New Tuna Regimes: Governing Sustainability and Equity in the Western and Central Pacific Ocean

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Thesis

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Te Mauri, Te Raoi ao Te Tabomoa
Health, Peace and Prosperity

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List of Abbreviations

CMM	Conservation and Management Measures
CoC	Chain of Custody
DWFN	Distant Water Fishing Nations
EEZ	Exclusive Economic Zone
Ell	Earth Island Institute
EU	European Union
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organisation of the United Nations
FFA	Pacific Islands Forum Fisheries Agency
FIP	Fisheries Improvement Project
FPA	Fisheries Partnership Agreement
FSM	Federated State of Micronesia
FSMA	Federated State of Micronesia Arrangement
HCRs	Harvest Control Rules
IA	Implementing Arrangements
ICCAT	International Commission for the Conservation of the Atlantic Tuna
IOTC	Indian Ocean Tuna Commission
IPNLF	International Pole and Line Foundation
ISSF	International Seafood Sustainability Foundation
IUU	Illegal, Unreported Unregulated
MOU	Memorandum of Understanding
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
MT	Metric Tonnes (also mt)
MTCs	Minimum Terms and Conditions
NGO	Non-governmental Organisation
NIE	New Institutional Economics
OPAGAC	Organizacion de Productores Asociados de Grandes Atuneros Congeladores (also, Producers' Association of Large tuna Freezers)
OTR	Old Tuna Regimes

PA	Principal-Agent
PAEs	Parties Allowable Efforts
PhD	Doctor of Philosophy
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
RFMO	Regional Fisheries Management Organisation
RP	Reference Points
SCRS	Standing Committee on Research and Statistics
SPC	Secretariat of the Pacific Community
sq km	Square kilometre(s)
TAC	Total Allowable Catch
TAE	Total Allowable Effort
UNCLOS	United Nations Convention on the Law of the Sea
UNFSA	United Nations Fish Stocks Agreement
US	United States
UST	United States Tuna Treaty
VDS	Vessel Day Scheme
WCP	Western and Central Pacific
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WWF	Worldwide Fund for Nature

Chapter 1. Introduction

1.1 Tuna institutions facing dynamic interests

Overfishing and overcapitalisation of fisheries over the last four decades has raised concerns about the ongoing sustainability of global seafood provision. Such concerns are even more pronounced in so called trans-boundary fish stocks such as tuna. For instance, the most recent global assessment indicates that only 69% of fish stocks are within biologically sustainable levels, down from 90% in 1974 (FAO 2016). But tuna has in general terms fared even more poorly. Among the principal tuna species, 41% of stocks are estimated to be fished at biologically unsustainable levels (FAO 2016). If tuna stocks are continued to be made vulnerable to overexploitation it will have a measurable impact on global seafood consumption. Total annual catches of tuna and tuna like species is 7.7 million tonnes, or 9% of total global fisheries production. It will also have an impact on wealth and wellbeing of coastal, and predominantly developing nations, who catch these tuna, with international trade worth of around US$ 6 billion a year.

On closer inspection the importance and sustainability of 'tuna' is divided clearly among species. The largest single set of tuna species are found in tropical waters. Just under half of global tuna catches are skipjack tuna with 3 million tonnes landed each year. The complication is that skipjack associates with yellowfin (1.5 million tonnes per year) and bigeye tuna (400,000 tonnes per year) (FAO 2016). But while skipjack is neither overfished or subject to overfishing, both yellowfin and bigeye have at different times been overfished and subject to overfishing (Harley et al. 2015). The reason for the precarious status of yellowfin and bigeye is that juveniles of these two species are caught with skipjack as so called 'non-target species' of purse seine fisheries utilising fish attraction devices – floating buoys around which pelagic species including tuna congregate (see Hare et al. 2015). While fishing and coastal nations wish to continue expanding skipjack catches, stock assessments have signalled the need to set limits on the exploitation of yellowfin and bigeye. As argued by Allen (2010), the reluctance to set such limits highlights many of the challenges facing trans-boundary fisheries worldwide.

States have made gradual progress in creating effective management regimes for trans-boundary tuna stocks. Two important developments have been made in the last four decades. First, the United Nations Convention on the Law of the Sea was ratified in 1982, establishing exclusive economic zones under the jurisdiction of coastal states (EEZs) (UN 1982). Second, the United Nations Fish Stock Agreement (UNFSA) of 1995, provided a framework for countries to cooperate in the multilateral management of trans-boundary stocks such as tuna, through the establishment of regional fisheries management organisations (RFMOs). Central to the UNFSA is the promotion of science-based and precautionary approaches to set limit reference points for fishing effort.[1] But in spite of these requirements for RFMOs being clearly set out in the UNFSA their application has remained patchy at best (see Aranda et al. 2012).

[1] See Article V and VI of the UNFSA 1995.

The apparent slow progress by RFMOs in fully complying with the UNFSA is underlined by the economic importance of tuna to coastal states and fishing nations, as well as its role in providing global markets with a relatively cheap source of (canned) protein. Defining sustainable fishing has been made contentious by the different positions and agendas of these coastal and fishing states, who support a highly diverse harvesting industry and highly concentrated processing industry for seafood (Havice et al. 2010, Havice et al. 2017). Seen as such, tuna fisheries provide insights into contemporary global environmental governance, replete with dynamic political interests of commercial sectors, conservationists and sovereign states (Hanich et al. 2010, Havice et al. 2017). Comparisons can be drawn to climate change, another trans-boundary environmental problem, where achieving international consensus on stabilization targets for greenhouse gas emissions through various mitigation measures is fraught with the misalignment of interests of politicians, scientists and policymakers (Young 2003, Wangler et al. 2012). In the case of tuna fisheries, state arrangements for management have been slow and ineffective because of the competing economic and political interests that continue to undermine long-term cooperative decisions.

The key challenge of the international tuna regime, like the governance of other global commons, is one of cooperation. Current institutional regulatory frameworks, including RFMOs, are thought to be insufficient to achieve the policy goals of biological and economic sustainability (Petersen 2006). This is because of (1) the diverse and dynamic political interests of actors, (2) inappropriate incentives for continuing unsustainable fishing practices, (3) inadequate knowledge on the impacts of different fishing gears such as fish aggregating devices (FADs), and (4) the continued high demand for limited resources and ineffective governance (Grafton et al. 2006). From the perspective of coastal states, allowing increased catches in their waters also provides a short-term means of supporting the small isolated populations (Langley et al. 2007, Langley et al. 2009, Harley et al. 2011). Central to the challenge of instituting sustainable management is therefore finding ways of combining short and long term benefits from tuna fisheries to incentivise cooperative decision making.

Arguably the region best representing the apparent trade-offs between sustainability and equitable wealth generation from tuna is the Western and Central Pacific Ocean (WCPO). In this region eight small island coastal states account for 60% of global tuna catches (Hamilton et al. 2011), and as such share a common interest to increase economic returns from their tuna resources. But like all other ‘tuna regions’ in the world (such as the Eastern Pacific, North Atlantic, Southern Ocean and Indian Ocean) instituting sustainable management has been complicated by not only the migratory nature of tuna stocks, but the predominance of distant water fishing fleets (with historical claims) operating in their waters. In the WCPO this is all the more pronounced because Pacific island nations have never invested in fishing fleets, leaving the extraction of tuna in their EEZs to these distant water nations in return for access fees. Also common to all tuna management is the wider challenge of cooperation between fishing states over fish in the high seas or what are termed ‘areas beyond national jurisdiction’.

From the perspective of Pacific coastal states then, instituting effective tuna management faces two major challenges. First, the challenge of overcoming what they perceive to be an unequal distribution of economic returns to fishing nations from the tuna resources (see also Chand, Grafton et al. 2003, Aqorau 2006, Barclay and Cartwright 2007, Aqorau 2009, Havice 2010). Second, and closely tied to the first, ensuring that ambitions to maintain or

even increase wealth to coastal states based on purse seine fishing with FAD targeting skipjack tuna does not negatively impact on yellowfin and bigeye tunas (see also Langley, Wright et al. 2009, Harley, et al. 2014 Hare et al. 2015). Balancing these issues goes to the heart of what can be termed the 'tuna dilemma' – coastal states argue that they are not receiving a fair share of the benefits from the tuna fishery, which has undermined their ability or willingness to reach an agreement over sustainability.

Taking this tuna dilemma as a starting point, this thesis argues that successful implementation of effective tuna fisheries management in the WCPO requires governance arrangements that can address both sustainability and equity – or put in more common terms, 'sustainable development'. Sustainable development remains a contentious concept given its definition and application depends on the perspective of different countries and socio-economic contexts. The common understanding of the term sustainability is derived from the 1987 United Nations Brundtland Commission definition of "meeting the needs of the presents without compromising the ability of future generations to meet their own needs" (UN 1987, p.6). It emphasises the need for long term goals in decision making that ensures both social and economic development to be defined in terms of sustainability for all countries. Equity is inherent to this definition, referring to the best possible outcome in sharing economic benefits between participating actors, i.e. between the harvesters and coastal state resource owners (Aqorau 2006, PNA 2010).

In tuna management, sustainability of tuna stocks and equal distribution of tuna benefits, is addressed by setting long term biological and economic objectives of coastal states and by creating institutions responsible for tuna management in the WCPO (Parris et al. 2006, Parris 2010, Yeeting et al. 2016, Emery et al. 2017). It is well understood that sustainability and equity can be achieved through better cooperation and adequate management strategies, through efficient institutions (Squires et al. 2016). Efficient institutions are those that can facilitate coordination between dynamic actors and interests toward a common goal (Hilborn et al. 2005). This refers to the role of so called 'governance institutions' in organising and enforcing management measures through appropriate regimes, contracts and agreements (Williamson 2000, Pacheco et al. 2010). Appropriate regimes refer to implicit and explicit principles, norms, rules and decision making procedures, that incorporate incentive schemes that can influence individual choices to secure collective welfare and improve collective participation (Grafton et al. 2006, Pacheco et al. 2010, Kozenkow 2013, Squires et al. 2016).

Academic scholarship on international fisheries (and environmental) agreements suggest that (full) cooperation is ideal (Munro 2004, Bailey et al. 2010, Hannesson 2011). Much of this literature, however, focuses on state-to-state cooperation and not on the myriad other 'private' or market actors that also cooperate to reach sustainability outcomes. It is also not clear in this literature what challenges states face in cooperating with industry and NGOs in developing a mix of economic and political governance arrangements for tuna sustainability. Such cooperative arrangements are becoming all the more important in the tuna industry given the close relationship of distant water fishing nations and private fleets they represent (see Havice and Campling 2017). In response to these gaps in knowledge, this thesis explores the emergent transition away from what might be termed as 'old tuna regimes', dominated by state regulatory systems and state-to-state cooperation, towards what is labelled here as 'new tuna regimes' that combine state and non-state institutions to address historical inefficiencies in achieving sustainability and equality.

This thesis posits that the rise of a new tuna regime can be observed in Western and Central Pacific Ocean (WCPO) where a wide range of state and market based sustainability institutions are being employed in tuna fisheries (outlined by Miller 2014). In particular a sub-group of eight tuna-rich countries of the Parties to the Nauru Agreement (PNA) – signatory of an international agreement signed in 1982 that sets terms and conditions for tuna purse seine fishing licences in their collective EEZs (PNA 1982). The members, made up of the Federated States of Micronesia (FSM), Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea (PNG), Solomon Islands and Tuvalu, have started to play a leading role in creating innovative institutions that combine state and private approaches in managing their tuna for sustainability.

1.2 The Western and Central Pacific and sub-regional PNA

The Pacific region is divided up into two geographical areas: the WCPO and the Eastern Pacific Ocean (EPO) (Figure 1.1). The area of the Western and Central Pacific Fisheries Commission (WCPFC), the RFMO responsible for the management of tuna stocks in the WCPO, was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC Convention) which entered into force on 19 June 2004. Within the WCPO and WCPFC convention area are 22 island states and territories covering over 31 million sq km of ocean space – making it the largest of the five tuna RFMOs globally. The WCPFC is also the youngest of the tuna RFMOs and seen as one of the most successful given the progress it has made in establishing science based advice to members states since its inception.

Within the WCPFC convention area lies the most productive area for tuna – in the equatorial zone stretching between 10^0 north and south of the equator (Langley el at. 2009, Havice 2013). This area directly corresponds to the waters of the eight tuna rich countries of the PNA, providing 80% of the total WCPO tuna catches and around 60% of global tuna supply every year (Hamilton et al. 2011). The PNA countries claim sovereignty over the tuna resources in their collective EEZs, but are challenged with lack of property rights over tuna resources in areas beyond national jurisdiction (see Figure 1.2 for high seas areas).

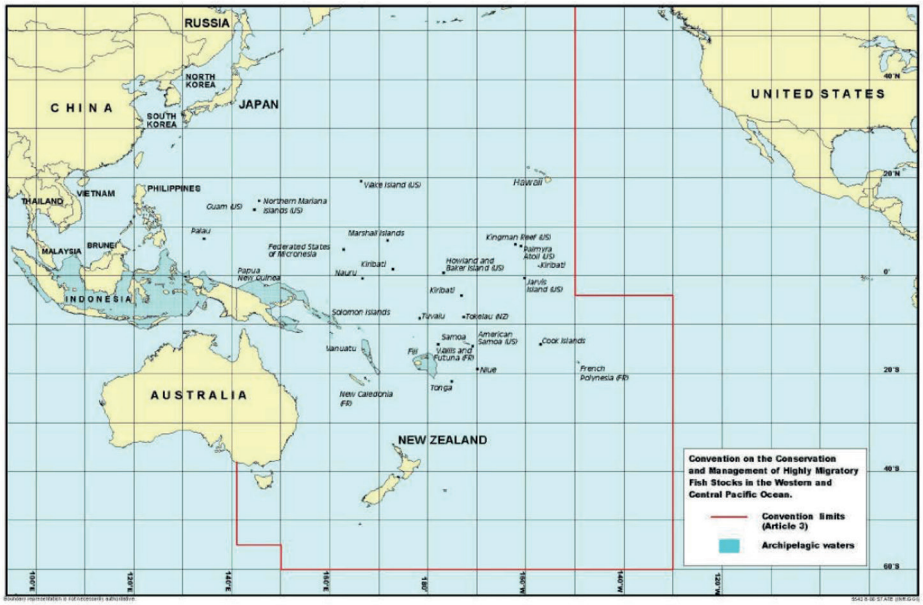

Figure 1.1 Convention area of the Western and Central Pacific Fisheries Commission (source: WCPFC 2000)

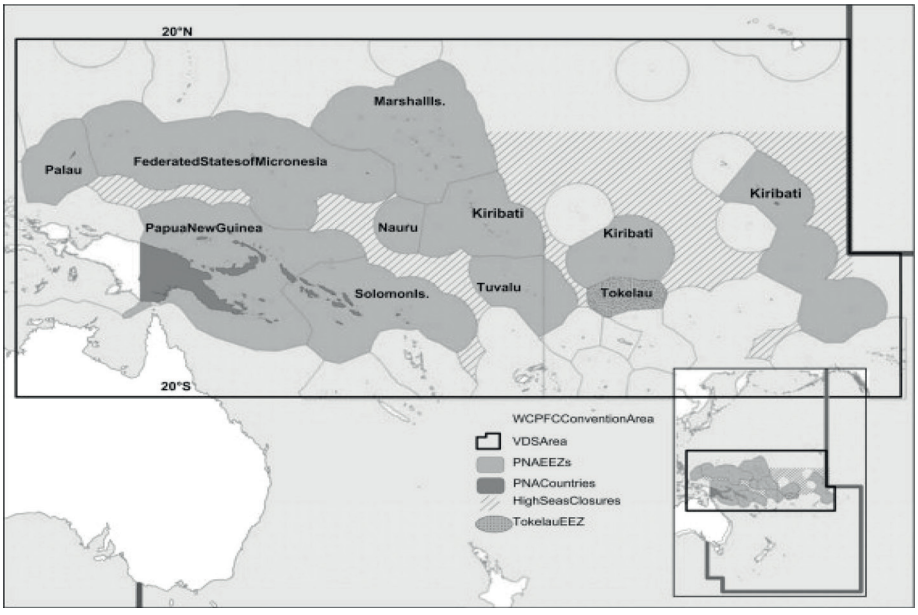

Figure 1.2 Map of the PNA (source: Havice 2013)

The PNA members share 'common interests' over tuna resources given their dependence, as developing island states, upon the rational development and optimum utilisation of tuna resources occurring in their fishing zones and as a common stock (PNA 1982). In an attempt to safeguard their common interests the PNA members took a further step by initiating new tuna regimes to address the complex tuna management issues associated with increasing purse seine efforts in the WCPO (Miller et al. 2014, Yeeting et al. 2016). They adopted a series of new measures including the vessel day scheme (VDS) to control purse seine effort in 2007, three implementing arrangements for effort and catch control for purse seine and fish aggregating device (FAD) management, and went through the third party Marine Stewardship Council (MSC) assessment certification in 2011 that led to the certification of the PNA fishery since 2012. In doing so the PNA have attempted to move beyond the cooperative stalemate that has led to slow progress at the level of the WCPFC. They have, as such, sought to go beyond the limitations of old tuna regimes and explore the possibility of a new tuna regime.

The VDS scheme arises from a cooperative arrangement of the PNA for the management of the western purse seine fishery that accounts for around 80% of the total fishing efforts in the WCPO every year (Havice 2013).[2] It establishes a system of tradable fishing days allocated to the parties in an attempt to regulate and control purse seine fishing effort. There is hope that the VDS would bring efficiency to the fishery if fully implemented by member countries. Successful implementation, therefore, depends on the level of compliance to the VDS rules. But it remains unclear what level of compliance to VDS is needed to maintain the support of the countries supporting cooperation and therefore fisheries regionalism at the sub-regional level.

The MSC certification and eco-labelling scheme is a private-led governance initiative used by the state to help promote sustainability goals. The PNA is using the MSC certification to achieve sustainability goals and in increasing transparency and governance in the fishery. The certification applies to the fishery and harvesting operations up until the catch is landed. More than 40% of the tuna caught in the Western and Central Pacific are MSC eligible (Banks et al. 2012). This certification applied as PNA-licensed WCP Purse Seine sets on unassociated/ Non fish aggregating device (FADs) free schools, and purse seine set using natural log, with skipjack tuna *(Katsuwonus pelamis)* and yellowfin *(Thunnus albacares)* as the target species. Successful implementation requires cooperation and collaboration between PNA member states and private fishing companies thus relevant for the analysis of public-private engagement in promoting multilateral arrangements and fisheries regionalism particularly at the RFMO levels.

In framing the emergence of these in the Western and Central Pacific ocean as a shift from an 'old' to a 'new' tuna regime, this study examines the extent to which barriers to cooperation between states, as well as between states and private sector, can be overcome. Before expanding on the analytical approach taken in the thesis, we first outline key barriers in old tuna regimes.

[2] See Palau Agreement 1992 (Amended 2007, 2009)

1.3 Cooperation in 'old' tuna regimes

Sustainability is as much a problem of (in)efficient institutions as it is of cooperation. (In)efficient institutions are driven by a combination of factors and forces stirred by diverse political interests. In the WCPO, these political interests are coordinated through the complex cooperative arrangements of three regional organisations: the WCPFC, the Pacific Islands Fisheries Forum Agency (FFA) and the PNA (Aqorau 2006). These cooperative arrangements are designed to coordinate diverse political interests of member states in managing their shared tuna resources with aims to maximize economic benefits, as well as to ensure sustainability of tuna stocks. Nevertheless, these cooperative arrangements are often challenged with the unequal distribution of benefits among coastal states, making it difficult to reach an agreement on sustainability goals.

To further understand the central problem associated with this diversity of interests, we now turn to a short review of four key inefficiencies that characterise 'old' tuna regimes in the context of the WCPO: (1) weak political institution to enforce property rights (Barclay et al. 2007, Langley et al. 2009, Havice 2010, Havice et al. 2010), (2) compliance issues in relation to regime ineffectiveness (Langley et al. 2009, Hanich et al. 2010, Pintassilgo et al. 2010, Bailey, et al. 2013), (3) asymmetric information and incentive gaps (Beddington et al. 2007, Vestergaard 2010, Banks et al. 2012, Jensen et al. 2013), and (4) inadequate incentives for fishers and managers to promote precautionary management approaches (Hilborn et al. 2005, Grafton et al. 2006, Bailey et al. 2016, Squires et al. 2016).

1.3.1 Weak political institution (Lack of property rights)

Management of tuna resources are complicated by the weak attribution of property rights that define patterns of exploitation as well as responsibilities for resource stewardship (Aggarwal et al. 2006, Perman et al. 2011). As outlined above, cooperation is needed to effectively manage shared, common and straddling resources like tuna because property rights are held in common. Generally, private use rights allow individuals or corporations to exclude others from using that resource. Common property is where a community, through either formal or informal mechanisms, controls right to exploit a resource held by persons in common (Scott 2000, Aggarwal et al. 2006). States hold common property rights over tuna resources, but allocate and design private property rights through individual quota systems in allowing resource users (private actors) access. However, because of unresolved issues with the design and allocation of property rights in the region, participating actors continue to compete for control and access of tuna resources.

The attribution and allocation of property rights are conducted through designated political institutions. Political institutions are responsible for formal rules such as constitutions, laws, and property rights. The aim of political institutions is concerned with improving coordination, supporting 'good' economic institutions, solving collective action problems and allocating access to resources through the protection of property rights and fostering economic benefits (Acemoglu et al. 2004). Limitations of the formal rules to protect common interests in connection to the allocation of property rights lead to weak political institutions. A common assumption is that the lack of property rights leads to market failure, inefficiencies and the overexploitation of resources (Coase 1984). Efficiency in the allocation

of property rights is often challenged with two issues: (1) the design and assignation of property rights (whether a private, a public or a common system can lead to higher efficiency), and (2) capacity to exercise property rights (transaction and enforcement problems) (Kozenkow 2013). These issues are common to all RFMOs and have the potential to undermine or weaken the formal political institutions to protect property rights.

The design and assignment of property rights is made particularly complex by the nature of migratory species and thus the lack of coastal states property rights beyond national jurisdictions and in the high seas. From the perspective of Pacific island nations, the nature of migratory tuna stocks challenges the effectiveness of sovereign rights over the tuna resources and economic aspirations of nations. In short, these nations have no control over tuna resources outside their jurisdictions (Barclay et al. 2007, Havice 2013). Designing quota systems, whether based on total allowable catches (TACs) or total allowable efforts (TAEs), are often debated for their efficiency in reducing fishing impacts. For instance, New Zealand, the EU, US and Canada are all strong advocates of TACs and are criticising the PNA for using TAEs (PNA 2014). Regardless of which form of right is used, both forms create tensions on the distribution of benefits among states and between states and fishing companies.

To set and enforce rights, an effective monitoring and enforcement is also required. But this too is expensive and difficult to enforce. The principal resource owners (usually the states) are often characterised as having limited capacity to perfectly monitor and control fishing in their waters. Furthermore, agreeing to appropriate conservation and management measures (CMMs) is difficult as states usually oppose measures that negatively impact their interest leading to slow processes in adopting measures for sustainability. Understanding how new tuna regimes can address problems with property rights is therefore a key piece of the puzzle.

1.3.2 Compliance and regime effectiveness

The second characteristic of old tuna regimes is their complexity. Previous literature on complex governance and regime effectiveness reflects the challenges of international agreement in relation to multiple goals and purposes because of diverse interests (Biermann et al. 2009, Gerber et al. 2009, Wangler et al. 2012). This literature refers in large part to the interests of states in making relative improvements to an environmental problem. In particular the literature has focused on what factors lead states not to commit to strong action. In international and regional settings, as lamented by Finus et al. (2008) and Wangler et al. (2012), evidence of successful international agreements is scarce.

Such problems are also common in tuna regimes, but is made even more complicated by the fact that the majority of active fishers (agents) in these waters are vessels from distant water fishing nations. From a coastal state's perspective, foreign countries with fishing interest in the region often exert pressure on fisheries regulation at the regional and national levels (Havice et al. 2010). They do so by influencing the terms of regulations towards the interest of their own fleets, even though these interests often conflict with the environmental and economic objectives of Pacific island countries (Hanich et al. 2010). As also claimed by Havice et al. (2010), firm-level strategies also hold important implications for environmental and economic outcomes, but are largely outside of the control of coastal states due to their

limitation to regulate commercial activities. These complexities pose serious challenges for the effectiveness of tuna regimes in governing compliance, and therefore affect the stability of cooperation between member states.

DWFNs are impacting the stability of cooperative tuna management given they are external agents to the treaties that underpin regional regimes, whilst at the same time arguing for historical rights. This is true of the WCPO, but also seen in the Indian Ocean and other regions where DWFNs claimed historical rights before coastal states' EEZs were established. It is often claimed that DWFNs continue to influence coastal states position by offering incentives or benefits to support their commercial interests (Havice 2010, Aqorau 2015). And as Balton and Zbicz (2004) argue, the first instinct of most governments in any international, regional and sub-regional arena is to protect and promote their own national interest with the best information they have. But in doing so, external actors and interests add to the complexity of the tuna governance system in the WCPO, thus driving some non-compliant behaviour, which can again lead to the instability of tuna agreements.

Previous studies of regime theory (e.g. Hilborn et al. 2005, Young 2011) and game theory (e.g. Munro 2008, Bailey et al. 2010, Hannesson 2011) argue that cooperation is ideal and can only be achieved when members have an incentive to comply and stay in the agreement. Thus the success of any regime depends on these incentives and the willingness of members to stay and comply. Nevertheless, the willingness to comply is challenged with external incentives offered by external players such as DWFNs. They form part of the tuna management complexity particularly at the regional and international setting where private actors and DWFNs are involved. This thesis examines how new tuna regimes can facilitate the stability and effectiveness of regional tuna agreements for sustainability and equity. It will also look at how these new regimes affects the historical coastal-DWFN relationship and the weak bargaining position of the coastal states seen in the context of old regimes.

1.3.3 Asymmetric information and incentive gaps

The third characteristic of old tuna retimes is imperfect control by resource owners over private agents such as fishers. In the fisheries economics and governance literature this imperfect control is linked to what is termed 'asymmetric information' and is conceptualized as a 'principal-agent problem'. The principal-agent problem describes the situation where the principal is the resource owner, here the state, who hires an agent, here fishing firms, to fish in their waters based on regulations set by the principal (Jensen et al. 2002). An asymmetric information problem arises when the states (principal) cannot perfectly monitor fishers' (agents') actions, leading to poor performance and creating incentive gaps between the actors (Macho-Stadler et al. 1997).

An incentive gap is the measurable difference between the states and fishers objective. The challenge for resource managers is to try to reduce existing incentive gaps by means of aligning incentives between the two actors (Jensen et al. 2002, Vestergaard 2010). Under the old tuna regimes, incentive gaps are not well understood as state regulations dominate tuna regimes without acknowledging the role of private actors and incentives, despites the latter putting pressure on states' sustainability decision. Old tuna regimes commonly fail to identify incentive gaps let alone close them by aligning state and private objectives. Such closure is

made all the more difficult given that multiple levels of incentive gaps may exist with multiple states and private actors.

Asymmetric information and incentive gaps are also seen as challenges to achieving sustainability. Under the condition of asymmetric information, it is often impossible to achieve the first best option. With asymmetric information, fisheries managers cannot facilitate effective contracts and agreements design for sustainability without access to perfect information about the fishery. This thesis fills this gap by exploring what new tuna regimes can do to address information asymmetries in tuna fisheries, and in doing so close incentive gaps which had been ignored by old regulatory regimes.

1.3.4 Inadequate incentives and misalignment

The fourth characteristic of old tuna regimes is the failure of institutions to incentivise behaviour and decision making in promoting sustainability. Under the 1995 UNFSA trans-boundary fish stocks are required to implement precautionary approaches to management, including harvest control rules (HCRs) and reference points for all managed species.[3] These should be implemented by subregional or regional fisheries management organisations on the basis of the best scientific evidence available. HCRs are pre-defined management actions that should be taken in response to changes in stock status (Bruyn et al. 2013). Biologically-based limit reference points are essentially the goals of a fishery – for instance, fishing within maximum sustainable yield (ibid.). When a limit reference point is approached, measures should be taken to ensure that it will not be exceeded (Allen 2010). On the basis of these rules, limits and targets also called harvest strategy is required to specify pre-determined management actions for defined species necessary to achieve agreed biological, ecological, economic and social management objectives (Hampton et al. 2012).

RFMOs have faced considerable challenges in establishing HCRs and reference points to promote a precautionary approach to management as required under international laws (Allen 2010). HCRs and their biological reference points should be developed in the management planning stage with the involvement of all stakeholders (Hampton et al. 2012). However, the complex nature of tuna fisheries, including multiple species and gear types, contributes to the difficulties for member states in agreeing to management measures that promotes the adoption of pre-cautionary approaches.

Previous studies (e.g. Havice et al. 2010, Aranda et al. 2012, Bruyn et al. 2013 and others) argue that the adoption (or not) of HCRs and reference points by RFMOs is a function of the (mis)alignment of political and economic goals of participating states given their vested interests in different species of tuna, the fishing gears used to catch them and the protection of often long standing access arrangements (see also Bailey et al., 2013, WCPFC, 2014). In other words, at the RFMO levels, these studies claim that the old tuna regimes or institutions have largely failed to provide adequate incentives for states and fishing industries to agree to precautionary approaches.

[3] United Nations Convention on the Law of the Seas (UNCLOS) and Food and Agriculture Organisation (FAO) Fisheries Code of Conducts

All four characterisation (and problems) outlined above are driven by the nature of trans-boundary tuna problems and the associated dynamic political interests and actors. Central to the challenges faced by old tuna regimes is that they are less able to address the inefficiencies of political institutions that influence the design of governance institutions i.e. decision making processes and instruments for sustainability and equity. This thesis demonstrates that in an attempt to overcome these institutional challenges a range of economic instruments have been implemented hence leading to the emergence of new tuna regimes which now play a crucial role in restructuring decision making processes towards sustainability. The next section provides a brief outline of three theories addressing cooperation in international environmental regimes before turning to outline the relevance of an integrated game theory and new institutional economic framework to understand and explain the emergence of new tuna regimes.

