations is illustrated in figure A.2. All four locations illustrated are profitable. However, since location 2 is the most profitable per unit effort, all vessels would prefer to be there.

Figure A.2
Profitability of different fishing locations



Profits will be maximized by always fishing at the most profitable location. However, the very act of fishing will reduce catchable biomass in the location, so the profitability of the location will go down over time in an endogenous way (i.e. due to fishing). Thus, while in figure A.2, the fleet will initially concentrate on fishing in location 2, the profitability of that location will soon be brought down to the profitability of location 3. When that happens the two locations will be fished jointly at the same profitability until this profitability will be brought down to the profitability of location 1 at which point locations 1, 2 and 3 will be fished jointly and so on. Under uncontrolled fishing, this process will continue until a full bio-economic equilibrium is found where the profitability of fishing in all locations has been reduced to zero. Whether or not that full bio-economic equilibrium is reached in any given year depends on the fishing capacity available.

There is a geographical pattern of fishing effort that corresponds to the above. For concreteness we may as well take this pattern to be proportional to the profitability of the

different locations illustrated in figure 1. So while fishing effort is initially focused on location 2, in bio-economic equilibrium all four locations receive an amount of fishing effort proportional to their initial profitability. This geographical pattern of fishing effort constitutes a useful benchmark which may be referred to as the *natural pattern of fishing effort*.

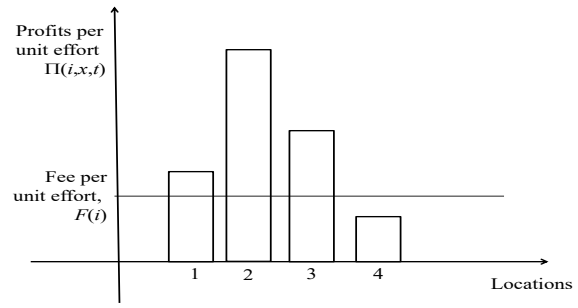
Fisheries management generally alters the equilibrium pattern of fishing effort. In fact, it often reduces the number of locations actually fished. To see this consider, for instance, the impact of fishing fees per unit effort (e.g. fees per day). This gives rise to net profits per unit effort by locations as:[73]

$$\Pi(i, x(i,t), t) - F(i), \text{ all } t \text{ and } i,$$

where $F(i)$ is the fee per unit effort at location i.

Now, if the fees per unit effort are equal across fishing location, the net profitability of the fishery may be as illustrated in figure A.3. To the fishing companies, the profitability of fishing in different locations is only the profitability above the fee. From the figure several inferences can be made:

Figure A.3
Profitability of different fishing locations under an equal fee regime



(1) There will be no fishing effort in location 4.

(2) Fishing will only bring profitability down to the fee rate.

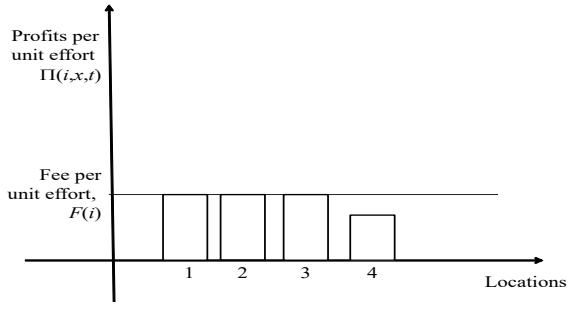
(3) Overall fishing effort (proportional to the total length of the columns above the fee) is reduced.

(4) The fraction of total fishing effort devoted to location 1 will be higher than in the natural pattern (figure A.2).

This simple analysis suffices to establish the above assertion that the geographical pattern of fishing effort is generally altered under fisheries management.

In bio-economic equilibrium profitability will be as illustrated in figure A.4. The fishery in equilibrium will be able to generate profits (net benefits) per unit effort equivalent to the fee per unit effort. However, at this point more fishing effort is not exerted as the proceeds will not suffice to pay the fee. Thus, as asserted above, one of the effects of the fishing fee is to reduce fishing effort.

Figure A4
Realized profits in equilibrium under an equal fee regime



It should be noted that figure A.4 applies

[73] Note that formulation may represent a fee per allowable fishing day.

in equilibrium only. Thus, if for instance the profitability of the different locations at the beginning of the year is as illustrated in figure A.3, the fishing companies will make profits per unit effort until the equilibrium illustrated in figure A.4 is reached. Similarly, the fees collected in location 2 will be highest because the fishing effort there is greatest.

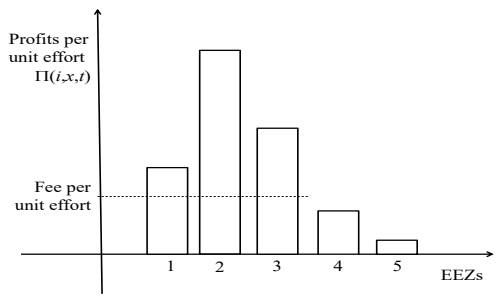
Appendix 4
Alternative fishing locations and the competitive fringe

Consider, as in case of the WCP-tuna fisheries, several discrete locations for fishing corresponding to the EEZs of the different nations. At a point of time, the profitability of fishing in these locations varies. This gives rise to a particular geographical pattern of fishing effort and harvests as discussed in appendix 3.

Now imagine, as is actually the case, that a subset of the EEZ-nations impose a fee on fishing effort in their EEZs while the other EEZ-nations do not impose any fishing fee. Then as explained in appendix 1, the geographical pattern of fishing effort and harvests will change. More precisely, it will shift away from the EEZs where the fee is collected and move to the EEZs of the nations not charging any fees.

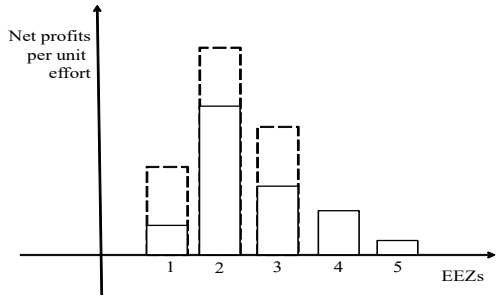
It is possible to explain this employing the same graphical device as in appendix 3. For ease of presentation let us consider five different EEZs with profits per unit effort as illustrated in figure A.5. As is apparent, the profitability of the first three EEZs is highest and the profitability of the fifth EEZ very low. Let us assume for the sake of argument that initially the first four EEZs are fished but the fifth one isn't because there is insufficient capacity (maybe because of fishing opportunities elsewhere) to fish all locations down to full bio-economic equilibrium of zero profits. Fishing effort in the others is proportional to the length of the columns (above the profitability of the fifth EEZ).

Figure A.5
Profitability of five different EEZs



Now, let the first three EEZ-nations charge a fee per unit fishing effort as indicated by the horizontal line in figure A.5. As a result, the net profitability (profits in excess of the fee) of the five EEZs will be as illustrated in figure A.6. Fishers of course respond to net profitability. Hence, it should be obvious from figure A.6 that both total fishing effort and the geographical pattern of fishing effort is now shifted. All the reduction in fishing effort occurs in the EEZs charging the fee. Fishing effort in the fourth EEZ does not increase but as a proportion of total fishing effort it increases substantially. In fact, as the figure is drawn, it becomes more important in the fishery than the first EEZ. Finally notice that since capacity has now be freed up it is possible that the fifth EEZ now becomes fished.

Figure A.6
Net profitability after fee



Thus, we see that imposing a fishing fee in some of the possible EEZs will generally move the fishing activity away from these EEZsto those that are not subjct to fees. Moreover, it is possible that EEZs, or for that matter the high seas, that were not fished before will now become fished.

This location substitution, i.e. movement of fishing activity to alternative locations, obviously curtails the ability of any subset of EEZ-nations to collect fees from the fishing activity in their EEZs. How much of a limitation this constitutes depends on the availability of substitute locations. Thus, obviously, if all the EEZ-nations in the fishery impose the same fee, the possibility of location substitution is correspondingly reduced. It would not disappear altogether because in almost every conceivable realistic fisheries case there are alternative possible activities for the fishign vessels. In any case, to maximize fee revenue, the fee-setting nations must take location substitution into account.

The situation of two sets of players with the players in one set acting in concert trying to maximize their extraction of fees other players acting independently is well known in theoretical market competition theory (reference) as well as international trade theory (reference) including the international crude oil market. In this literature, the set of co-ordinated players are generally referred to as the cartel and the set of independent players as the competitive fringe.

The possibility of location substitution shows up as higher elasticity of the demand for fishing days in the EEZs of countries charging fees than would otherwise be the case. This reduces the amount of fishing fees that these countries can collect and makes it optimal for them to curtail the number of fishing days more than they would otherwise do.

To see this formally, we only need to compare the fee maximizing problem with and without a competitive fringe.

Without a competitive fringe, the static version of the fee maximization problem (see appendix 2) may be written as:

$$\underset{d}{Max}\ f(d,x)\cdot d, \text{ subject to } G(x)-Y(d,x),$$

where d is the number of fishing days, $f(d,x)$ denotes the fee depending negatively on the number of fishing days and positively on biomass, x, so that $f_d(d,x)<0$ and $f_x(d,x)>0$. The function $G(x)$ the natural biomass growth function and $Y(d,x)$ is the harvesting function.

Solving this problem yields the necessary condition in equilibrium:

$$G_x - Y_x + \frac{f_x \cdot d}{\lambda} = 0,$$

where λ is the shadow value of biomass.

With a competitive fringe, the same maximization problem would be written as:

$$\underset{d}{Max}\ f(d,x)\cdot d, \text{ subject to } G(x)-Y(d,x)-H(f(d,x),x),$$

where the function $H(f(d,x),x)$ denotes the harvest from the EEZs of the competitive fringe with, of course, $H_f > 0$ and $H_x > 0$.

Solving this problem yields the necessary equilibrium condition:

$$G_x - Y_x + \frac{f_x \cdot d}{\sigma} - \frac{H_f \cdot f_x + H_x}{\sigma} = 0,$$

where σ is the shadow value of biomass

Now, the only difference between this necessary condition and the one without a competitive fringe is the last term on the left hand side. Since this is unequivocally negative, it is straight forward to verify that the optimal equilibrium biomass will be greater (and fishing days therefore fewer) than when there is no competitive fringe.

This result is in accordance with standard economic theory of markets and competition. The nations setting the fee are structurally identical to monopolists; in this case monopolizing the limited resource. When faced with a competitive fringe the standard response of the monopolist is to reduce supply to maintain the price, in this case the fishing fee. Therefore he becomes even more conservative regarding the fish stocks (and therefore also the environment) than before.

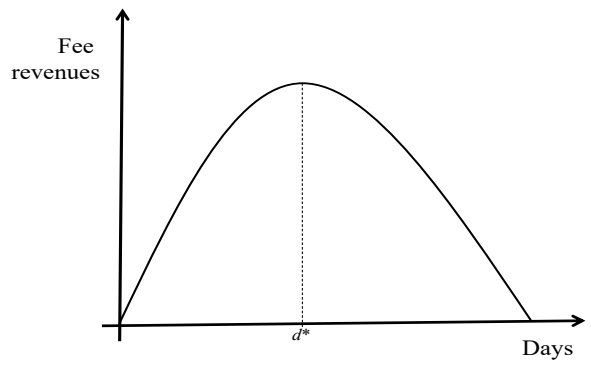
Appendix 5
The impact of a competitive fringe

Consider a coalition of nations offering fishing days in its EEZs in exchange for fees. Refer to this coalition as simply the *coalition*. As above, write the fee revenues of the coalition as:

$$F = f(d) \cdot d,$$

where d represents fishing days and the function $f(d)$ the (inverse) demand curve for fishing days where we have suppressed reference to the fish stock, x. This demand function informs us of the market clearing unit fee corresponding to each level of fishing days. It normally depends negatively on the number of fishing days as explained in appendix 2. As a result, fee revenues as a function of fishing days will generally have a maximum at some number of fishing days, d^*, as illustrated in figure A.7

Figure A.7
Fee revenues



Now, imagine there are nations outside the coalition that can also offer fishing opportunities. Let us refer to these outsiders as the *competitive fringe*. The existence of a competitive fringe increases the (negative) slope of the inverse demand curve of the coalition. The size of this increase would depend on the ease by which fishing in their EEZs could substitute for fishing in EEZs of the coalition. Let us express this in a fairly general way by writing the inverse demand function as:

$$f(d, \varepsilon),$$

where the positive parameter, ε, indicates importance of the competitive fringe, i.e. its capacity to substitute for the fisheries of the fee-setting authority (in this case the PNA EEZs). The competitive fringe of course has a negative impact on unit fees, i.e. $f_\varepsilon < 0$. Moreover, since as stated the competitive fringe increases the negative slope of the demand function, its second derivative $f_{d\varepsilon} < 0$.

As explained in appendix 2, maximization of fees implies the necessary conditions:

(1) $f_d(d, \varepsilon) \cdot d + f(d, \varepsilon) = 0,$

(2) $f_{dd}(d, \varepsilon) \cdot d + 2 \cdot f_d(d, \varepsilon) < 0.$

Obviously, according to these maximum conditions, the optimal number of fishing days depends on the importance of the competitive fringe, i.e. $d(\varepsilon)$. It is easy to show that the first derivative of this function is given by:

$$\frac{\partial d}{\partial \varepsilon} = \frac{-(f_{d\varepsilon} + f_{\varepsilon})}{(f_{dd} \cdot d + 2f_d)}.$$

On the assumptions we have made about the function $f(d, \varepsilon)$, this derivative is negative, i.e. $d_{\varepsilon} < 0$, for the denominator must be negative according to (2). This produces the first result:

Result 1. As the competitive fringe increases in importance, the optimal number of fishing days offered by the coalition goes down.

The existence of the competitive fringe also reduces the maximum fee revenues the coalition can collect. To see this, note that by virtue of the function $d(\varepsilon)$ fee revenues may be written as:

$$F = f(d, \varepsilon) \cdot d = f(d(\varepsilon), \varepsilon) \cdot d(\varepsilon).$$

Taking the total differential yields:

$$\partial F = \left((f_d \cdot d + f) \cdot d_{\varepsilon} + f_{\varepsilon} \cdot d \right) \cdot \partial \varepsilon.$$

But $(f_d \cdot d + f) = 0$ by (1). Therefore:

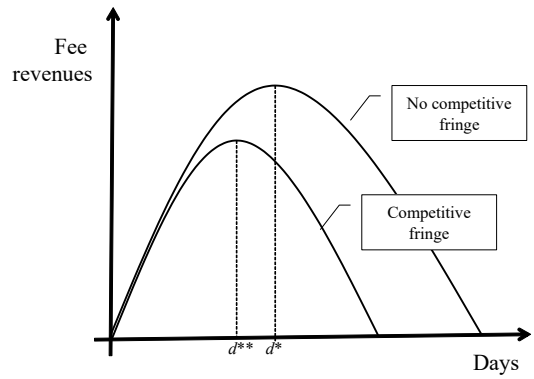
$$\frac{\partial F}{\partial \varepsilon} = f_{\varepsilon} \cdot d,$$

which is unambiguously negative. We state this as our second general result:

Result 2. As the competitive fringe increases in importance, the maximum attainable fee revenue obtainable by the coalition goes down.

We may illustrate results 1 and 2 with the help of figure A.8. The upper curve corresponds to fee revenues of the coalition without a competitive fringe. This obviously has a maximum at *d**. The lower curve describes fee revenues in the presence of a significant competitive fringe. This curve has a maximum at a lower number of fishing days, *d***, as claimed in result 1.

Figure A.8
Fee revenues of the coalition with and without a competitive fringe



Also, as illustrated in figure A.8, the maximum fee revenues with no competitive fringe is higher than when there is no competitive fringe as claimed in result 2. Indeed, as illustrated in figure A.8, fee revenues under a competitive fringe are lower at all fishing days expect zero than they would be if there were no competitive fringe.

Finally, we observe that the sum of the fee revenues collected by the coalition and the competitive fringe is never greater and generally lower than that attainable if they act in unison. To see this, it is really sufficient to realize that coordinated sale of fishing days by the two parties must produce at least the same fee revenues as uncoordinated sales. To see this more formally, write the fee revenues of the coalition and the competitive fringe respectively as:

$$F^1 = f^1(d^1, d^2) \cdot d^1 \text{ and}$$
$$F^2 = f^2(d^1, d^2) \cdot d^2,$$

where the superscript 1 refers to the coalition and the superscript 2 to the competitive fringe. The presence of d^2 in the demand function for the coalition's fishing days and d^1 in the demand function for the competitive fringe's fishing days reflects the assumption that to the fishers these days are at least to some degree substitutable. Presumably, of course, $f^1_{d^2} < 0$ and $f^2_{d^1} < 0$.

If the each party adjusts its fishing days to maximize its fee revenues without regard for the other, their respective optimal behavior would be described by:

(3) Coalition: $f^1_{d^1}(d^1, d^2) \cdot d^1 + f^1(d^1, d^2) = 0,$

(4) Competitive fringe: $f^2_{d^2}(d^1, d^2) \cdot d^2 + f^2(d^1, d^2) = 0.$

Solving these two simultaneous equations yields the equilibrium values of fishing days, d^1 and d^2, which then will yield the equilibrium unit fees for each party according to the inverse demand equations $f^1(d^1, d^2)$and $f^2(d^1, d^2)$as well as their respective fee revenues, F^1 and F^2.