1.4 Cooperation and the New Institutional Economics (NIE) framework

The NIE framework is an approach designed to integrate approaches from economics, law and social and political sciences to explain and address complex societal (and fisheries environmental) problems (Williamson 1990). In response to the challenges outlined above in section 1.3, the NIE framework provides a means of assessing how different institutional arrangements drive or hinder cooperation to development management measures for resources such as fisheries between states using market incentives. More specifically it is used to examine current institutional arrangements and identify ways forward to more efficient and effective modes of sustainability governance of trans-boundary stocks under varying degrees of public and private international cooperation. To achieve this, coalition and principal agent theories (two applications of game theory) are applied to strengthen the NIE framework in analysing new tuna regimes. This section reviews the application of NIE framework and game theory in fisheries agreements before proceeding to discuss the relevance of integrating game theoretic approaches.

1.4.1 New Institutional Economics

The varied success of RFMOs in achieving the economic and biological objectives desired of them is largely a function of the competing (and sometimes contradictory) interests of the actors involved. Recognising this, scholars and policy makers alike have argued for more effective and coherent institutional frameworks for global environmental governance (Petersen 2006, Biermann et al. 2009, Young 2011). The NIE framework is one approach to both understand the role of and interplay between political and economic institutions that can enable decision makers to incentivize and improve the design of rules for resource use over the long term (e.g. Williamson 2000, Acemoglu et al. 2004, Pacheco et al. 2010). In the context of RFMOs, such interplay can represent interactions between states and private actors (such as fishers or processors), and by default the legal and market logics in which they are embedded.

NIE seeks a middle road between sociology, political science and economics. As outlined by Pacheco et al. (2010), political science is interested in how institutions are formed through

political action, sociology on the organization of actor engagement and legitimacy, and economics on the enforcement of property rights, through the creation of law and policy. All three fields are, however, fundamentally focused on rule formation and their use in shaping action. Seen as such, NIE is a means of understanding the interaction of dynamic social processes that lead to the creation and recreation of rule systems based on market, political and social 'logics' (Kozenkow 2013). As Kozenkow (2013) argues, NIE expands mainstream neoclassical economics by considering how rights and transaction costs affect social and political incentives in addition to economic behaviour. In a similar line this thesis is interested in using the NIE framework to examine the design of new market based and incentive based approaches to complement regulatory, command and control together with eco-system approach to help promote cooperation and governance for sustainable outcomes.

The dynamic interaction between these market, political and social logics is inherent to the NIE framework. As regimes evolve to respond to new social, economic or environmental challenges they reframe old issues, and in doing so allow for changes in terms of who is involved in influencing the creation of new rules (Muzaka 2010). As introduced by Williamson (2000), the NIE framework analyses this dynamism by breaking regimes into four institutional levels that identify the conditions under which public and private interests can enable rather than constrain effective resource management and allocation (see Figure 1.3). Each of these levels also change at different speeds – similar to different sized cogs of a gear box. In doing so the framework allows for a better understanding of the role of economic institutions in either weakening or strengthening political institutions and in restructuring governance institutions.

Level one of Williamson's framework focuses on social institutions – including norms customs, traditions and codes of social conduct. These social institutions are slow to change, but hold pervasive influence over a range of social processes – including individual action. Level two of the framework points to the political institutions. Representing the state, these institutions are made up of the "executive, legislative, judicial, and bureaucratic functions of government" (p. 598). These political institutions also exert *de jure* power, as in most instance their legitimacy follows from democratic processes of policy and law formation. Level three of the framework represents governance institutions, constituted by rules for that craft order for contracts and enforcement mechanisms in the pursuit of mutual gains from, for example, the exploitation of natural resources. Finally, level four encompasses economic institutions that structure incentives and motivations for transactive decisions making. In contrast to political institutions these economic institutions exert *de facto* power, drawing on the legitimacy of everyday modes of production and consumption.

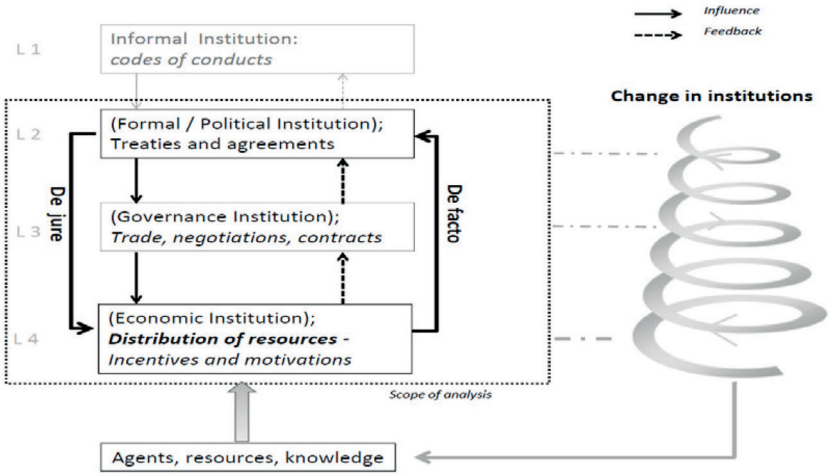

Figure 1.3. A Dynamic New Institutional Economics Framework. (Based on Williamson 2000 and Acemoglu et al. 2004)

As outlined by Ostrom (1990), all of these levels do not exist in silos, but are instead subject to continuous review as a function of the actors, knowledge and resources that constitute each set of rules as well as move in and out of each level. She also argued that economic institutions, are the fastest in renewing themselves means they are more subject to experimentation and iterative improvement compared to the other institutional levels (see also Pacheco, 2010; Overdevest et al. 2014). As these institutions adapt with new knowledge, resources and interests of actors they influence the creation of governance, political and social institutions. But they are at the same time also themselves influenced by political decisions aimed at capturing rents from economic behaviour (e.g. Liebecap 2008). In between these levels governance institutions, as rules in action, are the outcome of the interaction between economic and political levels. As illustrated in Figure 1.3, this combination of both political, governance and economic institutions can be described as the prevailing 'governance' framework, reflecting the incentives of decision makers to choose certain policies, the inclusion of actions, and ultimately how a decision making process leads to different choices, each with their own economic outcomes (see for example Borner 2005).

The NIE framework is imminently useful for examining the governance of public resources, such as fisheries, especially where so called market or incentive based instruments are used in parallel to the state. Institutional economics has been influential in analysing the impact of public policy by providing insights into the role of incentives created through economic institutions to achieve desired environmental outcomes (Paavola 2007). It is particularly relevant to problems where cooperation is central to the success of reaching these outcomes. This means not only understanding how economic incentives are applied and responded to by agents, but also how state's decision making conditions and voluntary collective action over environmental resource use. In short, it is then possible to ask how cooperation can be sustained and improved. In the context of tuna fisheries, this means questioning how 'old regimes', which have failed due to weak motivation and incentives for cooperation, can

transition to new regimes which create decentralised motivation for self-governance and/or improved compliance to state regulation.

But while NIE provides an analytical framework to examine the shift from old to new tuna regimes, NIE alone is not sufficient to further our understanding on the extent of how this shift from old to new regimes, nor how they can contribute to the long term cooperation. For that, this thesis integrates coalition theory and principal-agent theory to complement and strengthen the NIE framework. The integration of these theories provides a deeper understandings of the extent to which the shift from old to new tuna regimes can be understood in view of better cooperation among the states and between states and private companies using incentive based mechanisms.

1.4.2 Game theory – coalition theory and principal agent theory

Game theory has been used widely to examine strategic interactions in international agreements for trans-boundary problems. Its application to fisheries agreements began in the late 1970s around the time when the 200 mile zone was recognised, establishing *de facto* property rights of coastal states over the fish in extended zones (Bailey et al. 2010, Hannesson 2011). Game theory has been applied extensively to the issue of how such shared fish stocks will be exploited (Lindroos 2004, Kronbak 2007). Questions focus on how cooperation can be achieved given that countries differ, the outcomes of competition versus cooperation and what could be done to secure a cooperative outcome (Bailey et al. 2010, Hannesson 2011). For instance, coalition theory, one branch of game theory, analyses international environmental agreements on trans-boundary problems caused by externalities, such as migratory tuna stocks (Bailey et al. 2010, Hannesson 2011). This research examines the extent to which cooperative arrangements succeed or fail to secure positive environmental outcomes (e.g Lindroos 2004, Kronbak 2007, Pintassilgo 2010 and others), as well as the degree of stability of the cooperation in maintaining these outcomes over time (Dellink 2011).

For example, Kaitala and Lindroos (1998) found that grand coalitions of states can be stable and lead to pay-offs for cooperation. But they also found that breaking out of such grand coalition results in the depletion of the fish stock. Pintassilgo (2003) builds on Kaitala and Lindroos's (1998) findings by claiming that coalitions are likely to be undermined by one member leaving and profiting from free riding on the remaining coalition. Such observations open up further questions around the internal and external stability to further understand how political and external influences impact the willingness of states to maintain cooperation over time (Hannesson 2011). It is exactly this line of questioning that this thesis focuses on. For instance, how external economic institutions influence the internal stability of the coalition between PNA member states in effectively setting governance institutions.

Returning to the NIE framework, the challenge is then to understand the extent to which coalition theory can determine whether new tuna regimes are strengthening (coalition stability) or weakening (coalition instability) political institutions. More specifically, coalition theory can be used here to examine the effectiveness of new tuna regimes and how they strengthen formal political institutions (or state cooperation) for collective participation.

Additionally, the thesis extends the analyses of cooperation beyond states to examine the potential of public-private cooperation through goal alignment. In doing so, this thesis uses

principal-agent theory (yet another branch of game theory) to examine cooperation between coastal states and private fishing companies in managing tuna resources for long term outcomes (Hannesson 2011, Kozenkow 2013). Principal-agent theory has been variously applied to trans-boundary fisheries to analyse, the relationship between fisheries regulators and fishing agents characterised by *incentive gaps*, and the level of compliance under conditions of imperfect information and imperfect control, termed '*asymmetric information'* problem in the fishery (Jensen et al. 2017). Asymmetric information has two forms; *moral hazard*, referring to imperfect control of effort and catch, and *adverse selection*, referring to imperfect information about the agents' interests and conditions (Jensen et al. 2002, Bailey et al. 2016, 2017). With asymmetric information, incentive gaps are observed between fisheries regulators and agents.

The principal-agent literature models the effect of incentive schemes and the options to close incentive gaps through, for instance, subsidies (Jensen et al. 2002), landing and effort taxes (Clarke and Munro 1987), individual transferable and non-transferable quotas (Jensen et al. 2001, Jensen et al. 2002), and logbook schemes (Jensen et al. 2007). Specifically, these studies emphasise the need to close incentive gaps and thereby open up questions about the role of incentive schemes making private information transparent in order to close these gaps. In the context of trans-boundary regimes the application of principal-agent theory also helps to identify the existence of multiple incentive gaps between the multiple levels of governance that prevail in regional governance regimes (e.g. Bailey et al. 2016).

Again returning to the NIE framework, third level governance institutions, where contracts and agreements are located provides space for the analysis of public-private interaction using principal-agent theory. Specifically, principal-agent theory can examine the role of new tuna regimes in addressing asymmetric information problem and improve governance institution by closing incentive gaps between the states and private fishing companies. By examining this interaction through principle-agent theory this thesis examines how new tuna regimes facilitate closing of multiple levels of incentive gaps between states and private fishing companies in the PNA fishery.

In analysing the extent of how institutional changes formulate new tuna regimes and how new regimes restructure incentives and outcomes, integration of NIE framework and coalition theory and principal-agent theory is utilised. Both coalition and principal-agent theory are fisheries economics approaches and tools used to examine the extent to which new tuna regimes restructure institutions at different levels (see Figure 1.4). The integration and application of these theories implies that understanding interaction between the NIE levels can be improved by analysing how cooperation is enabled or hindered by incentives and constraints to the delivery of these incentives.

1.5 Research questions

This thesis examines the emergence of and transition to a new regime for managing governing sustainable and equitable trans-boundary tuna stocks in the WCPO. In doing so the research seeks to understand: i) the shift from political institutions new the interplay political and market institutions, and ii) how these new tuna regimes influence management outcomes. To achieve this the central question of the thesis is:

What characterises the shift from old to new regimes for trans-boundary tuna management, and to what extent is the emergence of a new tuna regime able achieve sustainable and equitable outcomes in the Western and Central Pacific?

In answering this central thesis question, the thesis systematically address the following four specific questions which correspond in turn to the four empirical chapters (see Figure 1.4 for thesis structure).

First, *how has the shift from an old to new tuna regime come about and what institutional changes implemented in the PNA have facilitated this shift*? To better understand the rationale for new tuna regimes, the second chapter provides an in-depth analysis of an historical shift from old to new regimes in the context of a sub-regional PNA fishery and its influence over the WCPFC. In doing so the chapter outlines in greater detail the role of the NIE institutional levels and how the interaction between these institutions affect change at both sub-regional and regional levels in the WCPO.

Second, *to what degree has the implementation of the vessel day scheme in PNA brought about greater stability to the signatories of the Palau Agreement?* This question is addressed in chapter 3 by examining the extent to which the PNA, as a coalition, are incentivised to maintain their cooperation through the vessel day scheme. In doing so, the chapter investigates how the VDS as an economic institution strengthens the PNA as a political institution. Based on this analysis insights are drawn on whether and how international cooperation can be improved through the economically derived incentives.

Third, *to what extent does third party certification increase transparency through improved monitoring and control and, in doing so, address misaligned interests between states and private sector actors in the fishery?* This question is addressed in chapter 4 and focuses specifically on issues of asymmetric information and as such uses principal-agent theory to investigate the extent of how private schemes like the MSC is able to address asymmetric information problem and close incentive gaps in the fishery. Again, this chapter focuses on the role of an economic institution (the MSC) to influence the PNA as a political institution in the formation of governance institutions like harvest control rules and conservation and management measures.

Fourth*, can private institutions such as third party certification facilitate improvements to conservation and management measures at the RFMO level?* This last question moves beyond the WCPO to explore the role of private institutions again focusing on MSC program in three RFMOs. This final empirical chapter seeks to conduct a comparative analysis of three RFMOs in the Pacific, Indian and Atlantic oceans and their interaction with the MSC. Specially, the chapter highlights the extent to which the MSC incentivises the adoption of precautionary management measures as required of them under the United Nations Fish Stocks Agreement. As such the chapter provides a further examination of how economic and political institutions interact to forge new governance institutions for sustainable and equitable tuna fisheries.

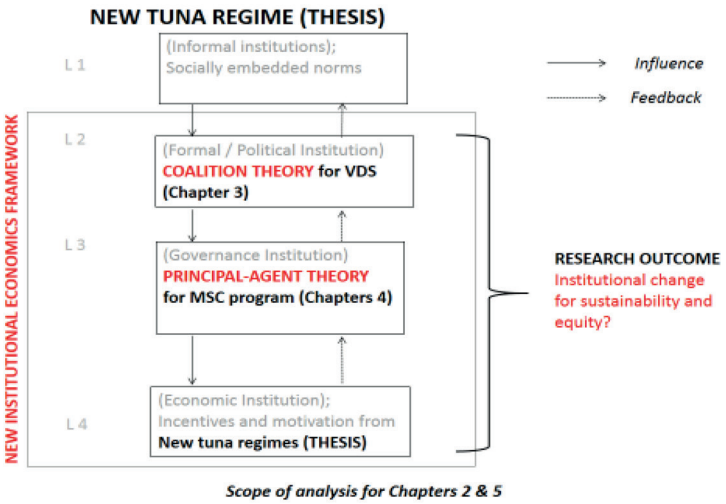

Figure 1.4 Thesis outline – Integrating coalition and principal agent theory in NIE framework

1.6 Research methodology

1.6.1 Research strategy and design – Case study

To answer the thesis questions a case study methodology is employed. The use of case studies is commonly used in social science qualitative research to make empirical inquiries on problems connection to real-life contexts (Yin 1994). The research takes an inductive approach by starting with theory in formulating the research goal and questions that are going to be tested in the research (Boeije 2010). The case studies help in setting a platform where to apply and test the theory to real-life. In doing so, the thesis uses a mix of: (1) historical institutional analysis based in documents and interviews; (2) observations of meetings and negotiations (3) mixed qualitative and quantitative interviews and document reviews.

The various chapters in this thesis are also based on multiple inductive cases. The value of such an approach is that it can address a phenomenon from different 'viewpoints' or 'angles', meaning that generalisations around a phenomenon, such as the interaction of the state with incentive based mechanisms, can be made more convincingly (Eisenhardt and Graebner 2007). As outlined by Tolentino-Zondervan (2017), the use of multiple inductive case studies is also well suited to understanding new and innovative phenomena of private incentive mechanisms. Because their impacts and influences are still in motion multiple cases around the same wider case (in this thesis, the PNA), can again contribute to more generalizable results.

1.6.2 Data collection

Data was collected through a combination of semi-structured interviews, participant observation at the tuna regional meetings, literature and document (regional and national) reviews. Data collection was conducted from 2013 to 2017 for all four chapters. The details of specific field work are covered in each of the following chapters. The initial research activity involved participating as part of the Kiribati and PNA delegation team in the WCPFC and PNA annual meetings in 2013 and 2014 respectively, with the intention of informing participants of the research and establishing networks with tuna informants. These were followed by a series of interviews and document analyses in building up the data sets for all four questions.

Participant Observation. Throughout the research, conferences and meetings relevant to the study were attended. Participant observation proved particularly helpful in establishing networking and relationships with key tuna informants around the region and globally (Boeije 2010). The key tuna meetings attended include the 2013 and 2014 Western and Central Pacific Fisheries Commission (WCPFC), the 2013 European Tuna Conference, the 2014 PNA, Palau Agreement, Federated States of Micronesia Arrangements (FSMA), and 2015 Pacific Tuna Forum. Most of these meetings were attended as a participant, to gain knowledge on the most up to date debates on the status and development of tuna management measures. Fortunately insider information was also collected through participation in the Kiribati delegation team at the 2014 and 2015 WCPFC meetings. It provide the opportunity to observe the strategic interactions of state and non-state actors in tuna negotiations at the RFMO level. Participation at subregional PNA, Palau Agreement and FSMA meetings, not only provide a good understanding of the structure of multiple tuna arrangements, but also provide the opportunity to observe member states' actions in close sub-regional meetings *without* fishing states and companies. To maintain the balance of interpretation, interviews with all stakeholders from state to private is also conducted.

Semi-structured interviews. Qualitative and semi-structured interviews were conducted (where possible) at the meeting venues and subsequently by appointment with interviewees. Semi and open structured interviews were used to give interviewees the freedom to share their personal and professional perspectives and experiences (Boeije 2010). Both face-to-face and online interviews were used throughout the research. Any further information, including clarifications from the interviews were sough via email. Online communication is particularly useful as informants are spread across the globe. Interviews were recorded where permission was given, and notes were taken where recording was not permitted.

A total of 82 interviews were conducted throughout the research period from December 2013 to March 2017. Before the interviews, questions were prepared to structure and guide the reciprocal discussions between researcher and interviewees. Different interview questions are asked to different participants depending on their role. The majority of the interviewees worked directly with tuna, either as: i) state representative, ii) expertise (regional officials and consultants) and iii) private actors (fishing companies, conservationists and non-government organisations) (see Table 1.1). The interview questions were organised and structured in line with the research questions. Some participants were repeatedly interviewed throughout the research given their expertise and knowledge on the case studies and tuna fishery in general.

Table 1.1 List of interviews

Corresponding chapter; ***Time scale of interview***	**Type of Respondents (Face to face and online communication)**	**Number of Respondents**
Chapter 2; *December 2013 to December 2014*	Govt. fisheries officials Experts Privates	4 7 3
Chapter 3; *March 2015 to December 2015*	Govt. fisheries officials Experts Privates	6 12 4
Chapter 4; *March 2015 to March 2017*	Govt. fisheries officials Experts Privates	12 12 6
Chapter 5; *October 2016 to March 2017*	Govt. fisheries officials Experts Privates	- 7 9
Total interviews		**82**

Explanation of respondent type and repeated respondents

i. *Govt. fisheries officials; Government representatives (6 repeated)*
ii. *Experts; Regional fisheries officials* (3 repeated), consultants (2 repeated), scientists (1 repeated), and researchers*
iii. *Privates; NGOs, fishers, companies (1 repeated), clients*

**Regional and subregional RFMOs: WCPFC, PNA, FFA, SPC, IOTC, ICCAT*

Document analysis. Throughout the research process, document analysis was conducted to complement the qualitative data collected from observations and interviews. The documents examined range from peer reviewed publications, to technical reports from government and non-government organisations. These documents provided quantitative evidence and support to qualitative interview data. Document analysis was also essential given most quantitative data are difficult to obtain during the interviews (e.g. catch, effort, and economic data). Moreover at the fleet and national level, economic data are treated with confidentiality.

To avoid issues of confidentiality, only reports available in the public domain were used; for example from organisations like the PNA, WCPFC, Pacific Islands Forum Fisheries Agency, Secretariat of the Pacific Community (SPC), Food and Agriculture Organisation of the United Nations (FAO) and other RFMOs. For calculations, quantitative effort and economic data, the research used aggregated data made available by PNA delegations and the PNA Secretariat. Consent was given by the PNA Secretariat to use their data for this research.

We now turn to the first empirical chapter of the thesis, which provides an analysis of the shift from regulatory policy to new economic policy instruments through the lens of new institutional economics.

Chapter 2. Implications of new economic policy instruments for tuna management in the Western and Central Pacific.

Abstract

Tuna management in the Western and Central Pacific is complicated by the conflicting interests of countries and agents exploiting tuna resources in the region. Historically, regulatory attempts by Pacific Island Countries to control fishing effort within their Exclusive Economic Zones (EEZs) have met with limited success. The introduction of new economic policy instruments by the Parties to the Nauru Agreement (PNA), such as the vessel day scheme (VDS) and Marine Stewardship Council (MSC) certification, has supported and complemented existing conservation and management measures. By bringing in new incentives for the PNA states, greater control over fishing effort and the formulation of perceptibly new sustainable fishing practices have emerged. Using a new institutional economic framework, this paper analyses the shift from regulatory policy to new economic policy instruments through the lens of new institutional economics. The results show how the adoption of the VDS and MSC certification program has brought new changes and improvements to tuna negotiations, to agreements, and to outcomes amongst parties. Investing in these new instruments has elucidated ways in which new economic institutions strengthen de jure political control over trans-boundary fish resources and fishing fleets.

This chapter has been published in *Marine Policy*.

Yeeting, A., S.R. Bush, V. Ram-Bidesi and M. Bailey (2016) Moving towards new economic policies for Tuna Management in the Western and Central Pacific – The Case of the PNA. *Marine Policy* 63: 45-52.

2.1 Introduction

The impact of the skipjack tuna purse seine fishery on the more vulnerable yellowfin and bigeye tuna stocks in the Western and Central Pacific Ocean (WCPO) has become increasingly controversial in recent years (Langley et al. 2009). Stock assessments from the WCPO consistently report that bigeye is overfished while yellowfin remains fully exploited (Harley et al. 2013, Harley et al. 2014). The impetus to continue (over)exploiting these more vulnerable stocks comes from the economic importance of skipjack to coastal states – who rely on revenues from licensing arrangements with mixed fishing vessels ranging from distant water fishing nations to locally owned and joint-venture fishing vessels. Pacific coastal states' revenue from licensing arrangements ranges from between 2% to almost 60% of their GDP (Barclay et al. 2007, Havice 2010, Bell et al. 2015). Developing management arrangements that balance the ongoing exploitation of skipjack tuna stocks, while reducing pressure on yellowfin and bigeye tuna, is therefore largely dependent on cooperation for balancing conservation and economic goals between the 16 coastal states of the Pacific including the eight Parties to the Nauru Agreement (PNA) states.

Despite continued recognition of the conservation and economic benefits that can be derived from improved cooperation around tuna management in the region (Bailey et al. 2013), examples of effective cooperative international regimes remain scarce (Hilborn et al. 1988, Sumaila 1999, Ram-Bidesi et al. 2004, Bailey et al. 2010, Havice et al. 2010). It is also apparent that past access arrangements governing the WCPO tuna fisheries have not led to significant increases in economic returns to coastal states, until the recent implementation of the Vessel Day Scheme in 2012 (Havice 2010, Havice et al. 2010). Inappropriate incentives, inadequate knowledge, a high demand for limited resources, and ineffective governance are noted among the main contributing factors that undermine cooperation (Grafton et al. 2006, Grafton et al. 2006). As (Campbell et al. 2015, Hanich et al. 2015) note, cooperative measures that deliver on both effective management and equitable distribution of wealth from these resources have therefore remained a central development policy objective for the region.

Contrary to this trend, the Parties to the Nauru Agreement (PNA), a sub-regional group of eight tuna rich countries, have strengthened the coordination of tuna fishery management across their joint jurisdictions. The PNA members have adopted two new economic policy instruments – the Vessel Day Scheme (VDS) in 2005 and the Marine Stewardship Council (MSC) certification program in 2011 – in an attempt to strengthen and complement existing regulatory conservation and management measures for tuna fisheries. The new policy instruments have been adopted by the PNA group to ensure both the ecological objectives of the Western and Central Pacific Fisheries Commission (WCPFC) and the economic goals of its member countries are achieved. These new approaches are intended to influence individual countries' choices around securing collective welfare in the fishery, thereby improving not only cooperation and tuna governance in the Pacific (Havice et al. 2010), but also meet Pacific island countries' aspirations of gaining greater benefits from tuna (Barclay et al. 2007).

This paper examines the design and implementation of these new economic policy instruments through the lens of New Institutional Economics (NIE); an approach designed to integrate approaches from economics, law and social and political sciences to explain and address complex societal (and fisheries environmental) problems (Williamson 1990). The paper describes the reasons for the shift to these new economic instruments and analyses how they influence the political (*de jure*) and economic (*de facto*) control over fishing resources in the waters of the PNA. In doing so we analyse how this shift has come about and the institutional changes that have been implemented by the PNA as a result. The paper begins by introducing the NIE framework before providing an overview of regional tuna treaties and regimes and the conditions under which the PNA has shifted from a regulatory approach to new economic policy framework. Finally, we examine how these policy instruments affect the de jure and de facto power over fishing resources in the PNA.

Data and information were gathered through literature and document review, as well as interviews and observations at regional and sub-regional tuna management meetings from December 2013 to December 2014. These meetings included the 10th and 11th regular meeting of the WCPFC, 19th meeting of the Parties to the Palau Agreement, 19th meeting of the Parties to the Federated States of Micronesian (FSM) Arrangement, and 33rd annual meeting of the PNA. In addition, 14 in depth interviews were conducted with senior officials and delegations from each of the PNA countries, officials and consultants from the regional organisations in particular Fisheries Forum Agency and PNA Office, and fishers or vessels operators, observers and NGO representatives.

2.2 New Institutional Economic (NIE) Framework

The complexity of balancing the interests of multiple conflicting states, has led to the emergence of international regimes that seek to combine both regulatory and market logics into finding solutions for global environmental problems through international cooperation (Biermann et al. 2008, Young 2011). As a result, the perceived ineffectiveness of command and control approaches have led to questions about how states and other actors try to achieve desired outcomes. Creating the right incentives then becomes central to the effectiveness of institutions. As regimes evolve in response to the emergence of new issues, they reframe old issues, allow for the entrance of new agents, and/or the changing interests of existing agents, leading to new knowledge and/or a redistribution of power (Muzaka 2010). Understanding such a dynamic institutional environment is essential in determining the conditions under which public and private interests can enable rather than constrain effective resource management and allocation.

A conceptual understanding of this evolving process can be derived from new institutional economics (NIE). NIE is relevant for understanding how dynamic political interests influence decisions over the (environmental) governance of trans-boundary and common resources, by focusing on the processes that lead to inefficient policy outcomes and the design of innovative policy solutions. To this end, NIE offers an interdisciplinary approach to analyse

the form and function of institutions in allocating rights and responsibilities for efficient resource use and stewardship (Coase 1984, Williamson 1990, Hodgson 2006, Paavola 2007).

Williamson (Williamson 2000) provides a hierarchical NIE framework consisting of four institutional levels, each with a different pace of change (see Figure 2.1). The first two levels refer to informal and formal institutions. Informal or social institutions include socially embedded norms customs, traditions and codes that often hold slow change but pervasive influence over societal conduct. Formal or political institutions constitute the institutional environment within which "executive, legislative, judicial, and bureaucratic functions of government, as well as the distribution of powers across different levels of government" are located (p. 598). Level three of Williamson's hierarchy refers to institutions of governance, constituted by rules for mitigating conflict and creating mutual gains by 'crafting order' through contracts and enforcement mechanisms. Finally, level four refers to economic institutions that structure incentives and motivations for 'day-to-day' transactions and decisions making. The dynamic nature of agents, resources and knowledge encompassed by economic institutions are subject to continuous review, with greater frequencies of change compared to governance and political institutions (Ostrom 1990). This also means that experimentation and iterative improvement are also likely in these economic institutions compared to the other institutional levels (Pacheco et al. 2010).

The four levels are ordered to the extent that 'higher' levels have a direct influence over those below. So that social institutions direct the formation of political institutions which craft the conditions under which everyday economic practice occurs. But while Williamson recognised that feedbacks between levels are possible, he did not elaborate what these feedbacks would be, nor what consequence they might have. Recognising this gap, Acemolgu et al. (Acemoglu et al. 2005) argue that the interactions between these institutional levels are fundamentally based on feedbacks which determine the distribution of two types of decision making power. First, *de jure* power derived from the political institutions that underscore state representation, and second *de facto* political power derived from economic institutions that determine the allocation of economic resources. They argue that the control over resources, such as trans-boundary fish stocks, at any given time is determined by a process of co-production between political (level two) and economic (level four) institutions (Williamson 2000, Acemoglu et al. 2004).

Following Acemoglu et al. (Acemoglu et al. 2005) economic institutions are therefore not a function of political institutions, but instead constitutive of political decisions to capture the benefits associated with economic outcomes (Borner 2005). Likewise, it opens up the possibility for political institutions to directly structure economic institutions, and in doing so internalise incentives for improved resource stewardship (Acemoglu et al. 2005). But returning to Williamson, this process of co-production is not a binary process. It is instead mediated by 'level three' governance institutions. Recognising this mediating role therefore opens up questions about the design of these governance institutions, how they are negotiated, what incentives they 'craft', and ultimately how they influence the balance between political de jure and economic de facto power. As illustrated in Figure 2.1, this combination of both political, governance and economic institutions can be described as the

prevailing 'governance' framework, reflecting the incentives of decision makers to choose certain policies, the inclusion of actions, and ultimately how a decision making process leads to different choices, each with their own economic outcomes (Borner 2005).