Joint maximization where d^1 and d^2 are adjusted simultaneously to maximize the sum of fishing fees yields by contrast:

(5) Coalition: $f^1_{d^1}(d^1, d^2) \cdot d^1 + f^1(d^1, d^2) + f^2_{d^1}(d^1, d^2) \cdot d^2 = 0,$

(6) Competitive fringe: $f^2_{d^2}(d^1, d^2) \cdot d^2 + f^2(d^1, d^2) + f^1_{d^2}(d^1, d^2) \cdot d^1 = 0.$

Comparing the joint maximization behavior, i.e., (5) and (6), with individual maximization, (3) and (4), shows that the latter miss one term each, namely $f^2_{d^1}(d^1, d^2) \cdot d^2$ and $f^1_{d^2}(d^1, d^2) \cdot d^1$, respectively. This means that un-coordinated behavior by the parties is different from the coordinated behavior. The only exception is when $f^2_{d^1} = f^1_{d^2} = 0$, i.e. the demand for their fishing days is independent of what the other party does; in other words, the fishing days are substitutable.

Solving the two simultaneous equations, (5) and (6) yields the jointly optimal fishing days, respectively and subsequently unit fishing fees and fee revenues as discussed for the un-coordinated maximization conditions above. It is easy to show that under the un-coordinated

regime both parties offer more fishing days and both fishing fees would be lower than under the joint profit maximization. We express this as our result 3.

Result 3. Under individual (un-coordinated) fee revenue maximization, the number of fishing days selected by both parties would be higher and unit fishing fees lower than under the joint maximization.

Now, the joint maximization, by definition, maximizes the sum of fee revenues. Thus, we have also shown that co-ordinated sales of vessel days generates higher total fee revenues than the un-coordinated one. We express this result as formally as:

Result 4. Total fees are maximized by the coalition and the competitive fringe acting in unison.

The size of the difference obviously depends on the importance of the competitive fringe, i.e. its capacity to replace or substitute for fishing days in the EEZs of the coalition. Numerical calculations indicate that the difference can in principle be quite large. What it might be in the particular case of the WCPO tuna fisheries is a matter for empirical investigation.

Appendix 6
Trading of vessel days between VDS-partners

Imagine two PNA-partners with PAE equal to d_1 and d_2 respectively. Let the VD prices, i.e. unit fees they are faced with be f_1 and f_2. We take it, for sake of the argument, that the two unit fees are different and unrestrictively assume that $f_1 > f_2$.

Let us now assume they can trade without cost. In that case, they will select trading volume z to maximize their net fees:

$$\text{Partner 1: } \underset{z}{Max}\ f_1 \cdot (d_1 + z) - f_2 \cdot z,$$
$$\text{Partner 2: } \underset{z}{Max}\ f_2 \cdot (d_2 - z) + f_1 \cdot z.$$

The solution to both problems is that $f_1 = f_2$. This means that trading volume will increase until the two unit fees are equal and in trading equilibrium they will be equal! However, the trading equilibrium may not be reached because, the sellers may have run out of days to sell before.[74]

Now, as discussed in appendix 2, trading fees equal marginal profits of fishing. Empirical evidence that these profits decline with the total number of fishing days applied. This could be because of reduced fish abundance, crowding and various other factors. Thus, as days are moved from partner 2 with the lower fees to partner 1 with the higher fees, f_1 falls and f_2 increases. Thus, we conclude that free trading of VD between PNA partners unit fees more equal and possibly equalizes them completely.

The optimal geographical pattern of fishing requires that the marginal profits of fishing in each area are equal to the shadow value of biomass and, hence, also each other. But, since the marginal profits of fishing equal unit fishing fees, this is just another way of saying that free trading in VDs between partners will move the fishery toward the optimal geographical pattern.

[74] This is not very likely in the PNA context becasue of the high number of sellers.

Appendix 7
Bio-economic model of the purse seine tuna fishery

The tuna fisheries in the WCPO are among the most complicated in the world. Even restricting attention to PNA-region still leaves us with a highly complicated multi-species, multi-cohort, multi-national, multi-gear and multi-fleet fishery.

In this appendix, we develop a simple bio-economic model to describe essential elements of the PNA purse seine tuna fishery. This model is specifically designed to investigate fishing fee policies and assess whether and to what extent the PNA-nations are maximizing their fee revenue from the fishery. Thus, while containing a very simplified description of the fishery compared to pre-existing models (see e.g. Kirchner et al. 2014, Anonymous 2014), it is more practical in the sense of allowing a straight-forward assessment of the optimal fee-policy for the PNA-nations in a theoretically and logically consistent manner. Moreover, the structure of the model may contain useful suggestions as to how to extend more complex bio-economic models in this particular direction.

The essential structure of the current bio-economic model is as follows:

***Biological regeneration*:** Aggregate biomass growth functions are used, one for each species. The functional form selected is that proposed by Fox (1970). The generic form of this function is:

$$\dot{x}(i) = \alpha(i) \cdot x(i) - \beta(i) \cdot x(i) \cdot \ln(x(i)),\ i=1,2,3,$$

where the index i refers to the three tuna species; skipjack, yellowfin, and bigeye. The purse seine catch of albacore and other species in the PNA area is so small that this was ignored in the modelling. The variable $x(i)$ denotes the biomass and $\dot{x}(i)$ biomass growth of species i. $\alpha(i)$ and $\beta(i)$ are biomass growth parameters for the three species respectively

The Fox biomass growth function is asymmetric, skewed to the left as seems to be the accepted biological wisdom for WCPO tunas (Harley et al. 2013, WCPFC 2013). So over the relevant ranges of biomass, the Fox functional form seems to replicate the biological knowledge reasonably well. It is only for quite large biomasses, which are of little interest for exploited species, that the Fox biomass growth function seems to deviate from the prevailing biological understanding.

***Tuna diffusion*:** It is assumed that tunas move in and out of the PNA area according to the relative density of tunas within and without the PNA area. A simple way to express this is:

$$z(i) = \varphi(i) \cdot (x(i) - b(i) \cdot x(i,4)),\ i=1,2,3,$$

where $z(i)$ is the net inflow of tuna of species i, $x(i,4)$ is the density of tuna outside the PNA area and $b(i)$ is the equilibrium ratio of the two densities, so that when $x(i)/x(i,4) = b(i)$ there will be no net inflow or outflow of tuna. Finally the parameter $\varphi(i)$ measures the speed of tuna migration toward an equilibrium geographical distribution. In the numerical modelling, the speed of diffusion will be assumed to be high.

***The harvesting function*:** The harvesting function employed is the generalized Schaefer one:

$$y(i) = q(i) \cdot d(i) \cdot x(i)^{\delta(i)},\ i=1,2,3,$$

where $y(i)$ denotes the harvest of species i, $q(i)$ is the catchability coefficient for species i and $d(i)$ the fishing days directed at species i. There is actually strong evidence that in the purse seine fishery, effort can not target specific species and that bigeye and yellowfin are primarily bycatches of the skipjack fishery. If that is the case, fishing days that are applied cannot be targeting specific species and $d(i) \equiv d$ for all species. Finally the coefficients $\delta(i)$ are the respective schooling parameters for the species.

***Other harvests*:** The PNA purse seine fishery catches only a part of the total harvests of skipjack, yellowfin and bigeye in the WCPO area. More precisely, the proportions in recent years have been about 0.64, 0.53 and 0.44, respectively. It follows that the fisheries policy adopted under the VDS cannot control the evolution of the respective biomasses which also depends on harvests by the other fisheries. It is difficult to predict the evolution of these other tuna fisheries. For our modelling purposes, it is assumed that the other fisheries take a constant proportion of the available biomass of the three species. Formally:

$$yo(i) = a(i) \cdot x(i),\ i=1,2,3,$$

where $yo(i)$ refers to the other catch of species i and $a(i)$ is the corresponding proportion of the biomass.

The cost function: The cost function is specified as:

$$c(i) = \lambda \cdot p(i) \cdot y(i) + \mu(i) \cdot d(i)^{\eta(i)},\ i=1,2,3$$

where λ represents the costs that depend directly on the landed value of catch, $p(i) \cdot y(i)$, such as the crew's share, landings costs etc. and $\mu(i)$ and $\eta(i)$ are fishing days cost coefficients. In what follows the term, $p(i) \cdot y(i)$, will often be referred to as simply crew share. In accordance with the general observation that aggregate fisheries profit functions are concave, the coefficients $\eta(i)$s would normally be greater than unity.

It may be observed that this cost function contains no fixed costs. The reason is that to maximize fees or other aggregate measures in this fishery involves adjusting the number of vessels. Each vessel that enters the fishery comes with its so-called fixed costs (according to the profits and loss accounts) and each vessel that leaves the fishery takes with it the same fixed costs. So, from the perspective of this study and, therefore, the modelling, the fixed costs are really variable and are treated as such.

The price function: Because of the relatively large size of the PNA tuna fishery, there are reasons to believe that alterations in PNA landings of may affect the landings prices of the tunas in question (see e.g. Kirchner et al. 2014). A simple specification of this relationship is:

$$p(i) = A(i) \cdot y(i)^{\varepsilon(i)},\ i=1,2,3,$$

where $\varepsilon(i)$, which is presumably negative, is the elasticity of price with respect to the landings og species i. $A(i)$ is merely a price parameter.

The above five sets of equations specify the bio-economic model of this study. The parameters of the model were not systematically estimated but selected in accordance with the various information gathered about the purse seine tuna fishery in particular that found in WCPO (2013), Williams and Terawasi (2013), Kirchner et al. (2014) and Anonymous (2014) so that the model behaviour is (i) in accordance with basic bio-economic knowledge and (ii) approximately reproduces known empirical facts about the purse seine tuna fishery. The parameters selected are listed in the following table:

Table A.7.1
Bio-economic model: Numerical specifications

Biological parameters	Symbol	Skipjack	Yellowfin	Bigeye
Alpha	α	6.6089	3.2430	1.4066
Beta	β	0.7528	0.3934	0.1942
Diffusion parameters				
Diffusion speed	φ	5	5	5
Equilibrium ratio	b	10	10	10
Reference stock	$x(i,4)$	500	200	80
Harvesting function				
Catchability	q	0.029968	0.016550	0.008994
Schooling	δ	0.8	0.8	0.8
Other harvests				
Proportion of biomass	a	0.1334	0.1384	0.1371
Price of landings				
Price coefficient	A	3.2288	2.5963	2.0920
Elasticity	ε	-0.1	-0.05	-0.02
Costs				
Value of landings	λ	0.3	0.3	0.3
Vessel days	μ	8.92295	8.92295	8.92295
Vessel days exponent	η	1.1	1.1	1.1

Assuming, quite unrealistically, that the three fisheries can be pursued separately by the purse seine fleet, the sustainable revenues and costs in these fisheries according to the above specifications are summarized by the following three diagrams.

Figure A.9
Skipjack: The sustainble fishery

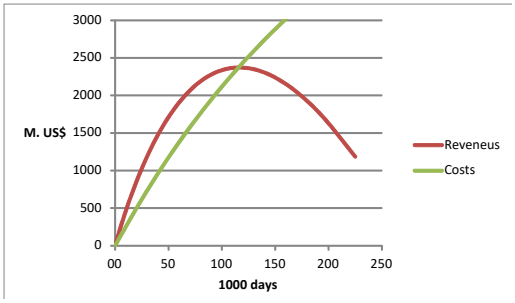
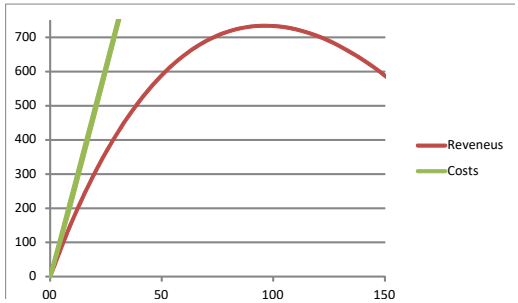
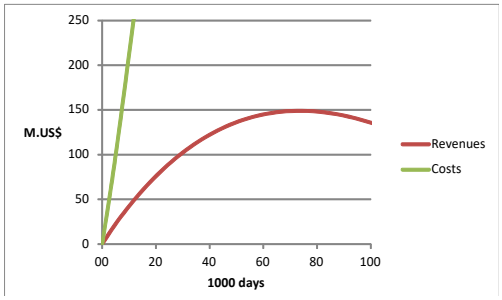


Figure A.10
Yellowfin: The sustainble fishery



According to these diagrams, the purse-seine skipjack fishery can be very profitable on a sustainable basis with maximum profits obtained at about 52 thousand fishing days. (It may be mentioned that maximum fees occur according to this model at somewhat fewer fishing days). By comparison, the yellowfin and bigeye fisheries operated separately cannot break even on a sustainable basis at any number of fishing days except zero.

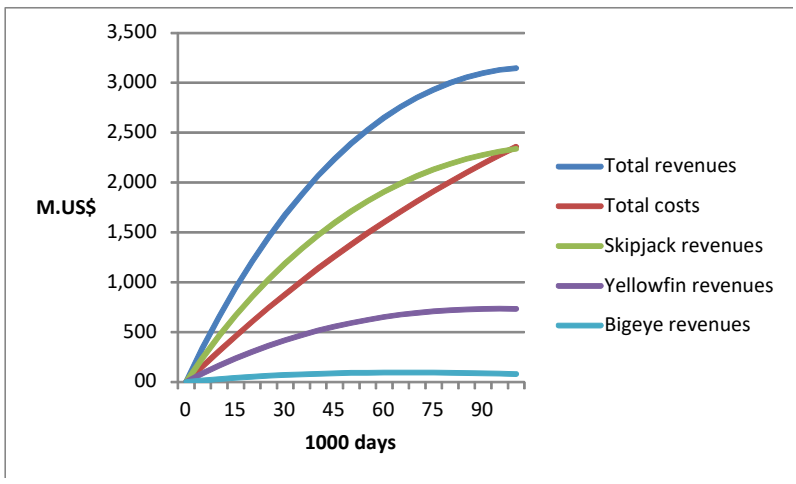
Figure A.11
Bigeye: The sustainble fishery



In the purse seine tuna fishery, yellowfin and bigeye tuna are predominantly bycatch of the skipjack fishery which is the primary target species. Thus, while expending fishing days at targeting skipjack tuna, the purse seine fleet also captures significant amounts of yellowfin and bigeye tuna. These catches obtained as a by-product of the skipjack fishing effort are of course economically beneficial to the purse seine fleet.

Regarding yellowfin and bigeye as pure bycatch of the skipjack fishery, the model generates the representation of the sustainable fishery depicted in figure A.12. The figure illustrates total fishery revenues as a function of fishing days (the blue curve). This is the sum of the revenues from the catch of skipjack, yellowfin and bigeye whose individual revenue curves are also drawn in the diagram. It is worth noting in this diagram that the sustainable revenues of the bigeye fishery are negligible compared to the other two tuna fisheries.

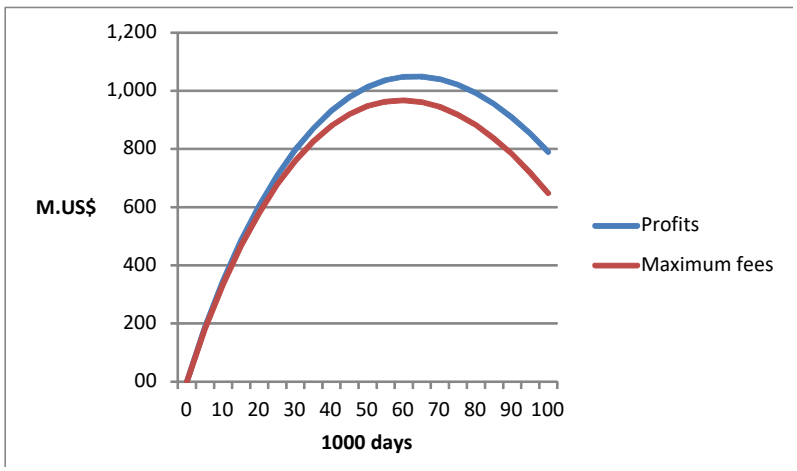
Figure A.12
The purse seine tuna fishery: Sustainable representation



On our assumption that the three species are jointly caught, it is not possible to distinguish between the fishing costs of skipjack, yellowfin and bigeye. Thus only total fishing costs are drawn as the red curve in the diagram. A visual inspection of the diagram suggests that sustainable profits in this fishery are maximized at some 63 thousand fishing days. At that level of fishing effort, according to this model, which, as already pointed out is not very accurate, the skipjack stock would still be well above its maximum sustainable yield (MSY) level and above 1/2 of its unexploited stock level. The yellowfin stock will also be just above its MSY level and above 1/2 of its unexploited level. The bigeye stock would be in a poor shape of about 1/2 of its MSY level and about 1/5 of its unexploited level. As before, it should be noted that the fishing fee maximizing fishing days are less than the profit maximizing number although, according to this model, the difference is not very large.

Industry profits (before fees) and maximum attainable fees as a function of allowable fishing days according to this model are illustrated in figure A.13. Maximum profits are found to occur at effort level 62.8 thousand fishing days. Maximum fees[75], however, are found at 59.5 thousand fishing days with maximum total fees around 965 M. US$. The corresponding maximum unit fee per fishing day is calculated to be about 15 thousand US$.

Figure A.13
The purse seine tuna fishery: Sustainable profits and fees



This fishing fee per day may seem high compared to the current benchmark fee per day, but is not out of line with outcomes from the PNAO economic model under development (see Kirchner et al. 2014, Anonymous 2014 and personal communications with some of the designers of that model).