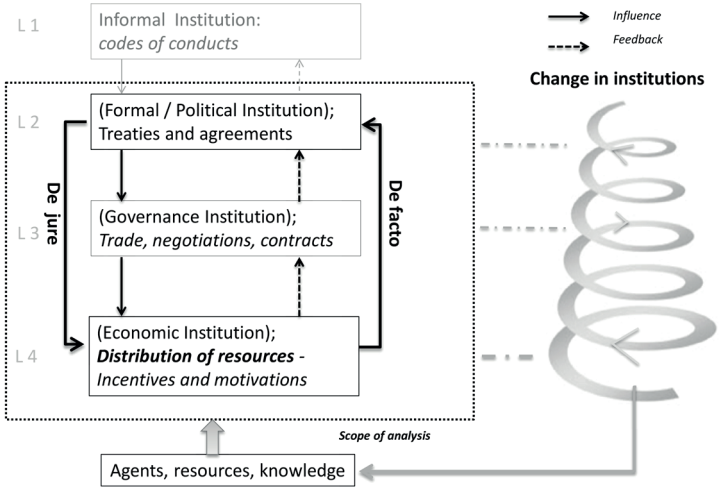

Figure 2.1 Theoretical framework of political and economic institutions (adapted and modified from Williamson 2000 and Acemoglu et al. 2005).

2.3 PNA's shifting focus to incentive driven strategies

The introduction of the VDS and MSC certification of free school purse seine fisheries demonstrates a clear shift in strategy from using political to economic institutions to govern trans-boundary fisheries by the PNA. In this section we outline the challenges faced by political institutions and the corresponding emergence of these two economic policy instruments, as well as the relationship of these instruments to contemporary fisheries management in the Western and Central Pacific Ocean.

2.3.1 Palau Agreement and Federated States of Micronesian Arrangement

Under the 1982 United Nations Convention on the Law of the Sea (UNCLOS, 1982), tuna fisheries are governed at different geographic and jurisdictional levels and scales from subnational to national and regional (Fanning et al. 2007). In the Pacific access to sovereign resources have been governed through a combination of bilateral access and joint venture arrangements, both of which also aim to provide economic development opportunities and

lower transaction cost for coastal states. However, despite the goal of managing regionally shared resources, the outcome of these arrangements have often favoured the interests of the fishing industry dominated by foreign owned, but locally flagged and joint venture vessels. These industry interests have then in turn, been expressed as national interests at the regional level (Barclay et al. 2007, Havice 2010, Kumoru 2014, Pangelinan 2014). As a result access arrangements for tuna fisheries in the WCPO have failed to provide significant increases in economic returns to coastal states (Grafton et al. 2006, Havice 2010). While most bilateral agreements are rather driven by national political aspirations, weak governance and a lack of political will related to multiple competing interests, have led to a continued overexploitation and inefficient allocation of tuna resources.

The first shift towards new economic policy instruments was initiated through the Palau Arrangement in 1992 and the Federated States of Micronesia Arrangement (FSMA) in 1994. The Palau Arrangement restricted the number of purse seine vessels in PNA waters to 205 (Wright et al. 2006, Langley et al. 2009) and the FSMA provides preferential access to vessels engaged in domestic development and offering discounted fishing licenses and reciprocal access between PNA member countries (Langley et al. 2009, Havice 2010). Reflecting a wider shift to inter-state investment in fishery resources, the FSMA also marked a fundamental shift in the design of access agreements by offering incentives for economic development opportunities through domestic initiatives (Havice 2010, Havice et al. 2010, Havice 2013). For example, while giving coastal flagged state vessels preferences, both the Palau Agreement and the FSMA required the development of domestic fisheries, ports and infrastructure, as well as the provision of employment opportunities for PNA nationals.

Despite the conditions set out by both arrangements, it became clear by 2000 that these goals have not been reached (Langley et al. 2009). The FSMA failed to promote investment in domestic development largely due to the lack of transparency and limited development opportunities provided by joint venture partners, despite having been in operation in the region for the past 20 years. As argued by national officials, distant water nations offered limited development opportunities that were also not conducive to national aspirations, and offered very limited employment opportunities for nationals. Furthermore, as argued by interview respondents, the Palau Agreement failed to create a competitive environment for vessels given the lack of support from distant water fishing nations (DWFNs). Vessel numbers were fixed at 205 leaving no room for competition, and allocation rights were given to vessels instead of PNA members (Ram-Bidesi et al. 2004, Langley et al. 2009). The result was a stagnation of access fees charged by the PNA at 5 to 6% of catch values (Havice 2013), jeopardising hopes that foreign investment would increase.

Over time it also became apparent that the measures put in place by the Palau Agreement and FSMA were ineffective in mitigating negative effects of purse seining on yellowfin and bigeye tuna. The fishery faced a continued expansion of 'effort creep' associated with the entry of larger more efficient vessels and the expanded use of georeferenced floating fish aggregating devices (FADs) (Langley et al. 2009, Hanich et al. 2010, Shanks 2010). As a result, catches have been consistently increasing over the years, albeit at a reduced rate (Aqorau 2015, Clark 2015). The latest record indicates that the 2014 WCPFC statistical catch

record was slightly higher than in previous years, but relatively stable compared to the average over the past five years (Clark 2015, WCPFC. 2015). The provisional 2014 purse seine catch was estimated at 2,020,627 mt, was the highest on record. Skipjack catches accounted for 1,957,693 mt – 68% of the total catch, yellowfin catch is the second largest at 608,807 mt – 21% of the total catch, and bigeye and albacore are around 161,299 mt and 132,849 mt – 6% and 5% of the total catch respectively (WCPFC. 2015).

By 2010 bigeye tuna was overfished and overfishing still continues. To remediate this situation, the scientific committee of the WCPFC has called for a reduction of at least 32% in fishing mortality from the average 2006-2009 levels, signalling a need for new mechanisms to address overfishing, and provide a long-term solution to stock decline (WCPFC. 2014, WCPFC. 2014).

2.3.2 Shift to New Economic Policy Instruments

In response to lower returns from access arrangements and the perceived erosion of sovereign control over resources by distant water nations represented by the WCPFC, the PNA called for a review of the Palau Agreement in 2000 with assistance of the Forum Fisheries Agency (FFA). At the conclusion of this review in 2007, it was decided to move from capacity limits to effort control. The outcome was the adoption of the VDS in 2005 to replace the limit of 205 purse seine vessels under the Palau Agreement. In doing so, the PNA increased control over the level of fishing effort with limited fishing days in an effort to support both ecological goals set by the WCPFC and economic goals of the PNA member states.

The goal of the VDS is to improve economic benefits to resource-owning states by generating a real limit on fishing days, thereby creating demand and competition between vessel operators. The scheme does not put restrictions on the number of vessels, but rather provides flexibility for new entrants that may offer higher fees. Economic gains with VDS are measured and dependent on the price charged per fishing day. Fishing days allocated to coastal states were limited and fixed, so coastal states were given more flexibility to either use the benchmark price or independently increase the price of their days (PNA 2012). By tightening effort and limiting the number of days, the PNA has aimed to further increase competition for licenses while also improving fishing efficiency by eliminating inefficient vessels (Pangelinan 2014). Although alternative systems were proposed, the VDS was adopted because it was seen as technically feasible, with real time monitoring through a mandatory vessel monitoring scheme (Havice 2013). However, full adoption of the scheme was delayed until 2012 because of diverse political interests undermining the necessary consensus by PNA members to move to full implementation. The current allocation of days is based on the 2010 effort levels (WCPFC. 2014, WCPFC. 2014). The recommended PNA Total Allowable Effort (TAE) in which Parties allocated effort for 2015 is 44,623 days (PNA. 2014).

In parallel with the implementation of the VDS, the PNA also initiated steps to move towards MSC certification – widely seen as the ‘gold standard’ for fisheries management

(Gulbrandsen 2009). This was not the first consideration to have the tuna fishery certified. However, earlier proposals were never taken forward, largely because of bycatch issues associated with FAD-based purse seine fisheries, and because of the perceived weakness of sustainability claims around pole and line fisheries (Brownjohn 2014). The goal of the new initiative was to certify skipjack tuna in PNA waters that employ 'free school' or non-FAD purse seining, thereby reducing effort on vulnerable non-target yellowfin and bigeye tuna with purse seining associated with FADs (Miller et al. 2015). In doing so the PNA sought certification of potential landings equivalent to approximately 60% of the WCPO fishery, and help create a new market for sustainably certified purse seine tuna. The hope is that this market would lead to greater overall recognition and credibility for the PNA implementing arrangements and (again reinforcing the Palau and FSM Arrangements) ensure higher control, economic returns and commercial opportunities for member countries.

The PNA also saw MSC certification as a means of capturing more market control over the tuna traded from their waters. In 2010, the PNA secretariat entered into a 50/50 joint venture with the Dutch based company Pacifical BV to promote and market MSC certified skipjack (Miller et al. 2015). Fishers changing their practices to comply with the MSC non-FAD requirement are rewarded with a 10% price premium, with canneries receiving a further 3%, and the PNA/Pacifical receiving a further 7% (Brownjohn 2014). Having gone through both pre-assessment (independent third party assessment) and full assessment (stakeholder's input) processes, PNA was granted MSC certification in 2011 and a chain of custody (COC) certification in 2013. The first Pacifical MSC tuna products were on European supermarket shelved in November 2013.

2.4 Analysis of the VDS and MSC certification

From the perspective of new institutional economics both the VDS and MSC certification are designed to (re)allocate rights and responsibilities by packaging and delivering economic incentives for compliance with state defined conservation and management measures. The intended outcome of implementing these instruments by the PNA is to enhance the protection of member's common interest over state owned and controlled tuna stocks, as established under UNCLOS 1982, and create a competitive advantage as well as economies of scale within the region. The question remains, however, as to what extent have they been able to achieve this goal. Returning to our combined NIE framework (Figure 2.1), we now examine how these new economic policy instruments have realigned the interaction between political, governance and economic institutions and in doing so influenced the *de facto* and *de jure* control over tuna resources in the region.

2.4.1 The Vessel Day Scheme

The VDS is based on vessel days held by the members of the PNA that are allocated through the Total Allowable Effort (TAEs) and the Parties Allowable Efforts (PAEs), both of which

are determined at the annual meeting of the PNA. The WCPFC, which includes distant water fishing nations, agrees on conservation and management measures in a given year that will support or maintain maximum sustainable yield (MSY) based on the best available scientific information (WCPFC. 2014). Subsequently, the PNA members determine TAEs and allocated PAEs (measured in vessel days) among members based on historical effort and biomass levels that will support ecological objectives of the WCPFC (PNA. 2014). Additionally, the PNA governs the VDS by agreeing on the minimum benchmark price of fishing days or vessel days, and through a trading mechanism for transferrable days among members. The minimum benchmark price of a vessel day, give members the flexibility to sell their days for higher prices.

The implementation of the VDS can be broken into four phases. In the first phase, from 2007 to 2010, the design of the VDS progressed with some PNA members starting to sell vessel days to purse seine vessels. However, because the coverage of the scheme was partial and alternative access remained possible through non-participating members, the scheme was not successful (Aqorau 2009). The second phase saw the full implementation of the VDS in 2011 with hard limits on the PAEs. The third phase saw all member states agreeing to the establishment of a benchmark price through a signed Memorandum of Understanding (MOU) in 2012. With this MOU, the PNA members took the first step to form a cartel-like agreement to control fishing day price and increase revenue from purse seine fishing vessels (Havice 2013). At this time member states recognised the value that was being created by capping purse seine fishing effort leading to an increase in demand of fishing days, and increasing competition among fishing vessels. Their vision for the VDS at this point was that inefficient vessels would be removed from the fishery as prices would be driven up by more efficient vessels. The fourth phase saw a commitment by PNA members to also trade days among themselves, with the goal of creating greater flexibility to more efficiently allocated effort, and thereby create an incentive for members not to overshoot their collective TAE (Kumoru 2014, Pangelinan 2014, PNA. 2014, Taanga 2014).

Although the VDS has been widely seen as a success, a number of criticisms have been levelled at the scheme, focused on unresolved technical loopholes and the lack of evidence of improved fish stock health. For example, stock analysts claim that fishing mortality per day is expected to increase because vessels participating in VDS have become more efficient at catching fish via investment in human and physical capital and technology (Banks 2014, Harley et al. 2014). Also, while VDS places limit on purse seine effort, it has failed to place limits on the use of FADs, which is considered by some as key in addressing the decline in bigeye tuna stocks (Aqorau 2014). The inconsistent application of fishing and non-fishing days also remains a key challenge to effective monitoring and enforcement, leading to under reported fishing days and thus undermining the goal of restricting effort. For instance, in 2014, a record of non-fishing days has reached 8041 days, which is about 65% higher than the level it should be (PNA. 2014, Aqorau 2015). Finally, concern has been raised that the existence of non-VDS areas and participants within the WCPO will continue to put pressure on the conservation goal of the VDS given the free-rider effects of non-VDS participants are able to attract distant water fishing vessels to fish outside PNA waters. It is for these reasons

that the VDS is reviewed annually to allow members to examine its effect, as well as improve the VDS.

Despite these concerns, the VDS has created clear economic returns. From 2010 to 2015 access fees have increased from 3-6% to 14% of the total value of tuna landed from PNA waters. These returns have led to further strengthening the PNA's commitment to support and improve the VDS. Indeed, part of VDS improvement is the continued review of the MOU on benchmark price every year, which has resulted in an increase in benchmark price from US$5,000 in 2012 to US$6,000 in 2014 and $8,000 in 2015, and a further restriction on fishing effort (PNA. 2014). At the regional level, the VDS is gaining recognition and acceptance by the WCPFC (Aqorau 2014, Pangelinan 2014), which also appears to have increased the profile and overall bargaining power of the PNA with distant water fishing nations.

As illustrated in Figure 2.2, the economic incentives created through the VDS have also fed back into strengthening de jure political control over sovereign resources in three ways. First, the VDS has created a mechanism through which the PNA members are able to collectively and directly renegotiate fishing access with DWFNs, instead of at the WCPFC and through often divisive bi-lateral agreements. The VDS therefore appears to have empowered PNA members to take ownership and exercise rights and control over the allocation of their sovereign waters through a regionally coordinated and standardized negotiation structure (Kumoru 2014, Pangelinan 2014). It has also enabled PNA states to incentivise binding conservation measures through regional monitoring and enforcement, given allocation is determined by biomass and average actual vessel days in their respective EEZs. Third, the VDS provides member states with further leverage to expand control over purse seine vessels under the two multilateral agreements in the region including: (1) the Federated States of Micronesian Arrangement (FSMA) and (2) the United States Treaty (UST). In both cases, vessels have to incorporate VDS in their agreements with the eight PNA members indicating a significant shift in both de jure and de facto control over tuna resources.

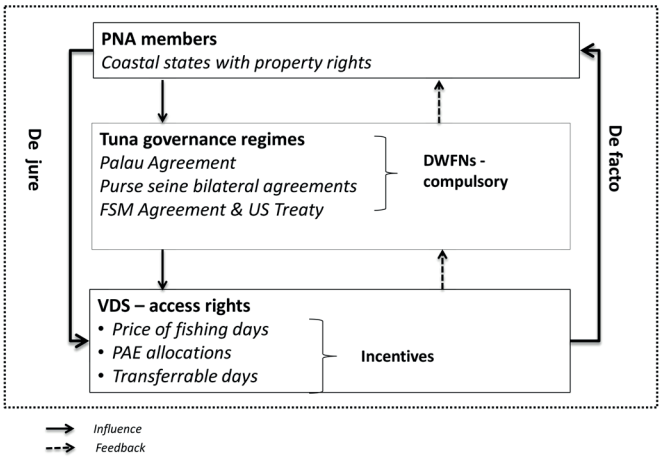

Figure 2.2 VDS dynamics and implications.

2.4.2 MSC certification

The MSC certification of free school or non-FAD purse seining complements the VDS by changing the catchability of a portion of purse seine fishing. By having the fishery certified, the PNA members' intend to generate added value from tuna through greater domestic participation in the tuna supply, set conditions for access to high value markets for fishing vessels and generate greater control over the activities of the purse seine fleet.

There are three key incentives provided by the MSC certification program. First, Pacifical BV (of which the PNA Secretariat is a 50% shareholder) set an initial price premium for MSC compliant tuna at 14%, which is expected to be distributed among fishers, processors and retailers (Banks et al. 2012). The price premium is intended to be paid to reward agents and partners taking part in the value chain of the MSC eligible tuna products. At the harvesting level, it is expected to motivate fishers to invest in non-FAD fishing, which will assist the PNA and WCPFC reach conservation goals for bigeye tuna (Brownjohn 2014). Second, certified skipjack will have preferential market access to EU and US retailers who have committed to selling MSC certified fish by 2018 or 2020 (Miller et al. 2015). In Europe, supermarkets dominate global canned tuna sales, with an increasing volume under direct contract to retailers selling the fish under their private labels (Miller et al. 2015). Despite the certified volume being limited to approximately 0.2% of the potential MSC eligible catches in 2014, PNA is hopeful that between 50-60% of the PNA tuna catches can eventually be MSC labelled (Brownjohn 2014). Finally, by also certifying the chain of custody PNA

members also hope to 'push' processing companies to invest in domestic processing plants and in doing so support the original FSMA goals for increasing domestic economic benefits.

Since obtaining the chain of custody certification in May 2013, it took the PNA two years to deliver its first supply to the market, largely due to an ongoing conflict between 'Pacifical' and Ell Dolphin safe label (Miller et al. 2015), limited supply of certified tuna, and delays in delivering processed tuna to the EU supermarkets (Brus 2014). It is premature to determine the economic outcome of MSC certification, given that progress has been limited due to the voluntary nature of the programme. Nevertheless, the annual net wholesale value of MSC certified products up to September 2014 has reached US$4.5 billion (Atuna 2014). Having MSC representing an increase on the same amount of landed product it is thought that PNA could earn up to 5% of MSC's net wholesale value, an estimated annual revenue PNA can get from participating in the value added tuna products besides revenue only from access fees every year (Brownjohn 2014).

As illustrated in Figure 2.3, the MSC has provided the PNA with a means of developing new incentives to shape everyday fishing practices. Just like the VDS, the MSC certification has enabled the PNA to increase their *de jure* control over the tuna industry in two directions. First, MSC compliance provides a reinforcement of existing state-based monitoring and enforcement measures, such as 100% observer coverage and the separation of FAD and free-school catches. In this way the investment in the MSC certification program is expected to support the enforcement and protection of property rights through the VDS. Second, and extending beyond the VDS, the MSC chain of custody certification provides greater transparency on where, when and how the fish is being caught and processed, which adds economic data that was previously not included in the wider governance of the fishery (PNA. 2015). By directly engaging in the tuna value chain, where global supply remains lower than demand, the PNA have used the MSC to reinforce the original aspirations of the FSMA. PNA countries such as PNG and the Solomon Islands are responding by establishing new contracts with processing and fishing companies to invest in improving domestic processing plants (Brownjohn 2014). Building on this, the PNA members are now discussing landing quotas, whereby fishing vessels could offload the catches in their domestic plants for processing (Kumoru 2014). In doing so, the PNA countries are able to again further contribute to domestic economic growth and employment opportunities for PNA members. If the PNA can eventually compete with Thailand, their main processing competitor;1) by supplying their catches to their domestic plants and 2) by exercising greater control over the tuna supply through VDS, by putting further restrictions on fishing effort.

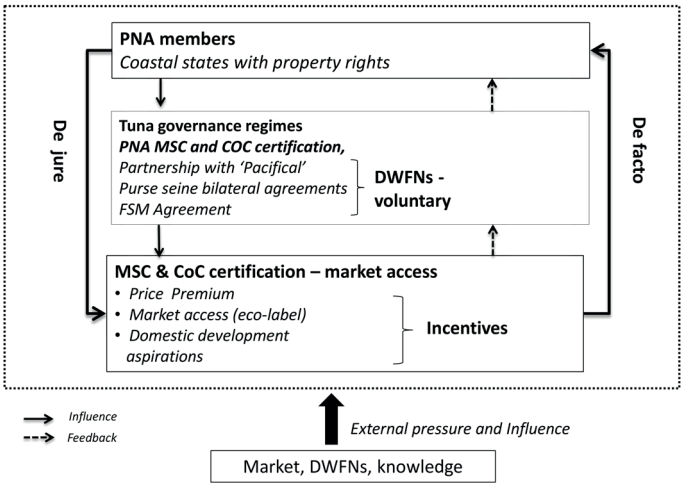

Figure 2.3 MSC certification dynamics and implications.

2.5 Discussion

Seen through the lens of NIE, our analysis demonstrates a clear interplay between *de facto* control of the PNA states and the *de jure* control of firms and distant water fishing nations, driven by the iterative feedback between political and economic institutions. Furthermore, our analysis indicates that the PNA has been able to strengthen their control over the tuna resources within their collective EEZs by extending what has proven to be relatively weak de jure power under regional treaties through the introduction of the VDS and MSC certification. In doing so, the PNA has developed greater control over the *de facto* power of everyday fishing practices, and consequently, extended sovereign control over transnational fish stocks and fishing fleets.

Our analysis also demonstrates, following Acemoglu et al. (Acemoglu et al. 2004, Acemoglu et al. 2005), the reinforcing role of continual feedback between political and economic institutions in the PNA. The results show that the VDS and MSC program change the incentive structure of resource and market access for distant water fishing nations and in doing so directly reinforce the formal political institutions associated with tuna conservation and wealth generation. In the case of the VDS, the benchmark price and trading mechanism has transformed access rights away from the distant water fishing country to the distant water fishing vessel level. In doing so, the scheme creates leverage for the PNA states to counter the normative and economic power of member states represented at the WCPFC level (Miller et al. 2015). But it is the fourfold increase in revenues to PNA states that appears to have been most influential in reinforcing state power beyond what the Palau Agreement alone was

able to accomplish in the previous 14 years that has reinforced political support for the scheme.

The MSC certification is similar to the VDS in that both are economic institutions which allows the PNA to exercise greater control over everyday fishing practices. In doing so, it also shifts attention from the country to vessel level. But instead of regulating resource access, the MSC certification regulates market access by stipulating what changes need to be complied with to land and sell MSC labelled fish to export markets. The feedback from MSC regulation of fishing practices and market access is seen in the partnership of the PNA with Pacifical BV, delivering a direct economic return for every tonne of MSC fish landed and sold. As such, the PNA receives a direct incentive to continue investing in harvest control rules that underlie both associated and un-associated FAD fishing. Like the VDS, the MSC certification therefore enables greater *de jure* power through the use and feedback from economic institutions which in turn enables greater *de facto* control over tuna resources.

Both cases also demonstrate the importance of governance institutions (Williamson 2000) in mediating the feedback between political and economic institutions. Williamson's observation of the 'third level' governance institutions appear to be fundamental to these feedbacks. The extension of *de jure* power of the PNA states and the erosion of *de facto* power of distant water fishing vessels is facilitated through the VDS and MSC as economic institutions, but neither of these economic institutions are directly related to the formal state institutions of the PNA members. Instead, governance institutions such as the benchmark price and trading mechanism of the VDS, and the harvest control rules required for MSC certification, have enabled a translation of the multi-lateral treaties such as UNCLOS, the Palau and FSM Arrangements into terms that directly regulate economic practices.

The greater cooperation between PNA states that both economic institutions have fostered also appears to be influencing the negotiation of major international treaties of PNA members. For instance, the PNA member states appear to be pressuring Kiribati to review their fisheries partnership agreement with the EU to comply with the VDS and other purse seine management regimes in the PNA (Taanga 2014). As the EU increases its market power over the region, the PNA countries are consolidating not only resource access, but also market access (Brownjohn 2014). In addition, the recognition and popularity of VDS has led to greater interest by non-PNA members, such as Tokelau joining the Palau Agreement, allowing for an expansion of VDS application to non-PNA waters (Aqorau 2014). A similar integration of MSC compliance between member states is more problematic, however ideas of tabling compulsory landings have been discussed (Kumoru 2014) with the wider goal of standardisation and integration of the PNA management for all purse seine vessels in the region and ensuring more participation in the value chain of the tuna products.

Despite the apparent successes of applying economic institutions for gaining greater political control over trans-boundary fish stocks, the future trend and success of such a strategy remains unclear. Following a new public management line of thinking (e.g. Christensen et al. 2002), this paper might be seeing the gradual merging of political and economic institutions, and as such an extension of *de jure* over *de facto* power. But this extension appears to be only

possible at scales above the nation state – akin to so called 'new fisheries regionalism' (Miller et al. 2014). At the centre of this upscaling of control are the governance institutions of the PNA, implementing incentives and cooperation that provide an alternative 'region' to the WCPFC that incorporates the interests of distant water fishing nations (see also Campbell et al. 2015). Without effective governance institutions setting incentives for cooperation between states and the inclusion of vessels, both interplay between the Palau and FSM Arrangements and the VDS and MSC are likely to be less effective.

It also remains unclear how these instruments can contribute to conservation objectives of state-based conservation measures over the long term. Although WCPO stocks of skipjack and yellowfin have been reported to be in a healthy state in 2014, overfishing continues, catch rates continue to increase (WCPFC. 2014). At the same time the market indicates excess supply of tuna resulting in declining tuna prices (Brus 2014). It is worth noting, that technology also evolve with new instruments, contributing to the ongoing power struggles between coastal and fishing states, requiring new and additional instruments. While the VDS and MSC certification may provide PNA members incentive to extract better economic gains, it also provides firms and fishing companies, incentive to invest in larger efficient vessels. Efficiency in fishing could improve tuna market prices in the long run, but with greater possibility leading to overcapitalisation and overfishing. Solving such issues may require yet a new balance between political, economic and governance institutions.

2.6 Conclusion

Our analysis highlights the significant institutional shift from a regulatory based regime to new economic policy based incentives for tuna management in the waters of the PNA aimed at both improving the conservation outcomes and domestic wealth generation. The experience with the VDS and MSC certification demonstrates that these new economic tools can contribute to these goals because they provide a means of realigning *de facto* economic with *de jure* political power. In doing so the instruments appear to have strengthened existing international treaties, provided a strategy to counter the influence of distant water fishing nations over the PNA member states under the WCPFC, and established greater credibility to the PNA's own conservation and management measures.

The results also demonstrate that the success of new economic policy instruments in aligning political and economic institutions is dependent on the effectiveness of meso-level governance institutions. The cooperation of the PNA members in maintaining these governance institutions has contributed to the apparent success of these economic tools in strengthening *de jure* control over tuna resources. Whether these arrangements can be maintained will in large part be determined by the strength of continued PNA cooperation and the delivery of incentives for ongoing investment in the institutions such as the VDS and MSC certification by PNA states. By internalising the economic externalities associated with overfishing into these political institutions, durable long-term improvements in the PNA tuna management may well be possible. But to ensure success, both regional and sub-regional

institutions need also to continue to provide effective governance institutions that will enable both political and economic actors to realise the incentives available.

Chapter 3. Stabilising cooperation through pragmatic tolerance: the case of the Parties to the Nauru Agreement (PNA) tuna fishery

Abstract

Purse seine fishing of skipjack tuna in the Western and Central Pacific Ocean (WCPO) raises concern over increasing impacts on yellowfin and bigeye tuna by-catch. To address sustainability concerns, the Parties to the Nauru Agreement (PNA) adopted the Vessel Day Scheme (VDS) for the management of purse seine fishing in the WCPO. The VDS has the potential to improve economic benefits for PNA members and to contribute to sustainability of the tuna stocks, and since 2012, has become an important mechanism to regulate fishing access rights in PNA waters. Despite this, monitoring and enforcement remain weak leading to violations of the agreement. Using a game theoretic framework, this paper examines the effectiveness of the VDS and its implications for fisheries regionalism. We examine the payoffs of member countries of the Nauru Agreement under full compliance, and payoffs under the currently observed partial compliance. Our findings indicate that member states' partial compliance with VDS rules plays a role in stabilising the agreement. Requiring full compliance, on the other hand, may encompass strong incentives for PNA members to deviate from the VDS since third parties offer attractive benefits in return for privileged access to fishing grounds. However, pragmatic tolerance of deviations from full VDS compliance seems to play a facilitative role in promoting cooperation and fisheries regionalism.

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Yeeting, A. D., H.-P. Weikard, M. Bailey, V. Ram-Bidesi and S. R. Bush (2017). "Stabilising cooperation through pragmatic tolerance: the case of the Parties to the Nauru Agreement (PNA) tuna fishery." Regional Environmental Change: 1-13.

3.1 Introduction

Regionalism, or the development of shared processes and structures between geographically proximate states (Gochhayat 2014, Miller et al. 2014), gained prominence in the management of trans-boundary fisheries in the 1970s in response to increasing depletion of the world's fisheries resources (Tsamenyi et al. 2001). Today fisheries regionalism involves cooperation among states to develop policies, mobilise resources and execute relevant activities with appropriate degrees of integration (Hughes 2005, Hegland et al. 2012). In complex environmental and political 'seascapes' like the Western and Central Pacific Ocean (WCPO), regional and sub-regional organisations have become the cornerstone of economic and social development of Pacific Island states, strengthening their position in the international policy arena that addresses trade, conflicts and trans-boundary marine resources such as tuna.

The Western and Central Pacific Fisheries Commission (WCPFC), established in 2004, is responsible for managing straddling and highly migratory fish stocks in the WCPO (Tsamenyi et al. 2004); a region that accounts for approximately 60% of annual global tuna production (Harley et al. 2014). However, the effectiveness of the WCPFC to achieve sustainable management of tuna stocks is challenged by the dynamic and diverging interests of Pacific Island member states and those of distant water fishing nations (DWFNs), including access and foreign aid agreements with the United States (US) and the European Union (EU) (Langley et al. 2009, Hanich et al. 2010, Bailey et al. 2013). Amidst these interests, the WCPFC is tasked with maintaining the healthy status of the purse seine fishery for skipjack tuna while establishing conservation and management measures for non-target yellowfin and bigeye tuna stocks (Harley et al. 2014). Additionally, the Commission needs to consider demands of Pacific Island nations to increase harvesting of skipjack tuna, of which they receive only 3-6% of the total landed value but that value contributes up to 10-40% of their GDP (Aqorau 2006, Havice 2010).