In interpreting these results, the reader should be mindful that the current model is both very simple and relies on many estimates of empirical quantities including those carried out as a part of the PNAO economic modelling work. All of these estimates are uncertain and many subject to quite wide confidence bounds as the sensitivity analysis below reflects. For these reasons, the results generated by the model and presented above need to be treated with caution. In our opinion they should primarily be seen as indicative. Our assessment is that further empirical and modelling research is needed establish more firmly whether the basic results of our model are sufficiently reliable to be acted upon.

Sensitivity analysis

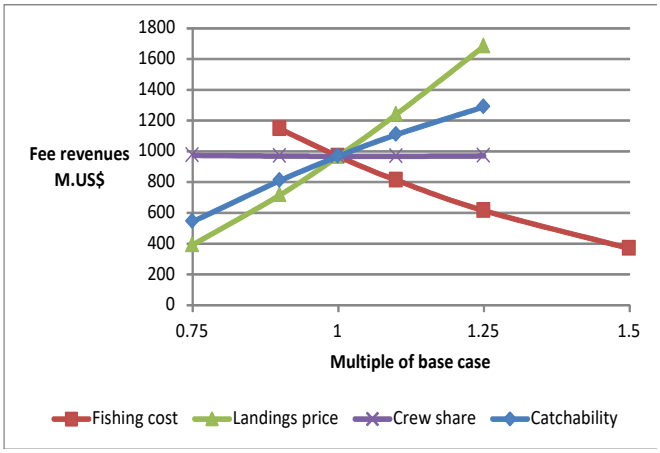
To assess the sensitivity of the above results to key empirical assumptions employed in the bioeconomic model, a sensitivity analysis has been conducted. In this sensitivity analysis, the empirical assumptions on fishing costs, landings price, crew share and catchability are varied over a range of -25% to +50% and resulting fee maximizing fishing days, fee revenues and fishing days calculated. The key results of this exercise are summarized in figures A.14 to A.16 below.

As can be inferred from figure A.14, the maximum attainable fees are strongly dependent upon fishing costs and tuna landings price. Thus an increase in fishing costs by 25% reduces the maximum attainable fees by almost 40% and a reduction in landings price by 25% reduces maximum fees by about 60%.

[75] It may be recalled from appendix 2 that the maximum fee per fishing day collectible from the fishing companies equals their (expected) marginal profits of one more fishing day. These marginal profits can be derived from the model as specified.

This large impact of fishing costs and tuna landings price on fee revenues is primarily due to two interdependent factors: First, as the cost of fishing increases or tuna landings prices fall, the marginal profits of fishing day drops. This leads to lower fishing fees per day. Second, for the same reason (i.e. lower marginal products per fishing day) the fee maximizing level of fishing days is also reduced and this effect is very substantial as illustrated in figure A.15.

Figure A.14
Sensitivity of maximum total annual fees

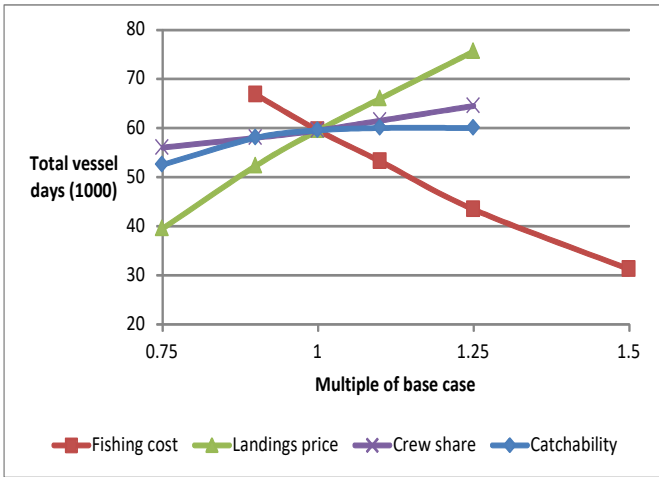


The impacts of changes in catchability are in the same direction but not as strong as that of the tuna landings price. An important reason is that increased catchability increases sustainable catches at a diminishing rate due to the limitation of the tuna stocks.

By contrast, maximum fee revenues are almost independent of the of the crew share of the landed value. The main reason for that is that, as explained above, an altered crew share is assumed not to affect total fishing costs, only the share of costs that depends directly on landed value.

The sensitivity of the optimal number of vessel days to fishing costs, tuna landings prices, catchability and the crew share is illustrated in figure A.15. Similar results apply. The optimal number of fishing days is very sensitive to fishing costs and tuna landing prices. Thus, if the landings price is reduced by 25%, the optimal number of vessel days fishing days is reduced by approximately 1/3 and falls to about 39.5 thousand days (compared to the base case of 59.5 thousand days). The sensitivity of vessel days to fishing costs is similar, albeit slightly less.

Figure A.15
Sensitivity of fee-maximizing number of vessel days

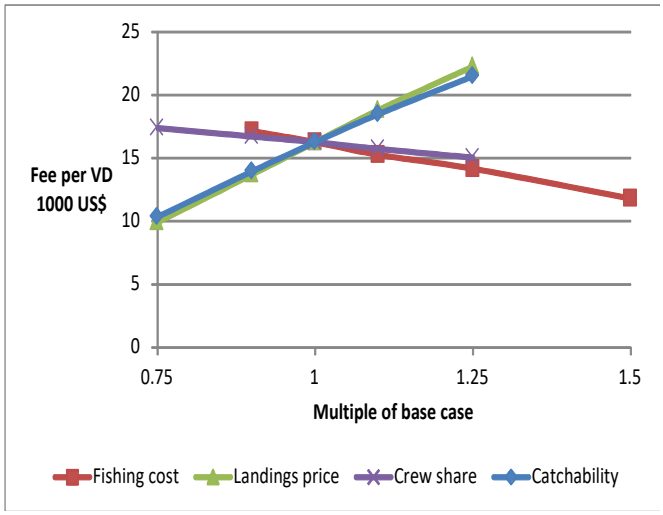


The sensitivity of the fee maximizing number of vessel days to crew share and catchability is small by comparison. The fee maximizing number of vessel days increases with the size of the crew share. This is because the higher the crew share the more concave (curved downward) will the costs curve become (see e.g. figure A.9) and, therefore, the fee maximizing number of fishing days increases. Increased catchability increases the

optimal number of fishing days simply because it reduces the cost of catching any given volume of fish.

Finally, the sensitivity of fees per vessel day to the various empirical assumptions is illustrated in figure A.16. Fees per vessel day are most sensitive to tuna landings price and catchability. Thus if either tuna landings price or catchability is reduced by 25%, the maximum fee per day is reduced by some 37%.

Figure A.16
Sensitivity of fee per vessel day



The sensitivity of fees per fishing day to fishing costs is considerably less although still significant A 25% increase in fishing costs reduces fees per fishing day by some 9%. The reason why this sensitivity is so much less than the sensitivity of fee revenues is that as fishing costs increase, the optimal number of vessel days decreases with this reduced supply of fishing days partly counteracting the lesser profitability per fishing day.

The sensitivity of fee per vessel day to crew share is still smaller but significant. If the crew share is increased by 25%, fee per vessel day is reduced by about 8%. The reason is that as the crew share increases, the optimal vessel days is also increased leading to a fall in the market clearing fishing fee.

The most telling outcome of these sensitivity studies, however, is that the conclusion that total fee revenues can be substantially increased seems quite robust to empirical specifications. In order to reduce the maximum attainable fee revenues to the neighborhood of current fee collection (which is around 250 M. US$), the costs of fishing must be substantially higher than what has been estimated, price of landed tuna much lower or some other empirical estimates used in the model parameters correspondingly adjusted.

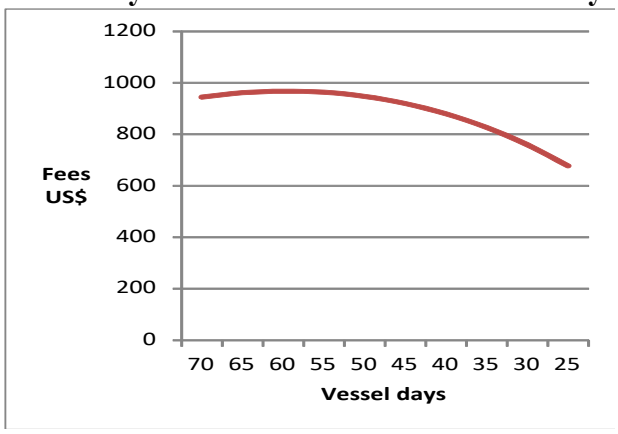
It is worth noticing that even if tuna prices and catchability are reduced by 25% compared to the base case, the market clearing fee level is still about 10 thousand US$ per VD. Thus, the bio-economic model and its empirical specifications must be quite far off the mark if the current fee level (6 to 8 housand US$) is close to what maximizes fee revenues.

The result that the number of fishing days (TAE) should be increased is somewhat less robust. A 25% reduction in in tuna landings price and estimated costs brings the calculated optimal vessel days into the neighborhood of current levels (base case assumes 42000 vessel days). Thus, it could be said that current TAE is within the bounds of uncertainty.

Further, it is important to realize that the surface of the total fee curve as a function of total vessel days (TAE) from say 40 thousand vessel days to 65 thousand vessel days is relatively flat (see figure A.17). This means that even for the base-case specifications of the bio-

economic model, there is not a great deal added fee revenues to be obtained by increasing the total number of vessel days.

Figure A.17
Sensitivity of total fee revenues to vessel days

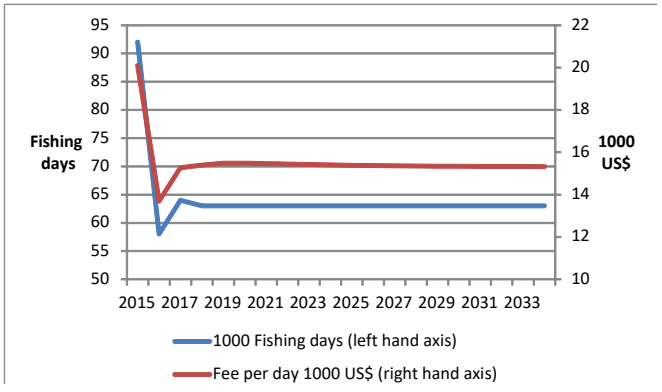


Dynamic adjustment paths

It is well known that, provided the rate of discount is positive, the optimal dynamic equilibrium is less resource conservative than the maximization of sustainable economic benefits (Clark and Munro 1975). Thus, in reality, it is not optimal for the PNA to maximize annual sustainable fees. What the PNA should do is to maximize the present value of fees collected subject to an appropriate (real) discount rate. This is a dynamic problem, requiring the selection of an adjustment path of allowable fishing days (or equivalently path of minimum fishing fees) so as to maximize the present value of fees collected.

It so happens that the current state of the fishery (i.e., biomasses) is not far away from what constitutes the long run dynamic equilibrium according to the bio-economic model described above. As a result, the optimal dynamic path does not require the drastic changes that are so common in fisheries around the world. Figure 18 describes the optimal path of fishing days and annual fees under the model specified above and an assumed real rate of discount of 6%.

Figure A.18
Optimal path of fishing days and fees per day



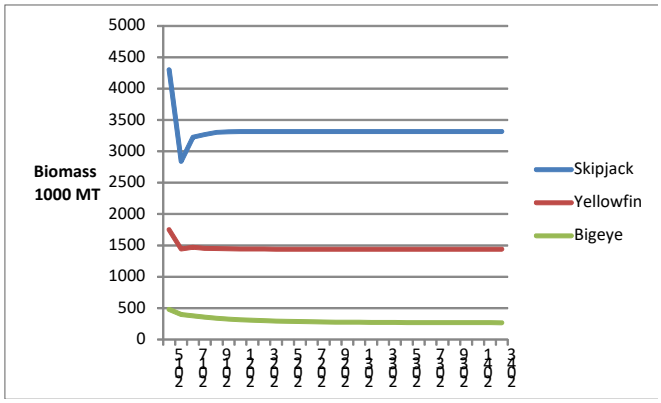
Both paths have an initial increase followed by a fluctuating adjustment to the long run optimal equilibrium. The initial increase is because, as discussed above, the skipjack fishery, the mainstay of the purse seine fishery, is estimated by the bio-economic model to be economically underestimated. This means that the initial fishing days should be high. For the same reason, the marginal profits of fishing is initially very high and therefore also the fishing fees per day.

It is also notable the optimal dynamic long run number of fishing days is calculated to be considerably higher than the current number. The corresponding fee per day is much higher

that is currently collected. Both results are in accordance with the static sustainable equilibrium results and similar to other bio-economic studies on this fishery (Anonymous 2014).

The corresponding paths of tuna biomasses are illustrated in figure A.19. Not surprisingly, given the increase in fishing days compared to the current level, all biomasses are reduced. The skipjack stock is reduced but as discussed above stays well above the MSY level. The yellowfin stock is reduced to just above the MSY level. The bigeye stock, already a matter of biological concern, is reduced even further to well below the MSY level (which is about 500 thousand mt).

Figure A.19
Evolution of tuna biomasses under the fee maximizing policy



The reason why the fee maximizing policy reduces the biomass of bigeye even further is our modelling assumption that the purse seine fishery cannot target the bigeye tuna separately. This, of course, is not empirically accurate. It is to a certain extent possible, for instance by limited and judicious use of the various types of FADs, to reduce catches of juvenile bigeye. To the extent that this is feasible, it becomes possible to adjust its catch rate and in that way keep all three biomasses closer to optimal sustainable equilibrium and thus increase sustainable revenues from the fishery. This increased selectivity in harvesting can only be done at a cost, however, so the question becomes whether the gains are worth the cost. This has not been investigated in the current study but is obviously a matter worth investigating.

A related question is how much net fee collection would be lost if fishing effort would be curtailed to keeping the bigeye biomass close to the MSY level. Approximate calculations on the basis of the model suggest that fishing days would have to be kept at some 22 thousand days, in which case the maximum equilibrium fee collection would be reduced by some 35% or over 340 M. US$ per annum. Of course, in that case, the stock size of skipjack and yellowfin would be in a very good shape as well.

Appendix 8
Auctions of fishing days

Although economists have long been interested in auctions, the modern theory of auctions is relatively recent. Its beginnings may be somewhat arbitrarily traced to Vickrey's seminal article in 1961. Since then, especially from the 1980s studies of auctions have mushroomed as well as their practical use in novel contexts (Myerson 1981, Milgrom 2004, Klemperer 1999, 2004).

It is important to realize that auctions inevitably place economic agents in a situation where the behaviour of other agents (namely their bids) can affect their personal outcomes. This gives rise to strategic interactions between the bidders as well as between then and the auctioneer. The natural tool to study strategic interactions is game theory, primarily the non-cooperative variety but also the co-operative game theory. Indeed, auction theory is generally seen as that branch of game theory that considers human behaviour in auctions and the ensuing outcomes of the auctions (Myerson 1981, Klemperer 2004).

Auction theory (see e.g. Milgrom 2004 and Klemper 2004) has identified two main reasons for the use of auctions:

(1) Improve resource allocation.
(2) Maximize the revenue from selling a particular asset or set of assets.

In the context of the PNA VDS we are primarily interested in the second reason. However, it should be noted that the two are not independent. To maximize the long term revenues from selling fishing days, improved resource allocation (having the right number of the most efficient fishing fleets doing the fishing) is of great importance. For this reason, modern auction theory (e.g. Milgrom 2004, Klemperer 2004) recommends that auctions should be conducted in a way that does not necessarily maximize current revenues from selling the asset.

In the context of the PNA VDS, it is important to note that countering monopolistic or oligopolistic behaviour is not one of the arguments forwarded in favour of auctions. (Milgrom 2004, Klemperer 2004). Obviously, auctions do not in general alter the conditions for oligopolistic behaviour. Therefore, if the current trading of fishing days is subject to oligopolistic behaviour by the buyers this behaviour is likely to continue in the context of auctions as well. In fact, one of the major problems in designing and conducting auctions is to cope with the danger of collusion and oligopolistic monopolistic behaviour by the bidders (Klemperer 2002).

An important argument for the efficiency of auctions is that transaction costs in auctions are lower than in many other types of trades (Milgrom 2004). In fact, most auction theory implicitly assumes that preparing, conducting and participating in auctions is virtually costless (Milgrom 2004, Klemperer 2004). This assumption, however, is highly questionable.

Design of auctions

To design an auction that will maximize revenues is not a simple matter. The overall situation has to be studied carefully and the auction designed to fit the situation. In this process it is easy to make mistakes. Even with very high expenses, it is easy to make serious mistakes

which reduce or even eliminate the possible benefits of the auction (Klemperer 2002, Milgrom 2004). A case in point is the New Zealand auction of TV licences in 1990 (see e.g. Hazlett 1998, Milgrom 2004). Many other cases of mishandled auctions exist (Klemperer 2002, 2004). The US auction of radio spectrum licences is widely thought of as having been successful (Milgrom 2004, Klemperer 2004). This, however, took a long time in preparation involving numerous experts at undoubtedly very high cost.