Predating the WCPFC is the 1982 sub-regional Nauru Agreement instituted to promote the equitable and sustainable use of tuna with the WCPO. The eight Parties to the Nauru Agreement (PNA) include the Federated States of Micronesia (FSM), Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea (PNG), Solomon Islands, and Tuvalu (see Figure 3.1). About 80% of the skipjack tuna caught in the WCPO is sourced from their waters, making them heavily dependent on the resource (Aqorau 2009, Harley et al. 2015). In 2007 the PNA countries adopted a Vessel Day Scheme (VDS) and implemented it in 2012 under the Palau Agreement, with the aim of improving control and management of the skipjack purse seine fishery (Aqorau 2009). The VDS is an economic instrument designed to limit the fishing effort of purse seine vessels by setting a benchmark price and allocating tradable fishing days. In this way, the PNA are seeking to strengthen their position as a regional fisheries organisation by reinforcing cooperation through more effective and equitable trans-boundary management of tuna.

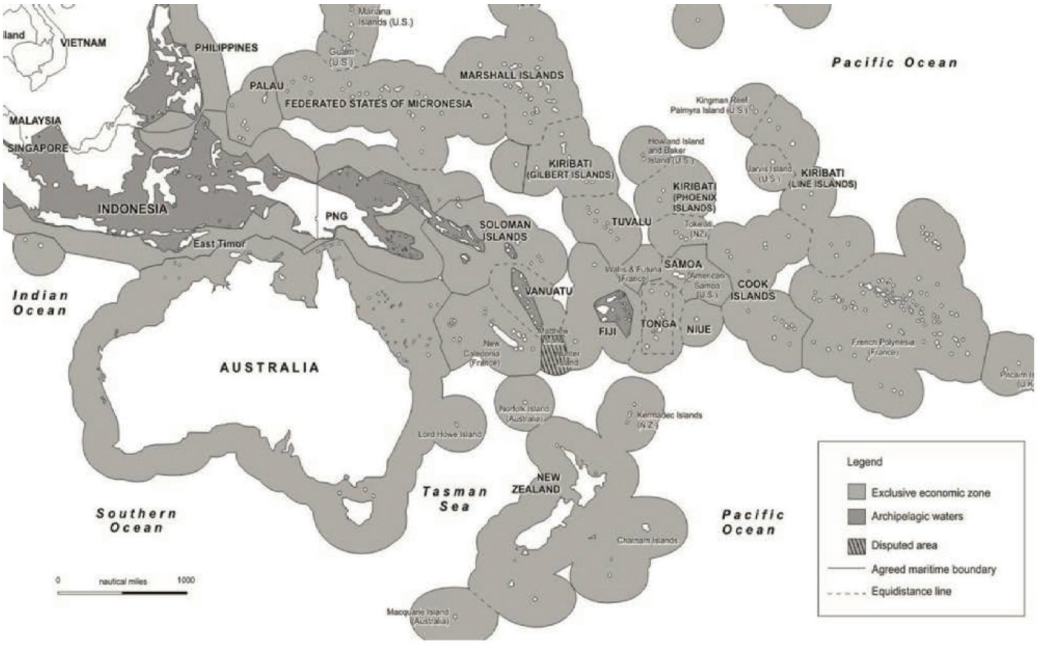

Figure 3.1 Map of the Parties to the Nauru Agreement (PNA) and non-PNA countries (Hanich and Ota 2013).

While the VDS has become an important economic mechanism to regulate fishing rights in PNA waters, its implementation remains dependent on the interests of both member states and DWFNs. This dependence in turn challenges the overall stability and effectiveness of the PNA as a 'new' form of fisheries (sub-) regionalism that can overcome the limitations of the WCPFC (Havice et al. 2010, Havice 2013, Miller et al. 2014). PNA officials acknowledge that the effective implementation of the VDS could potentially improve economic rents and at the same time achieve sustainability objectives (Aqorau 2014, Kumoru 2014, Pangelinan 2014). Yet, it has proven difficult to implement a level of monitoring sufficient to achieve full compliance with VDS rules due to (pre)existing multilateral fishing access and trade agreements with major international players such as the EU and US (PNA 2014, PNA 2015).

This paper analyses the present-day internal stability of the Palau Agreement by assessing the incentives each member has to either stay or leave (using data from 2014) (Pintassilgo et al. 2010, Hannesson 2011). In doing so we examine the role of transfers from third parties like the US and EU to the PNA members to remain in or deviate from the VDS. We use the terms 'full participation' to refer to membership, and 'full compliance' to refer to members' actions in accordance with the VDS. 'Partial agreement' refers to some party leaving the Nauru Agreement while others stay on, and 'partial compliance' refers to violation of VDS rules while maintaining PNA membership. The basis of our analysis is the allocation and use of VDS fishing days within agreed limits of total allowable efforts (TAEs), or sale of these days at or above a benchmark price. We determine PNA members' payoffs under partial and full

compliance. In doing so we determine how the level of VDS compliance facilitates cooperation towards strengthening the PNA as a new form of fisheries (sub-) regionalism.

The following section provides a brief account of the application of coalition theory to international fisheries agreements. We then present details of the VDS in the presence of (pre)existing tuna treaties, explain our methodology for calculating payoffs, and present our results. Finally we discuss and evaluate the wider political economic setting of (pre)existing access and trade agreements using the case of Kiribati and Papua New Guinea (PNG). Kiribati and PNG are key players with the largest fishing efforts in the region, and are countries who can either severely impair the agreement or foster compliance with the VDS.

3.2 Internal stability of fisheries agreements

Coalition theory (a branch of game theory) has been applied widely to analyse international environmental agreements on trans-boundary problems caused by externalities, such as migratory fish stocks (Bailey et al. 2010, Hannesson 2011). There is consensus in the literature on international fisheries management that countries with shared resources benefit from regional cooperation to conserve and manage those resources (Lindroos et al. 2008, Rahikainen et al. 2008, Bailey et al. 2010, Hannesson 2011, Walker et al. 2016). Knowing that cooperation can be beneficial, it is important to understand the wider political context that has, in many cases, undermined the potential for cooperation in the first place. The focus of current research on international environmental agreements using coalition theory is therefore an analysis of drivers of stability of cooperation. In the literature, stability of an agreement is defined as a situation where each member of an agreement is better off than if it were to leave the agreement and to act as a free rider (internal stability) and, at the same time, there is no outsider (non-member) who would be better off by joining the coalition (external stability) (Lindroos 2008, Pintassilgo et al. 2010).

Theoretical studies of international environmental agreements suggest that so-called ‘shallow’ agreements, with a low level of commitment, are associated with broader participation, and that shallow agreements can lead to more effective cooperation than agreements with ambitious targets and strict rules (Barrett 1994, Barrett 1998, Finus et al. 2008). A common assumption in this literature is that deviations from international agreements occur when incentives to violate the agreement outweigh the gains from compliance (Mitchell 2007, Finus et al. 2008, Wangler et al. 2012), or when there are loopholes in the agreement (Havice et al. 2010, Havice 2013, PNA 2014). Finus and Maus (2008) further argue that, given persistent free rider incentives, a stable coalition is not always facilitated by full compliance. Rather, members may find it beneficial to slightly deviate, and prefer this to leaving the agreement. However, it remains unclear whether this deviation will be tolerated by other members in the long-term. Our study provides empirical evidence for the theoretical finding that pragmatic tolerance, i.e. allowing for less than full compliance, may stimulate participation.

3.3 Data and approach

We operationalize and apply the concept of pragmatic tolerance in a three-step approach. First, using VDS data from 2014 we analyse the Palau Agreement in the context of the multiple tuna treaties existing in the region. The different treaties do not only have separate goals and applications, but may also conflict with VDS implementation. We estimate revenues from access fees based on the rules for different fleets and countries that define the uptake, monitoring and enforcement of the VDS. We calculate countries' payoffs under full and partial compliance with the rules of the VDS, taking into account transfers from third parties and their implications on countries' payoffs. Second, comparisons of payoffs allow us to study incentives for deviation that are inherent to (pre)existing access and trade agreements with third parties. Finally, we provide a more in depth analysis of the two most influential countries in the PNA, namely Kiribati and Papua New Guinea, and the influence of their access and trade agreements with the European Union and the US.

Our analysis is based on information and data gathered through interviews, observations and document reviews of a number of regional fisheries meetings attended by the first author.[4] A total of 22 interviews, including online communications, were conducted between 2014 and 2016 with officials from all PNA countries and experts from the PNA office, the Pacific Island Forum Fisheries Agency (FFA), and industry. Qualitative and semi-structured interviews were recorded where permission was given, and notes were taken where recording was not permitted. Quantitative data – at fleet and national level – are challenging to obtain, due to confidentiality, therefore we rely on reports that are made available in the public database domains of the WCPFC, FFA, and Secretariat of the Pacific Community to calculate external incentives. We also use aggregated VDS data made available by PNA delegations and the PNA Secretariat to calculate countries' payoffs. Details of data used for calculations are provided in supplementary materials.

3.4 Implications of tuna treaties on the VDS

3.4.1 Tuna regimes and VDS

The 1982 United Nations Convention on the Law of the Sea and the declaration of the 200 miles exclusive economic zone (EEZ) provide the legal framework for countries' right to manage and exploit resources within their designated zones (UNCLOS 1982). The EEZ declaration has motivated Pacific countries to build a forum to promote regional harmonisation of fisheries policies as a means to jointly manage tuna resources and provide technical advice and support for tuna access agreements (Havice 2010). However history shows that slow progress has been made towards the effective management of both economic returns and sustainability of tuna stocks.

[4] The meetings attended include the 10th and 11th regular meeting of the WCPFC, 19th and 20th meeting of the Parties to the Palau Agreement, 19th and 20th meeting of the Parties to the Federates States Micronesian Agreement, the 33rd and 34th meeting of the PNA, and the 5th Pacific Tuna Forum meeting.

Prior to the VDS, access to fishing in the Pacific was regulated through bilateral and multilateral agreements with DWFNs, whereby DWFNs were allowed to fish freely in any of the Pacific waters without restriction (Havice 2010). The 1992 Palau Agreement was a first attempt to reduce purse seine fishing effort by setting a cap on the number of vessels. This restriction was replaced with the VDS in 2007, which further defines tradable efforts using fishing days that are allocated to member states. Introduction of the VDS was an explicit move towards rights-based fisheries management (Aqorau 2009, Havice 2013), and its implementation began in 2012, soon after a cartel-like agreement was formed in 2010 to control the benchmark price for fishing days (Havice 2010). Through the VDS, PNA members aim to create scarcity and improve fishing efficiency and economic returns to members while maintaining sustainable effort levels (currently set at the 2010 levels) (Harley et al. 2014, WCPFC 2014), which is achieved through regulation of access to fishing grounds. Since its implementation the VDS has become an integral part of the PNA's and the WCPFC's management systems. The VDS covers approximately 70% of purse seine fishing that takes place within 20 degrees north and south of the equator, covering the EEZs of the eight PNA countries (see Figure 3.1).

VDS rules require members to fish within the TAE limits, or sell those days at the benchmark price (or higher) to distant water vessels under license agreements. The minimum terms and conditions for license agreements with foreign vessels are coordinated under the 'implementing arrangements' (PNA 2012), which require foreign vessels to be registered and licensed, report catches, maintain log books, allow observers on board and maintain transparency over their fishing activities (PNA 2010, PNA 2016). These operational requirements form the basis for all purse seine license agreements in the combined EEZs of the PNA member states, though the actual implementation at the country and fleet level remains key to management success.

The distribution of TAEs is coordinated and agreed by members at the PNA annual meetings (PNA 2012, Clark 2014). The TAEs are allocated to purse seine vessels fishing under four types of agreement: (1) the US Tuna Treaty (UST), (2) the Palau Agreement, (3) so-called 'joint venture and flag state arrangements' under the Federated States of Micronesia agreement (FSMA), and (4) the EU-Kiribati fisheries partnership agreement[5]. Table 1 provides a brief comparison of the different agreement types and how they differ from the Palau Agreement for VDS, and they are expanded upon below. Further, for TAE allocation, priority is given to the FSMA and the UST treaty (the two multilateral agreement in the Pacific), while remaining days are allocated to countries to sell to their bilateral fishing partners (Clark 2014, Pangelinan 2014, Taanga. 2014). Table 3.2 provides the distribution of TAEs by country according to the three agreement types (excluding EU-Kiribati agreement) in 2014.

The FSMA motivates PNA members to participate in domestic fishing rather than relying on access fees alone by allowing members to enter into joint ventures and flag state

[5] EU vessels with access through the EU fisheries partnership agreement were exempt from the VDS at the time of writing.

arrangements with foreign companies. FSMA vessels are given concessions to fish in domestic waters at a rate of US$ 4,000 in 2014 as compared to the cost of fishing within the VDS area of around US$ 6,000 (see Supplementary Table 2.1). PNA countries realise that reduced access fees through the FSMA are undermining the Palau Agreement by undercutting the VDS benchmark price and offer additional incentives for DWFNs to increase fishing outside the VDS (PNA 2014, PNA 2015).

The UST treaty has similar implications on the VDS for two reasons. First, priority is given to the US vessels where 6,827 fishing days were contributed from PNA members[6] in 2014 without pre-negotiations with the member countries. Second, the price of a US fishing day is set at US$ 5,500, still lower than the VDS benchmark price, although the application of the VDS to US vessels resulted in improving the total value of the UST treaty to US$ 63 million, which is about three times the amount that was paid by US vessels prior to VDS.

3.4.2 Non-fishing Days and High seas efforts

Exceeding the assigned TAE under the VDS leads to an adjustment of the following year's vessel days by deducting "(i) the amount of the excess, if the excess is less than 100 days, and (ii) 120% of the excess if the excess is 100 days or more" (PNA 2012:11). Although the consequences of an infringement are clear, monitoring and enforcement remains weak due to existing loopholes associated with (pre)existing legal obligations to tuna regimes in particular the UST treaty and the FSMA (Aqorau 2014, Kumoru 2014, Pangelinan 2014). These loopholes prevent PNA from effectively enforcing VDS rules. In practice, countries fail to consistently apply their limit on fishing days and to stop fishing when their allocations have been exhausted.

Respondents observed that under the FSMA fishing effort in both archipelagic waters and territorial waters is counted as non-fishing days and thus not deducted from the TAEs (PNA 2015). In 2013 and 2014 non-fishing days reached 8,500 and 7,660 days, respectively, accounting for 15% of the total days fished in PNA waters (PNA 2014). We assume that the reported 7,160 days in the archipelagic waters were fishing days, but the remaining 500 non-fishing days were transit days and not fished (see Supplementary Table 3). For our analysis we define excess efforts as days fished reported as non-fishing days in the archipelagic waters plus the days fished by EU/Spanish vessels which were not deducted from the Kiribati TAEs, giving 7,644 non-fishing days in 2014 (Table 3.2 column F, and Supplementary Table 3 for details). Assuming that TAEs reflect a sustainable effort level, we consider this excess effort as overfishing, implying that they will reduce future stocks. We refer to the reduction of stock as lost resources, and include it in the calculation of *long-term* incentives to deviate from full compliance (Table 3.3, column G, see also the Appendix in the Supplementary material).

[6] In 2014 and 2015, US vessels claimed 8,000 days from PNA members.

Table 3.1 Purse-seine fisheries regimes in the PNA waters

Purse seine tuna Agreements in the PNA waters	**United States Tuna (UST) treaty**	**Palau Agreement**	**FSM Agreement**	**EU-Kiribati fisheries partnership**
Signatories	*FFA members (Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu); and the United States*	*PNA members (Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu)*	*PNA members (Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu)*	*Kiribati and EU/ Spanish Vessels*
Year	1978	1992	1994	2003
Objectives	To strengthen political and economic ties between US and FFA members through fisheries sector development	To enter into cooperation to strengthen management of purse seine fishing in the PNA waters	To secure maximum sustainable economic benefits through a regional access agreement as a mechanism for domestic vessels of the PNA to access the resources of other parties	To provide fishing opportunities for Spanish vessels in the Kiribati EEZ in return for access fees and financial contribution to support the Kiribati fisheries policy
Measures	Limiting efforts i) by setting a cap at 40 for US vessels; and ii) licensed US purse seine vessels may fish freely in all FFA EEZs	Limiting efforts i) by setting a cap at 205 purse seine vessels in the PNA EEZs; and ii) restrict access to vessels adhering to the 1st and 2nd implementing arrangement of the PNA	Restricting access to vessels adhering to 1st and 2nd implementing arrangements (but no clear limits or cap set for participants)	Granting access to 4 purse seine vessels and 4 longline vessels for 15,000 tonnes catch per year
Target gear/ species	i) Purse seine for skipjack ii) Longline for bigeye and yellowfin	Purse seine for skipjack	i) Purse seine for skipjack ii) Longline for bigeye and yellowfin	i) Purse seine for skipjack ii) Longline for bigeye and yellowfin
Area of application	FFA members 200 miles EEZs	PNA members 200 miles EEZs	All waters of the PNA EEZs and territorial waters	Kiribati 200 miles EEZs

Further development with VDS and new measures	**May 2013** – VDS applied to US vessels only in the PNA waters **Result**: An allocation of 5515 days on top of the TAEs for VDS **2014** – US claimed more days from PNA **Result**: 7827 days on the TAEs **2015** – US claimed 8000 days from PNA **Result**: 8000 days are allocated and taken from PNA members' allowable efforts	**2007** – VDS was adopted to replace the 205 vessel number limits with fishing days limits **Result**: every year PNA members agreed on i) TAEs and allocations based on historical catch (7 years back) and biomass ii) fishing days benchmark price iii) improving monitoring and compliance levels	**2007** – domestic vessels are allocated 3907 fishing days cap based on fished countries (those EEZs fished by FSMA vessels) **2014** – domestic vessels are allocated 3907 fishing days based on fishing countries (PNA members having FSMA vessels)	**2013** – VDS is proposed but not applied **2014** – VDS is sold to Spanish vessels at the price smaller than the agreed benchmark price **2015** – Kiribati proposed the use of VDS benchmark price to Spanish vessels but no agreement was reached – agreement was suspended

(Source: fieldwork – compiled from purse seine fisheries treaties, agreements from FFA and PNA documents, 1987 to 2015)

Table 3.2 Fishing days allocation by country in the waters of the Parties to the Nauru Agreement (PNA) 2014

PNA countries	Total allowable effort (TAEs) in days under VDS [a]	Days to bilateral agreements [b]	Days to FSMA [c]	Days to UST [d]	Days in the high seas [e]	Days in the archipelagic waters [f]
	A=B+C+D+E	B	C	D	E	F
FSM	6135	4530	462	243	900	721
Kiribati	11187	3499	627	4737	2324	4593
Marshall	3292	1887	992	413	0	464
Nauru	2292	1354	0	670	268	557
Palau	510	495	0	0	15	123
PNG	15495	11435	1732	54	2274	1079
Solomon	2805	2466	0	11	328	80
Tuvalu	1764	700	0	699	365	27
Totals	**43480**	**26365**	**3813**	**6827**	**6475**	**7644**

Footnote
a - Total days in the countries' EEZ used by the three agreements and in fishing in the high seas.
b - Adjusted 2014 total allowable efforts from VDS outcomes, extracted from report of the purse seine VDS administrator 2014 and 2015.
c - Fishing days used by FSMA vessels in 2014, extracted from 20th meeting of the Palau Agreement paper on purse seine VDS PAEs for 2015 to 2017.
d - Fishing days used by US vessels in 2014, extracted from 20th meeting of the Palau Agreement paper on purse seine VDS PAEs for 2015 to 2017.
e - Estimated efforts in the high seas (see supplementary material for details).
f - Estimated efforts in the archipelagic and days fished by EU vessels (see supplementary material for details).

(Source: fieldwork)

3.4.3 Incentives for compliance

We analyse the stability of the Palau Agreement by looking at the incentives set by the various external agreements to deviate from full compliance with VDS rules. The countries (players of the game) are the Parties to the Palau Agreement[7] and we label the set of players as *N*, where a typical country is labelled $i \in N$. Country i has a total allowable effort measured in days, $\bar{d}_i$, that are sold under different types of agreements, *a*, with different prices for the VDS benchmark price (p_{vds}) applicable under the bilateral agreements[8], the Federated States of Micronesia Agreement (p_{fsm}), the US treaty (p_{us}) and the EU-Kiribati Fisheries Partnership Agreement (p_{eu}). No revenues are collected for days fished in the high seas ($p_{hs} = 0$), but these days are deducted from the TAEs. The set of agreements is labelled as $A = \{vds, fsm, us, eu, hs\}$. The total allowable effort (fishing days) for country *i* is allocated to the different agreements, see Supplementary Table 2.1

$$\bar{d}_i \geq d_i \equiv \sum_{a \in A} d_{i,a}$$

The payoff of country i, for all $i \in N$, is therefore given by:

$$\Pi_i = \sum_{a \in A} d_{i,a} \cdot p_a$$

The stability of the Palau Agreement is dependent on the preference to stay in the coalition as opposed to leaving the coalition (i.e. free riding). We construct scenarios to compare the payoffs when countries fully comply with VDS rules, and the payoffs under partial compliance. Full compliance with VDS means that all conditions of the Palau Agreement are met. The conditions include limiting effort within the total allowable effort (fishing days), and selling fishing days at or above the agreed benchmark price (PNA 2012). We assume full compliance when, $d_{i,fsm} = d_{i,us} = d_{i,eu} = d_{i,hs} = 0$, i.e. when $d_{i,vds} = \bar{d}_i$. Partial compliance is when fishing days are allocated to agreements where the VDS benchmark price is undercut, i.e. $d_{i,fsm} + d_{i,us} + d_{i,eu} + d_{i,hs} > 0$, or when countries fail to close their waters when their days are exhausted, i.e. $d_i > \bar{d}_i$.

Days fished in domestic and archipelagic waters are reported as non-fishing days and are denoted $d_{i,nfd}$. Non-fishing days do not just mean foregone revenues from access fees in a given year, but also represent fishing efforts beyond sustainable levels (i.e., above and beyond the TAE) and therefore a loss of resources for future use. We calculate the value of forgone revenues due to overfishing ($d_{i,nfd} \cdot p_{vds}$) and estimate the impact of overfishing on the future sustainable (steady state) catch. To assess the latter we use a Gordon-Schaefer model (see

[7] Tokelau is a member of the Palau Agreement, but is not included in the payoff calculation given it is not a PNA member and accounts only for a small number of fishing days, see Supplementary Table 2.1.
[8] We use *vds* as notation for bilateral agreements as they strictly apply VDS.

Supplementary material) and find that excess fishing of 15% beyond sustainable yields is associated with a reduction in sustainable harvests of about 2.2%. This implies a loss of 957 fishing days to be subtracted from future TAEs. Assuming a discount rate of 5%, we estimate the value of lost resources due to overfishing (Table 3.3 column G); for details see Supplementary Table 4 and the explanatory note in Supplementary material.

3.5 Payoffs under partial and full compliance

In order to assess the stability of the Palau Agreement and the incentives for VDS compliance, we estimate: 1. free rider payoffs, 2. VDS revenues from access fees for all PNA countries, 3. payoffs under full and partial compliance, 4. transfer payments received, 5. lost revenues and 6. lost resources due to overfishing (Table 3.3). We assume that free riders engage in overfishing and in doing so can at least fish all their vessel days and engage in fishing in the archipelagic waters. Using the vessel days allocation and non-fishing days data (Table 3.2), free rider payoffs for individual countries are larger than their payoffs under full compliance (Tables 3.3 and 3.4). We conclude that with strict enforcement and full compliance to VDS rules the Palau Agreement would be unstable. Our results also indicates that under partial VDS compliance the Palau Agreement would only be stable in the short term but not in the long term (Table 3.4 columns b and c).

We also observe that partial compliance is preferred to full compliance in the short term by a number of countries, including Marshall Islands, Palau, PNG, Solomon Islands and Tuvalu (see Table 3.4 column d). However, these payoff calculations do not account for lost revenues and lost resources from the allocation of fishing effort in domestic and archipelagic waters as non-fishing days (see Table 3.3 columns F and G). The results indicate that from a longer term perspective, it does not pay to overfish even if revenues for non-fishing days were collected (which is not the case) (comparing Table 3.3 columns F and G). This holds even if we use a high discount rate of 10% and the result is strengthened when applying lower discount rates (see Supplementary Table 4).

Table 3.3 Parties to the Nauru Agreement (PNA) countries' Vessel Day Scheme (VDS) payoffs in 2014

PNA countries	Free rider payoffs (partial agreement)[a]	Payoffs under full compliance [b]	Access fees under partial compliance	Transfer from third parties [c]	Payoffs under partial compliance (status quo)[d]	Lost revenues from fishing in the archipelagic waters (non-fishing days)[e]	Net present value of long term loss of resources (*i=0.05*)[f]	Long term payoffs under partial compliance
	(million US$)	(million US$)	(million US$)	(million US$)	(million US$)	(million US$)	(million US$)	(million US$)
	A	B	C	D	E=C+D	F	G	H=E-G
FSM	41	37	30	3	34	4.3	16.2	17
Kiribati	95	67	50	16	66	27.6	29.5	36
Marshall	23	20	18	9	27	2.8	8.7	18
Nauru	17	14	12	1	12	3.3	6.1	6
Palau	4	3	3	1	4	0.7	1.3	2
PNG	99	93	76	68	144	6.5	40.9	103
Solomon	17	17	15	13	28	0.5	7.4	20
Tuvalu	11	11	8	5	13	0.2	4.7	8
Total PNA	**307**	**261**	**211**	**116**	**327**	**45.9**	**114.8**	**212.1**

Footnote

a - Countries individual payoff under partial agreement - the situation where one party leaves the Palau Agreement while others stay on. Free riders can at least fish all their vessel days and would engage in fishing in the archipelagic waters. Values is estimated using the benchmark price.

b - Payoffs under full compliance: estimated VDS revenues from access fees where full membership and full compliance with the rules of the Palau Agreement are achieved. All vessel days are sold at the benchmark price and no days allocated to FSMA, UST and the high seas.

c - Payoffs under partial compliance (status quo) is an estimated VDS revenues from access fees and transfers from third parties. Under partial compliance, some vessel days are sold at reduced prices under FSMA and UST, and days in the high seas are free of charge. See supplementary materials 2, 2.1 and 4 for details.

d - Value of excess fishing days in 2014 due to fishing in the archipelagic waters and vessel days used by EU/Spanish vessels. See supplementary materials for details.

e - Foregone revenue in 2014 due to not collecting fees for fishing in domestic and archipelagic waters. See supplementary materials for details.

F - See explanatory note and Supplementary Table 4 for calculation and distribution of value of long term loss of resources.

Explanatory note

- All figures and totals are rounded numbers

(Source: fieldwork)

Table 3.4 Parties to the Nauru Agreement (PNA) countries' incentives for participation and compliance

	Incentives to participate			***Incentives to comply***	
PNA countries	**Stability under full compliance**	**Short term stability under partial compliance**	**long term stability under partial compliance**	**Short term incentive to deviate from full compliance**	**Long term incentive to deviate from full compliance**
	(million US$)	**(million US$)**	**(million US$)**	**(million US$)**	**(million US$)**
	a=B-A	**b=E-A**	**c=(E-G5)-A**	**d=E-B**	**e=(E-G5)-B**
FSM	-4	-7	-24	-3	-19
Kiribati	-28	-29	-58	-1	-31
Marshall	-3	4	-4	7	-1
Nauru	-3	-5	-11	-1	-7
Palau	-1	0	-1	1	-1
PNG	-6	44	3	51	10
Solomon	0	10	3	11	3
Tuvalu	0	2	-2	3	-2
Total PNA	-46	20	-95	66	-49

Explanatory note

- *Table 3.4 is linked to the columns in Table 3.3.*
- *See Supplementary Table 4 for i=5% and i=10%.*
- *All figures and total are rounded numbers. Countries with 0 incentives in fact, are having small negative incentives rounded to 0.*

(Source: fieldwork)

Overall we estimate that lost resources due to overfishing amount to about US$115 million assuming a 5% discount rate (Table 3.3). The results also show that the members of the PNA allow fishing outside the VDS area because transfers received from third parties are high enough to compensate for the lost revenues from forgone days. However, when potential future lost resources are considered, these payments are not enough to offset the externalities produced by the allocation of 'non-fishing days'. As shown in Table 3.3 (column H) and Table 3.4 (column e), with a long-term perspective to management full compliance is the best option. In this case the only countries with an incentive to deviate from full compliance are PNG and Solomon because of their interests and participation in domestic fishing. Domestic fishing allows for fishing outside the countries' EEZs and is therefore accounted for as 'non-fishing days'.

Transfers from third parties include dividends from joint venture fishing companies, benefits from employment, and grants for fisheries related development under the (pre)existing treaties

(see Table 3.3 column D).[9] The PNA's joint benefits from these transfers in 2014 are around US$116 million, of which about 60% is received by PNG. From the Palau Agreement's point of view, these benefits, however, come at the cost of lost revenues and excess efforts undermining the VDS rules due to concessions and reduced rates.[10]

Transfers from third parties offer an opportunity to look at the political challenges of why VDS cannot be fully implemented. Our payoff results indicate that the VDS implementation suffers from individual countries' taking short-term gains offered through the (pre)existing access agreements at the expense of the long-term collective sustainability goals. The result indicates that the incentives are large enough to compensate for loss of revenues and lost resources from forgone fishing days, i.e. US$116 million compared to US$84.5 million[11] currently. Hence overall, countries still have some incentives to deviate from full compliance with the VDS rules. This means that the transfers from bilateral contracts dis-incentivise full VDS compliance in the short term. On the assumption that TAEs are set optimally, the lenient implementation of the VDS implies that fewer resources will be available in the future.

Although it appears that PNA countries prefer partial compliance to full compliance in the short term due to the transfers received, this is not the case when countries adopt a long term perspective. Over the long term, partial compliance leads to overfishing and lower TAEs. The value of the resources lost due to overfishing (Table 3.3, column G) is very sensitive to the discount rate. Assuming a 5% discount rate, long term payoffs under partial compliance are less than under full compliance (Table 3.3 column H). Only at very high discount rates (exceeding 8.7%) do PNA members have an incentive to maintain the status quo of partial compliance.

However at the country level, three of the PNA members i.e. FSM, Kiribati, and Nauru have negative incentives to deviate from full compliance in both the short term and long term.[12] The negative incentives indicate that these countries depend on revenues from access fees, and would therefore be worse off through violation of the VDS. This is because their benefits from transfers are not high enough to compensate for the cost of partial compliance. This is also true assuming a 10% discount rate (see Supplementary Table 4). Assuming a 5% discount rate, however, the collective advantage of full compliance amounts to US$49 million compared to partial compliance (Table 3.4, column e).

In summary, the results provide empirical support of Finus and Maus (2008), who theoretically argue that partial compliance or pragmatic tolerance provides incentives for countries to remain in a coalition. This indicates that while PNA cooperation may not appear rational today, it is rational to cooperate for benefits in the future. It also means that prescribing full cooperation

[9] See Supplementary Table 1 for transfers from third parties calculation and Supplementary Tables 1.1 to 1.4 for raw and secondary data used for calculations.
[10] See the details discussed earlier in section '*Implications of tuna treaties on the VDS*'
[11] Total lost resources from fishing outside the VDS area, i.e. US$45.86 million (Table 3, column F) and US$38.9 million (6,475 high seas efforts * US$6,000).
[12] Six countries are having negative incentives to deviate from full compliance when considering the long term.

today may cause a breakdown of the PNA if countries are myopic and give little weight to future gains of cooperation. Allowing slight deviations, pragmatic tolerance, may be an appropriate means of maintaining the coalition. The Nauru Agreement is therefore potentially internally stable under partial compliance with the VDS, although we acknowledge that individual countries still seem to have an incentive to leave. Full compliance is the first best outcome as revenue from access fees are greater than they are under partial compliance, but only if there are no incentives to deviate from full compliance. The presence of free rider incentives is then likely to make the Palau Agreement internally unstable. Therefore, partial compliance with VDS rules or pragmatic tolerance with deviation facilitates full participation in the Palau Agreement.

3.6 Case analysis - Papua New Guinea (PNG) and Kiribati

To further understand the role of transfers from third parties in stabilising the Nauru Agreement under partial compliance, we now turn our attention to PNG and Kiribati. Both countries are central to the implementation of the VDS given they have the largest share of both fishing effort and catch within the PNA. As dominant players they also play the most important role in the overall stability of the VDS and therefore the success of new fisheries regionalism. They are also particularly interesting for our analysis because, based on the 2014 data, both Kiribati and PNG have the most non-fishing days at 4,593 and 1,074 days respectively (see Table 3.2). Furthermore, both countries are firmly engaged in (pre)existing access and trade agreements with, amongst others, the European Union. We now provide a more detailed account on the influence of both countries on the stability of the VDS.

3.6.1 Papua New Guinea

The analysis of payoffs indicate that PNG is better off with partial compliance rather than with full compliance under the status quo (Table 3.3). Specifically, PNG's estimated revenue from access fees under partial compliance is around US$76 million compared to US$93 million under full compliance (see Table 3.3, column C and B). However, PNG gains about US$68 million as transfers from third parties under partial compliance, making PNG's current payoff under the status quo to be around US$144 million.

Transfers from third parties include grants and associated benefits from access agreements under the UST treaty and the FSMA. The UST treaty allocates at least US$0.5 million annually to each Pacific Island country in addition to any access fees (for details see Supplementary Materials). The distribution of FSMA grants is negotiated and decided bilaterally between the PNG government and foreign firms. However, the FSMA countries tolerate the high rate of "non-fishing days" in the archipelagic waters - of which PNG has the largest area. Based on non-fishing days data, we estimate the value of lost resources to PNG at around US$41 million

(Table 3.3, column G). But this estimate also shows that PNG's long term payoff under partial compliance is still preferred to full compliance. Therefore, in the case of PNG we see a role for pragmatic tolerance even in the long term. PNG is better off as member than as a free rider, but this would not be true for full compliance. Also note that PNG's short term incentive to deviate from full compliance is stronger than its long term incentive.

According to Hamilton et al. (2011), the EU interim economic partnership agreement that allows duty free access to the EU markets for PNG is also a factor undermining the VDS. The concern was that distant water fishing nations investing in processing capacity in PNG to gain access to FSMA flagged vessels will increase the overall fishing capacity in archipelagic waters. However, the EU interim agreement has since forced PNG to improve the application and enforcement of the VDS, with specific attention being given to the declaration of non-fishing days in the archipelagic waters (Atuna 2015). Failure to do so could jeopardise about US$60 million in employment benefits if conditional access of PNG processing plants to the EU market was lost. Respondents argue that although PNG has addressed non-fishing days in 2015, by enforcing VDS in the archipelagic and territorial waters, the VDS price remains an issue. Our results indicate that addressing non-fishing days will reduce PNG's lost resources from excess efforts (Table 3.3, column G), but could potentially improve long term payoffs. It therefore appears that addressing non-fishing days can present a positive incentive for long term resource stewardship, which also supports our claim that longer term gains can be realised by addressing compliance issues of the VDS.

3.6.2 Kiribati

Our results indicate that Kiribati is better off under full rather than partial compliance with the VDS. Based on available data, Kiribati is currently earning about US$50 million under partial compliance compared to US$67 million should strict application of the VDS rules be applied (Table 3.3). Like PNG, Kiribati also bears the highest loss of revenues for high seas fishing given their share of efforts in the high seas. However, an additional US$16 million in transfers from third parties increases the total payoff for partial compliance to US$66 million. These calculations highlight that the US$1 million shortfall under partial compliance should incentivise Kiribati to support full VDS compliance.

Transfers from third parties to Kiribati are contributed from grants and payments associated with the UST treaty, FSMA and the EU-Kiribati fisheries partnership agreement. While these transfers appear to offer some incentive for Kiribati to allocate part of its TAE to the high seas in support of its domestic or joint venture partners, they do not appear large enough to compensate for both current lost revenues and loss of resources. Based on the 2014 data, Kiribati contributed the largest share of fishing effort of all PNA members outside the VDS. Assuming a 5% discount rate, we estimate that this allocation leads to a US$30 million loss in future resources for

Kiribati. It therefore appears that the benefits from transfers are not large enough to compensate for Kiribati's losses from fishing outside the VDS (Table 3.3 column H). Table 3.2 shows that Kiribati is the biggest defector with the highest share of fishing outside the VDS. Therefore, it also suffers the largest losses of revenues. For this reason, our result suggests that Kiribati is better off under fully enforced VDS rules given this will increase payoffs in both the short and long term (Table 3.4, columns d and e). Second, our result suggests that while Kiribati enforces VDS rules in the high seas by deducting TAEs, they could also improve benefits by engaging in domestic fishing and processing like PNG. A similar analysis also applies to other countries with negative incentives to deviate from full compliance, in particular FSM and Nauru.

In contrast to PNG, the EU agreement with Kiribati appears to undermine the VDS. Kiribati has exempted the EU's (mostly Spanish) purse seine vessels from the VDS and agreed to a vessel day rate of US$2,207 in return for US$8 million in aid from the EU. It appears that in doing so Kiribati is accepting short term over long term benefits. Including fishing efforts by the EU vessels as non-fishing days leads to both lost revenues (Table 3.3, column F) and a loss of resources (Table 3.3, column G). After facing increased pressure from within the PNA to consistently apply VDS across all vessels, Kiribati began applying the VDS to the Spanish vessels in 2015. Because the EU did not agree to the terms of the VDS, the EU-Kiribati fisheries partnership agreement has been suspended. At the time of writing, Spanish vessels have left the Kiribati waters and are entering into a new fisheries agreement with Cook Islands. Though these latest changes are not included in our analysis the suspension of EU-Kiribati fisheries partnership will result in short term economic losses from reduced access payments for Spanish vessels. But in the long term Kiribati will gain by mitigating the future loss of resources (Table 3.3, column G), and will eventually improve the incentives for full compliance (Table 3.4, column e).

3.7 Implications for fisheries regionalism

Our analysis demonstrates the challenges of full VDS compliance by the PNA countries in the presence of free rider incentives. In doing so we provide insights in how the stability of the PNA as a 'new fisheries sub-region' adjacent to the wider WCPFC is maintained. Our empirical application supports the notion that players are better off under full cooperation in the long term (Kronbak et al. 2006, Bailey et al. 2013), but full cooperation only appears to be more beneficial in the absence of free rider incentives derived from (pre)existing access agreements. As a result incomplete compliance emerges as the more rational option in the short term. The results also indicate that full participation is not always stable (Wangler et al. 2012). In support of Finus et al. (2008), we show that stability of coalitions can be improved when partial compliance to the VDS are tolerated by coalition members. This is what we call 'pragmatic tolerance'. We find that a stable coalition is maintained as long as members' payoffs improve marginally beyond free rider payoffs.

The results also clearly point to the importance of the transfers from third parties to countries' economic gains. In summary, without transfers from third parties, our results indicate that payoffs from participation are better with full compliance – which corresponds to the theoretically ideal situation and future goal. The role of these transfers in dis-incentivising compliance to the VDS opens up wider questions around the political economy of fisheries agreements and their implications for the success of fisheries regionalism. In our case, we observe that both violations and pragmatic tolerance to partial compliance with the VDS are strongly influenced by agreements with (and in favour of) distant water fishing nations. As such, the design and implementation of the VDS cannot be seen in isolation from the dynamic and complex nature of the underlying political pressure of the DWFNs gaining and maintaining access to tuna resources (e.g. Havice 2010; Parris 2010; Campling and Havice 2012). Understanding these political dynamics helps us to better understand the internal dynamics of tolerance in ensuring the ongoing stability of an international agreement (Finus et al. 2008, Wangler et al. 2012). As this study shows, the current levels of compensation for tolerating partial compliance may not be sustainable over the long term given that tolerance today may have negative impacts on future stocks, thus threatening sustainable tuna catches.

The specific cases of PNG and Kiribati further demonstrate how the decisions of member states are largely based on short-term gains, even-though they would be better off under full compliance over the long-term. Despite criticisms of myopic decision-making (Chwe 1994, Walker et al. 2016), the results do indicate that countries are aware of the long-term value of the resource derived from full VDS compliance. It is therefore plausible that countries can be incentivised to remove loopholes in the VDS relating to the allocation and accounting of non-fishing days and the alignment of access fees under different access agreements to the VDS benchmark price. Progress is indeed already seen in this direction. PNG has reduced the number of non-fishing days in response to the EU interim agreement. If such incentives for trade could be extended to other PNA members' non-compliance issues, a new set of incentives may be developed to resolve these issues. Kiribati, despite facing short term loss, has chosen to enforce the VDS at the expense of a (pre)existing agreement with the EU, particularly the Spanish vessels. Both moves by PNG and Kiribati have improved the overall governance and transparency not only within PNA but also between PNA members and DWFNs.

Building on earlier observations, our results indicate that economic institutions like the VDS can strengthen forms of fisheries sub-regionalism like the PNA (Miller et al. 2014, Yeeting et al. 2016). This paper adds to this observation by demonstrating that economic institutions can also play a key role in strengthening the political stability of these regional coalitions. But in support of Havice and Campling (2010) we also demonstrate that economic institutions are by no means isolated from the interests of powerful distant water fishing nations. Nevertheless, the VDS has re-opened the negotiation of (pre)existing access agreements with a view to apply consistent measures across all purse seine vessels in the PNA waters, and also the possibility of negotiating improved conditions beyond the PNA. In effect, PNA members have been able to improve their

bargaining position for better economic gains from the treaties, not only in increasing economic returns, but also in developing clear limits and restrictions on fishing effort. The move towards consistent application of purse seine management across all purse seine vessels in the PNA waters have significantly improved transparency and better coordination of fishing access.

3.8 Conclusion

Our analysis provides two significant contributions to the study of international fisheries agreements. First, pragmatic tolerance of small deviations, and therefore short term partial compliance, can be an important stepping stone in moving towards full cooperation. In light of this finding, and similar to discussions around shallow agreements, full participation in international agreements on shared resources may be improved if some flexibility is allowed. Second, countries that receive greater benefits from transfers than the value of lost resources have incentives to support pragmatic tolerance, whereas members with less benefit from transfers have no incentive to give away their fishing days for free or at a low price. Once transfers are removed countries are likely to push for full VDS compliance rules in order to maximise their potential gains from full cooperation.

These findings hold consequences for the design of new forms of fisheries (sub-) regionalism at scales both at and below the level of regional fisheries organisations like the WCPFC. If economic institutions like the VDS offer a requisite level of incentive to members to fully cooperate, they can directly influence politically motivated side payments or transfers that have historically obstructed the success and effectiveness of sub-regional cooperation for sustainability. Said differently, such economic institutions can provide a means of addressing inefficiencies by strengthening the *de-facto* political power of resource managers to renegotiate and restructure institutions and incentives. Further research could focus on comparative analyses at different scales and in different regions, including other regional fisheries organisations or other international regimes. Doing so would provide a more rigorous understanding of the economic and political linkages between states and their role in structuring region-building based on the stewardship of valuable and contested natural resources.

Chapter 4. Does certification improve fisheries governance? The case of MSC certification of Western Central Pacific Tuna

Abstract

The world's largest tuna fishery is found in the fishing zones of eight Pacific Island countries who are Parties to the Nauru Agreement (PNA), but despite regulatory measures, monitoring and enforcement has remained weak. Since 2010, the PNA states have been engaged in the Marine Stewardship Council (MSC) certification program in facilitating transparency and disclosure and in improving the management of tuna in the region. However limited understanding prevails on how and to what extent the MSC program has achieved these expectations. This paper fills the gap by advancing our understanding on how the MSC program addresses monitoring and enforcement problems in the PNA tuna fishery. The study uses the principal-agent framework to examine the state (who is the Principal) and private firms (who are the agents) relationship in light of incentive gaps and how the MSC processes affect these relationships by closing these incentive gaps. In doing so, we focus on the role of MSC program in addressing imperfect control over catch and effort of purse seine fishery in the PNA waters in view of closing incentive gaps. Our findings suggest that; (1) there are incentive gaps at multiple-levels of trans-boundary resource management; and (2) the MSC program has a role in closing some incentive gaps (although not all), and restructure the state and private relationship. We conclude that the private institutions like certification have a role in facilitating goals of public resource managers.

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4.1 Introduction

For many fish stocks, regulatory institutions have not achieved the desired economic and ecological objectives of sustainable fisheries management because of weak compliance and monitoring (Beddington et al. 2007). As a result, about 90% of fisheries are over or fully fished (FAO 2016). The mismatch between the outcomes desired by fisheries managers (sustainability) and the outcomes observed in reality (overfishing) is referred to as an 'incentive gap' (Miller, 2005; Vestergaard, 2010). This gap manifests itself based on the fact that resource owners and users have different and sometimes divergent interests. It is assumed that weak governance an ineffective management regimes result in larger incentive gaps (Bailey, Miller, Bush, van Zwieten, & Wiryawan, 2015). Closing the incentive gap depends on many things, but one important consideration is the extent to which information asymmetries associated with imperfect knowledge and control over a firms' fishing activities can be addressed and objectives can be aligned through appropriate incentives (Bailey et al. 2017).

Because the principal-agent problem is usually one described between resource owners (government) and resource users (fishers), it has usually been used to examine how incentive-based regulatory measures, such as transferable input (effort) and output (catch) controls can reduce the incentive gap (Clarke et al. 1987, Grafton et al. 2006, Vestergaard 2010, Havice 2013, Jensen et al. 2013). However, less attention has been given to alternative incentive-based approaches that operate in many ways outside the government, such as Marine Stewardship Council (MSC) certification which aims to reward sustainable fishing practices with preferential and higher value market access (Agnew et al. 2014). In this paper, we examine the role of the MSC in improving fisheries management by setting incentives for greater transparency and disclosure in the purse seine tuna fishery of the eight tuna rich countries of the Parties to the Nauru Agreement (PNA), thus helping to solve the principal-agent problem.

The waters of the eight PNA countries - made up of the Federated States of Micronesia (FSM), Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea (PNG), Solomon Islands and Tuvalu – hold approximately 25% of the world's tuna stocks (Aqorau 2015). Skipjack (*Katsuwonus pelamis*) is fished at a level less than what the stock could maintain sustainably and yellowfin tuna (*Thunnus albacares*) are currently assessed as fully exploited (i.e., they cannot withstand more fishing pressure without problematic losses to the spawning biomass). But there remains concern over bigeye tuna (*T. obesus*) which is currently overfished with overfishing continuing (Harley et al. 2014, Hare et al. 2015). The status of bigeye tuna is related to its by-catch in purse seine fishing on fish aggregating devices (FADs) targeting skipjack (Aqorau 2006, Harley et al. 2014, WCPFC 2015). So while the target skipjack fishery could increase its pressure, the potential consequences for the non-target species is problematic. In response, the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC) has called for a reduction of at least 32% of bigeye fishing mortality from the average 2006-2009 levels.

In 2010 the PNA member states decided to apply for MSC certification of skipjack and yellowfin with the dual goals of strengthening management of tuna resources and maximising economic returns from the market (PNA 2010, Aqorau 2014, Kumoru 2014, PNA 2015). The MSC standard combines three principles for sustainable fishing that include: (i) the status of the fishery or fish stock, (ii) the fishing method/gear that reduces impact on the ecosystem, and (iii) the fishery governance and management framework (Ponte 2012, Bellchambers et al. 2016). However, underlying these principles is the increased transparency through improved monitoring and control of both fishing activities through the fisheries standard and the chain of custody standard (CoC) (Auld et al. 2010).

In this paper we analyse the extent to which MSC fisheries and chain of custody certifications have increased transparency through improved monitoring and control and how the associated disclosure has closed what others have labelled a 'double' principal-agent gap (Jensen & Vestergaard (2001), Bailey et al. (2016)). As explained below, we examine how the MSC certification program closes first the incentive gap between the PNA and member states, and second the gap between the member states and distant water fishing purse seine fishing fleets operating in the PNA waters.

In the next section, the MSC certification scheme is briefly outlined, then the (double) principal-agent framework is introduced, and finally the problem of asymmetric information in the PNA tuna fisheries is discussed. Using the framework, the study analyses the extent to which the MSC certification program has addressed issues relating to incomplete information as a moral hazard and which in turn has improved compliance to the overarching conservation and management goals of the PNA. The paper concludes with a discussion on the significance of these findings to the role of private certification in facilitating the goals of public resource managers.

4.2 A double principal-agent framework

Principal-agent theory has been variously applied to trans-boundary fisheries to analyse the relationship and level of compliance under conditions of imperfect information and imperfect control (e.g. Jensen et al. 2002, Jensen et al. 2013, Bailey et al. 2017). Research has predominantly focused on how states are able to set contracts under conditions where they have no or only partial access to private information about fishing practices when negotiating contracts for fishing access (Vestergaard, 2010). As argued by Clarke and Munro (1987), principal-agent theory assumes that the principal has a formal authority to set incentives for rule compliance by agents, whereas the agents have an information advantage over the principal. In this situation the agents take actions to reach their own goals, thus revealing 'incentive gaps' as their actions result in an outcome that differs from what the principal tries to implement.

In the context of regulatory policy making incentive gaps are defined as the difference between the objectives of the regulator (principal) to implement an ideal or first-best situation and the

objectives of the agents who pursue their private interests. These differences arise due to asymmetric information. Asymmetric information has two forms in this context: *moral hazard*, referring to imperfect control of effort and catch; and *adverse selection*, referring to imperfect information about the agents' interests and conditions (Jensen et al. 2002). The principal agent framework analyses a principal's challenge in setting contract conditions that enforce transparency and disclosure, and this challenge is due to the incentive gap. The principal chooses an incentive scheme that will maximise their own benefits while providing the agents the freedom of action to guarantee some minimum return (Grafton et al. 2006).

The principal-agent problem has been applied in fisheries to model the effect of subsidies (Jensen et al. 2002), landing and effort taxes (Clarke and Munro 1987), individual transferable and non-transferable quotas (Jensen et al. 2001, Jensen et al. 2002), trans-boundary tuna management in the Pacific (Bailey et al. 2017), and logbook schemes (Jensen et al. 2007). The findings of these studies indicate that under conditions of asymmetric information, first best solutions usually cannot be reached. These studies also highlight the lack of empirical evidence that show that incentives can in fact be set to reveal private information (Jensen et al. 2013). Furthermore, fishery related studies have mainly focused on incentive schemes that are controlled by the state rather than 'private' or 'non-state' schemes such as third-party certification.

The trans-boundary context of tuna fisheries also highlights the complexity of understanding the impact that incentive based schemes can have on fisheries management. As outlined by Jensen and Vestergaard (2001, 2002) the role of incentives for revealing private information is also made more complex in regional trans-boundary resource settings, where asymmetric information problems involve at least two principal-agent relationships. Under these conditions regional organisations act as principals tasked with setting regional conservation and management measures, and member states act as both principals (over fishing companies) and agents (under regional rule setting organisations). The principal-agent framework therefore highlights multiple information asymmetries and as such multiple incentive gaps.

In the remainder of this chapter we assess the role of the MSC as a private incentive based scheme in closing the apparent double incentive gap between the PNA, member states, and fishing companies in the Western and Central Pacific Ocean (WCPO). In doing so we argue that principal-agent theory can help to explain how private governance can improve management through improved disclosure, and can contribute to a wider understanding of incentive-based mechanisms in the context of complex, multi-level regional fisheries management regimes.

4.3 Analysing the PNA as a double principal-agent problem

The PNA Secretariat was established under the Nauru Agreement of 1982 to help member states develop and coordinate efforts to conserve their tuna resources, while at the same time maximise

sustained economic benefits for its members through commercial programmes (PNA 2010, PNA 2012). The agreement gives the PNA Secretariat the mandate to conserve tuna stocks in its members' EEZs with a particular focus on addressing overfishing associated with purse seine activities (PNA 1982, PNA 2009). In doing so, the PNA members signed the Palau Agreement in 1994 to put limits on purse seine efforts which led to the adoption of the vessel day scheme (VDS) for effort control in 2007 (see Yeeting, Weikard et al. forthcoming). The PNA fishery constitutes a double principal-agent problem as tuna management measures and objectives are set at the regional PNA level while implementation takes place at the national level under fishing access as either: (1) bilateral agreements between one PNA member with a fishing state or company; or (2) multilateral agreements between a group of PNA members and a fishing state (in this case distant water fishing nations) or a group of fishing states (such as the European Union).

In support of the 1982 Nauru Agreement and 1994 Palau Agreement for purse seine control, the member states agreed to three implementing arrangements (IA) between 1982 and 2008. These arrangements set forth minimum terms and conditions of access to the fisheries zones of the PNA members. More specifically, they set standard procedures to coordinate and guide efforts to monitor and control purse fishing with aims to reduce overfishing of bigeye and to a lesser extent yellowfin tuna. However implementation remains within multi-level relationships between the principals and agents. For example, the PNA Secretariat is mandated to monitor fishing activities of its member states, whereas member states are mandated to monitor fishing activities in their national jurisdictions in-line with the national, regional and international regulations (Banks et al. 2016). In this way, and regardless of the type of access agreement, the PNA Secretariat has no direct control or knowledge about effort and catch in member's national jurisdictions (see (Yeeting et al. 2016, Yeeting et al. forthcoming)). The VDS as part of the second IA is a direct control over effort set by the PNA and is implemented at the national level, but relies on bilateral agreements which are beyond control of other member states. The double principal-agent framework that results (as illustrated in Figure 4.1) not only demonstrates the two incentive gaps in the PNA, but also defines the actors and their role in each principal-agent relationship.

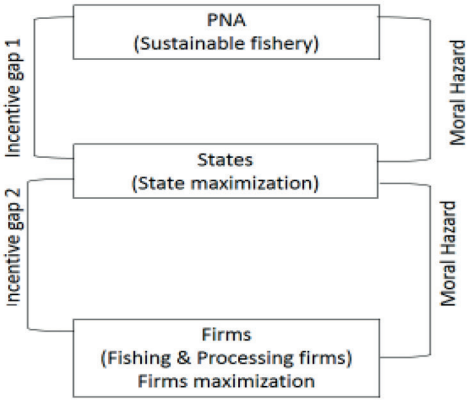

Figure 4.1 PNA double principal-agent Problem (Adapted and modified from Jensen and Vestergaard 2001; Bailey et.al. 2015).

4.3.1 Marine Stewardship Council Certification Program

The MSC label and fisheries certification aims to promote seafood sustainability by recognizing and rewarding sustainable fishing practices and influencing the choices buyers make when purchasing seafood. The MSC chain of custody is a traceability standard that is applied to the full supply chain from a certified fishery to the final sale. Fisheries that want to improve their fishing practices are assessed against the MSC standard for being well managed and sustainable. The process requires appointment of an independent third party accredited assessment body to assess the fishing practices. This involves a pre-assessment evaluation of the fishing, full assessment and further assessment surveillance audit to assess continued compliance with the MSC fisheries standards. Each company in the supply chain handling or selling an MSC certified product must have a valid MSC Chain of Custody certificate which is based on four core principles including: purchase from a certified supplier, products to be identifiable, segregated and recorded. This assures consumers and seafood-buyers that MSC labelled seafood comes from a certified sustainable fishery.

The 2011 certification of PNA free school skipjack fisheries passed the MSC third party assessment, although not without objections (Christian et al. 2013), with a score of >80% against all three principles, with six conditions and seven recommendations to be addressed by 2016 (Banks et al. 2011). The fishery also achieved chain of custody (CoC) certification in 2013, thereby assuring the traceability of fish from the water to retail shelves marketed under the joint

venture brand between the Dutch based Brus Seafoods and the PNA countries 'Pacifical' (Brownjohn 2014, Brus 2014). All suppliers to, and buyers of, Pacifical must conform to the fishery and/or CoC standard for a consumer product to be labelled with the MSC logo. Using the PA framework, we first examine the extent to which the MSC enables the PNA to address moral hazard by setting management measures to control and monitor member states (noted as the first incentive gap in Figure 1). The second incentive gap emerges between member states of the PNA who regulate access to fish in their national jurisdictions under licencing agreements, and the fishing fleets as agents with whom the principal enters into contracts (as illustrated by the second incentive gap in Figure 1). More specifically we focus on how the requirements set out under MSC fisheries and CoC certification increase the transparency of private information for the PNA and restructure the two observed incentive gaps.

4.4 Empirical Approach

The empirical analysis was structured around four key lines of inquiry: (1) identify and define the different actors, objectives and incentives in the PNA purse seine fishery; (2) investigate the management challenges (moral hazards issues) and reasons for incentive gaps; (3) identify the management measures influenced by MSC; and (4) examine MSC's implication on the PNA governance structure. These objectives were applied in a two-step data collection strategy. The first step involved reviewing the PNA implementing arrangements and noting policy changes in relation to the MSC fisheries and CoC standards (see Table 4.1). In doing so we limited the scope of our analysis to effort and catch controls as changes to improve regulatory requirements. In the second step, we analysed the extent to which the MSC principles close the two incentive gaps by assuming that transparency reveals fishing activities when principles are complied with. In doing so we identify key improvements made for MSC compliance, as summarised in Figure 4.2.

Data were collected through a combination of semi-structured interviews, participating in and observations at tuna regional meetings, literature, and regional and national document reviews. A total of 30 face-to-face interviews were conducted with government officials (n=12), regional officials and experts (n=12), and representatives from fishing companies (n=6). The first set of interviews were conducted at a series of PNA meetings, 8-14 March 2014 in the Solomon Islands, and another at the 11th regular meeting of the WCPFC, 1-5 December 2015 in Apia, Samoa. Interviews were recorded (with consent) and continued through follow up email exchanges on points of clarification. Questions focused on the experience, implications and challenges of aligning the third implementing measures of the PNA with the MSC program. Document reviews provided guidance on the changes to the regulatory measures and the role of PNA, state and fishing company responses to increasing transparency in response to these measures.

4.5 MSC compliance and moral hazard

The following outlines the changes to the VDS and the implementing arrangements of the PNA for monitoring and enforcement related to the requirements under the MSC and CoC standards (see Table 4.1 for a summary).

4.5.1 MSC implications on the Palau Agreement

The Palau Agreement has driven the PNA's objective to minimise purse seine and FAD impacts on yellowfin and bigeye stocks, which we deem as consistent and parallel to the MSC principles. The MSC assessment identified key sources of 'moral hazard' undermining the Palau Agreement. Here we mean moral hazard to refer to the fact that agents are taking on 'risky' behaviour that they are unlikely to bear its full costs. More specifically, these included: (1) the increase in vessel number from 204 in 1994 to 222 in 2007, and to more than 300 to date; (2) the expansion of the US fleet to 40 vessels, with an increase in effort by 74% in 2010 from the 2001 efforts; and (3) the limitations of the Palau Agreement to apply effort control across all purse seine fleets in the western and central pacific ocean (WCPO) (Banks 2009, Banks et al. 2012). The observed moral hazards in the first incentive gap, refers to the failure of member states to fish or sell fishing effort below or within the agreed allowable effort limits causing overfishing to continue.

In addressing these issues, the MSC conditions and recommendations were designed to guide the PNA's actions to a level within the scoring range of 80 to 100 for all MSC principles by 2016 (Banks et al. 2011). Four out of five MSC conditions have been met and closed during the second and third round of surveillance audit (Banks 2014). The single remaining condition pushes PNA and WCPFC to establish clear harvest control rules focusing on yellowfin and bigeye (Aqorau 2014, Banks 2014). In doing so, the WCPFC agreed to a workplan aiming at target reference points for yellowfin by 2018 and bigeye by 2019 in order to develop harvest control rules (WCPFC 2016).

Our analysis, summarised in Table 4.1, shows the influence of the MSC principles on the PNA measures. MSC principles (1 and 2) have had little influence over the formulation of the VDS, rather the development of the VDS has been driven by the PNA member states as an innovative approach to protect their common interests, following the failure of many attempts to control effort towards the mid 2000 (PNA 2012, Aqorau 2014). Instead the Palau Agreement and the VDS are fundamental pre-conditions in meeting MSC principles 1 and 2 for a healthy stock and ecosystem impacts respectively.