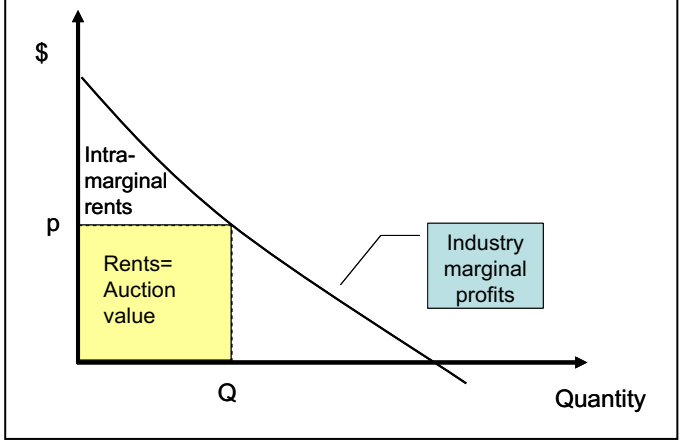
So, auction theory and experience has established that there is no single form of auctions that will maximize auction revenues (Zhen 2008). To maximize revenues, the design of the auction for this purpose must be in accordance with the empirical situation. It follows that it will normally require considerable work and substantial costs to prepare an effective auction for this purpose. The alternative, of rushing in with an ill-prepared auction may easily be counterproductive in the sense of reducing revenues and possibly causing other problems.

It should not be forgotten either that there will be costs associated with actually conducting the auctions. While this cost may in most cases be expected to be relatively small, the possibility of disputes and even lawsuits could increase the costs dramatically

Revenue generation

In principle, it is possible to extract all the rents attainable from a resource (in this case fishing days) by the means of auctions. Allowing non-uniform auction prices (each pays his own bid price) it is even possible to extract virtually all economic surplus from using the asset. To see this, consider the diagram in figure A.20. In the diagram, the marginal profits of the harvesting industry from using varying numbers of fishing days are drawn. This downward-sloping curve is equivalent to an (inverse) demand curve for fishing days. It represents the whole industry so it is an aggregate of the marginal profit functions of a possibly very large number of vessels (companies). Now, let us assume that the number of fishing days for auction is Q. Auctioning this off so that every successful bidder pays a uniform price will, in a well designed auction, lead to the auction price p and the auction revenue or value $p \cdot Q$, which happens to be equivalent to the economic rents for the quantity Q. Note in figure A.20 the successful bidders will enjoy some intra-marginal rents in spite of paying the auction price.

Figure A.20
Auction: Uniform price

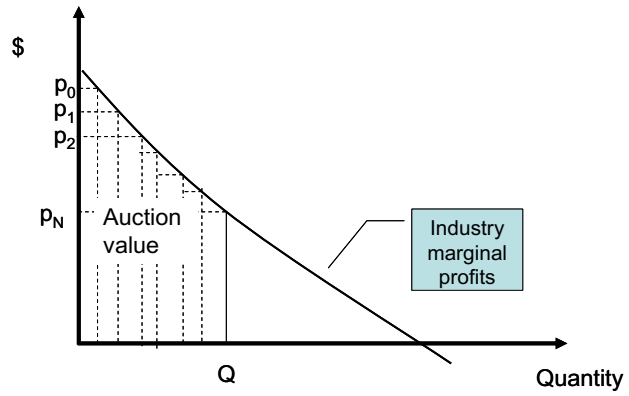


Importantly, there are ways for the auctioneer to expropriate the intra-marginal rents illustrated in figure A.20 as well as the rents. To this we now turn.

Consider the situation where every bidder offers to buy a certain number of fishing days at a certain price and, then, if successful pays that price. Assuming as above that the auction is well designed so that every bidder bids his valuation. In that case the situation is more like the one illustrated in figure A.21. As illustrated there, the most efficient firm will bid p_0 for a

certain quantity. The second most efficient firm will bid p_1 for another quantity and so on. Bids are accepted in order of unit price until the total quantity Q has been sold. As evident from the diagram, the auction value, i.e. the total auction revenue now collects a substantial proportion of the intra-marginal rents on top of the resource (or basic) rents and is close to the total profits form the resource. Obviously by inviting bids for an ever finer subdivision of the total quantity, the auctioneer may, in principle, extract all possible profits from using the resource.

Figure A.21
Auction: Each bidder pays his bid price



It is of course tempting for anyone with the right to auction off assets to maximize his revenue from the auction. The PNA is presumably not immune to this temptation. The PNA, however, should be mindful of the dynamics of the tuna fishing situation. Future fee revenues depend on the resource being in good shape and the fishing fleets being as efficient as possible. This suggests first of all that the number of fishing days offered for sale should be in accordance with the long term health of the fish stocks and secondly, it may be counterproductive to extract too much fees from the fishing industry lest this drives away the best companies and leads to less efficient industry in future years.

Experience of auctions in fisheries

There are many examples of auctions for allocating fishing rights in recreational fisheries both inland in in the ocean. However, there are few examples of auctions being used for allocating commercial fishing rights in ocean capture fisheries. We have located only five such examples of note in Estonia, Russia, Chile and Washington state.

Russia and Estonia auctioned fish quotas and fishing gear quotas (Estonia) for a few years at the beginning of this century. In both countries the auctions were established through a government initiative, in order to divert more of the fishery rent to the government and to increase efficiency in the industry. In both countries the auctions were abandoned after 2 years because of various difficulties and pressure from industry (Eero et. al., 2005, Anferova et.al., 2005).

Chile, probably has more experience with auctioning ocean fishing rights than any other country. In 1991 Chile introduced an auction system for harvesting privileges in a new, large-scale industrial fishery targeting Patagonian toothfish (Gonzalez et al. 2001). The auction system was designed to provide equal opportunities for bidders, provide revenue for the state budget, and to avoid monopolies in the market for fishing rights. It was also seen as a way of minimizing complaints and conflicts among fishing interests. As the fishery was fairly new, no change in the structure or distribution of the fishery was needed. Fishing companies in the fishery at the time the auction system was implemented were granted prior-use rights. Initially they were allowed to continue their fishing activities for a period of three years, and after this period were granted permits totalling 10% of the allowable catch. These permits had a term of 10 years. The fraction of the allowable catch allocated to firms decreased by 10% each year

and the 10% was then re-auctioned. This auction continues to this day. In 2013, 50% of the permits were apparently reserved for artisanal fishers (http://www.fis.com/fis/worldnews/worldnews.asp?l=e&id=57821&ndb=1). In 2000, harvesting quotas for a few more small, but valuable inshore fish stocks in the southern part of the country including lobster were put up for tender (Cerda and Urbina-Véliz 2000). As far as we know these auctions are still continuing, but we have not managed to locate any reliable information about how well they have worked.

The Washington State Department of Natural Resources in the US manages the state's geoduck (kind of marine shellfish) resources in Puget Sound. This department has auctioned off the harvesting rights of geoduck for several years. The financial proceeds of these auctions have been meager and the efficiency of the fishery much inferior to the neighboring Canadian state of British Columbia where fishers of geoduck have property rights.

Appendix 9
The vessel day trading situation

The VDs are essentially for use is the EEZs of specific Parties to the PA (VDS-partners). It follows there are at least eight types of VDs. There are, moreover, two sets of holders of these VDs, VDS-partners and fishing companies. Thus there are potentially three types of VD-trades; (i) between VDS-partners, (ii) between fishing companies and (iii) between VDS partners and fishing companies. Because of the various restrictions on trades and VD use under the VDS, each type of trade will generally take place at different prices. Thus, at each point of time, there are at least 24 (3·8) different equilibrium prices for VDs under the current VDS. The stipulation that some VDs apply to more than one EEZ (pooling) further increases this complexity.

The following table summarizes the market or trading variables of relevance in this set up of the VDS.

Table A.9.1
The trading situation: Assets and prices

Market/trading variable	Symbol	Type of variable
Vessel days held by partner *i* at time *t*	$VDs(i,t)$	Stock
Vessel days held by vessel *k* at time *t*	$Vd(i,k,t)$	Stock
Trades of partner i to partner *j* at time *t*	$z(i,j,t)$	Flow
Price of the trade of partner *i* to partner *j* at time *t*	$p(i,j,t)$	Price
Trade of partner *i* to vessel *k* at time *t*	$u(i,k,t)$	Flow
Price of the trade of partner *i* to vessel *k* at time *t*	$w(i,k,t)$	Price
Trade of vessel *k* to vessel *l* at time *t*	$y(k,l,t)$	Flow
Price of the trade of vessel *k* to vessel *l* at time *t*	$v(k,l,t)$	Price

The table first of all underlines the high complexity of this marketing set-up. It secondly suggests the difficulty of accounting for empirical data in this complicated situation. Thirdly, the table highlights the potential deviations of this market for what is essentially just one commodity, namely a right to fish in the VDS region, from what would be economically most efficient.

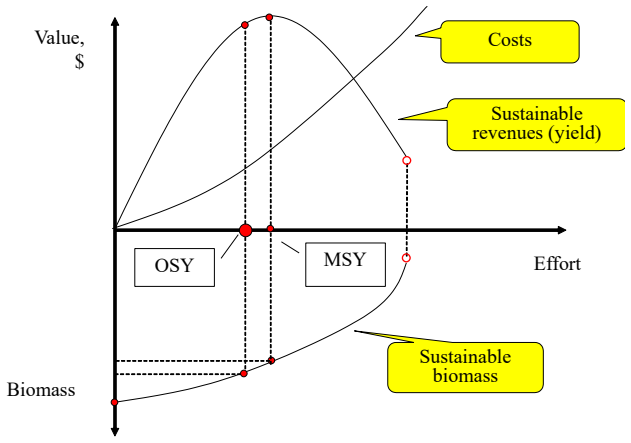
The fragmentation of the VD market illustrated in the above table bears many similarities to the fragmentation of a set of markets that are subject to various trading restrictions and/or tariffs, an arrangement that was common in world trade some decades ago but has now been greatly diminished.

Appendix 10
Maximizing profits conserves tuna resources

It is well-established in fisheries economic theory (see e.g. Clark and Munro 1975, Arnason 1990) as well as empirical observations that maximizing sustainable net benefits from fisheries generally implies biomass in excess of the maximum sustainable yield one. In this sense the benefit maximizing policy yields is environmentally conservative.

The basic arguments for this result are summarized in figure A.22. In this diagram, the volume of biomass as a function of sustainable fishing effort is measured in a downward direction. The figure illustrates that since the sustainable fishing effort that corresponds to maximum economic benefits (labelled OSY in the diagram) is less than the fishing effort corresponding to maximum sustainable yield (labelled MSY), the biomass corresponding to maximum economic benefits is also greater.

Figure A.22
The sustainble fisheries model



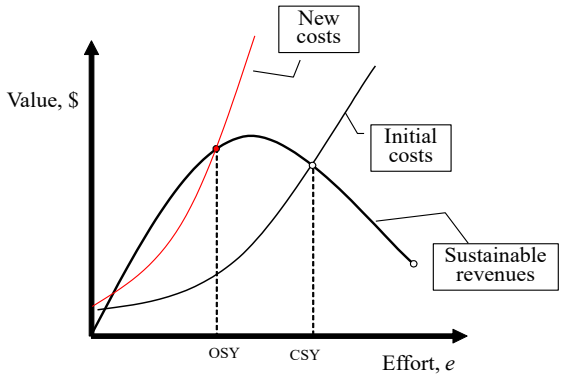
This establishes that the biomass corresponding to maximum economic yield is quite conservative of the fish stock. In addition it should be noted that maximizing fishing fee revenues implies even less fishing effort (see appendix 7) and, therefore is even more conservative of the fish stocks.

Appendix 11
The simple theory of effort restriction and fees

Fishing effort in the sense of generation of fishing mortality can be and generally is produced by numerous economic inputs. Fishing days is just one of these inputs. Others are various attributes of the vessel, the fishing gear and crew as well as various types of auxiliary equipment to locate fish concentrations, transport catch and so on. Many of these inputs are partial or close substitutes for each other. Restricting one or a few of these inputs will generally lead to an increased use of the substitute inputs. As a result, fishing costs as a function of the constrained input will rise and this increase in costs will continue as long as the expansion in alternative inputs is profitable (Clark 1990, Hannesson 1993, Arnason 2007b).

This process is illustrated in figure A.23, where one economic input, e.g. fishing days, is measured along the horizontal axis and a sustainable revenue and an initial cost curve are drawn. Initially the fishery finds itself in the usual common property equilibrium at effort level CSY (Competitive Sustainable Yield) in the diagram. At this point, fishing costs equal revenues so there are no net benefits. The maximum benefits, however, are obtained at the effort level OSY (Optimal Sustainable Yield). Suppose now that OSY effort level is imposed. This will initially reduce fishing mortality and catch and plunge the fishery into a situation of loss. However as biomass gradually increases, profits emerge and it becomes profitable to expand the other economic inputs that are unrestricted. This increases costs, shifting the cost curve upward. This process continues until the cost curve has shifted sufficiently so that a sustainable equilibrium found at the restricted effort level OSY in the diagram. At this point there are no profits in the industry and the companies will not find it beneficial to expand unrestricted effort components further.

Figure A.23
The impact of effort restrictions

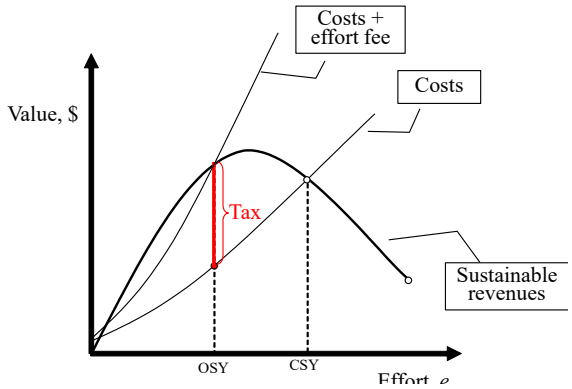


This argument shows that restricting one or a subset of the possible economic inputs will in general not increase the profitability of fishing and may not even conserve the fish stocks in the long run unless the restrictions are continuously made more restrictive. This result, of course, holds just as much for limiting fishing days as other economic inputs. This suggests that the limited fishing day aspect of the VDS does not represent an effective management of the fishery in the long run.

Now consider a tax on economic fishing inputs, for instance a fee on fishing days. This fee will shift the fishing cost curve upward in a way similar to that illustrated in figure A.24. If, as illustrated in figure A.24, the tax is set so that the new cost curve passes through the sustainable revenue curve at the OSY effort level, this will constitute an equilibrium for the fishing companies. At this effort level, they will enjoy no profits so they will not seek to expand fishing effort. However, although the fishing companies have no profits, the fishery generates profits equivalent to the taxation revenue. Thus, from a social perspective fishery it has become efficient. However, all the benefits are collected by the taxation authorities and

none by the fishing companies. This is the way it has to be, for if the fishing companies actually collected some profits, this would induce them to expand fishing effort so their profits would be wasted on excessive fishing effort.

Figure A.24
The impact of tax on effort



In spite of these attractive properties of the tax on fishing inputs, it is important to realize that it is also subject to the substitution of the taxed inputs with untaxed inputs. As a result, a tax on specific inputs will never be able to generate a fully efficient fishery and, by the same token, maximize net economic benefits from the fishery.

The impact of a combination of effort restrictions and taxation can be inferred from the above. The ultimate ineffectiveness of limited fishing days if employed alone will to a certain extent (but not fully) be counteracted by the fee on fishing days. Interestingly, this positive impact of the fee on fishing days will be maximized when it is actually the fee that determines the number fishing days and not the direct restriction on fishing days. However, because of substitution to alternative inputs, discussed above, fees on fishing days will never be able to generate and efficient fishery and, therefore maximize tax revenues from the fishery.

To illustrate these principles, it may be useful to consider an explicit numerical example. Let the harvest function be:

$$y = f(e1, e2) \cdot x,$$

where x represents biomass and the function $f(e1, e2)$ denotes fishing mortality with $e1$ and $e2$ being economic inputs that generate the fishing mortality. The input $e1$ could for instance be fishing days and $e2$ other economic inputs.

Now, let the fishing mortality production function be the constant-returns-to-scale Cobb-Douglas form:

$$f(e1, e2) = a \cdot e1^{\alpha} \cdot e2^{1-\alpha},$$

where a and α are positive parameters and $1-\alpha>0$. Note that this function exhibits a considerable degree of input substitutability (elasticity of substitution equals unity)

Let the cost of fishing function be:

$$C(e1, e2) = w1 \cdot e1 + w2 \cdot e2 + \tau \cdot e1,$$

where $w1$ and $w2$ are unit costs per inputs $e1$ and $e2$, respectively and τ is the fishing fee per input $e1$.

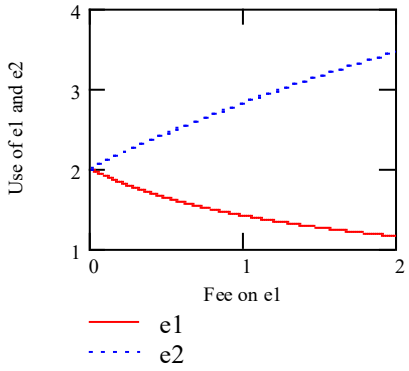
It is now straight-forward to show that the use of the two economic inputs that minimizes the cost of producing fishing mortality f is given by:

$$e1(f) = \frac{f}{a} \cdot \left(\frac{w1 + \tau}{w2} \cdot \frac{(1-\alpha)}{\alpha} \right)^{\alpha - 1},$$

$$e2(f) = \frac{f}{a} \cdot \left(\frac{w1 + \tau}{w2} \cdot \frac{(1-\alpha)}{\alpha} \right)^{\alpha}.$$

These two equations show that as the tax on input 1, i.e. $e1$, is increased, there will be a substitution away from using $e1$ to generate f and toward using $e2$. The relationship is illustrated in figure A.25.