Table 4.1 Summary analyses of MSC outcomes

PNA pre-MSC measures	MSC implications on PNA measures			
Palau Agreement and three implementing arrangements	**Principle 1 (P1) Sustainable fishery and/or stock**	**Principle 2 (P2) Ecosystem impacts from Fishing**	**Principle 3 (P3) Effective Management**	**Chain of custody and traceability**
Vessel Day Scheme (VDS)	*Existing and relevant to support P1	*Existing but unclear how VDS is supporting P2	**Existing with new changes required: i.Improve coverage ii. Linking effort control to limit reference points iii. Adoption of a revised WCPFC CMM for bigeye, yellowfin and bigeye and CMM on the provision of operational level catch and effort data by WCPFC members	*No implication
Observer program for effort and catch control	*Existing and relevant to support P1	*Existing and relevant to support P2	*Existing and relevant to support P3	**Improved with new traceability requirements
Licensing procedure – Minimum terms and conditions	*Existing and relevant to support P1	*Existing and indirectly supporting P2	*Existing and relevant to support P3	**Improved with new additional terms and conditions under Pacifical e.g a memorandum of understanding is required
Maintenance of Logbooks	*Existing and relevant to support P1	*Existing and relevant to support P2	**Existing with new changes required: information about FAD associated and unassociated sets and catch distribution (status and identified risks); information coverage on HS fishery status and identified	**Existing and new traceability requirements improving logbook information and coverage but only to MSC fleets and companies

PNA pre-MSC measures	MSC implications on PNA measures			
Palau Agreement and three implementing arrangements	**Principle 1 (P1) Sustainable fishery and/or stock**	**Principle 2 (P2) Ecosystem impacts from Fishing**	**Principle 3 (P3) Effective Management** risks to improve measure in the HS measure	**Chain of custody and traceability**
Maintenance of logbooks in the high seas (catch per set reporting)	**Improvement of information coverage, more certainty to stock assessment process covering the high seas	**Improve information coverage on by catch, ETP status of the high seas - identify risks	**Improve information coverage on HS fishery status and identified risks to improve measure in the HS	*No implication as catch in the high seas are not MSC eligible (outside the unit of certification)
VMS on vessels (vessel and fishing location)	*Existing but not relevant to P1	*Existing but not relevant to P2	*Existing and relevant to support P3 for national and regional regulations	*Existing and indirectly supportive to P3
Prohibition of transhipment at sea (catch verification at port)	**Existing with new measures relevant to support P1	**Existing with new measures relevant to support P2	**A regional measure to address misreporting of catch and by catch due to transhipment at sea	**Strengthen transhipment at sea measure by adding no processing at sea to avoid mixture, and adding designated ports of landings within the PNA.
FAD seasonal closure	*Existing and relevant to support P1	**Existing and relevant to support P2 by giving support to the adoption of a new WCPFC CMM 2014-06 on	**Existing and new measures at the WCPFC level in support of harvest strategies	**Strengthen/ supplements FAD measure by encouraging free school fishing; FAD closure can contribute to more free school fishing

PNA pre-MSC measures	MSC implications on PNA measures			
Palau Agreement and three implementing arrangements	**Principle 1 (P1) Sustainable fishery and/or stock**	**Principle 2 (P2) Ecosystem impacts from Fishing** establishing a harvest strategy for key fisheries and stocks in the WCPO, and new WCPFC CMM 2014-06 to supports PNA's objective to address bycatch problem through harvest strategy control focusing on yellowfin and bigeye	**Principle 3 (P3) Effective Management**	**Chain of custody and traceability**
FAD high seas closures	*Existing and relevant to support P1	**Existing and relevant to support P2 by giving support to the adoption of a new WCPFC CMM 2014-06 on establishing a harvest strategy for key fisheries and stocks in the WCPO, and new	** New WCPFC measure - CMM 2014-01 now replaced by 2015-01 - high seas purse seine effort limits - 3 months FAD closure in the HS and addition closures (4th month or FAD sets limit)	*No implication

PNA pre-MSC measures	MSC implications on PNA measures			
Palau Agreement and three implementing arrangements	**Principle 1 (P1) Sustainable fishery and/or stock**	**Principle 2 (P2) Ecosystem impacts from Fishing**	**Principle 3 (P3) Effective Management**	**Chain of custody and traceability**
		WCPFC CMM 2014-06 to supports PNA's objective to address bycatch problem through harvest strategy control focusing on yellowfin and bigeye		

**No MSC implication on measures*
***MSC having implication on measures*
(Source: fieldwork 2014 to 2016)

In contrast, MSC principle 3 has had a direct influence over the VDS throughout the certification period. To comply with principle 3, improvements in the coverage of the VDS was required indirectly, by including fishing effort in the high seas and archipelagic waters which were outside the VDS area of application. This was confirmed by respondents who argued that the VDS is a sub-set of the total PNA purse seine catch and effort because of the limited VDS coverage, that is, within the EEZs of its members (PNA 2012, Kumoru 2014, Pilling et al. 2014). This issue was realised as soon as VDS was successfully implemented around 2012, when fishing outside the VDS area became attractive causing shifts in fishing effort. From the Palau Agreement point of view, the impacts of purse seine fishery outside the VDS undermines the Palau Agreement, and are observed moral hazards in light of asymmetric information (Aqorau 2014, Banks 2014, PNA 2014, PNA 2016).

In support of the above claim, Table 4.2 shows the distribution of effort and catch data inside and outside the VDS. Our estimate of catch per unit of effort (fishing day) in the three fishing areas i.e. EEZs, archipelagic waters, and high seas, indicates alarming concern on high catch rates per vessel day outside the VDS areas especially the high seas: on average 45 metric tonnes (mt) per vessel day from 2012 to 2014 compared to catch per day in the PNA EEZs of 30 mt per vessel day (see Table 4.2). Also effort and catch distribution from 2010 to 2014, were estimated at around 76% (effort) and 78% (catch) inside the VDS, while the remaining 24% (effort) and 22% (catch) was outside the VDS. This was a significant portion of effort and catch outside the VDS that needed to be addressed. Accordingly, fishing outside the VDS area is considered as catch outside the unit of certification and not MSC eligible, justifying MSC requirement to improve VDS coverage.

The extent to which MSC has helped in addressing moral hazards or non-VDS fishing activities is by strengthening and enforcing the Palau Agreement to also include fishing activities outside the VDS area. Based on interview and document reviews, a progressive improvement in the VDS coverage is seen within the period of certification. They include: (1) the expansion of VDS to Tokelau's EEZ (non-PNA country) in 2013 which added an additional 1000 tradable fishing days to be included under the VDS; (2) the expansion of VDS to the US fleets from mid-2013, with 8000 days contributed from all PNA countries every year for the US fleets; (3) the expansion of VDS to the archipelagic waters of PNG and the Solomon Islands in 2015, which helped reduce high non-fishing days since VDS implementation; and (4) the expansion of VDS to high seas areas in-line with the high seas effort limits set by the WCPFC (WCPFC 2014, WCPFC 2015).

Table 4.2 Distribution of fishing days within and outside VDS areas

Year	Inside VDS TAEs (days)/ year	Outside VDS Days in the Archipelagic waters/year	Outside VDS Days in other waters[a] /year
2010	43982	5825	3282[b]
2011	46928	8199	2782[c]
2012	45703	8082	5079
2013	46284	7985	8497
2014	45608	7160	8264
Catch distribution (ave.2010-2014)	76%	7%	17%
Effort distribution (ave.2010-2014)	78%	13%	10%
Catch per unit effort [d] (mt) (ave.2010-2014)	30	18	45[e]

Explanatory notes:
a-efforts in non-PNA waters and in the high seas
b&c- efforts in non-PNA waters only, high seas effort not available
d- average catch per unit effort from 2010 to 2014
e-exclusive of 2010 and 2011 because of incomplete data
(Source: fieldwork)

The outcome of expanded VDS coverage has two implications related to economic and conservation gains. Firstly, more days have become available to be traded in the case of Tokelau days, and at least US$90 million in revenue is collected from the US fleets for 8000 days annually compared to US$23 million from past experiences (Ruaia 2014, Yeeting et al. 2016). Secondly, VDS limits are being enforced outside the PNA EEZs, in the archipelagic and high seas areas, which addresses what PNA members claim as undermining the Palau Agreement, i.e. the abuse of non-fishing days and excessive efforts (Aqorau 2014, PNA 2015). These improvements to the VDS, largely influenced by MSC Principle 3, are designed to de-incentivise fishing outside the VDS area through its extended coverage of monitoring and control measures over fishing. In support of these findings, Table 2 also holds two contentious claims by; (1) the PNA to enforce effort control through the reduction of non-fishing days and excessive efforts which is fishing activities outside the VDS (Aqorau 2014, Kumoru 2014, PNA 2015); and (2) the MSC program to motivate fishing within the unit of certification – an incentive to expand effort control coverage (Banks et al. 2012, Banks 2014). In light of asymmetric information, moving forward with the MSC conditions and recommendations are seen to facilitate better alignment with the Palau Agreement than before the certification, by addressing some moral hazards.

4.5.2 MSC implications on the PNA's implementing arrangements

Enforcement of the Nauru and Palau Agreements relies on the three implementing arrangements that aim to coordinate and guide efforts to monitor and control purse seine FAD fishing with the aims to reduce overfishing of bigeye and to a lesser extent yellowfin tuna. The arrangements are

- 1982: sets out the minimum terms and conditions (MTCs) for access to be granted to foreign fishing vessels that includes licensing procedures, maintenance of logbooks, and vessel monitoring scheme on vessels.
- 1990: provides additional MTCs including maintenance of logbook in the high seas, prohibition of transhipment at sea, and observer program. The maintenance of logbook and observer program has revealed the issue about persistent increased FAD impacts, which has led to the adoption of the third arrangement.
- 2008: allows for FAD management through a 3 months (July to September) closure and the two high seas pocket[13] closures – the first FAD management measure to be adopted.

Nonetheless, misreporting of purse seine effort and catch have long existed and have been considered as a main source of moral hazard between member states and fleets leading to overfishing. In the PNA, fisheries managers claim that misreporting is a concern of fisheries governance due to decentralized arrangements of monitoring and enforcement (PNA 2016), the absence of a standardized data recording and reporting system, language gap and corruption (Pilling et al. 2014, Banks et al. 2016). Corruption refers to actions by fleets to avoid expensive fees and punishment in cases where non-compliance occurs. The complex nature of tuna management has led to inconsistent reporting standards and information gaps about catch and effort (Pilling et al. 2014, Banks et al. 2016). All these governance issues contribute to persistent misreporting and incentive gaps between states and fleets. For example, due to complex tuna management, observer and logbook coverage are a subset of regional total purse seine activities covering up to 80% and 85% respectively of all fishing activities in the countries EEZs (Williams 2012). For the remaining 20% and 15% information is missing, which accounts for fishing activities outside the countries EEZs not covered by these measures. Also, specific to the purse seine fishery, there was a lack of direct control over FAD fishing.

Even with the three implementing arrangements, it is clear that there are still remaining asymmetric information problems. Our analysis summarised in Table 4.1, indicates that the MSC has no influence on the formulation of PNA implementing arrangements (Aqorau 2014, Kumoru 2014), but like the Palau Agreement, MSC also influences some improvements and changes in an effort to establish harvest control rules and reference points.

[13] The two high seas pockets are the area of high seas bounded by the national waters of FSM, Indonesia, Palau and PNG and the area of high seas bounded by the national waters of FSM, Fiji, Kiribati, Marshall, Nauru, PNG, Solomon, Tuvalu.

We observe that the MSC principles have no implication on the measures of the first and second implementing arrangements (see Table 4.1) - including minimum terms and conditions for access to be granted to foreign vessels, maintenance of logbooks, electronic vessel monitoring scheme, and national observers on board - as they came into force with the Nauru Agreement in 1982 and 1990 respectively, before MSC certification program began in the late 1990s and later became global standard towards 2010 (Gulbrandsen 2009) when picked up by the PNA in 2010 (PNA 2010, Aqorau 2014). However, as we argue below, the MSC CoC, which relies on all the monitoring and enforcement measures under the first and second implementing arrangements and has specific traceability requirements, has helped to drive the change.

The changes to the first and second implementing arrangements, in particular the maintenance of FAD and non-FAD catch reporting, are attributable to the role of Pacifical in implementing the MSC CoC. Pacifical is a 50/50 shareholding company between the PNA Secretariat and a Dutch private company – 'Sustunable'. It is established to facilitate both the marketing of the MSC tuna products on the one hand, and enforcement of the traceability system on the other hand. Pacifical acts on behalf of the PNA member states in serving their commercial interests, given the complex nature of tuna value chain and the lack of states ability to participate in commercial activities. Under Pacifical, fleets, firms and companies interested in harvesting and processing MSC tuna, sign a Memorandum of Understanding with Pacifical, on top of access agreements (where applicable for foreign fleets). These provide an additional contract with fleets and firms to indicate 1) their eligibility to harvest and process MSC tunas, 2) their willingness to participate in MSC fishing as well as support the PNA's initiative for sustainability and 3) their willingness to a greater level of monitoring compliant to MSC CoC requirements and traceability.

In practical terms, fleets wishing to land MSC eligible tuna are now required to apply for MSC trips before conducting MSC compliant fishing, and ensure traceability is in place from the site of harvest to an MSC processing plant[14] (see (Daume et al. 2016). Monitoring involves the use of logbooks and VMS observer data, which records the time of catch, location, species and volume. This information is preserved for batches of fish landed through to the processing plants and ultimately consumer products. Through Pacifical, PNA states are also expanding control, and thus have information access over the tuna value chain, beyond just harvesting (Brownjohn 2014, Brus 2014, Adolf et al. 2016). Landing in designated ports is encouraged to enable traceability monitoring through to MSC domestic processing to work, but also to facilitate landing of potential MSC catches to be processed in the PNA as well as landing of potential non-target catches to be used for domestic consumption.

[14] In 2015, six eligible tuna processing plants are listed in the PNA. To date, SSTC Wewak of PNG, Frabelle Lae of PNG, have processed MSC eligible Tuna in the PNA (Brownjohn 2015).

Again referring to Table 4.1, we also observe that the MSC program through principle 3 for effective management has had a direct influence on the improvement of the third implementing arrangement to reduce FAD impacts. In 2007, the PNA countries agreed to the third implementing arrangement to set limits on FAD sets through a three month (July to September) closure and two high seas pocket closures.[15] In relation to MSC's push for PNA and WCPFC to establish harvest control rules and reference points, new measures have been adopted (Daume et al. 2016). These new measures include: (1) the adoption of a revised management measures for bigeye, yellowfin and skipjack tuna in the WCPO, high seas purse seine efforts limits to be implemented in 2015, the purse seine and longline catch measures for yellowfin tuna to be implemented in 2014 and extended to 2015, and a new section related to the provision of operational level catch and effort data by members; and (2) the adoption of a new conservation and management measures (CMM) 2014-06, on establishing a harvest strategy for key fisheries and stocks in the WCPO which was updated in 2016 with clear targets to agree on target reference points by 2018 and 2019 in order to develop harvest control rules (WCPFC 2016).

At the time of writing, the process of developing harvest strategies for tuna species has been ongoing. However, limit reference points have been agreed at the PNA and WCPFC levels (Aqorau 2015). Work on refining the target reference points and a harvest strategy for key target species has been progressing through a series of meetings and workshops through scientific committee meetings of the WCPFC (Hampton et al. 2012, Daume et al. 2016, WCPFC 2016). Overall, we observe that the development of the third implementing measures for high seas limits and FAD management, are attributable to the conditions and requirements set out under the initial MSC audit on the PNA's implementing arrangements. These implementing measures are also fundamental to dealing with moral hazard given they are all directly related to improving fisheries information and transparency for the PNA and member states through improving monitoring and surveillance of fishing activities in PNA waters.

The real impacts of MSC program will ultimately be seen in the change or shift in fishing patterns, which is still to be observed. Based on interviews, the assumption is that FAD seasonal closure seems to give some positive contribution to the increase in the proportion of free school sets since 2010 (Hare et al. 2015, PNA 2016). Based on Secretariat of the Pacific Community (SPC) sets distribution data, 66% accounts for free school un-associated sets compared to 34% FAD sets (Pilling 2016). However, it is still observed that the average catch dependency ratio indicates the need for a further shift from FAD to free school in order to reduce fishing mortality (Hare et al. 2015, Pilling 2016). The average catch per set between 2012 - 2014 in PNA EEZs was around 63% for purse seine FAD sets compared to 37% for purse seine free school sets (Pilling 2016). Also, as Hare et al. (2015) demonstrate, free school sets increased during the three months FAD closure from July to September since 2010, while FAD sets increased outside

[15] The two high seas pockets are the area of high seas bounded by the national waters of FSM, Indonesia, Palau and PNG and the area of high seas bounded by the national waters of FSM, Fiji, Kiribati, Marshall, Nauru, PNG, Solomon, Tuvalu

FAD closure. This implies that the increase in free school fishing is linked to new measures on FAD management associated with MSC outcomes, rather than fisher's incentive to fish free school for MSC catches. Specifically, based on sets and catch per sets data, it is not clear whether this is attributable to the MSC certification, though there is an apparent direct link between the free school sets and FAD measures.

There are some necessary notes points of concern that need to be raised. Firstly, FAD and non-FAD fishing and their impacts are not observed and controlled separately, but rather a controversial practice of 'extreme compartmentalisation' occurs. This means that one fishing trip can be made up of both 'sustainable' (MSC certified) and 'unsustainable' (non-certified) catch. What could potentially be happening is that boats going out and fishing on FADs can cash in on both a low value high volume fishery, while still cashing in on a lower volume higher value fishery by fishing on a free-school during the same trip. As mentioned in the paragraph above, this puts into question the extent to which certification is or can drive change towards more free school fishing. In fact, other than the increase in free school fishing during the FAD closure, FADs fishing effort has increased more than free school fishing since certification (Pilling et al. 2016).

MSC observers are deployed to avoid MSC and non-MSC catch mixing during harvesting and transhipment at sea and also to improve port landings data. This is certainly commendable, but the second issue of note has to do with the credibility and efficacy of the observer program. Almost 8% of observers in the WCPFC (including but not limited to observers on MSC trips), reported that they experienced instances of things like assault, intimidation, and interference (WWF 2015). Additionally, almost 1 in 5 observed trips had instances of vessels failing to comply with CMMs (WCPFC 2015, WWF 2015). So while certification through MSC has made some governance changes, the magnitude of associated sustainability gains have yet to be seen.

4.6 Discussion

Our study provides three important contributions to advance our understanding on principal agent problems in relation to asymmetric information and incentive gaps, and the role of market certification schemes in addressing them. First, our results are in line with Jensen and Vestergaard (2001, and 2007), showing that within complex fisheries regional setting with dynamic actors and interests there are multiple principals and agents, and therefore multiple incentive gaps and moral hazards (see Figure 4.2). Saying that differently, within the PA regional setting, there are multiple levels of incentive gaps, which brings attention to the fundamental question of between whom are incentives misaligned in order to create the resulting gaps. Identifying the actors (principals and agents) and their objectives are paramount in finding solutions to address asymmetric information problems. Second we demonstrate the significant role of the MSC program in addressing some asymmetric information problems and incentive

gaps (but not all) by incentivising change for sustainability. Third, we find that the PNA 'Pacifical' model in implementing the MSC CoC program has played a significant role in configuring the double PA framework by building a direct relationship between the regional PNA (on behalf of member states) and fleets catching MSC tunas. In this way, some incentives can circumvent the double PA problem by reducing the gap to only one principal (PNA) and one agent (fleets).

The application of the double PA framework is useful in a regional setting where multiple agreements exist. It allows for the analyses of agreements in relation to specific and appropriate PA relationships, which are often overlooked in the analysis of agreements for trans-boundary resources. Our study builds on Jensen and Vestergaard (2001, 2002) and (Bailey et al. (2016), Bailey et al. (2017)), double PA framework by identifying the multi-levels of asymmetric information gaps between principals and agents and in doing so seeing the different strategies of MSC certification in incentivising change through its related principles. More specifically, we analyse the effectiveness of the Palau Agreement for VDS in the first PA relationship between the PNA secretariat and member states, and the three implementing arrangements for the second PA relationship between the member states and fishing vessels (see Figure 4.1). In doing so, we are able to determine between whom asymmetric information and incentive gaps exist, and how to identify appropriate actors in designing and finding solutions to address them.

Our case demonstrates that the Palau Agreement and implementing arrangements are designed to support the economic and biological objectives of the member states. We argue that these agreements have not been able to achieve their objectives due to persistent challenges associated with asymmetric information and incentive gaps that have materialized because of different objectives of multiple principals and agents. We observe the important role of the MSC program in incentivising change for and improvement of measures that in turn address asymmetric information and incentive gaps in the fishery. Our study argues that cooperative monitoring arrangements are more appropriate and effective than individual state monitoring, in light of trans-boundary tuna resources. We observe the role of MSC program in supporting cooperative arrangements in promoting and strengthening the role of regional PNA. The MSC program does so by not only validating existing PNA measures but also incentivising further improvements in tuna measures in order for the PNA to maintain certification. In this case, the MSC program has thus promoted the protection of states' common interests, especially where member states have limited capacity to perform.

Reflecting on the double PA framework in Figure 4.1, the first incentive gap is observed between regional PNA and member states and caused by the complex nature of tuna regimes associated with different national regulations, and different bilateral and multilateral agreements. The direct relationship between the regional PNA and member states is important in relation to the principal agent problem for two reasons, namely 1) PNA is trying to get control over fishing access in the waters of its members through the expansion of harvest strategies, and 2) PNA is trying to address member states' misalignment through multilateral and cooperative arrangements. We

demonstrate that the MSC has been central to this process in three ways (Table 4.1, illustrated in Figure 4.2). First, by meeting principles 1 and 2 of the MSC, related to stock status and minimising ecosystem impacts, the PNA was able to better comply with the conditions set for principle 3 on effective management by linking effort control to limit reference points (see Table 4.1 for new measures). Second, by enforcing new reporting requirements for FADs, the PNA was able to improve the coverage and implementation of the VDS, place high seas limits and the established limit reference points. Thirdly, the MSC program supports the existing PNA measures by demanding the implementation of precautionary measures such as harvest control rules and reference points as prescribed under international laws - UNCLOS (Banks et al. 2012, Daume et al. 2016).

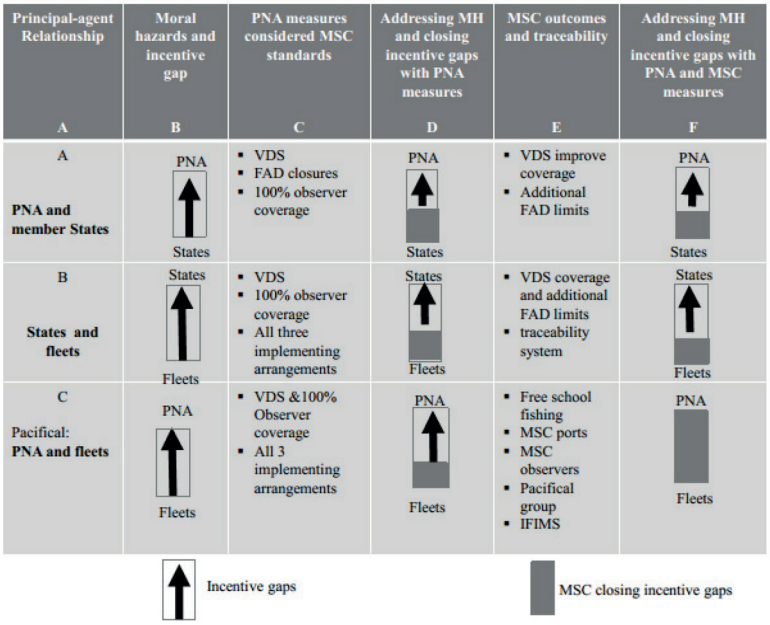

Figure 4.2 MSC implications on the incentive gaps of the PNA

In light of the complex nature of tuna regimes, we observe the second incentive gap between member states and fleets. In this relationship, complex and multiple PA relationships exist, as many states and fleets are involved. Through cooperative arrangements, member states designed three implementing arrangements to monitor fishing activities in their collective waters, yet still it has proven difficult to achieve first best solutions, as overfishing continued Our observation of this relationship is in line with observations of Grafton et al. (2006), on the challenge of the state

to choose an incentive scheme that will maximise their own benefits while giving the agent the freedom of action to guarantee some minimum return. As such, member states argue that with MSC, benefits from price premium is distributed along the value chain to private actors (State excluded), while assuming sustainability benefits for the State in relation to addressing moral hazards. In light of this view, Figure 4.2 demonstrates that there is no impact of MSC on the incentive gaps between member states and fleets. This is not a surprise by the unclear economic benefits accounted for member states from the MSC program.

What we instead observe is the role of the Pacifical in closing the incentive gap or creating a direct relationship between the PNA and fleets catching MSC tunas. The creation of Pacifical addresses the double PA problem faced by the PNA, in particular for a portion of the purse seine fishery engaged in MSC fishing. By creating new informational demands that are compliant to MSC fisheries and CoC certification, the PNA has 1) created a direct link to eligible MSC fleets, and 2) expanded control over the firms and companies in the MSC tuna value chain. We demonstrate in Figure 4.3 that the Pacifical model highlights the program's governance contribution by configuring the standard double principal agent relationship within a complex regional setting. Configuring this double principal agent relationship reduces a double incentive gap by creating a direct relationship between the regional PNA and the fleet level, in support of member states. This is consistent with claims about the role of MSC in facilitating fisheries regionalism (Yeeting et al. 2016) by strengthening states performance to monitor fishing activities in their waters. In addition, the CoC promotes transparency by going beyond the standard monitoring requirements and demanding new information about traceability. Traceability improves informational quality by observing fishing activities all through the tuna value chain.

Overall, it therefore appears that a combination of VDS and FAD measures, with all the monitoring schemes under the implementing arrangements and traceability, have improved not only effort control but also observation and monitoring of purse seine fishing activities in the whole PNA as well as the value chain. Nevertheless, while the creation of Pacifical CoC addresses the double PA problem and improves tuna governance to some extent, the overall goal of motivating more free school fishing still seems yet to be met. The extent to which the PNA and the MSC program, has been successful in moving the fishery to meet this overall goal, instead of simply performing the requirements set out by the MSC remains unclear. Evidence to date shows that the distribution of FAD and free school sets and catches has not yet changed from before the implementation of MSC. Instead the MSC has influenced the overall improvement and additional measures on FAD management and VDS coverage. This means that while the provision of information is met, thereby reducing moral hazard in the fishery, it is less clear if these information incentives will translate into incentives for changing fishing practices from non-certified FAD fishing to certified non-FAD fishing.

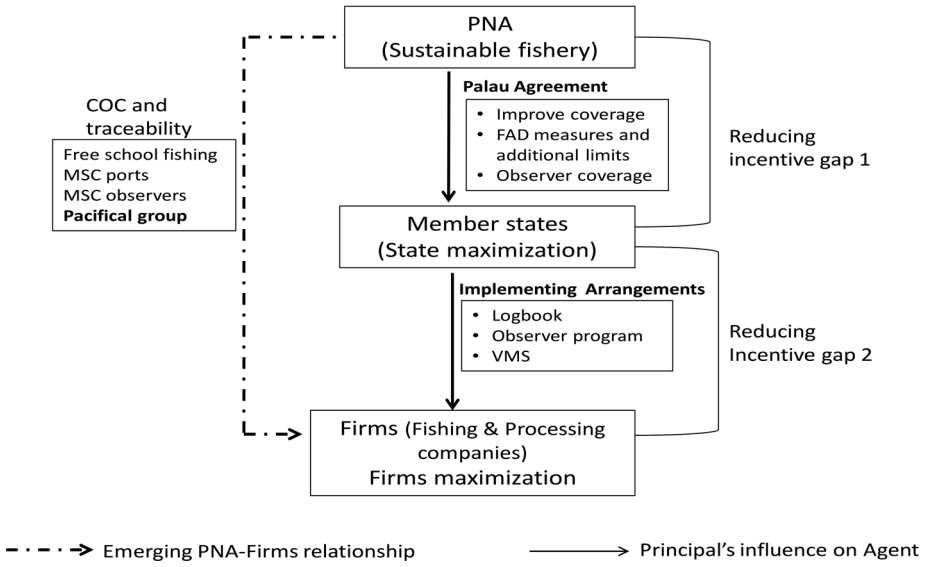

Figure 4.3 MSC COC implications on the PNA double principle agent problem

Our principal-agent application of the MSC program, provides evidence of the potential and role of private schemes in the revelation of catch and effort information. Through the lens of principal agent theory, we demonstrate the role of MSC program through three processes in overcoming asymmetric information problem and incentive gaps. These include 1) validating existing measures through the assessment process, 2) improving regional measures through MSC conditions, and 3) increasing transparency by the flow and control of information through traceability. More specifically from the principal agent perspective, they do so by identifying asymmetric information problems with existing measures, and using MSC conditions and traceability requirements to affect change and improvement in overcoming the problems.

Lastly, our analysis of the MSC program also supports claims of Jensen et al. (2007) and others, saying that under the conditions of asymmetric information it is difficult to reach the first best option. As indicated we demonstrate that the PNA measures and the MSC program have been successful in overcoming different levels of asymmetric information and reducing the incentive gaps, but the first best solution of only free-school fishing remains elusive. There are still remaining asymmetric information and incentive gaps (perhaps minimal) that will continue to undermine fisheries regionalism and cooperative arrangements for trans-boundary tuna

resources. This implies the ongoing need for a coherent and more effective approach in affecting institutional change for sustainability.

4.7 Conclusion

Our study provides empirical evidence of multi-level incentive gaps in a complex trans-boundary problem and regional setting, and the role of the private MSC program in addressing them. We build on Jensen and Vestergaard's (2001, 2002) and Bailey's et al. (2016, 2017) double PA framework by confirming for the PNA case that there are multi-level asymmetric information problems and resulting incentive gaps. Within complex regional settings we also observe the role of a market-based mechanism, here a certification scheme, in addressing some but not all incentive gaps. In particular, our application of the double principal-agent problem and our attempt to analyse the role of the MSC scheme, opens up the potential of the private certification incentive in addressing these multi-level incentive gaps and asymmetric information problems. In overcoming these multi-level problems, we analyse the significant role of the MSC scheme in providing multi-level impacts by affecting change in a complex regional setting. The multi-level impacts of the MSC scheme are related to the different strategies of the MSC scheme driven from its principles based on stock status, ecosystem conditions, management system, and the CoC, which all have a role in addressing the different problems within a complex regional fishery setting.