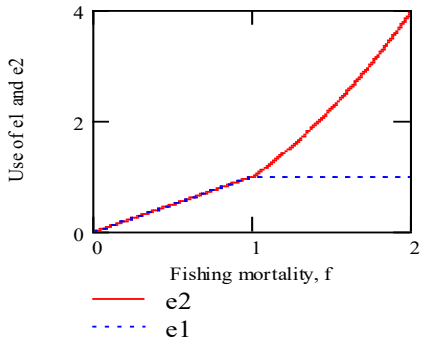
Figure A.25
Dependence of e1 and e2 use on fee on e1



Now, since the fee distorts the use of the two inputs, the cost of fishing goes up. This represents a real cost which reduces the available fees from the fishery.

A direct restriction on $e1$ use as under the VDS has a similar impact. Once the restriction on $e1$ becomes binding, fishers will attempt to counteract by using more $e2$. This effect is illustrated in figure A.26. As fishing mortality increases both inputs increase linearly according to the above two equations. At fishing mortality f=1 the restriction on $e1$ becomes binding and from that point onward, the use of $e1$ is constant but the use of $e2$ increases faster with f than before.

Figure A.26
Dependence of e1 and e2 use on restriction on e1 use (e1≤1)



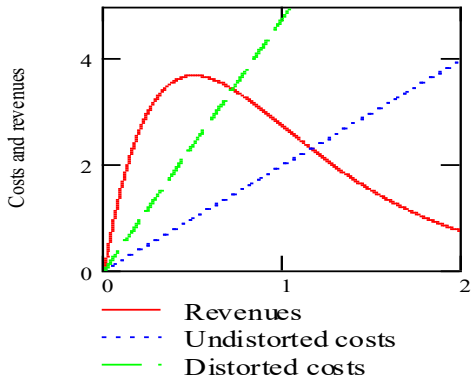
This increased use of $e2$ to generate fishing mortality also represents an economic distortion, i.e. a deviation from what would be the least cost method of producing a given fishing mortality. This is a real cost which reduces the available fees from the fishery.

Figure A.27 draws the sustainable fishery for undistorted costs and distorted cost due to a restriction on fishing effort variable $e1$ as well as certain fee on $e1$. The fee is set so as to approximately maximize attainable fee revenue from the fishery. As indicated in figure A.27, for this model and numerical specifications, distortions in the use of economic inputs increase

real costs of fishing considerably. As a result, as can be approximately read from the diagram in figure A.27, the maximum attainable fee revenues under this management regime are only about 65% of what could be obtained if the input distortions did not take place.

This numerical example serves to illustrate the general weakness of restrictions and fees on particular fishery inputs as a means to manage fisheries and to obtain net fee revenues from a fishery. The same qualitative results would hold for any fishery. The exact quantitative impact would, however, depend on the empirical particulars of the fishery.

Figure A.27
Sustainable fishery with input distortions due to restriction and fee on the use of input e1



Appendix 12
Harvest-based systems: ITQs

Restricted effort based system, even when complemented with fishing fees, suffer from fundamental problems of effort substitution which tend to undermine the long term efficiency of these systems (see appendix 11). Restricted effort based system suffer from several other difficulties having to do with the heterogeneity of fishing vessels and the uncertain relationship between the various components of fishing effort and actual catch.

Harvest-based systems such as individual transferable quotas (ITQs) do not suffer from these difficulties. The main reason is that it harvests represent extraction from the fundamental natural resource, the fish stocks, and for the fishing fleets there are no substitutes for harvests

ITQs are widely used around the world in many kinds of fisheries and their success in generating efficiency in fisheries is well-established (Arnason 2007b). ITQs have been very successfully applied in manly large scale purse seine fisheries (e.g. those Chile and Peru) and the multi-national, multi-jurisdictional purse seine fisheries of the North Atlantic. Although none of these fisheries are tuna fisheries, some of them are large volumes mackerel purse seine fisheries which are not unlike the skipjack tuna purse seine fisheries.

Compared to the restricted effort system under the VDS, ITQs have several important advantages:

- They restrict extraction from the resource. This allows greater precision in stock control and substantially improves the property rights value of the fishing rights with respect to harvest (see section 2.2 in the main text).
- They are not subject to the fundamental weaknesses of effort–based systems of input substitution discussed in appendix 11. Therefore, unlike those systems, ITQs are capable of generating maximum attainable economic benefits from the fishery on a sustainable basis.
- ITQs as other harvesting rights represent a fairly homogenous asset, i.e. the right to extract a volume of fish from the stock. Therefore, there is no need to restrict the ITQs to particular EEZs or particular vessels or vessel types; extraction of a given volume of fish has much the same impact wherever in the PNA area it takes place and whatever vessel extracts it. Therefore, pooling of rights becomes pretty straight-forward. Moreover, transfers of ITQs between vessels and vessel types does not pose a problem as do transfers of VDs.
- ITQs make it easier (simpler and less expensive) to reduce bigeye tuna mortality. First, a restrictive bigeye quota will induce the fishing companies to search for cost-efficient ways to avoid it. Second, the market price of bigeye quota will indicate to the fishing companies the imminent scarcity of quota for this species. Third, by trading bigeye quotas, the fishing companies can move bigeye harvesting rights to the companies/vessels that find it most difficult to avoid it.[76]

The main drawback of ITQs (and similar individual harvest-based systems) as a fisheries management tool in the PNA context is the enforcement of the system. For ITQs to work, they have to be sufficiently enforced. This means that preferably catches and at least landings

[76] Experience has amply verified the theoretical prediction that ITQs are extremely well suited to deal with problems of multi-species fisheries.

have to be monitored for each vessel. Since, the PNA tuna fishery is a multi-species one and the quota restrictions for some species, in particular bigeye tuna, are likely to be more restrictive than for others, there will may arise an incentive discard the catch of those species (Arnason 1994). As a result monitoring of actual catches or discards may need to be undertaken. This can only be effectively done at sea, normally by on-board observers.

Sufficiently effective enforcement of individual harvesting constraints in the PNA tuna fishery, thus, is a major undertaking. While, an enforcement system for the VDS has been gradually built-up over time, little has been done in terms of catch monitoring. The magnitude of the task should not be overestimated, however. First, much of the purse seine tuna harvest is landed to canning factories which normally keep good records of the volume and species composition of the landings by vessels. Second, a reasonable condition for receiving fishing rights within the PNA area is that the vessel in question carefully keep a log-book of catches and landings and offloads catch only in acceptable ports. Third, and most importantly, compliance depends on essentially the extent monitoring and the penalty for violations. The higher the penalty, the less monitoring is needed (Arnason 2013). In the case of the DWF-fleets in the PNA area, it appears that it would be a relatively easy matter to impose high penalties. Forfeiture of fishing quota and fines out of an initial deposit come to mind as a simple way to do this. In any case, various fisheries with a much larger number of vessels and landing ports than is the case in the PNA-area have successfully overcome ITQ enforcement problem. Their experience suggests that similarly efficient way of enforcing ITQs in the PNA context probably exist. Possibly even, their experience will suggest what may work in the PNA-area.

The theoretical advantages of ITQs or similar harvest-based systems over effort–based systems suggest that it may be worthwhile to systematically investigate the costs and benefits of switching the management of the PNA tuna fisheries to ITQs. Before the results of that study are in, it is not reasonable to recommend the switch.

To clarify the issues it may be helpful to describe one fairly natural way to introduce ITQs in the PNA purse seine tuna fisheries. Possible main components could be as follows:

- TACs are set for the three main tuna species (and possibly other species) annually
- These TACs are allocated to the Partner Nations as PAQs (Party allocated Quotas).
- The allocation rule could be determined in a similar way to the PAE today.
- The PAQ can be harvested in any EEZ of the nations participating in the system.
- The PAQs would be perfectly divisible and tradable
- Partner nations sell the harvest quotas to fishing companies or dispose of them in any way they like.
- PAQ could also be sold centrally e.g. via a well designed auction
- The PNAO keeps an up-to-date quota registry listing the holders of and their amount of un-used quotas continually updated by trades and catches.
- Trades would not become effective unless registered at the quota registry.
- Purse seiners without a sufficient quota holding would not be allowed to operate within the PNA area.

Appendix 13
Terms of Reference for the study

Schedule A
TERMS OF REFERENCE
Independent Review of the Purse Seine Vessel Day Scheme

Background:

The purse seine vessel day scheme (VDS) established by the Parties to the Palau Arrangement is an innovative system for the management of the tuna purse seine fishery across their exclusive economic zones. This fishery provides over 40% of the global catch of tuna for canning. Since its establishment, the scheme has entrenched the rights of these eight coastal states over their fisheries resources; has maintained total fishing effort within limits agreed by the Western Central Pacific Fisheries Commission; and has seen fisheries access fee revenue collected by the coastal states more than double in value. The allocation of fishing rights in the form of vessel days has also been instrumental in attracting foreign investment in the catching and processing sectors in some countries. In 2012 Tokelau became a participant in the VDS through an MOU with the Parties to the Palau Arrangement. Other members of the Forum Fisheries Agency have also expressed interest in subscribing to the VDS.

The scheme is now in its fifth year of operation, and, in spite of these successes, a number of issues have emerged which the parties feel require an independent review to resolve. The chair of the PNA has requested the Forum Fisheries Agency to manage the consultancy.

Objective:

The objective of the review is to produce a clear plan of action that will improve the governance, integrity and implementation of the VDS, to provide secure, equitable and sustained benefits to the parties to the Palau Arrangement.

Consultancy Services Required:

Consultancy services are therefore required to carry out an independent review of the VDS. It is envisaged that the review will be carried out by a fisheries specialist with expertise in rights-based management systems, and an expert in governance and corporate systems. Desk based analysis by a legal specialist is also envisaged.

Detailed ToR:

More specifically the consultants are required to review the VDS with regard to the following broad headings:

1. ***Governance and management***

   Current systems for the governance of the VDS are failing to provide the basis for sound decision-making, or allow effective management of the scheme. The consultants will examine options for improvements, including an earlier proposal to establish a professional board of directors for the scheme, with outcome-based reporting to Ministers. The roles of the PNA office and meetings of officials will be clearly defined.

   Management responsibilities are also confused. The consultants will propose clear accountabilities for the different management and administrative functions needed to implement a sophisticated fisheries management system.

In a similar context, the relationship between the legal instruments that all or most Parties to the Palau Arrangement are also party to (FSMA, PA, PNA, VDS, LLVDS) will be defined by the consultant, along with options for optimising this mix.

Draft legal instruments to implement these changes will be developed.

2. ***Design objectives***

The VDS suffers from conflicting objectives, with parties variously seeking: increased access fee revenue; increased supplies for local processing operations; improved long-term sustainability of the resource; and, what they perceive as a more equitable share of the fishery for themselves. There is a need to develop clear and compatible objectives which can optimise sustainable benefits and secure the support of all parties. These should include: sustainable management of the resource; secure rights in the fishery; and maximizing benefits to the parties.

The study should also assess the nature of the fish use rights provided through the VDS, against the key characteristics of duration, flexibility, exclusivity, quality of title, transferability and divisibility; and make recommendations.

3. Allocation mechanisms

Currently the total allowable effort (TAE) is set by a decision of the WCPFC to freeze effort at the 2010 level; while the number of days allocated to each party (the party allowable effort PAE) was based on a formula using historical effort and estimated biomass in zone, and has been subject to frequent review and renegotiation. There is a need to reconsider both optimizing the TAE and the PAE setting mechanism, with a view to providing greater stability, while at the same time addressing more comprehensively the sense of unfairness that some Parties have expressed.

4. ***Participation and Management of Substitutes***

A key strength of the VDS is that it covers the bulk of purse seine fishing in the WCPO. However, substitutes do exist and these have the potential to undermine the effectiveness of the VDS as both a conservation measure and an economic tool, particularly if they grow in importance. Potential substitutes include purse seine fishing in the high seas, in EEZs of non VDS participants and in Parties' waters that are excluded, such as archipelagic waters and territorial seas. The consultancy will review these substitutes and their potential impact on the VDS as well as providing options for including or mitigating them in the VDS and elsewhere.

5. ***Trading arrangements***

In a highly mobile fishery, the allocation of fishing days to each party needs to be complemented by a system for trading days. While this has always been recognised, the VDS was launched without a formal system being put in place and trading arrangements continue to be ad hoc. The review will recommend improved trading processes, including pooling of days and auction mechanisms if appropriate. It will also explore equitable arrangements for revenue sharing when days are sold and fished in the waters of another party, and review the application of a benchmark price for traded days. The desirability or otherwise of secondary markets (on-selling of days from one fishing enterprise to another) should be examined.

6. ***Integrity of systems and processes***

A PNA Fisheries Information Management System (FIMS) has been developed to provide consistency and automation in the way that days are counted. However, day to day management of the VDS is decentralised to member countries, with each one responsible for selling days and monitoring their use. In many countries national fisheries licensing systems were not designed to handle this new type of transaction, in which administrative errors can be very costly, and the consultants will recommend on how processes can be strengthened. The consultants will conduct an assessment of the PNA FIMS, including the level of familiarity and use by Parties.

7. ***Compliance with the rules***

The strength of the VDS as both a management tool and to increase revenue relies on maintaining hard limits on the number of days fished. This can be undermined by countries exceeding their PAE, and through the inconsistent declaration of non-fishing days. These practices can cause the loss of millions of dollars. The consultants will conduct an assessment of the magnitude of this problem, review the rules on these issues; identify other possible loopholes; examine the nature and application of penalties; and make recommendations. The consultants will also propose improved mechanisms to resolve disputes, including a formal arbitration system.

8. ***Transparency***

There are a number of calls for greater transparency in the execution of the VDS; on the other hand the sale of days can involve complex negotiations in which the sellers cannot show their hands too soon. The review will make recommendations on the nature, the processes and timing for the disclosure of information into the public domain.

9. ***Amount of fees***

The purse seine VDS licence fees may not be fully capturing resource rents generated in the fishery with a resulting loss of wealth from members that is transferred to distant water fishing nations. The consultants will carry out a simple bio-economic study to assess whether the maximum fee amount is collected and if not to what extent. If fees are found to be significantly less than the potential, they will investigate the reasons; examine procedures for maximizing fees; and propose a method for maximizing fee collection.

10. ***Level of fishing effort (TAE)***

To maximize economic returns from the fishery, fishing effort needs to be set at an appropriate level each season. There are indications that this is not happening. The consultants will again use bio-economic modeling to determine the optimal path for fishing effort over time and compare this with past and likely future levels of fishing effort.

Expected Outcomes

The consultants are expected to:

- Participate in the annual meeting of the Parties to the Palau Arrangement, present their work plan, and obtain guidance on this and the conduct the review;
- Undertake extensive consultations with stakeholders in the Parties, regional agencies (PNAO, FFA, SPC) and wider regional stakeholders;

- Report regularly by teleconference to a three-person steering committee nominated by PNA members to provide guidance and oversight of the review;
- Produce a draft report for circulation and comment by Parties, PNA Office and FFA;
- Produce a final report, in the form of a 10-page summary with supporting annexes, incorporating these comments; and,
- Subject to additional funding, present their findings to a joint meeting of Fisheries and Finance Ministers.

Methodology:

The review will be making recommendations on issues of great importance to members and will need to ensure ownership of its findings. There will be a small steering committee established to guide the process, with regular electronic consultations by teleconference. It is likely that steering committee members will participate in some or all of the field visits, but it will not be the responsibility of the consultants to arrange this. The consultants will also take every opportunity to brief the full membership of the Parties to the Palau Arrangement on progress.

The study will involve a review of the documentation of the VDS, making use of reports held by PNAO and elsewhere. This will be followed up by field visits to at least four Parties to the Palau Arrangement in the region (including Solomon Islands as the host country of the PNA 2014 meeting) to collect additional data and examine current and planned operation of the scheme. The fieldwork will be undertaken by a fisheries specialist and a governance specialist – either of whom may be designated as team leader.

The study will nominally require six weeks' work by the team leader, but this time may be spread over a longer period. Approximately one week will be allowed for literature review and research. Three weeks will be allowed for participation in the PNA meeting, and at least three other PNA countries. Two weeks will be allowed for additional consultation and compilation of the draft report, which should be brief and to the point.

Approximately four weeks input is expected from the second specialist. This will include participation in the PNA meeting and at least one field visit to another country.

Two weeks' desk based input from the legal specialist, towards the end of the period, is also envisaged.

Timing:
The study will commence in March 2014, in time for the PNA meeting early March. A draft report should be ready for consideration by the end of August 2014, with a final report completed after receiving feedback on this. Some flexibility on timing may be necessary as the work develops.

Reporting Requirements

The Consultants shall report to the Director – Fisheries Development. They shall send reports specified above and invoices to him in the first instance; as well as brief updates on progress as may be requested from time to time.

ANNEX I
TABLE OF PNA RESOLUTIONS, DECLARATIONS AND OTHER DECISIONS

INSTRUMENT	SIGNED BY	GENERAL DECISION	CONSERVATION AND MANAGEMENT MATTERS	COMERCIAL MATTERS
2009 Bikenibeu Declaration on Cooperation on Management of Fisheries of Common interest	PNA Ministers	Agreed to establish PNAO	• Called for adoption of additional conservation and management measures. • Closure of additional high seas areas.	• Encouraged new initiatives including: o refuelling in port o unloading catches in PNA ports o requiring vessels to have PNA nationals as crew. • Encouraged LL VDS.
2010 Resolution: 5th Ministerial Meeting	PNA Ministers	Agreed to amend the Nauru Agreement and give legal status to the PNA Office	Supported proposals to allow observers from one PNA member to act as observers in other members' waters.	• Noted progress on PS and LL VDS • Discussed EU-Trade negotiations to ensure effective participation of PNA to shape Economic Partnership Agreement.
2010 Koror Declaration Committing Parties to the Nauru Agreement to Joint Efforts to Increase the Economic Value and Derive Greater Benefits from the Tuna Resources	PNA Leaders	Taking into account the NA, Implementing Arrangements, FSMA and PA, confirmed importance, at highest political levels, of maximizing economic gains through adoption of effective conservation and management measures and arrangements that control output and limit effort.	Agreed to: • Effectively conserve and restore highly migratory stocks … and explore suitable arrangements to control output and limit effort. • Close off specified high seas area by prohibiting PS licensed by Parties from operating there. • Confirm adoption of PSVDS.	Agreed to: • Initiate management practices that will enhance commercial and economic opportunities. • Proceed for skipjack certification assessment.

INSTRUMENT	SIGNED BY	GENERAL DECISION	CONSERVATION AND MANAGEMENT MATTERS	COMERCIAL MATTERS
2011 MOU between Parties to the PA on Minimum Bench Mark Fee for a Fishing Day under the VDS	PNA Ministers	Sets a non-negotiable minimum bench mark fee.		• Sets a fee of USD6,000 per fishing day. • Requires Parties to inform foreign fishing vessels of fee when bilateral access agreements are renewed.
2012 Resolution on Marine Animals	PNA Ministers	Commitment to implement even stronger management measures in joint EEZs order to maintain sustainable tuna fisheries and minimise impact on bycatch species.	• Established a PNA Observer Agency. • Approved work on developing a FAD registration and tracking scheme. • Agreed an amendment to the Palau Arrangement Purse-seine Vessel Days Management Scheme that provides a clear and unambiguous definition of the Fishing Day. • Encouraged continued advocacy within the WCPFC for more effective conservation and management measures to be implemented across the whole region.	• Adopted the MSC Implementation Plan. • Approved a PNA Office Business Plan.
2013 PNA Resolution 01-2013 on Renewed Commitment to Cooperation in Fisheries Management and Development	PNA Ministers	Builds on the regional solidarity underlying the 2009 Regional Tuna Management and Development Strategy adopted by FFC, as well as	• Reaffirmed commitment to VDS to ensure that no Party exceeds its Party Allowable Effort, and agreed not to penalize a Party for exceeding PAE on the	Technical implementation of the VDS: Set PNA TAE, to be allocated through mutual agreement. Noted agreement on revised definition of non-fishing days. Approved maintaining vessel length factors,

INSTRUMENT	SIGNED BY	GENERAL DECISION	CONSERVATION AND MANAGEMENT MATTERS	COMERCIAL MATTERS
		the Bikenibeu Declaration and Koror Declaration.	assurance of the Party to fully implement the VDS in 2013 and beyond. • Noted that a decision to increase in the benchmark price would be contingent upon strengthened implementation of management measures. • Regulation of the longline fishery and introduction of a rights based system for its management is an opportunity to ensure sustainability and leverage additional control and returns.	and called for review in 2014. Noted increase for minimum benchmark price through amendment to 2011 MOU. Agreed to open the Longline VDS Scheme text for signature. Supported MSC certification and stated that "PNA now encourages industry partners to deliver MCS skipjack to our processors…" Noted that officials have progressed well in the renegotiation of the US Treaty, and that Parties have agreed to contribute VDS days to cover the period from 15 June to 31 December 2013 (as renegotiations continue) Work should continue on the reform of the FSMA to strengthen the contribution that it makes to the promotion of domestic tuna development through preferential access to Parties' waters for domestic vessels.
2013 MOU on minimum benchmark price among PNA Parties	PNA Ministers	Minimum benchmark price		Minimum benchmark fee of USD6,000 per fishing day to be applied at the beginning of the 7th Management Year (2014).

INSTRUMENT	SIGNED BY	GENERAL DECISION	CONSERVATION AND MANAGEMENT MATTERS	COMERCIAL MATTERS
2013 Longline VDS Scheme	PNA Ministers	Longline VDS Scheme		Access for longline fishing vessels under a VDS Scheme. When operational, the estimated value of the PNA Longline Vessel Day Scheme was $65 million.

ANNEX II
COMPARATIVE TABLE OF NAURU AGREEMENT, PALAU ARRANGEMENT, PALAU ARRANGEMENT PURSE SEINE VDS, FEDERATED STATES OF MICRONESIA ARRANGEMENT[77]

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[77] All instruments are posted on http://www.pnatuna.com/Documents, except for the Palau Arrangement, as amended in 2012, which can be seen at http://iea.uoregon.edu/pages/view_treaty.php?t=2010-Amendment-1992-ManagementWesternPacificPurseSeineFishery.AA20100911.EN.txt&par=view_treaty_html. The Palau Arrangement Longline VDS was unavailable because it has not yet entered into force.

25. MCS
26. Cooperation in enforcement
27. Compliance powers
28. Arrest and seizure
29. Joint surveillance
30. Port State enforcement
31. Observer Programme
32. Relationship with other international or regional agreements
33. Implementing arrangements
34. Review and implementation
35. Decisionmaking
36. Dispute Settlement
37. Amendment
38. Ratification

Information relating to the PNA Implementing Arrangements is in footnotes under relevant parts of the Nauru Agreement, unless otherwise indicated. Designations are PNA IA 1, 2[78] and 3[79].

The Harmonised Minimum Terms and Conditions for Foreign Fishing Vessel Access, as amended in 2011 by FFC77, are not included in the table. A reference should be made to them and other relevant FFA agreements in any consolidation of the instruments.

Indicative titles of Articles is shown in the left column. It may not precisely match the Article number in the individual instruments, which are indicated in parentheses beside each entry, e.g. (Art 1)

	Nauru Agreement[80]	**Palau Arrangement**	**Palau Arrangement Vessel Day Scheme[81]**	**FSM Arrangement[82]**	**Comments**
1. Definitions		Director domestic vessel fishing vessel Fisheries Management Area foreign fishing vessel locally-based foreign fishing vessel Nauru Agreement Parties to Nauru Agreement Office Party Party to the Nauru Agreement member of the Forum Fisheries Agency Vessel Register Note:	ALC Adjusted PAE Fishing activities Fishing day FSM Arrangement home Party Length overall Management Year Palau Arrangement Party Allowable Effort Total Allowable Effort US Treaty VDS Register VDS Register Registration Period Vessel Day Scheme Management Area	Administrator Applicable national law Arrangement Area eligibility criteria eligible fishing vessel fishing fishing vessel of the Parties home party operator Party regional access licence related activities transhipment Note: • "fishing vessel of the Parties" refers only to	Some discrepancies among the instruments in the definitions are noted.

[78] 1990.
[79] 2010.
[80] 1982. Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, Tuvalu.
[81] As amended – Management Scheme (PSVDS)
[82] Federated States Of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, Tuvalu.

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
		The instrument provides "Parties to Nauru Agreement Office" or "PNA Office" means the office established under Article V of the Nauru Agreement as amended. However, in the version of the Nauru Agreement on the PNA website, an office is not established under Article V, which only refers to the FFA as the Secretariat.	Note: • "ALC" differs from definition in HMTCs. • "fishing activities" similar to but differs from "fishing" definition in FSMA and HMTCs. • "fishing day" refers only to purse seine vessels, longliners are covered in a separate agreement that has not yet entered into force. • "home Party" refers to definition in FSMA.	purse seiners flying the flag of or based in a Party, longliners are not covered. • "fishing" similar to but differs from "fishing activities" definition in PA and HMTCs. • criteria for defining vessels being "based in a Party" is not defined. • "transshipment" differs from definition in HMTCs.	
2. Coordination of fisheries management	Parties to seek to coordinate and harmonise fisheries management for common stocks, maintain sovereign rights (Art I)	Parties must have a management meeting at least once a year to review the current status of tuna stocks and to establish necessary measures for their management and conservation. (Art 3)			
3. Objective	Principles: Priority to parties' vessels Establish specified MTCs Establish other MTCs		• Enhance management of PS fishing vessel effort "in waters of Parties" by *inter alia* …maximizing economic returns, supporting development of domestic locally based PS fishing industries, promoting	*Inter alia*: • Cooperate, promote nationals' participation in fisheries; establish a licensing regime for the Area on terms no less favourable than under access agreements;	Application to waters of parties but decisions also have effect over high seas areas PA expressly refers to purse seiners

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
	(Art II)		effective administration, management and compliance). • Seek to limit level of fishing by PS in EEZs to TAE. (Art 2)	• Establish and enforce agreed criteria to ensure eligibility for licenses to fishing operations that provide economic benefits to Parties • Allow access consistent with PA and further objectives of Nauru Agreement. (Art 2)	PA and FSMA both refer to economic returns PA refers specifically to PS fishing, FSMA does not but makes it clear through defining vessels as purse seine vessels".
4. Regional Register of Foreign Fishing Vessels	**In PNA IA 1**: Parties to comply with procedures for Regional Register adopted by FFC in 1983. (Art I)	Parties to notify the Director of the name, call sign, local licence or registration number and regional register number, if any, of all fishing vessels licensed to fish in their exclusive economic zones, regardless of whether such vessels are considered for the purposes of national legislation as foreign, domestic, domestic-based, locally-based foreign fishing vessels or otherwise, at two monthly intervals. Deadlines shall be set at the first day of each month. (Art 7.4)			
5. Register of purse seine vessels			Register of Purse Seine Vessels (VDS Register) established.		Administrator has power whether to register PS vessels, but

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
			PS must be registered for fishing activities. Conditions for registration (Administrator must be satisfied it can meet requirements of Management Scheme) Requirements for deletion. Process for deletion. Monthly notification to parties of changes to Register. (Art 8)		no criteria on which to base his decision – i.e. to indicate whether vessel can meet require-ments of Scheme. Administrator is also the judge of whether a vessel has failed to meet the requirements of the Scheme.
6. Register of eligible fishing vessels				Register of eligible fishing vessels, notification to parties every 3 months of vessels on register (Art 3) Deletion of vessel (Art 4)	
7. Secretariat/ Administrator	FFA (Art V)	PNA Office (Defintions, Art 3.4)	Director of the PNAO (Art 11.1)	Director of the FFA (Art 7 (1))	
8. Functions of Administrator		The functions of the Director/Secretariat are set out in Article 7: Director to: • assist the Parties in the implementation and	• Performing any function required by this Management Scheme; • Receiving information and documents from the Parties; • Receiving Registration	• Performing functions required by Arrangement; • Receiving information, documents, payments; • Convening meeting s of the Parties;	Substantially similar; most functions are generic and could apply to both agreements. e.g. FSMA function to audit accounts could

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
		coordination of the PA. • coordinate the licensing, management mechanism and other mechanism under this Arrangement, including (a) evaluating the level of compliance by, inter alia, assessing returned catch reports on the SPC/FFA Regional Tuna Fisheries Database; and (b) evaluating reports received from Parties relating to compliance by fishing vessels with Parties national laws and reporting requirements. • notify the Parties of the name, call sign and registration number of all fishing vessels licensed to fish in the exclusive economic zones of all the Parties each month.	Application Fees; • Convening meetings of the Parties; • Performing functions directed by Parties; • Performing functions necessary for administration of this Management Scheme. Administrator to • perform functions consistently with Parties' direction • apply fees as directed • convene special meetings to consider operation of Management Scheme at request of 4 parties. (Art 11) *Administrator's responsibilities also described under Articles on*: • Annual meeting of Parties to the Palau Arrangement • Calculation of fishing days • PAE Adjustments: transfers between Parties and pooling • Register of Purse Seine	• Coordinating the observer programme; • Performing other functions necessary to satisfy requirements of Arrangement. Functions to be performed consistently with Parties' direction at annual, special meetings. Administrator to consult with parties. (Art 7) *Administrator's responsibilities also described under Articles on*: • Register of Eligible Fishing Vessels • Voluntary Deletion • Review and Evaluation • Access to the Arrangement Area • Meetings of the Parties • Provision of Information	also apply to PA, PA function to convene special meetings could apply to FSMA. Administrator's general functions are described together in one Article in each instrument, but more specific operational functions are also described elsewhere in separate Articles.

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
			Vessels • Monitoring • Compliance	Distribution of Payments • Auditing of Accounts • Cooperation in Enforcement • Observer Programme • Amendment	
9. Meetings of the Parties	Annual meeting at time of FFC to "promote implementation" of the Agreement. (Art V.2) Additional meetings may be convened at the request of 3 or more parties.[83]	Parties must have a management meeting at least once a year to review the current status of tuna stocks and to establish necessary measures for their management and conservation. (Art 3)	Annual meeting to consider matters relating to the administration of the Management Scheme, including: • Matters referred by VDSC; • Briefing from Administrator on catch and effort levels and effort creep; • Briefing from the Administrator on transfer of fishing days between Parties (ensuring transfers are not detrimental); • Setting the TAE; • Consider the need to establish procedures to consult with DWFNs, fishing parties and	Annual meeting to be in tandem with PNA meeting. Purposes include: • review vessels operations, assess satisfaction by vessel of eligibility criteria, fulfilment of objectives of Arrangement; • review eligibility criteria; • adopt amendments; • review fee level for regional access licences; • discuss cooperative enforcement measures; • consider effectiveness of	PSVDS does not provide for • Consideration of VDSC recommenda-tions • Special meetings and ob servers[84] • Budget • Review of economic benefits • adoption of amendments FSMA does not refer to consultations with other organizations.

[83] PNA IA 3: Refers to review of measures at the annual meeting of the Parties. (Article II)
[84] Note observers and guests are provided for in Establishment of a VDS Committee (Art 2.3), but not Annual Meetings.

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
			organizations, other relevant organizations; • Determine controls on high seas fishing to be applied to fishing parties, or other arrangements, treaties or agreements. (Art 2.4)	observer programme, adopt procedures to implement; • consider and approve administrative costs budget (direct costs); • consider requests to accede; • other functions to satisfy requirements or attain objectives. Administrator to convene Special Meeting on request of 3 parties. FFA members may be observers. Parties to adopt and amend rules of procedure for annual and special meetings, FFC rules to apply pending adoption. (Art 9)	Neither refers to Work Plans or compliance/ implementation/disputes by Parties.
10. Decisionmaking		The decisions of the Management Meeting will be arrived at by consensus and will be binding on the Parties. (Art 4)			

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
11. Establishment of a VDS Committee			VDSC is a "sub-Committee of the Palau Arrangement Parties" and is subject to their absolute control. It has responsibility for oversight of the Management Scheme. Functions are to: • consider, discuss and make recommendation to any meeting of PA parties on administration of VDS; and • make decisions on matters delegated by PNA Parties. Chair and Vice Chair, Meeting procedures, observers and guests, confidentiality and meeting agenda and record are provided. (Art 2.3)		This is a sub-committee of Parties to the PSVDS and not to the PA itself. It can decide matters "delegated by Parties", but there is no requirement that the matters be delegated by the Annual Meeting of Parties.
12. Application/ scope		Applies to all species of tuna and tuna-like species (including billfish and other incidental by-catch taken by fishing vessels, wherever they may occur in the Area (Art 2)			
13. Non-application to certain purse seine vessels			Management Scheme not apply to licensed UST PS vessels, except for purposes of calculating the TAE when adjustments are		

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
			necessary. However, the above does not apply where agreed by Parties to UST. (Art 3)		
14. Application to certain purse seine vessels			Applies to PS vessels operating under valid FSMA license while in EEZ of home party. Conditions specified for operations outside home party EEZ, including: • separate allocation of fishing days; • vessel to cease fishing when total number of days reached; • allocation of fishing days for previous Management Year applies where Parties do not set allocation of fishing days. (Art 4)		
15. Obligation to limit fishing days			Parties to ensure that number of fishing days by PS vessels in their EEZs does not exceed PAE or Adjusted PAE except for UST exception in Article 3. (Art 5)		
16. Calculation of fishing days			Technical specifications governing the calculation of a Party's use of its PAE or adjusted PAE during a Management Year, which the Administrator must		

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
			apply. (Art 6)		
17. PAE Adjustments: transfers between Parties and pooling		•	• Parties may agree to PAE transfers under specified circumstances. • Procedures for transfer of PAE. • PAE to be adjusted by Administrator where Parties have complied with requirements. • Parties may agree on pooling and shall adopt procedures for transfers and adjustments. (Art 7)		
18. Calculation of TAE and PAE			Sets out: • Calculation of the TAE • Allocation of the TAE among Parties • Allocation of TAE for FSM Arrangement and UST fleets • Updating PAE (Art 12)		
19. Licensing	Standardise Licensing procedures, including for ffv: uniform licensing			Regional access license. Vessel to be: • registered; • operated in accordance	

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
	measures and procedures and exploring central licensing system (Art III)[85]			with Annex V; • license denial Annex VI; • license cancelled where deleted from Register; • license suspension where fines or determinations not paid; • Administrator to maintain record of all regional access licenses; • Administrator to advise parties monthly re license information. (Art 6)	
20. Provision of information		7. Parties to notify the Director of the name, call sign, local licence or registration number and regional register number, if any, of all fishing vessels licensed to fish in their exclusive economic zones, regardless of whether such vessels are considered for the purposes of national legislation as foreign, domestic, domestic-based, locally-based foreign fishing		Administrator to: • provide, etc., data received (fishing activities in each Party and by each vessel) and distribute data agreed by Parties • maintain confidentiality. Parties to ensure confidentiality of data concerning fishing in EEZ of	

[85] **PNA IA 1:** Licensing MTCs: procedures (II.1); authorised personnel (II.2); catch reporting/logbook (II.3); report of catch, entry, exit (II.4); Identification of licensed vessels (II.5).
PNA IA 2: Licensing MTCs: transhipment at sea prohibited ((I.1); high seas catch reporting, logbooks (1.2); observers (I.3); Electronic position, data transfer (II).
PNA IA 3: Licensing MTCs: catch retention (bigeye, skipjack, yellowfin taken by purse seiners) (I.1); FAD closure season (I.2); prohibitions of sets associated with whale sharks (I.2A); closure of high seas areas (I.3); observers required from Party of sub-regional observer programme to monitor compliance with catch retention and FAD closure – and ALC to be on and operational.