From a fisheries regionalism perspective, the MSC program is not only validating PNA measures and cooperative arrangements but is facilitating improvements where States have limited capacity to perform. This is observed in the creation of a direct relationship between regional PNA and fleets through the PNA-Pacifical model. This direct relationship also implies the relevance and key role of the regional PNA in monitoring and controlling fishing activities in the collective PNA waters. In other words, this is not undermining the State's role in controlling fishing activities in their waters, but rather acknowledging the State's limited capacity to do so, and in fact strengthening control of the State through reducing the incentive gap and better aligning the objectives of principals and agents.

While we demonstrate the role of MSC program in addressing asymmetric information within the different principal agent levels, further studies could look at the economic benefits of implementing the MSC program to quantify and reflect on the level of incentive gap closed as a result of the certification program. Second we also demonstrate how MSC conditions have affected changes in management measures at the PNA and WCPFC levels, but remains unclear how these measures have affected change at the fleet level i.e. fishing activities and patterns. A study or review of the MSC program to effectively affect or incentivise change in fishing activities and patterns could potentially leads to more effective change for sustainability.

Chapter 5. Only one path to sustainability? Understanding the role of MSC certification in regional fisheries management organisations

Abstract

Regional Fisheries Management Organisations (RFMOs) facilitate international cooperation for the management of shared trans-boundary fish resources like tuna. However, RFMOs are challenged with dynamic interests which have slowed progress towards collective decisions on establishing key management measures such as harvest control rules (HCRs) and target and limit reference points. The private institutions like the Marine Stewardship Council (MSC), a third-party certification standard, have been introduced to incentivise the adoption of these and more measures. The role of MSC as a private institution is thought to work in a linear way – providing economic incentives for meeting its standards. However, based on a comparison of three RFMOs in the Indian, Pacific and Atlantic Ocean, this chapter shows how the MSC influences decision making in very different ways. In doing so we demonstrate different 'pathways' through which MSC has been applied to create change at the RMFO level. The findings hold relevance for a wider understanding of how third party certification contributes to change beyond market incentives alone.

A version of this chapter is undergoing final revisions for publication in the forthcoming book:

Yeeting, A.D. and S.R. Bush (Forthcoming) Only one path to sustainability? Understanding the role of MSC certification in regional fisheries management organisations In *Smart mixes in relation to trans-boundary environmental harm: interactions between international, state; and private regulation*, p. xx-xx J. Van Erp, M. Faure, A. Nollkaemper and N. Philipsen (Eds.). Cambridge University Press: Cambridge

5.1 Introduction

Overfishing, overfished stocks and overcapitalization of fishing fleets are functions of the success or failure of inadequate institutions (Squires et al. 2016). Rules for the exploitation of trans-boundary fish stocks like tuna are set by Regional Fisheries Management Organisations (RFMOs), with authority mandated through the 1982 United Nations Convention on the Law of the Sea (UNCLOS). RFMOs require coastal and fishing states to cooperate through international agreements to ensure the conservation and promotion of optimum utilization of highly migratory species within and beyond the exclusive economic zones (EEZs). Under the international laws (UNCLOS), RFMOs are expected to establish appropriate management measures in line with precautionary sustainability approaches. Despite the achievement RFMOs represent as international platforms for the management of tuna resources, their effectiveness in setting and enforcing effective effort limits and rules for harvesting tuna (even when measured against their own goals) has been limited by the difficulty of aligning political and economic interests of member states (Grafton et al. 2006, Squires et al. 2016). In light of RFMO's delayed actions in reaching for appropriate agreements in promoting sustainability for trans-boundary tuna resources, this chapter examines the role of smart mixes or mixed approaches in facilitating regulatory systems at the RFMO level.

One particular challenge faced by RFMOs has been the establishment of harvest strategies that refers to harvest control rules (HCRs) and reference points to promote a precautionary approach to management as required under UNCLOS and FAO Code of Conduct for Responsible Fisheries (Hilborn et al. 2005). Harvest strategies are considered to represent a best-practice approach to fisheries management decision making for the establishment of harvest rules (HCRs). They are proactive, adaptive and provide a framework for taking the best available scientific information about a stock or fishery and applying an evidence and risk-based approach to setting biological target and limit reference points (harvest levels). The challenge in setting these rules and levels is that they should be developed in the management planning stage with the involvement of all stakeholders (Hilborn et al. 2005, Hampton et al. 2012). However, the complex nature of tuna fisheries, including multiple species and gear types, contributes to the difficulties in member states cooperating for these sustainable management. As Aranda et al. (2012) argue, the adoption (or not) of HCRs and reference points by RFMOs is a function of the (mis)alignment of political and economic goals of participating states given their vested interests in different species of tuna, the fishing gears used to catch them and the protection of often long standing access arrangements (see also Bailey et al. 2013, WCPFC 2014).

To align diverging national interests of RFMO members, scholars and policy makers alike have searched for 'smart mixes' of political and economic institutions (Borzel et al. 2002, Andonova 2010, Ponte 2012, Foley et al. 2016). One such 'mix' is the adoption of third party certification, such as the Marine Stewardship Council (MSC), to set requirements supported by apparent market demand for sustainably managed fisheries – which includes the establishment of limit reference points and HCRs (Gray et al. 2007, Lodge et al. 2007, Allen 2010, Jones et al. 2016).

The three principles of the MSC require 1. the maintenance of healthy stocks, 2. limited impacts on the ecosystem, and 3. an effective management system to regulate fishing activity (Gulbrandsen 2010). By setting scientifically HCRs and reference points as major conditions for the fisheries it certifies that the MSC is considered a credible market institution for incentivising change in management regimes like RFMOs.

Using a new institutional economics (NIE) framework, this paper compares three cases of MSC-RFMO interaction to understand the role of third-party certification in contributing to the establishment of precautionary management measures for sustainability. In doing so we compare the interaction between MSC and RFMOs in the Indian, Pacific and Atlantic Ocean. Specifically, we examine how private institutions like the MSC facilitates state (public) regulation in improving measures for sustainable fishery, align incentives and address tuna management problems at the RFMO level. While previous analysis has focused on the role of MSC in improving rights and governance on individual fisheries, there is limited understanding of how the MSC program has contributed to systemic change at the RFMO level, in particular in relation to the adoption of HCRs and limit reference points.

Our analysis contributes to debate on the role of market institutions in facilitating state's objectives for sustainability. While still unclear, controversies against the MSC process in certifying the fishery with conditions for improvement opens up questions about whether *'improve-first-certify-second'* or *'certify-first-improve-second'* pathways have a chance to facilitate improvement for sustainability. This study do this by identifying longitudinal 'pathways' of improvement which can explain different sequential ordering of interaction between market and political institutions. In doing so we respond to claims that there is one order or process of applying third party certification, as well as the associated notion that absolute compliance to a standard, which leads to a priori exclusion from certification, is better than more inclusive approaches incremental problem identification and improvement and exclusion of poorly performing producers (e.g. Christian et al. 2013). Instead we argue that step-wise improvement of setting and closing conditions as a tailored process of improvement can offer more effective long term change in complex governance settings like RFMOs.

The chapter is structured as follows. We first provide an overview of the new institutional economics framework and its relevance for understanding smart mixes of market and political institutions. We then present the results of our three RFMO case studies, the Western and Central Pacific Fisheries Commission (WCFPC), Indian Ocean Tuna Commission (IOTC) and the International Commission for the Conservation of the Atlantic Tuna (ICCAT). Data are based on an extensive review of the certification documents available through the MSC, documents on each of the RFMO sites, as well as 16 semi-structured interviews with the fishery (MSC clients) n = 4, MSC respondents for each RFMO n = 7, and non-MSC respondents n = 5. The interviews are conducted from October, 2016 to April, 2017 through telephone and Skype due to different locations among interviewees. We then discuss these cases with a view to characterising

different improvement pathways emerging from these cases before drawing conclusions of the wider implications and application of our findings.

5.2 Understanding dynamic institutional interaction

The new institutional economics (NIE) framework describes the formation and effectiveness of different types of institutional interplay (Williamson 2000, Acemoglu et al. 2004). The NIE framework focuses on the evolutionary interaction between economic (market) and political institutions. NIE offers an interdisciplinary approach to analyse the form and function of institutions in allocating rights and responsibilities for efficient resource use and stewardship (Coase 1984, Williamson 1990, Paavola 2007). NIE also opens up an understanding of how the interaction of different kinds of institutions lead to (in)efficient policy outcomes and designs for innovative policy solutions in addressing misalignment and dynamics (Hilborn et al. 2005, Pacheco et al. 2010). The application of NIE is therefore relevant for understanding the challenges facing fisheries agreements and the processes of finding solutions for trans-boundary stocks in a dynamic multi-lateral setting.

Williamson (2000) provides a hierarchical NIE framework consisting of four institutional levels, each with a different pace of change (see Figure 5.1). In this study we focus on the interaction between political and economic institutions in the formation of governance institutions. RFMOs are political institutions representing member states with a mandate to conserve shared resources. Governance institutions are rules for mitigating conflict and creating mutual gains by 'crafting order' through contracts and enforcement mechanisms (Williamson 2000, Pacheco et al. 2010), which encompass precautionary measures like HCRs and limit reference points. Finally, economic institutions refer to structured incentives and motivations for operational decision making, which we argue corresponds to the role of the MSC standards and certification. The MSC standards and certification offer an incentive scheme through its eco-labelling instruments with an associated price premium on sustainable seafood products. The dynamic nature of agents, resources and knowledge encompassed by economic institutions are subject to continuous review, with greater frequencies of change compared to governance and political institutions (Ostrom 1990). This also means that experimentation and iterative improvement are also likely in these economic institutions compared to the other institutional levels (Pacheco et al. 2010).

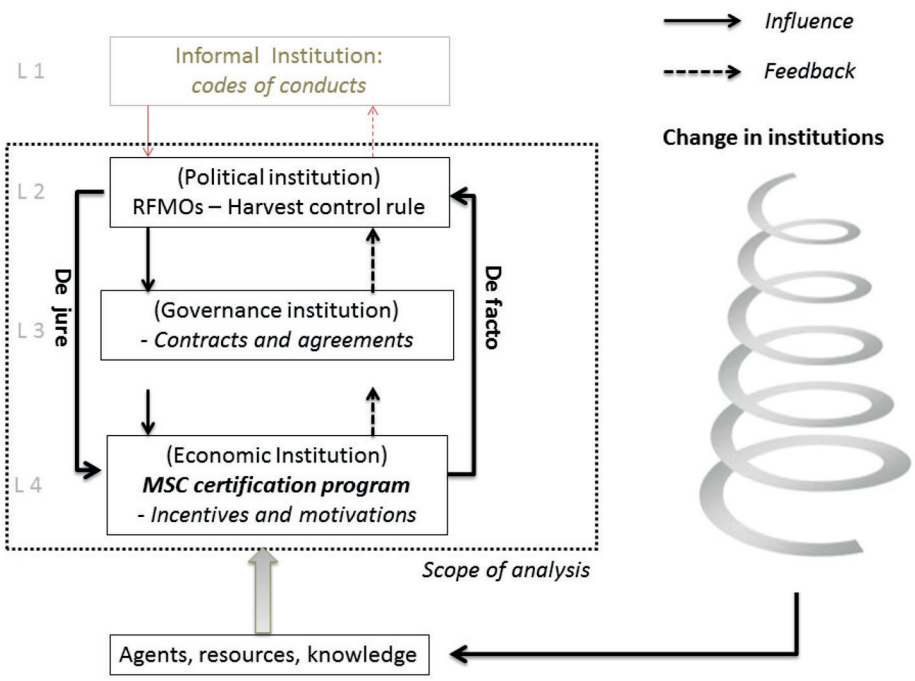

Figure 5.1 New Institutional Economics Framework (Adapted and modified from Williamson 2000 and Acemoglu et al. 2004, 2005).

Acemoglu *et al.* (2004, 2005), builds on Williamson' NIE framework by emphasising the evolutionary interactions between political and economic institutions that are based on feedbacks. They point to the interaction of influence and feedback as *de facto* economic power derived from the economic institutions, and *de jure* political power on the other hand, derived from the political institutions. Both Williamson (2000) and Acemoglu (2004), recognise the role of these interactions in a continual state of co-evolution reflecting the interactions between dynamic actors involved. In this sense the creation of governance institutions, such as law and policy, opens up questions about the kind of incentives required, and ultimately how they influence the balance between *de jure* and *de facto* power.

Previous studies have pointed at the variety of ways in which third party certification, as an economic institution, has generated changes in political and governance institutions. Foley (2013), for example, shows how MSC instigated change by conflating the state as a client and enforcer of regulatory change. Similarly Adolf et al. (2016) show how the state can reposition

itself as not only a client for MSC certification, but in doing so gain greater control over value generation in international markets. Gulbrandsen (2014) has also demonstrated that the principles of dynamic interactions can be drawn to understand how governance outcomes have been reached. Outside fisheries, research on international regimes has similarly demonstrated that the interaction of public and private modes of governance are located in 'regime' complex, where cooperation and completion between actors shape the formation of regime rules (Pattberg 2005). While all of these examples point at the form and function of institutional interaction, we argue that little attention has been given to the sequence of interactions and how this sequence can shed light on different strategies for applying economic institutions to create new incentives for changes in political institutions.

Characterising the sequence of institutional interaction opens up the possibility to identify different 'pathways' of institutional interaction and change. In doing so we imply an active choice and application of not only which institutions to apply to address an incentive gap, but also a strategy for the order and timing of its application. This in turn opens up the possibility to identify strategies for applying a tool like MSC to shape incentives for cooperation around rule setting by political actors. Pathways in this sense do not only mean structured dependency on a set of actors, interests and instruments (Peters et al. 2005), but also a series of decisions that can be made by fishery managers in the development of an overall strategy for change. As Overdevest and Zeitlin (2014) argue, such pathways are emergent because rather than being a unified set of rules and procedures set out by a multi-lateral regime, they are processes of experimental rule setting within multi-lateral organisations like RFMOs. In these pathways, economic institutions like certification can then be seen as a recurrent causal process that can explain (but also be used to shape) strategies for change in complex institutional settings.

These pathways should be understood analytically as stylized, ideal-typical trajectories leading from a characteristic starting point (national or international, public or private) towards the emergence of governance institutions. By characterising these improvement pathways we can therefore move beyond assumptions that underpin much of our understanding of the potential for and how third party certification create change. In doing so we challenge the assumption that the MSC has a single mode of change; starting with a fisheries improvement project, moving to pre-assessment then full assessment, where protest may disqualify a fishery (see Figure 5.2). Instead we open up the possibility of multiple pathways of change, which while generally following the expected sequence above, may illicit different responses from political actors and therefore different ways of bringing about change to governance institutions like HCRs and limit controls. As we now go on to illustrate there are multiple iterations of this assumed sequence of events involved in the certification of a fishery.

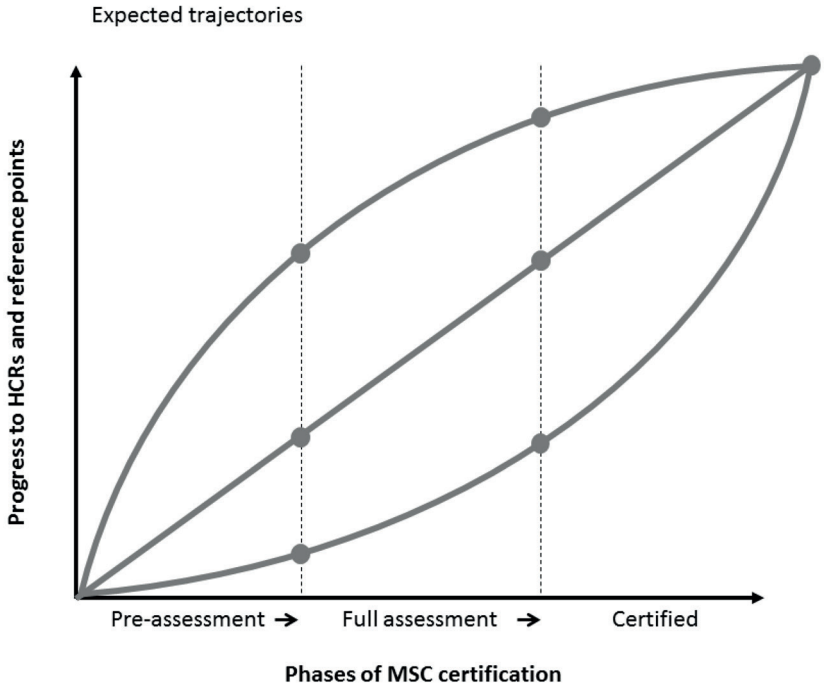

Figure 5.2 Expected MSC-RMFO pathways for developing precautionary management measures

We analyse and compare the sequence of interactions between the MSC and three RFMOs in the next section. Specifically we analyse how MSC-RFMO interactions in the three cases brings about institutional change for the adoption of HCRs and reference points. We do this by examining RFMOs past experiences and challenges with precautionary approaches. Second we evaluate the emergence and implications of MSC programs through selected MSC fishery clients within each RFMO. Lastly we determine and compare improvement pathways in each of the three RFMOs in making conclusions for the successful application and timing of MSC processes in facilitating change at the RFMO level.

5.3 Comparative analysis: MSC-RFMOs interaction.

5.3.1 Western and Central Pacific Fisheries Commission

Setting HCRs and reference points. The Western and Central Pacific Fisheries Commission (WCPFC), established in 2004, is responsible for managing straddling and highly migratory fish stocks in the Western and Central Pacific Ocean (WCPO) (Tsamenyi et al. 2004); a region that accounts for approximately 60% of annual global tuna production (Harley et al. 2014). The WCPO is home to the remaining healthy tuna stock that provides about two-thirds of the world's tuna supply every year (Havice 2010, Havice 2013). Of this catch, 80% of the total landings of the region are from the EEZs of the eight member states of the Parties to the Nauru Agreement (PNA) (est. 1982) including the Federated States of Micronesia (FSM), Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea (PNG), Solomon Islands, and Tuvalu.

Tuna management in the WCPO is divided between three regional bodies including the WCPFC, PNA and the Pacific Islands Fisheries Forum Agency (FFA) (est. 1979). The FFA represent all 22 coastal states of the Pacific Ocean including the PNA. The FFA focus on the general management of all tuna species and fisheries, while the PNA focuses on the management of purse seine and skipjack tuna (Barclay et al. 2007). But both FFA and PNA share common interest in ensuring: 1. effective management of tuna stocks and its ecosystem and 2. better governance for equitable distribution of wealth from tuna fishing in their collective EEZs. When the WCPFC was established in 2004, the FFA and PNA became sub-regional blocs within the WCPFC, in which the WCPFC provides a platform for coastal and fishing states to cooperate in managing fisheries of the Pacific Ocean.

The WCPFC meet annually to determine total allowable catch/effort limits for highly migratory stocks as the commission may decide, and adopt standards for the collection and timely exchange of data on fisheries in the convention area (Havice 2010, 2012). Decision making depends on the advice and recommendation of the Scientific Committee, but instruments are adopted by consensus as binding conservation and management measures (CMMs). Furthermore the Scientific Committee rely on the work and advice of the Secretariat of the Pacific Communities (SPC), with strong political supports of the FFA and the PNA.

Since the 1990s the advice of the Scientific Committee is to reduce effort and catch to maximum sustainable yield (MSY). Achieving this requires a harvest strategy with clear and defined target and limit reference points for all tuna species to be able specify measurable benchmarks (Hampton et al. 2012, WCPFC 2015). Yet the development of reference points has proven politically sensitive due to potential trade-offs between the benefits and costs between purse seine and longline fisheries in the region, which are respectively more or less important to different member states (Barclay et al. 2007, Havice et al. 2010, Parris 2010, Bailey et al. 2013). In particular, purse seine fisheries deploying Fish Aggregating Devices (FADs) targeting skipjack has led to overfishing of both yellowfin and bigeye tuna exploited by longline and

handline fisheries (Harley et al. 2014). The challenge in reaching agreement on setting precautionary limits to yellowfin and bigeye exploitation at MSY levels is to balance the interests of coastal and distant water fishing states taking into account the wealth generated by maintaining growth of the skipjack purse seine fishery.

MSC process. In response to the failure of WCPFC to formulate appropriate measures to put in place harvest controls and levels, the PNA has worked at the sub-regional level to set measures for sustainable fishing in line with their wider objective of generating greater wealth from their tuna resources. At the first presidential summit in 2010 the leaders of the eight PNA countries signed the Koror declaration, which established the intention to have skipjack and yellowfin certified against the MSC standards, and in doing so, expand their management control of tuna resources in the supply chain (PNA 2010, Aqorau 2015).

In preparation of the Kokor declaration the PNA underwent MSC pre-assessment in 2009 of their skipjack and yellowfin tuna purse seine fishery setting on 'free school' (or non-FAD) tuna, naturally occurring 'FADs' such as floating logs, and associated fisheries using anchored and drifting FADs (Banks 2009). The result determined that only the skipjack targeted purse seine fishery setting on free school tuna would pass full assessment, whereas yellowfin was considered ineligible because of concerns related to the health of the stock in other areas of the WCPO, especially in the Philippine and Indonesia waters. The PNA free school purse seine fishery entered full assessment in 2010 and was certified in 2011 with six improvement conditions and seven recommendations for improvement within the certification period to 2016 (Banks et al. 2011, Banks et al. 2012).

A major condition for re-certification was the adoption of appropriate limit and target reference points and the development of more effective harvest control rules by the PNA and WCPFC. These conditions were agreed to by the PNA and an action plan was developed for monitoring through an annual surveillance audit process within their 5-year certification period (Banks et al. 2011, Bellchambers et al. 2016). The agreed action plan also includes explicit milestones for the WCPFC to initiate identification and development of appropriate reference points in 2012 (year 1) which should be adopted in 2013 (year 2). Before re-certification in 2016 the PNA and WCPFC also committed to a well-defined HCR consistent with the limit reference point (Banks et al. 2011, Banks et al. 2012).

The PNA argued that the 'third implementing measures' developed in 2009 and the Vessel Day Scheme (VDS) established in 2007 constitute their harvest strategy for the skipjack purse seine fishery (Banks et al. 2012, Aqorau 2015). In particular, they refer to the vessel day scheme, and the third implementing arrangements (catch retention of all tuna, seasonal FAD closure, partial high seas closures, full observer coverage and the use of electronic vessel monitoring system) for purse seine vessels as their harvest strategy. However, even if these implementing measures qualified the PNA for closing out their MSC condition for HCRs, their challenge was to ensure that they had them adopted as binding CMMs at the WCPFC level, which would extend

implementation to the entire WCPO. For this reason, the adoption of HCRs and reference points at the WCPFC is key for PNA's achievement against MSC conditions and milestones and hence for PNA to maintain its certification for re-assessment.

The PNA has demonstrated progressive improvement in line with the conditions and milestones set by the MSC certification towards 2016. New CMMs have been adopted by the WCPFC either as a result of or in parallel to the MSC conditions for the PNA (Daume et al. 2014, Daume et al. 2016). In 2012, the introduction of HCRs and limit reference points were presented and discussed at a series of workshops and sessions at the 8th annual meeting of the Scientific Committee in preparation for the Commission's meeting (Hampton et al. 2012). These discussions led to CMM 2014-06 on establishing a harvest strategy for key fisheries and stocks in the WCPO, with a work plan to be achieved by 2017, and CMM 2015-06 which sets interim target reference points for skipjack tuna at 50% of biomass in the absence of fishing (WCPFC 2015). As a result, five of the six initial conditions from the initial assessment have been closed out, including those for setting limit reference points for skipjack (Daume et al. 2014). The condition for setting a harvest strategy remains in progress.

Pathway. The pathway of institutional interaction that emerges from this case conforms largely to the expected sequence of stages improvement of the MSC certification process (see Figure 5.3). The PNA purse seine fishery has moved from pre-assessment to certification and is pending re-certification. In the process key conditions for improvement have been observed, related directly to the definition and implementation of a HCRs and limit and target reference points. The PNA as a political institution has responded by working to close out these conditions in accordance with the surveillance audits. What this case emphasises, however, is the role of the PNA as a sub-regional level in using the MSC to set and measure progress to establishing a harvest control strategy in the absence of progress at the RFMO level. Reflecting the notion of dynamic experimentation in environmental regimes (Overdevest et al. 2014), the PNA states have played an active role through the MSC process to initiate dialogue and negotiation for the establishment of measures that will promote MSY based on precautionary approaches in line with UNCLOS.

Questions have been raised, however, as to whether the improvements seen to date at both the PNA and RFMO levels are attributable to the MSC process. Many of the elements associated with the harvest control strategy were established at the time or even before the MSC pre-assessment in 2009, perhaps indicating that the PNA would have anyway made progress to establishing a strategy for skipjack tuna. In that sense the MSC certification only verifies the actions the PNA was already undertaking. Though this may be true, the MSC still appears to have played a role in creating adequate incentives for the PNA to go beyond an internal management strategy. Without the MSC it may have been less likely that the PNA would have negotiated for the adoption and implementation of the VDS, negotiate and propose the process for adopting HCRs and reference points at the WCPFC, nor develop an action plan with well-defined milestones for improvements. Perhaps most importantly, it appears there would have

been less ambition to contribute to the reduction of negative impacts from purse seine fisheries beyond PNA waters on the overall tuna stocks.

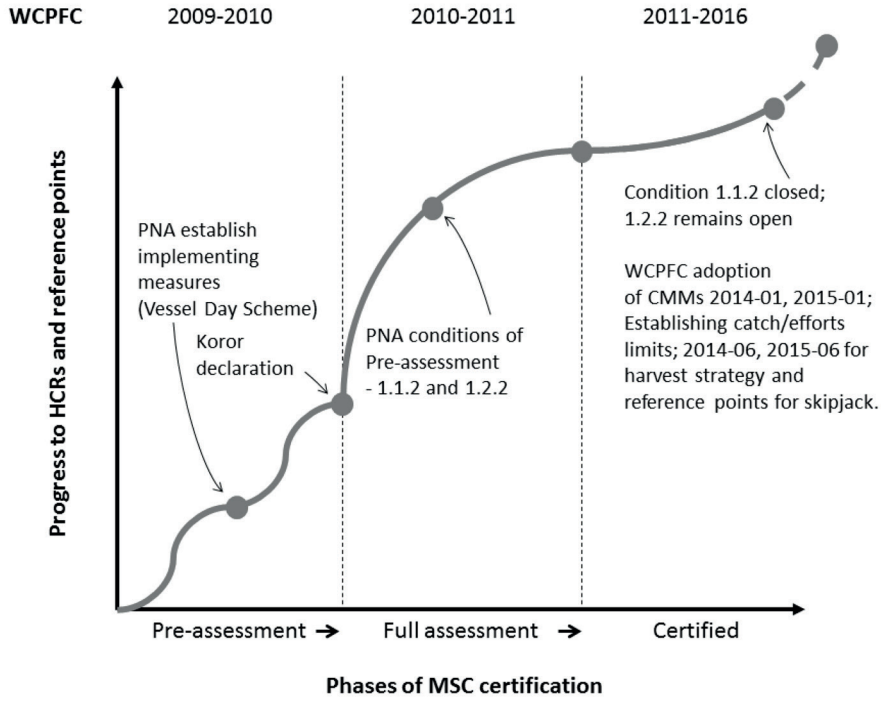

Figure 5.3 WCPFC-MSC improvement pathway

5.3.2 Indian Ocean Tuna Commission

Setting HCRs and reference points. The Agreement for the Establishment of the Indian Ocean Tuna Commission (IOTC) was ratified in 1993 and made operational in 1996 under Article XIV of the FAO Constitution to manage tuna and tuna-like fishes in the Indian Ocean. The IOTC area of competence is the Indian Ocean, defined as FAO statistical areas 51 and 57, including 'adjacent seas', expanding to north of the Antarctic Convergence (IOTC-PRIOTCO2. 2016). Membership of IOTC is open to Indian Ocean coastal states and to countries or regional economic integration organisations which are members of the United Nations (e.g. the Bay of Bengal Programme), or one of its specialised agencies and are fishing for tuna in the Indian Oceans (IOTC 1993). The adoption and design of economic institutions or policy instruments depend on the advice of the Scientific Committee and designated Working Parties for key species and fisheries.

Historically pole and line and long-line were the primary tuna fisheries in the Indian Ocean, with a combined reported annual total catch between 400,000 to 600,000 metric tonnes (mt) (IOTC 2009, IOTC 2012). With the introduction of the purse seine fishery in mid-1980s catches increased steadily to peak at 625,074 mt in 2006 (IOTC 2009). In 2006, the member countries of the IOTC agreed to reduce bigeye catches to the 2004 level and yellowfin to below the 2000 level (Anonymous 2009). Subsequently, catches declined to 455,999 MT and 428,719 MT in 2009 and 2010 respectively (IOTC 2012). Although the IOTC was successful in reducing catch levels, it remains unclear whether this reduction would achieve MSY for bigeye and yellowfin in the long run without the adoption of further HCRs and limit and target reference points. The reason for this is related to concerns over the increasing purse seine impacts on yellowfin and bigeye stocks in the long run, coupled with the lack of political support and Scientific Committee's capacity and capability to push for the adoption of precautionary approaches that would promote the MSY due to short term interests of some Parties (Huntington et al. 2009, IOTC 2009).

Unlike the WCPFC, the IOTC Agreement does not refer to the application of a precautionary approach (IOTC 1993, IOTC 2009). Instead it seeks solutions for optimal utilization throughout the convention area, and ensuring effective information about the fishery for scientific evaluation and advice (IOTC 1993). This is because the IOTC agreement was formed before the UNFSA and FAO CCRF of 1995 (Fanning et al. 2007). For that reason, the IOTC Agreement lacks the definition of important elements such as fishing, fishing operations and fishing vessels, which are significant impediments to the efficient implementation of the agreement (IOTC 2009). The first round of performance review of the IOTC conducted in 2009 recommended that this oversight be reformed and the ecosystem and precautionary approaches adopted – which would in turn provide a basis to establish HCRs and reference points.