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
		vessels or otherwise, at two monthly intervals. Deadlines shall be set at the first day of each month. (Article 7.4)		other Party; Parties to inform Administrator of Area (Art 9)	
21. Statistical data	FFA to assist in exchange, analysis (Art IV)				
22. Distribution of payments				Administrator obligated to deposit payment and distribute according to Annex VI (Art. 10)	
23. Fees for VDS administra-tion, charges for vessel days			Parties may agree upon or vary any fees to be charged by registered vessels to operate under the Management Scheme, and the scheme for administration of fees. Parties may agree on scheme for standardising fees for the sale of vessel days. (Art 14)		Parties should agree, etc on fees to be charged to registered vessels.
24. Auditing of accounts				Administrator to • arrange for FFA auditor to audit accounts, • permit Parties to inspect data, books, accounts. (Art 11)	
25. MCS	Rapid exchange of information, feasibility of joint surveillance, etc	Functions of Management Meeting include: (c) the establishment and implementation of a system of	PS vessel requirements for ALC. (Art 9)		PNA IA 3 and PSVDS both require ALCs, Compliance with applicable national laws is in Annex V of

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
	(Art VI)[86]	observation and inspection consistent with regionally agreed initiatives; (e) the development of surveillance and enforcement procedures consistent with regionally agreed initiatives; (Article 3)			FSMA. No express requirement in PSVDS that ALCs must make transmissions to PNAO; requirements are simply to provide location transmissions but it doesn't say to whom.
26. Cooperation in enforcement	Develop cooperative and coordinated procedures, examine reciprocal enforcement (Art VII)[87]	The functions of the Management Meetings include: (c) the establishment and implementation of a system of observation and inspection consistent with regionally agreed initiatives; (e) the development of surveillance and enforcement procedures consistent with regionally agreed initiatives; (Art 3.2)		• Parties to assist in investigation of alleged violations of FSMA • Where probable cause to believe specified actions by vessel and vessel has left jurisdiction, procedures for investigation of alleged violation by home Party. • Actions by home Party where report shows reasonable grounds of violation. (Art 13)	
27. Compliance		Each Party to ensure that its	Parties to ensure compliance by	• Parties to ensure its fishing	Parties to ensure

[86] **PNA IA 1, 2 and 3:** Some MCS-relevant licensing MTCs shown in previous footnote.
[87] **PNA IA 1**: Parties to ensure compliance with MTCs in Art II. (III)

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
powers		nationals and fishing vessels comply with any management measures adopted by the Management Meeting. (Art 3.5)	licensed PS vessels and PS flag vessels Procedures for where: • party exceeds PAE/adjusted PAE at any time during a Management Year • level of fishing in EEZ of a Party exceeds PAE for a Management Year. (Art 10)	vessels do not fish in other Parties unless licensed under Agreement or other arrangements. • Nationals, fishing vessels of one Party failing to comply with FSMA or fisheries laws of another Party dealt with by the other Party. (Art 12)	compliance.
28. Arrest and seizure				Procedure where nationals or fishing vessels of one Party are arrested or seized by another. (Art 14)	
29. Joint surveillance				Parties to cooperate in enforcement in accordance with **Niue Treaty**, and cooperate to develop regionally agreed procedures. (Art 15)	
30. Port State enforcement				Vessel may be detained where inspection of catch and documents discloses reasonable grounds of contravention of the FSMA. (Art 16)	
31. Observer Programme				Observer programme to be established by Parties, details elaborated including	

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
				monitoring compliance. Administrator to coordinate programme.	
32. Relationship with other international or regional agreements	No derogation of rights and obligations (Art VIII)	The Parties recognise the need to cooperate with other states or international organisations having an interest in the tuna resources within the Area.(Article 6)	Annual meeting to consider the need to establish procedures to consult with DWFNs, fishing parties, fishing organizations and other relevant organizations and provide direction to the Administrator. (Art 2.4) Circumstances for non-application to US Treaty vessels. (Art 3) Application to PS vessels operating under FSM Arrangement license • in national EEZ of home party • beyond national EEZ of home party according to conditions specified (Art 4)	Objectives include consistency with PA and furthering objectives of PNA (Art 2 (e), (f)) FFA is (was)Administrator, FFA members may attend meetings, etc. (FFA also referenced in forms annexed) (Art 7) Parties to cooperate under Niue Treaty (Art 15)	
33. Implementing arrangements	Parties may conclude such arrangements. (Art IX)				
34. Review and implementa-tion:	Parties to ensure compliance with MTCs in Article II, if necessary by	Management meetings to review implementation of Arrangement (Article 3)		Review and evaluation to include: Report of independent auditor, including required information	

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
	enactment of legislation.[88]			and other that parties may request. Parties to review at annual meeting operations of all vessels, including from auditor's report. Annual or special meeting to direct deletion of vessel from register where criteria, objectives of arrangement not met or insufficient information provided for evaluation. (Art 5)	
35. Dispute Settlement		At the request of any Party, consultations will be held with any other Party within sixty (60) days of the date of receipt of the request. (Article 8)		• Consultations process (Art 18) • Dispute settlement by means of own choice, including arbitration (Art 19)	FSMA only has "bare bones" consultations/dispute settlement provision. There is no provision for arbitration.
36. Amendment	By unanimous decision (Art XI)	By consensus (Article 9.7)	VDS may be amended by agreement of Parties to the Palau Arrangement. (Art 13)	By unanimous decision, process elaborate for timing, effect, Closed/Limited Areas. (Art 24)	PSVDS only allows amendment of VDS, not entire Arrangement (e.g. duties of Administrator etc)

[88] **PNA IA 3:** Parties are to review implementation of measures in Article 1 at annual meeting, and decide on their future application, taking into account (a) the effectiveness of the measures in reducing fishing mortality (especially of juvenile bigeye and yellowfin) and (b) the extent to which compatible measures are applied on high seas, and in waters of other members of **WCPFC.** The measures are to be implemented in accordance with a programme to be adopted by Parties (Art II).

	Nauru Agreement[80]	Palau Arrangement	Palau Arrangement Vessel Day Scheme[81]	FSM Arrangement[82]	Comments
37. Ratification	Required	Required	No provision	Not required; entry into force 30 days after signature by the last to sign of the FSM, Kiribati and PNG.	Entry into force requirements should be defined by each instrument according to agreement by negotiating countries.

ANNEX III
INDICATIVE FRAMEWORK FOR AN INTEGRATED INSTRUMENT

This framework is indicative only, and takes into account recommendations in the Report, existing legal instruments and best legal practices.

It is offered for purposes of discussion and possible elaboration by PNA Members in the broader decisionmaking process. The aim is to promote better understanding of the legal elements underpinning the decisions to be taken by regional leaders under the broader project.

To facilitate understanding of the basis for the proposed framework, references to relevant provisions in the Nauru Agreement, Palau Arrangement and FSM Arrangement are shown in footnotes for applicable sections.

Arrangement of Indicative Articles

1. Definitions[89]

Key terms used in the arrangements would be incorporated from existing definitions in the PA and FSMA, updated as appropriate and aligned with each other, the HMTCs and other regional precedent as appropriate.

New terms used in relation to new provisions would be incorporated.

2. Objective[90]

The objectives of the integrated instrument may the following elements, recognizing Parties sovereign rights over resource, and their responsibility to ensure the sustainability of shared fish stocks:

- establish and implement common standards and procedures for fisheries conservation and management;
- maximise benefits and economic returns from the fisheries resource, and to that end cooperate in the development and participation in commercially-based initiatives.

3. Principles

This is not addressed in any existing instrument, but is "best practices" and could refer to: e.g., cooperation and coordination, sustainability of the resource, maintenance of a healthy ecosystem, compliance, information exchange, transparency, accountability.

4. Application[91]

The application of the instrument should be agreed, e.g., to a stated geographical area (including eezs and high seas areas), parties and as appropriate vessels and persons. It can be broadly stated, for example to apply to vessels that have unresolved cases for IUU fishing pending in other parts of the world.

5. The Organisation[92]

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89 The instrument could build upon and align existing definitions in the PA (Article 1), PSVDS (Article 1) and FSMA (Article 1).

90 Provisions of the instruments could be drawn upon, as well as the decisions on the recommendations in the Report, as follows: NA (Article II), PSVDS (Article 2) and FSMA (Article 2).

91 The areas of application are stated in the definitions sections of the PA and FSMA (Article 1 for each) and the NA refers to foreign fishing vessels in the Parties' Fishing Zones.

92 None of the instruments set up an Organisation because the objective was to agree on standards and arrangements which the parties would be responsible for implementing. The PNA Office was not formally established, except by amendment to the PSVDS which implied establishment by designating as the Administrator the Director of the PNA Office (Article 11). The PA refers to the PNA Office in Article V of the Nauru Agreement as amended, but a copy of this amendment was not available on the PNA website.

The name (e.g. PNA Organisation, or other) and institutional framework of the organisation should be established. For example (indicative only, this could be elaborated to accommodate administration under the current FSMA and NA):

(a) PNA Committee
(b) VDS Board of Directors
(c) Trading/Auction mechanism
(d) Compliance Committee
(e) Finance and Administration Committee
(f) Secretariat
(g) Such other component as may be agreed among the Parties.

The legal personality and seat of the Secretariat should be indicated.

6. Institutional functions and responsibilities[93]

The functions, responsibilities and processes for each of the above indicative institutional components should be described, mindful of the two main functions of the Organisation: conservation and management, and commercial activities.

The mandate of the Organisation in respect of fisheries conservation and management would need to be expressed: an *advisory body* (to decide and advise on common standards for implementation by Parties), a *management body* (to take conservation and management decisions binding on its members). In this sense, the text of the Report recommends continuation of a strong role for members in terms of issuing licenses and participation in FIMS, and a supportive/advisory role for the Secretariat.

The mandate of the Organisation in respect of the legally binding nature of commercial decisions would need to be determined.

As appropriate, the recommendations in the Report relating to the VDS, as well as requirements of the FSMA and NA could be included throughout this part and a separate subsidiary body or bodies established for the activities under the latter two instruments.

Examples of functions and responsibilities of the indicative institutional components are shown below.

(a) PNA Committee[94]

The instrument should provide for structure, drawing upon provisions in existing instruments, and functions. The latter could include e.g. annual review of and decisions relating to the work programme and budget, working groups, [95] corporate plan/strategy, compliance, recommendations of the commercial arm.

[93] These are not addressed as such in the instruments because they did not establish an organisation.
[94] Drawing upon provisions in the NA (Article V.2), the PSVDS (Article 2.4) and the FSMA (Article 9).
[95] E.g. established under PA Article 5.

Arrangements for meetings (including those of officials and Ministers), decisionmaking, rules of procedure, financial regulations, elected officers, a bureau and other matters should be addressed.

The Committee's institutionally-related authorities should be described, such as establishing subsidiary bodies and appointing working groups.

(b) Commercial arm (VDS Board of Directors)[96]

The Report recommends that a commercial arm should be established and governed by a VDS Board of Directors, which would replace the existing VDS Committee, guided by a clear VDS objective. This would result in a clear separation of the broader governance of the Pan FSMA and NA from the operational management of the VDS (Section 2.1 items 1-3).

The function of the VDS Board of Directors could be to attain a stated objective of the VDS, as noted in section 2.1 of the Report.

The Board would need to have clear decisionmaking powers and, although the Report does not refer to oversight of the Board, one option is that it may make recommendations to Ministers as specified in an agreed legal instrument.

The appointment, term, functions, rules of procedure and accountability of a VDS Board of Directors would need to be described. The Report notes in section 2.1 that professional qualifications for board members should be developed.

Rules relating to disclosure of interest and conflict of interest should be adopted.

Legal best practices could include indicative options along the following lines:

(i) *Appointment*

- For an independent Board of Directors with commercial expertise: a recruitment process could be agreed, for example identification of qualifications, a call for applications and selection by a committee of the Organisation (or the country) that would comprise commercial expertise, e.g. the Governor of countries' Central Banks.

- For a representative Board of Directors: Parties could be invited to appoint one representative each, in accordance with agreed procedures and standards.

(ii) Functions

[96] None of the Agreements establish such a body and decisions on recommendations in the Report would guide its establishment, but its functions or activities may be relevant as appropriate to existing provisions in the PSVDS (Articles 2.3, 3, 4, 5, 6, 7 and 12) and the FSMA (Articles 6, 9, 10).

The generally indicates that the VDS Board should "carry out the functions of a corporate Board engaging the VDS Administrator/PNAO Director, approving budgets, setting certain parameters for the administration of the VDS, approving changes in the PNA Office."

However if it is agreed to merge the Administrator's functions under the NA, PA and FSMA, as is already the case, and the Board is only operating under what is now the PA, it may be useful to consider that the Committee be responsible for engaging and overseeing the Administrator/PNA Office Director generally, and the VDS Board overseeing that part of the work done on its behalf.

Some other options for functions of a Board, based on legal best practices and the Report in general, could include the following:

- Formulate commercial and trade strategies relevant to the objectives and functions of the VDS and the Organisation;
- Make recommendations/decisions in relation to the VDS, including setting benchmark prices, trading arrangements and overseeing compliance and implementation, fees for VDS administration, charges for Vessel Days and distribution of funds among Parties;
- Make recommendations on mechanisms or rules to manage effort creep (section 2.3 item 7);
- Make recommendations on allowing for the entry of new Parties to the VDS and a mechanism for calculating their proportional share of the VDS (section 2.3 item 4);
- Manage trading arrangements as appropriate;
- Liaise with relevant organizations and institutions.

(c) Trading/Auction mechanism

The Report recommends that work on designing auctions for VDs be initiated (2.5 item 4). Such a trading/auction mechanism or other mechanism could serve as broker of vessel days among fishing companies. In a legal instrument, the functions and rules – or identification of a process for development of rules – would need to be stated.

Relevant recommendations of the Report also include: studying the advantages and disadvantages of making the VD more homogeneous, allowing free trading of VDs between partners and development of a framework for facilitating trades; and allowing fishing companies to switch their VDs between EEZs under specified restrictions (section 2.5 items 1-3).

Indicative legal best practices provide examples of rules which could ultimately form part of a trading mechanism. They include eligibility criteria for vessel-owners, procedures for participation (e.g, owner-bids submitted under an auction system of fair market value assessment), designating a reserve price, prerequisites for and acceptance of bids, conduct of the auction, designation of the successful bid(s), conditions for payment, designating the right to reject tenders/bids, other conditions for the fishing rights, the period of validity and consequences for non-compliance with any condition of the auction process and award.

(d) Compliance Committee

The Report recommends that the VDS rules be as clear and complete as possible, have clear statements of the process of dealing with violations and relevant sanctions, penalties or compensation, as well as an "adjudication process" to determine the foregoing (section 2.7 items 1-3).

In each legal instrument, the Parties are responsible for compliance by their nationals and vessels with decisions taken pursuant to the instrument.

Establishment of a Compliance Committee under the Organisation could have functions to review compliance by Parties/Vessels/other with compliance and MCS requirements of the legal instrument(s), including results of any dispute prevention/resolution or arbitration, perform such tasks as may be assigned by the PNA Committee and make recommendations to the PNA Committee on sanctions, etc according to agreed rules.

It should build upon compliance and MCS obligations of Parties in existing instruments, which could be folded into the integrated instrument.[97]

The VDS Board may also be given authority to review compliance with agreed VDS rules and other stated commercial matters, based on an agreed process for decsionmaking and sanctions and similar recommendations in the Report (section 2.6 item 7, section 2.7 item 3 and section 2.8 items 3 and 4).

(e) Finance and Administration Committee

Establishment of a mechanism such as a Committee of Parties is standard best practice in regional and international organisations. It would, *inter alia*, address the review/oversight of the finance and administration of the Organisation, ensure transparency and accountability, perform such tasks as may be assigned by the PNA Committee and make recommendations to the PNA Committee.

(f) Secretariat[98]

The Report urges in section 2.1 that the PNA Office be formally established as a joint Secretariat to the PA and FSMA and that the functions of the Administrator be combined. This provision would address that option, and requirements from all agreements – as well as current *de facto* practice integrating the functions relating to the NA - could be merged.

The Report also makes a number of recommendations including to separate the management of the VDS systems and processes from broader PNA harmonization issues, clearly demarcate functions between the PNA Office and the VDS

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[97] Compliance requirements in NA Article VII, PA Article 3.5, PSVDS Article 10 and FSMA Articles 12 and 13. MCS in FSMA Articles 14, 15, 16.

[98] The Agreements refer to duties of an Administrator (PSVDS Article 11 and FSMA Article 7(1)), and the PA sets out functions of a Secretariat as such, including a Director (Article 7).

Administrator, and designates various responsibilities of the VDS administrator (section 2.6, items 1, 2, 3, 4, 5, and 6).

General functions of a Secretariat in best practices include appointment, general duties and accountability of the CEO, requirement for cost-effectiveness, establishment of transparent guidelines/procedures and options/criteria for procurement and outsourcing.

Functions should be included that encompass existing activities of the PNA Office, described in section 2.2 above, together with flexibility to allow for the designation of future responsibilities by the Organisation.

The administrative and reporting responsibilities of the broader Secretariat and those of the commercial arm (e.g. VDS, trading) should be clearly distinguished , based on decisions relating to the recommendations of the Report.

The matters to be implemented by Parties, but reported to the Secretariat, should catered for in a provision on "Obligations of the Parties" as shown below.

7. Financial[99]

Requirements should be included concerning adoption of financial regulations, sources of finance, auditing, reporting, revenue sharing, distribution of payments and other appropriate areas, taking into account the PNA Office commercial activities being developed.

8. **Decisionmaking**

The instruments generally do not provide for decisionmaking, except that the PA provides that the decisions of the Management Meeting must be arrived at by consensus and will be binding on the Parties. NA and FSMA require unanimity for amendments to the instrument. None of the instruments defines a quorum for decisionmaking.[100]

The Report addresses this issue in section 2.1. It recognizes that governance is currently done by consensus but underlines the importance of providing for decisionmaking for a commercial arm, in accordance with business practices, where a vote may be taken on matters of substance if agreement cannot be reached by consensus.

Best legal practices for regional organisations encourage decisions by consensus but if this cannot be reached, matters of procedure require a majority, and matters of substance require a three-quarters majority of members present and voting. The issue of whether something is a matter of substance is treated as such.

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[99] This could draw upon the following provisions: in the PSVDS requirements that relate to fees for VDS administration, charges for vessel days (Article 14) and in the FSMA requirements that provide for the distribution of payments (Article 10) and auditing of accounts (Article 11).

[100] The FSMA is the only instrument that requires Rules of Procedure: Parties are to adopt and amend rules of procedure for annual and special meetings, and FFC rules are to apply pending adoption. The requirements for a quorum could be stated in the Rules, but it is better to entrench this in the main instrument unless it is foreseen that flexibility may be needed.

The legal status of Resolutions and Declarations of the Organisation should be defined. None of the instruments currently address this.

9. Obligations of parties[101]

It is best practices to describe the obligations of Parties in regional instruments, for example those in the Conventions establishing SPRFMO (Article 24) and WCPFC (Article 23). General obligations of Parties could include reporting to the Secretariat and provision of data and information *inter alia* on fishing, licensing, the Area allowed for fishing, implementation of the instrument, compliance (including by their nationals and vessels) and other areas to be agreed.

10. Information[102]

Legal underpinning is needed to provide for the handling of information by the Organisation and its Parties. The Report makes a number of suggestions to this effect in section 2.8 on transparency, for which a process to develop rules could be designated (section 2.8, items 1, 2, 5, 6, 7, 8, 9 and 10).

The instrument should include basic standards for confidentiality.

11. Registers of information and information systems[103]

The Report makes recommendations regarding the establishment of register of trading information (section 2.8 items 5, 6, 8, 9 and 10) and refers to the operation of the FIMS information system (section 2.6). As appropriate a legal basis for establishment of the registers and operation of the FIMS system could be included in the instrument, possibly under separate provisions.

It is suggested in the Report that the VDS-related registers could be administered by the commercial arm, including (possibly as components of a broader VDS registry) including a Vessel Registry, a PAE Registry and a Company Registry. It is anticipated that the FSMA Register of Eligible Fishing Vessels would also need to be included.

The FFA-administered Regional Register of Foreign Fishing Vessels could continue to play a role in relation to the licensing of vessels, but this should be included elsewhere.

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[101] The instruments do not have a specific provision on the Obligations of Parties, which is best practices for RFMOs, including WCPFC. However it could draw upon existing provisions, e.g. the PA requires Parties to ensure compliance by nationals and vessels (Article 3.5), the PSVDS requires Parties to ensure compliance by its licensed vessels (Article 10) and the FSMA has a similar provision (Article 12) and requires parties to ensure confidentiality of data concerning fishing activities by its vessels in the waters of other Parties (Article 9).

[102] This could draw upon the PA which requires the Parties to provide certain information to the Secretariat (Article 7) and the FSMA which requires the Administrator and Parties respectively to provide certain information and maintain confidentiality (Article 9).

[103] This could draw upon provisions relating to registers under the NA (Article 1), the PA (Article 7) PSVDS (Article 8) and the FSMA (Articles 3 and 4), and to information systems including statistical data provided by other organizations as in NA (Article 19). The NA refers to the FFA Regional Register (Article 1).

12. Licensing[104]

The Report recommends that Parties continue to license vessels. The provisions on minimum standards for a vessel licensing process are provided in the Nauru Agreement and the FSM Arrangement addresses a regional access license, these should be addressed in view of any decision on the recommendations of the Report.

13. Monitoring, control and surveillance[105]

The Report focuses on compliance with the VDS Rules by Parties. The region in general has developed forward-looking instruments, strategies and mechanisms for MCS, but provisions in existing instruments may be reviewed and strengthened as appropriate, including those relating to cooperation in enforcement,[106] compliance powers,[107] arrest and seizure,[108] joint surveillance[109] and port State enforcement.[110]

14. Observer Programme[111]

The provision in the FSMA concerning establishment of an Observer Programme may be reviewed with the aim *inter alia* of ensuring transmission of information on compliance with the VDS, as recommended in the Report, and its relationship with other regional observer programmes. Standards, guidelines and procedures for the operation of the Observer Programme should be included in accordance with best legal practices.

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[104] Licensing is currently addressed in the NA (Article III), PA (Article 7.2 – Director to coordinate the licensing, management mechanism and other mechanism under this Arrangement and FSMA (Article 6).

[105] Various aspects of MCS are in the instruments: NA addresses MCS (Article VI) and cooperation in enforcement (Article VII); the PA requires the Director to evaluate (a) the level of compliance by, inter alia, assessing returned catch reports on the SPC/FFA Regional Tuna Fisheries Database; and (b) reports received from Parties relating to compliance by fishing vessels with Parties national laws and reporting requirements; and the PSVDS provides requirements for ALCs for purse seiners (Article 9) and as noted above under "Obligations of Parties", all require Parties to ensure compliance by licensed vessels. Other aspects of MCS are noted below.

[106] The NA requires Parties to develop cooperated and coordinated procedures (Article 8) and the FSMA requires Parties to insist in the investigation of alleged violations and a process where there are reasonable grounds to believe a violation has occurred (Article 13).

[107] The PSVDS (Article 10) and FSMA (Article 12) to ensure compliance.

[108] The FSMA sets out a procedure where nationals or fishing vessels of one party are arrested or seized by another (Article 14).

[109] The FSMA requires Parties to cooperate in enforcement in accordance with the Niue Treaty (Article 15).

[110] The FSMA permits a vessel to be detained where inspection of catch and documents discloses reasonable grounds of contravention of the FSMA (Article 26). However, this is an exceptionally weak provision in view of emerging international law and standards.

[111] The FSM elaborates details of an Observer Programme to be established by Parties.

15. Relationship with other international or regional agreements[112]

The instruments respectively refer to relationships between them and other international, regional and bilateral agreements, and such references could be updated, consolidated and strengthened to apply as widely as possible.

Key provisions include: a standard provision that the instrument does not derogate from existing obligations;[113] a requirement that the annual meeting must consider procedures to consult with DWFNs, fishing parties, fishing organizations and other relevant organizations and provide direction to the Administrator;[114] circumstances for non-application of the instrument to the US Treaty vessels;[115] application of the PSVDS to vessels operating under a FSMA license;[116] an objective of the FSMA that it should be consistent with the PA and further the objectives of the NA;[117] relations with FFA[118] and cooperation by parties under the Niue Treaty.[119]

If the instruments are integrated, the existing description of relationships should be streamlined as appropriate and, at the same time, broadened in a general manner to establish a mechanism that promotes consistency and clear relations with other regional organizations and agreements.

16. Cooperation with non-Parties

The PA declares that the Parties recognise the need to cooperate with other states or international organisations having an interest in the tuna resources within the Area. (Article 6) Otherwise none of the instruments provide for cooperation with non-parties, which is recommended in the Report in section 2.4 in the context of the VDS.

The Report recommends that VDS partners actively try to expand the VDS coalition or at least attempt to get nations in the competitive fringe to act cooperatively with the VDS (section 2.4 item 1).

17. Review and implementation[120]

The NA and PA require review of implementation of specified measures at an annual meeting and the FSMA sets out items for review and evaluation. The annual meetings of the Parties to the PSVDS are only mandated to " consider matters related to the administration of this Management Scheme",[121] and there is no provision for review of implementation by Parties.

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[112] Existing provisions could be drawn upon: NA (Article VIII), PA (Articles 3.2 and 6) and PSVDS (Articles 3 and 4) and FSMA (Article 2(e) and (f), Article 7 and Article 15).
[113] NA Article VII.
[114] PSVDS Article 2.4.
[115] PSVDS Article 3.
[116] PSVDS Article 4.
[117] FSMA Article 2.
[118] FSMA Article 7.
[119] FSMA Article 15.
[120] The PNA Implementing Arrangement requires Parties to review implementation at annual meeting and decide on future application taking into account specified considerations (Article II).
[121] Article 2.4.

An integrated instrument should cater for reviews of implementation/compliance by Parties and administration by the Secretariat (and commercial arm, if this is established), as well as reviewing the effectiveness of the instrument and decisions taken under it.

The Organisation should be empowered to determine the terms of reference and methodology for such reviews and take into account their recommendations.

18. Dispute prevention and settlement[122]

Background explanations for this section are given in section 3.2.1 of the text above.

(a) General requirements for dispute prevention and settlement

As general requirements, Parties should be obligated to cooperate to prevent disputes. Where the interpretation or implementation of the instrument is the subject of dispute among two or more Parties, the instrument should encourage them to consult among themselves with a view to resolving the dispute, or to having the dispute resolved by negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement or other peaceful means of their own choice.

(b) Technical disputes

Where Parties cannot resolve technical disputes between themselves, procedures for establishment of an *ad hoc* expert panel or use of a *sole expert* should be agreed by the Organisation.

The panel should be required to confer with the Contracting Parties concerned and endeavour to resolve the dispute expeditiously without recourse to binding procedures for the settlement of disputes.

Examples of procedures to establish an *ad hoc* panel could involve a process for designation of panel members (suggestions in text), agreement on the terms of reference, the number of panelists, timeline, various notifications and submissions, oral/written procedures, venue, costs and the non-legally binding nature of the process.

Examples of procedures to designate a *sole expert* could involve designation by mutual agreement or appointment by a specified institution or institutions, and other procedures similar to those used for the *ad* hoc panel.

(c) Legally binding dispute resolution mechanisms

Where a dispute is not referred for settlement within a reasonable time of the consultations referred to in paragraph 2, or where a dispute is not resolved by recourse to other means referred to in this article within a reasonable time, possible legally binding dispute resolution mechanisms may be stated.

[122] The PA requires parties to consult at the request of any Party with any other Party within sixty days of the date of receipt of the request (Article 8). The FSMA (Articles 18 and 19) which aim to encourage the parties to settle disputes through means of their own choosing.

(i) Dispute resolution under UN Conventions

Dispute resolution elaborated under the Law of the Sea Convention, the Fish Stocks Agreement and others is discussed in the text.

(ii) Dispute resolution by arbitration

A key consideration in designing an arbitration mechanism is the identification of relevant arbitration rules, and where Parties cannot agree an instrument should designate applicable rules. There are two main choices: the Rules of the Permanent Court of Arbitration (PCA) or those of the United Nations Commission on Trade Law (UNCITRAL). It is recommended in the text that UNCITRAL Rules could be the better option.

An arbitration mechanism should include the following rules:

- The arbitration will be final and binding.
- A Party may make a request for consultations.
- Consultations among Parties shall be held within a given time (e.g. 60 days of receipt of a request).
- Other Parties to be notified of the request and may participate in the consultations in a stated capacity.
- A timeframe for proceeding to arbitration must be agreed (e.g. 120 days after receipt of a request).
- The *compromis*, or agreement on terms of reference for the arbitration must be agreed in accordance with applicable Rules.
- Number of arbitrators (e.g. can be a sole arbitrator or a panel of three).
- Appointment of arbitrators (e.g. by agreement of parties, by each party appointing one arbitrator and the arbitrators selecting a third, failing agreement on appointment designating an appointer such as the Secretary General of the Permanent Court of Arbitration at The Hague).
- Place of arbitration (e.g. failing agreement by the Parties at a designated place).
- Language of arbitration.
- Non-confidential nature of the arbitration (public proceedings and arbitral award, unless the Parties otherwise agree).
- Parties to promptly carry out the award and/or other decision of the arbitration.
- Costs of the arbitration.

19. Amendment[123]

The PA requires amendments to be taken by consensus, and the NA and FSMA provide for amendment by unanimous decision. The PSVDS only caters for amendment to the VDS itself and not to other legal aspects of the instrument. The FSMA process for amendment states the time an amendment will become effective and includes a procedure for proposals by Parties to establish Closed Areas or Limited Areas and a provision

[123] NA Article XI; PA Article 9 ; PSVDS Article 13; FSMA Article 24.

None of the existing instruments has a procedure for amendment setting out the role of the Depositary and comprising requirements for making proposals (e.g. circulation to the Parties within a specified time frame of an annual meeting) or circulating an agreed amendment to Parties.

20. Ratification and entry into force[124]

The NA requires ratification, the PA requires ratification by a minimum of five Parties including five signatories including FSM, Kiribati and PNG, the PSVDS makes no provision and the FSMA requires signature but not ratification and provides for entry into force 30 days after the signature by the last to sign of the FSM, Kiribati and PNG.

An integrated instrument may require either signature or ratification, but mindful of the subject matter and commercial aspects, countries may prefer ratification. The instrument should state the countries that eligible to become Party, if it is not already stated under the provision on application of the instrument.

Parties should agree on requirements for entry into force of an instrument.

[124] NA Article X; PA Article 9; FSMA Articles 20 and 21.

ANNEX IV
COMPARATIVE TABLE OF THE CONSOLIDATED TABLE IN ANNEX II OF THE TEXT OF
Nauru Agreement/Implementing Arrangements, Palau Arrangement, Purse Seine Vessel Day Scheme, FSM Arrangement and INDICATIVE FRAMEWORK IN ANNEX III for an Integrated Instrument

The requirements of existing instruments vary; constraints, gaps and inconsistencies were identified above in section 3.1, Annex II and Annex III.

This chapter makes a number of recommendations to address the constraints, gaps and inconsistencies, and the indicative framework for an integrated instrument was developed to promote legal underpinning for them, as well as to provide an example of a robust instrument consistent with best legal practices.

A comparative table of the framework of provisions in the consolidated table the four legal instruments, and the indicative framework for an integrated instrument appears below. Its objective is to show possibilities for integration of the instruments into a streamlined and consolidated instrument, including options for institutional elements.

Although many elements of both frameworks appear identical, the content is not necessarily the same, as described in Annex III. Draft Articles in the indicative framework for which no provision exists in any of the instruments is indicated by an asterisk (*).

CONSOLIDATED TABLE of the text of the Nauru Agreement/Implementing Arrangements, Palau Arrangement/Purse Seine Vessel Day Scheme FSM Arrangement	INDICATIVE FRAMEWORK for an Integrated Instrument
1. Definitions 2. Coordination of fisheries management 3. Objective 4. Regional Register of Foreign Fishing Vessels 5. Register of purse seine vessels 6. Register of eligible fishing vessels 7. Secretariat/ Administrator 8. Functions of Administrator 9. Meetings of the Parties 10. Decisionmaking 11. Establishment of a VDS Committee 12. Application/Scope of the instrument 13. Non-application to certain purse seine vessels 14. Application to certain purse seine vessels 15. Obligation to limit fishing days 16. Calculation of fishing days 17. PAE Adjustments: transfers between Parties and pooling 18. Calculation of TAE and PAE 19. Licensing 20. Provision of information 21. Statistical data 22. Distribution of payments	1. Definitions 2. Objective 3. Principles* 4. Application 5. The Organisation* 6. Institutional functions and responsibilities* (a) PNA Committee (b) Commercial arm/VDS Board of Directors (c) Trading/auction mechanism (d) Compliance Committee (e) Finance and Administration Committee (f) Secretariat 7. Financial arrangements* 8. Decisionmaking 9. Obligations of parties* 10. Information* 11. Registers of information and information systems 12. Licensing 13. Monitoring, control and surveillance 14. Observer Programme

23. Fees for VDS administration, charges for vessel days 24. Auditing of accounts 25. MCS 26. Cooperation in enforcement 27. Compliance powers 28. Arrest and seizure 29. Joint surveillance 30. Port State enforcement 31. Observer Programme 32. Relationship with other international or regional agreements 33. Implementing arrangements 34. Review and implementation 35. Decisionmaking 36. Dispute Settlement 37. Amendment 38. Ratification	15. Relationship with other international or regional agreements 16. Cooperation with non-Parties* 17. Review and implementation 18. Dispute prevention and settlement 19. Amendment 20. Ratification and entry into force