MSC process. The introduction of the precautionary approach to the IOTC began through the engagement of the MSC certification of the Maldives pole and line skipjack fishery in 2012. At the start of the assessment process, the Maldives submitted a formal application for full membership of the IOTC in response to the MSC requirement to contribute to the management of the skipjack stock within the IOTC framework. This brought the fishery, which accounts for 21% of the global pole and line tuna catches (and 80% of reported skipjack tuna catches) in the Indian Ocean under the RFMO (IOTC 2015). Handline targeting yellowfin tuna was initially part of the Maldives MSC application but was suspended due to the poor condition of the stock.

The rationale for the Maldives to apply for MSC certification began in 2008 (IOTC 2009), as part of a wider plan supported by the World Bank to manage the bait fishery on which the pole and line industry depends (Huntington et al. 2009). Within this action plan the government outlined the need for a precautionary approach to realise the sustainable development of fisheries for economic diversification and growth (Huntington et al. 2009). The development of a precautionary approach drove the Maldives to enter the MSC process, due to a clear indication of

a healthy skipjack stock and minimum pole and line negative impacts on the fishery ecosystem, and also seeing the potential role of the MSC program in helping to develop and achieve their strategy for implementing the precautionary approach. The pole and line fishery within the Maldives EEZ went through MSC pre-assessment from 2009 to 2010 and successfully completed full assessment in November 2012, with eight conditions for improvement within the five years of certification until 2016 (Huntington et al. 2009).

In response to the MSC conditions the Maldives government developed an action plan to reach certification within the five years (Scott et al. 2014). The plan included a clear timeframe for the development of a fisheries management plan for skipjack by 2012, a review of catch, effort and size frequency data by the end of 2013, and the implementation of the management plan by the third quarter of 2014, and a recovery plan for yellowfin tuna. However, two of the eight MSC conditions were the development of HCRs and establishment of target and limit reference points for skipjack tuna, which required implementation by the IOTC (Huntington et al. 2009). After their membership to the IOTC, the Maldives conducted a number of sessions with other coastal states on the relevance and importance of establishing HCRs and reference points with the support of key international and private organizations, including the International Pole and Line Foundation (IPNLF), International Seafood Sustainability Foundation (ISSF), World Wildlife Fund (WWF), the World Bank and the MSC itself.

The end result was the adoption of Resolution 12-01 on the implementation of the precautionary approach, which marks the introduction of the precautionary approach and harvest strategies in the IOTC (IOTC 2016). The Maldives subsequently submitted a proposal to the IOTC in 2013 for the implementation of an interim HCRs rule for skipjack tuna. The proposed HCR formulated a procedure for making harvest policy decisions to achieve a desired state. In 2013 as part of the surveillance audit there was also an attempt to assess the eligibility of yellowfin stocks against MSC Principle 1 for healthy stock which started in 2013 (and still in progress to date) (Scott et al. 2014). In 2016, Resolutions 16-01 and 16-02 were adopted, which set a stock rebuilding plan for yellowfin. They do this through reductions by gear type to reduce the 2016 catch level by 20% relative to 2014 (IOTC 2016). Resolution 16-02 was adopted for the establishment of HCRs for skipjack tuna in the Indian Ocean – the first harvest control rule to be developed (IOTC 2016).

The experiences of the Maldives contrasts markedly with the experiences of the second fishery in the IOTC to apply for MSC certification. Echebastar, a family company from the EU and Seychelles fishing in the region since 1981 applied for MSC certification in 2013 for their free school purse seine fishery targeting bigeye, yellowfin and skipjack (Nicks et al. 2015). The assessment was finalized in November 2015, showing that all three units of certification scored above the 80 point threshold for certification. However, the final approval for certification was upheld due to the absence of HCRs and reference points at the IOTC (Nicks et al. 2015, WWF 2016). Six of the ten conditions identified by the assessors related to the development and adoption of HCRs and reference points for all three species (yellowfin, bigeye and skipjack) by

2019. But in contrast to the Maldives, which faced similar conditions, the Echebastar fishery was not certified. At the time of writing the Echebastar fishery is still undergoing an assessment process, and yet no evidence or progress seen for the fishery to influence improvement at IOTC.

Pathways. We observe two slightly different improvement pathways of MSC in the Indian Ocean (see Figure 5.4) that do not adhere to the expected pathway (as outlined in Figure 5.2). The Maldives pole and line case shows a pathway based directly on certify-first-improve-second which imply a certified fishery with the political engagement with improvement conditions at the IOTC level. On the other hand, a private fishery unit of certification remains in a prolonged assessment process despite having the similar requirement for improvements set for the IOTC level.

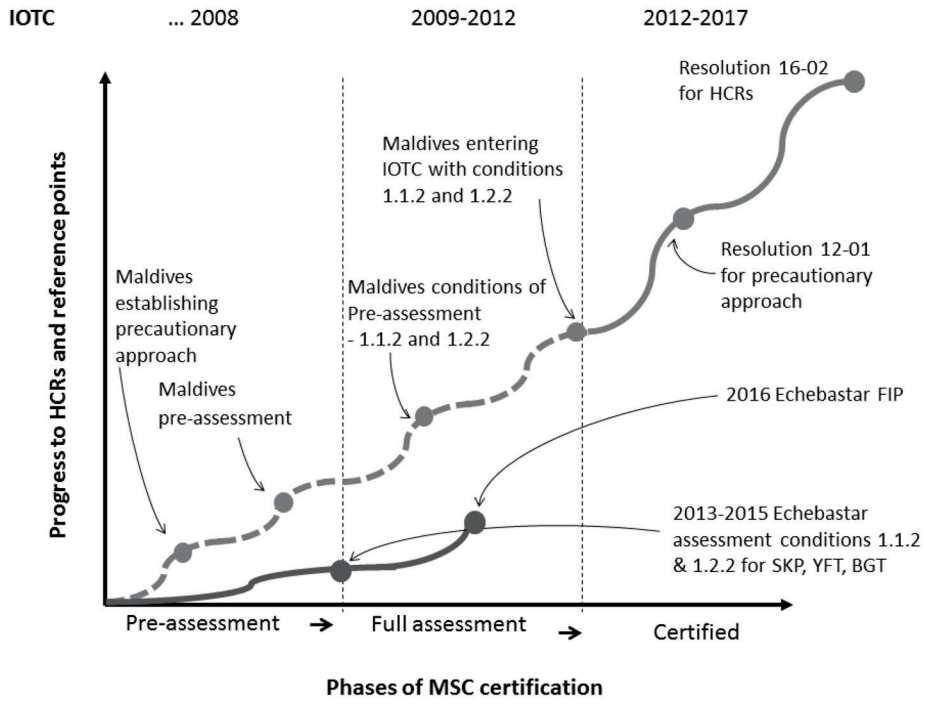

Figure 5.4 IOTC-MSC improvement pathway

In comparing the two pathways, we find that the public-private engagement is more successful in driving change at tuna RFMOs than the fishing industry (private) acting alone without the state's support. The difference between these fisheries is the Maldives' capacity as a member state of the IOTC to influence decision making at IOTC. This implies that a pathway of 'certify first and improve second' appears more attainable to a client-state than a private unit of certification like

Echebastar, which has less potential to influence decisions at the IOTC-level. The Echebastar case in turn raises questions about the credibility of the MSC process in supporting fisheries without the ability to influence what are essentially political decisions at the IOTC level (WWF 2016). Having HCRs and reference points for skipjack adopted at IOTC in 2016 does open up the potential for Echebastar to progress certification of skipjack perhaps subject to the suspension of yellowfin and bigeye. The case therefore shows that although private intervention is key for improvements and changes at tuna RFMOs, our IOTC cases demonstrate the significant role of the state in using private institutions is seen to have a chance of success with political support speeding up developments at the RFMO levels.

5.3.3 International Commission for the Conservation of Atlantic Tuna

Setting HCRs and reference points. ICCAT was established in 1970 in response to the widespread concerns over the overexploitation of stocks of tuna and tuna-like fishes in the Atlantic Ocean and its adjacent seas (Hurry et al. 2008, Allen 2010). Historically, overexploitation of Atlantic tuna was driven by the expansion of the large-scale long line sector and purse seine fishery in the late 1950s and mid-1960s respectively (Saunders et al. 2016). The ICCAT convention area covers more than 30 species, of which Atlantic bluefin tuna is the most economically and politically significant, followed by bigeye, albacore and yellowfin (Saunders et al. 2016). The stated objective of ICCAT is to "cooperate in maintaining the populations of these fishes at levels which will permit the maximum sustainable catch for food and other purposes" (cited in Hurry et al. 2008 p.1).

The Commission currently includes 51 contracting member states and is organised into a number of constituent bodies responsible for data collection, the definition of conservation and management measures and recommendations for monitoring, control and surveillance. The specific functions and tasks of ICCAT are separated based on the sub-regional division of fish stocks. These sub-regional divisions are particularly important because the stocks represent the political interests and capacity of the actors and participants of the fishery. For example, albacore tuna is treated as three separate stocks in the northern Atlantic Ocean, southern Atlantic and the Mediterranean Sea. Bluefin is divided into the Eastern and Western Mediterranean stocks and Swordfish into the Northern, Southern and Mediterranean stocks. Bigeye and yellowfin in contrast are treated as a single stock.

ICCAT catches increased from 1950 to a peak of nearly 600,000 mt in 1994, from which time they have declined (ICCAT 2015). After 50-60 years of stock decline and growing pressure on the Commission from nongovernment organisations (NGOs) and key member states, ICCAT adopted a number of long term recovery plans for, albacore since the 1990s and bluefin in the late 2000s (Hurry et al. 2008, Saunders et al. 2016). These plans focused on setting catch limits, size limits, seasonal closures based on both areas and times of fishing, and the closure of the

Gulf of Mexico spawning area for the bluefin stock (Allen 2010, Carleton et al. 2010). ICCAT has adopted a number of recommendations for northern albacore since 1998 including limits on fishing capacity, which was later updated for north Atlantic albacore catch limits for the period 2008-2009, as well as subsequent recommendations for the establishment and implementation of a rebuilding program.

Although plans are in place to recover overexploited stocks, the recovery of stocks has been slow, with claims that ICCAT has failed to reach its own objectives (Hurry et al. 2008, Merino et al. 2016). Critiques of the recovery plan have focused on the failure of the Commission to adopt appropriate recommendations of the Standing Committee on Research and Statistics (SCRS) due to the political pressure from member states and economic pressure from the industry (Hurry et al., 2008). Others have noted the failure of some contracting parties to comply with their obligation to provide timely and accurate data, as well as the presence of illegal, unregulated, and unreported (IUU) fishing efforts (Saunders and Haward, 2016). Some respondents also note that until 2008 ICCAT measures were based on the recovery plan with the aim of increasing biomass instead of developing a clear management plan, which has undermined the long term sustainability of the stocks in question.

The outcome of the 2008 independent review of ICCAT recommended the adoption of the precautionary and ecosystem approach to fisheries management in line with the 1995 FAO CCRF and UNFSA (Hurry et al. 2008). However, ICCAT countered this review by stating that the precautionary and ecosystem approaches were already introduced in 1997 when ICCAT established an ad hoc working group and committee, and since 1998 ICCAT progressed by adopting subsequent recommendations for stock recovery plan. But as respondents noted, progress was slow and substantive change lacking because of the persistent dynamic political issue of conflicting conservation and economic interests (also see Hurry et al. 2008). From 2008, more practical and ongoing work has been done within the separate committees and panels in broadening their efforts to incorporate precautionary and ecosystem approaches, including the continued dialogue on the definition and evaluation of precautionary reference points and HCRs through the implementation of a management strategy evaluation approach (Saunders et al. 2016). Such dialogue continues until these days, and there has not been any decision on the adoption of such measures supporting a precautionary approach to management.

MSC process. Many claim that the MSC has played a significant role in influencing improvement towards the adoption of precautionary approaches in ICCAT (ICCAT 2015, Atuna 2016, Silva et al. 2016). However, MSC's presence in ICCAT, is both narrow and recent. This is mainly due to the poor status of most tuna stocks in ICCAT and the ongoing recovery work plan for all tuna stocks (Hurry et al., 2008; OPAGAC and WWF, 2016). We identify three types of MSC engagement in the Atlantic Ocean, which includes a failed assessment, an ongoing fisheries improvement program, and one certified fishery. We outline these three engagements with MSC, and in doing so examine how this multiple engagement has influenced the development of HCRs and reference points in the Commission.

The St. Helena pole and line fisheries for albacore, bigeye, yellowfin and skipjack tuna went through MSC assessment from February 2009 until July 2010 (Carleton et al. 2010). This small isolated island located inside the southern tropics of the Atlantic Ocean has a capacity of 500 mt of fish providing income to 40 fishermen on the island. The fishery failed the assessment because albacore, bigeye, yellowfin failed the MSC's stock status requirements at the regional level. For example, the status of bigeye and yellowfin for the entire Atlantic, the eastern half of the Atlantic for skipjack, and the southern Atlantic for albacore (Carleton et al. 2010, ICCAT 2016, Silva et al. 2016). After the St. Helena assessment there was no further involvement of MSC in ICCAT managed fisheries until 2016 because it was not until then that the health of stocks were at a requisite level to be certified (ICCAT 2016, Silva et al. 2016).

The Producers' Association of Large tuna Freezers (OPEGAC) developed and agreed to a global tuna fisheries improvement plan (FIP) work plan in 2016 with WWF in response to the slow progress by ICCAT in setting requirements for implementing a stock rebuilding plan (OPAGAC and WWF, 2016). Accordingly and in line with ICCAT's rebuilding plan for bigeye, yellowfin and skipjack tuna, OPAGAC agreed to prioritise activities to meet MSC standard for healthy stocks noting key ICCAT's recommendations for tropical tunas. These recommendations include the establishment of a multi-annual management plan, updating catch limits on bigeye and yellowfin to the 2010 levels, and a framework for developing a harvest strategy for each stock (ICCAT, 2015; OPAGAC and WWF, 2016). Though none of the ICCAT-OPAGAC fisheries are MSC certified or in assessment, there are apparent interests from the fishery for tropical tunas to enter MSC once stocks are fully recovered and MSC standard for healthy stock is satisfied.

Also in 2016, the north Atlantic albacore (Spanish) fishery was awarded full MSC certification. The clients are the Spanish Inshore Producers Organisations from Guipuzcoa (OPEGUI) and Biscay (OPESCAYA), and the San Martin de Laredo Fishermen Guild. The fishery covers 129 vessels, of which 87 are troll vessels that capture albacore from June to October and 42 pole and line vessels which fish from July to November, within the Bay of Biscay and adjacent North Atlantic waters. In 2014, the fishery accounts for 28,000 mt total allowable catches which is well below the MSY catch level of 31,680 mt.

The northern albacore fishery's interest in MSC certification began in the late 2000s, but did not comply due to the status of the stocks. They re-entered the certification process in 2014 when the stock is still recovering and went into full assessment in 2015 when there was a near full recovery of the stock (97%). The fishery was ultimately awarded certification in July 2016 (Silva et al. 2016). One of the five conditions set under the certification is to develop a clear and well-defined HCRs despite ICCAT having recommendation 11-13 for HCRs is in place and operational. The point raised by the MSC assessors was that these HCRs remain too poorly defined to assess north Atlantic albacore as a separate stock (Silva et al. 2016). A condition is raised and MSC is organizing a pilot harmonization meeting for ICCAT albacore fisheries. This means that while HCRs were under development, progress had been seriously stalled. In response the northern albacore fishery has developed an action plan to adopt a well-defined

HCRs by the Commission by 2020, which reinvigorates the ICCAT's existing strategic plan from 2015 to 2020 (ICCAT 2015).

Pathways. In contrast to other RFMOs what we see here are multiple pathways converging to reinvigorate a stalled process of setting HCRs and reference points (see Figure 5.5). These pathways are separate in that they are set up in separate fisheries and regions. But they also differ in the order through which they seek to pressure ICCAT. The St. Helena failed, but played an important advocacy role in highlighting that when measured against an independent measure the ICCAT process was failing. The OPEGAC FIP is based on a more traditional process of closing out conditions before certification, which in itself is a risky proposition because it based on an ambition for certification rather than the risk of (very publically) losing certification. The northern albacore certification may play a highly complementary role to the OPEGAC FIP because it is under a strict timeline to close out conditions, similar to what we see in the WCPFC and IOTC cases.

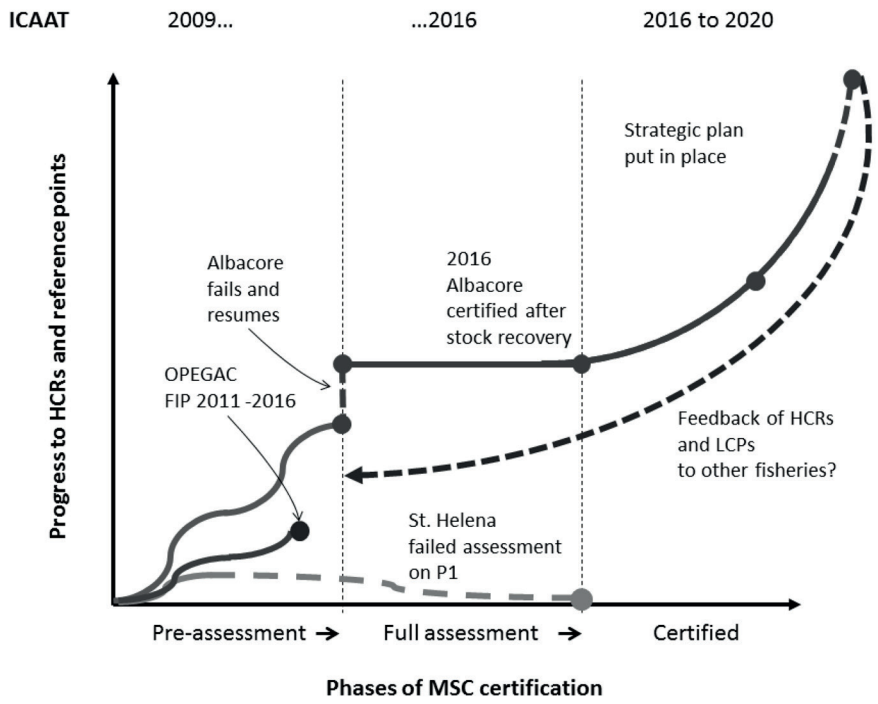

Figure 5.5 ICCAT-MSC improvement pathway

5.4 Discussion

Our study confirms that there is no single pathway of progressive improvement in RFMOs through engagement with the MSC certification process. Instead we find multiple pathways of engagement and improvement. Our observations of how the MSC plays a dynamic role in the RFMOs also contributes to a wider understanding of how market-based instruments can influence change. We see that the MSC works perhaps most effectively in the context of RMFOs when conditions have to be closed with a clear time line to re-certification. We also see that the change is more likely to occur when it is the state (member countries of RFMOs) that is the client of certification, rather than private actors. In doing so we move beyond assumptions that underpin much of our understanding of the potential for and how third party certification facilitate improvement through a single mode of change.

Together the three cases demonstrate that the MSC has enabled different and multiple strategies of those seeking certification to stimulate the implementation of precautionary management measures in RFMOs through the adoption of new measures for harvest strategies. In the case of the WCPFC we see the leading role of the sub-regional PNA in initiating rules and measures that were pre-conditions for the third party certification. However, once certified the MSC conditions pushed the PNA to lobby for the implementation of reference points at the regional level. The IOTC case also demonstrates the effect of the conditions set out by MSC certification, with membership of the Maldives and precautionary measures established during rather than before the certification process began. The prolonged certification process of the Echebastar certification also shows an apparent bias to state rather than private units of certification. Although such a bias is not made explicit in this case, comparison with the other two cases also support such a claim. When member states are engaged in the MSC process they are inherently better positioned to see changes through than companies having to lobby member states to act on their behalf. Finally, the ICCAT case shows a more fragmented process of RFMO change, with failed, ongoing and certified fisheries all contributing to reinvigorate a stalled process of adopting precautionary measures at the RFMO level.

Reflecting the NIE framework of Acemoglu (2004) and Williamson (2000), our analysis of MSC-RFMO interaction also sheds light on the different strategies for applying economic institutions to create new incentives for changes in political institutions. Our results support the role of both de facto economic and de jure political power in creating dynamic negotiations over the formulation of governance institutions such as a harvest strategy. The results also demonstrate how the MSC as an economic institution sets multiple de facto incentives for state action that go beyond market payoffs in the form of assumed price premiums. All three cases show the important role of the MSC conditions that set a clear and publically accountable goal for member states to achieve collectively at the RFMO level. But perhaps more importantly, these conditions provide a clear timeline. This means that the dynamic interaction between economic and political institutions is not open ended, but sets along a clear improvement pathway to re-certification. Meeting this timeline set outside the RFMO appears to enable

progress to realising the adoption of the legal principles (for precautionary management) set out under international law (UNCLOS).

Reflecting wider discussions over the interaction of political and economic institutions is the important role for the state as a client to the MSC. Building on the work of Foley (2012, 2013), we observe that the role of the state in certification is direct rather than facilitative. This appears to be all the more important in the context of RFMOs where only member states have the right to negotiate and ratify harvest control measures and reference points. The Echebaster case in the IOTC draws out most clearly the contrast with the weaker negotiating position of private units of certification who remain reliant on states to close out conditions for them. This not only reflects the weaker bargaining position of private actors, it also indicates the multiple and changing incentives for states to demonstrate the sustainability of their fisheries. As Adolf et al. (2016) and Miller et al. (2014) note in the Western and Central Pacific Ocean, the boundaries are blurring between the position of the state as a political and economic actor given the PNA owns, regulates and plays a role in marketing its tuna. What this reflects is the prominent role that small island states (the PNA and the Maldives), whose economies are dependent on tuna resources (see for example Schurman 1998, Barclay et al. 2007), have had in responding to the potential for greater wealth generation from tuna through the MSC processes. Their engagement with MSC is politically driven by the need to ensure long term economic benefits and wellbeing of their populations.

Our observation of multiple pathways of MSC-RFMO interaction holds consequences for how the role of certification as a tool for improving fisheries management should be understood. By recognising the existence of these multiple pathways our results contrast to recent critiques of the role of conditions in the MSC process. Christian et al. (2013) argue that the objections procedure of the MSC is flawed because while objections are lodged against fisheries these rarely lead to a fishery being denied certification. Similarly WWF's (2016) review of MSC engagement in the Indian Ocean claims that "the reliance on conditions only perpetuates a psychology that sub-standard fisheries should be embraced within 'the MSC Program' in order to foster their improvement. Experience to date has largely discredited this notion" (p. 2). Both of these authors ultimately argue that fisheries should improve their performance before being certified, and in being so, allowed to make sustainability claims in the marketplace. There are certainly concerns that conditions set by the MSC in the WCPFC, IOTC and ICCAT remain open. However, we argue that a more linear process of 'improve-first-certify-second' would essentially reduce any pressure to move along a clear timeline of improvement. Reflecting on our observation of the more effective position of states as clients of certification, we argue that a 'certify-first-improve-second' pathway does can provide an effective means of incentivising change.

Finally, the multiple pathways of MSC-RFMO interaction demonstrate the value of experimentalist approaches to institutional change in international environmental regimes (Overdevest et al. 2006). The various pathways observed not only highlight the value of certifying fisheries and setting conditions over time, but the value of parallel processes of, for

example, failed and successful certification and FIPs. We argue that even unsuccessful certifications contribute pressure on RFMOs, just as failed attempts to close out conditions do. This is not to say that ultimately it is outcomes that need to be seen in terms of the improving status of stocks. Instead it places greater appreciation on the multiple and various outputs certification leads to procedural change in political institutions like RFMOs as well as the rule change in governance institutions (Green 2013). For example, looking beyond the outcomes in a single fish stock we see that conditions for establishing HCRs and reference points at the RFMO level also oblige all members to implement and comply, which in turn improve governance and management of trans-boundary tuna resources at all waters regardless of where the fish is caught.

5.5 Conclusion

We challenge the assumption that the MSC has a single 'theory of change': starting with a fisheries improvement project, moving to pre-assessment then full assessment, where protest may disqualify a fishery. Instead we observe the possibility of multiple 'pathways of change', which refers to the significant role of sequential interactions between economic and political institutions, and the active choice and application of strategies by MSC clients to affect change. In doing so certification appears to be an effective means of aligning political and economic interests of member states to push for the adoption of precautionary fishery management measures as set out under UNCLOS.

Our analysis demonstrates the important role of MSC conditions in structuring these improvement pathways. But they also show that the application of the MSC is closely related to the specific structure of the RFMOs as political institutions. Building strategies for change in RFMOs therefore requires a 'smart mix' of certification into the structure and rules that govern these regional organisations. Our results also support the mode of certify-first-improve-later, by showing that including rather than excluding fisheries in the MSC process will ultimately bring the most lasting change towards sustainability. In short, if a fishery is excluded from certification until it has reached requisite level of a priori improvement, it is less likely to overcome political resistance to change. In all three cases, regardless of the outcomes reached, the MSC stimulated changes to governance institutions. Finally we conclude that the state continues to play a significant role in the success of economic institutions like third party certification.

Further research should focus on how these institutional outputs observed in RFMOs can in turn be translated to outcomes in terms of economic benefits to fisheries and its impact on the status of stocks. This would provide insights into the long term viability of the MSC program. As interest in the MSC is increasing from private clients in tuna fisheries a closer look at the MSC procedural process in view of balancing the role of the private and state clients in closing out the MSC conditions is needed. These results would demonstrate the benefits of wider engagement in certifying tuna and potentially stimulate a further shift to 'global tuna governance' beyond the state.

Chapter 6. Discussion and Conclusions

6.1 Introduction

The failure to achieve sustainable and equitable outcomes in trans-boundary tuna fisheries is a consequence of inefficient and ineffective institutions at national, regional and international levels. This thesis has argued that these inefficient and ineffective institutions have been dominated by regulatory political systems and are, hence, constitute what are termed here as 'old tuna regimes' (OTRs). These 'old' institutions, represented by the five tuna RFMOs mandated under the UNFAS (including the WCPFC), have not been able to achieve the policy goals of biological and economic sustainability (de Yturriaga 1997, Aqorau 2006, Parris 2010, Bailey et al. 2010, de Bruyn et al. 2013). Many of the institutional challenges that these old style regimes face are due to a combination of dynamic political interests of actors and inappropriate incentives, coupled with the consistently increasing demand for global tuna products that continue to put pressure on tuna stocks (Havice et al. 2010, Aqorau 2015).

At the same time this thesis has explored the emergence of what are labelled 'new tuna regimes', a mix of regional and sub-regional organisations employing a range of incentive based mechanisms emerging that use market or economic incentives to meet tuna sustainability goals. In doing so the thesis has asked: *What characterises the shift from old to new regimes for trans-boundary tuna management, and to what extent is the emergence of a new tuna regime able to achieve sustainable and equitable outcomes in the Western and Central Pacific?*

The remainder of this thesis explores this question by discussing the extent to which we see a shift from old to new tuna regimes, what generalizable characteristics can be identified and whether they incentivise state-state and state-industry cooperation to achieve sustainable and equitable outcomes. Building on a new institutional economics perspective to trans-boundary fisheries governance, the central message emerging from this discussion is that the shift from old to new regimes is facilitated through a step-wise process of strategic and dynamic interactions between public and private actors. It is also clear from the results that the emergence of new tuna regimes does not mean old tuna regimes will totally disappear. Instead these regimes complement each other – opening up multiple new opportunities for responsive forms of sustainability governance into the future.

The chapter is structured as follows. The next section (6.2) presents an overview of the findings of the four chapters of the thesis. This is followed in section 6.3 with a discussion on how the findings from these chapters contribute to a better understanding of how incentive based tools and mechanisms can contribute to (public/public and public/private) cooperation for meeting the goal of sustainable trans-boundary fisheries management. Based on this discussion section 6.4 reflects on the contribution of the thesis to the integration of new institutional economics with the game theory approaches. The final section then presents policy recommendations and directions for future research.

6.2 Revisiting the empirical chapters

The empirical chapters of this thesis were organised around four sub-questions all contributing insights on how economic incentives are created by state and non-state actors to implement and enforce conservation and management measures in tuna management. In doing so the chapters contributed insights into how competitive behaviour between states and fishing fleets in regulatory or (old) state-only tuna regimes can be improved by a mix of short and long term incentives for the creation of new (or adaption of existing) tuna management regulations and measures.

Chapter 2 addressed the question: *How has the shift from an old to new tuna regime come about and what institutional changes implemented in the PNA have facilitated this shift?* The assumption underlying this chapter claims that weak political institutions are attributable to the lack of property right over trans-boundary fish stocks, which in turn undermines long-term sustainability outcomes. This is also true for tuna management in the Western and Central Pacific, where the PNA member states have struggled to set clear access rights and conservation and management measures over the tuna in their individual and collective EEZs. The historical outcome, and key characteristic of old tuna regimes, has been a continued increase in fishing effort, tuna landings and by-catch of non-target species. The long term outcome is in turn the risk of unsustainable exploitation of (some) tuna stocks while coastal states only receive limited economic benefits compared to the overall value of the catch landed.

The chapter provided an in-depth analysis of the significant institutional shift from a regulatory based regime to one using new economic instruments for tuna management in the waters of the PNA. The incentive of such instruments being both improved conservation outcomes and a contribution to domestic wealth generation. The PNA have achieved this shift to new economic instruments through the VDS and MSC program, both of which require political institutions (the PNA secretariat and ministers, to set governance institutions for monitoring and enforcement of purse seine fishing. The results indicate that the initial experience with the VDS and MSC certification opens up the possibility of characterising new tuna regimes as those which can realign *de facto* economic with *de jure* political power to achieve long term sustainability outcomes.

The results of this first empirical chapter also argued that the future of these new economic instruments will be determined in large part by the strength of continued cooperation among participating actors. But to ensure success, both regional and sub-regional institutions also need to continue to enable both political and economic actors to realise the incentives made available through these instruments. The limited understanding on the extent to which new tuna regimes can facilitate cooperation through political institutions to maintain governance institutions for conservation and wealth distribution motivated the second and third research questions of the thesis.

Chapter 3 addressed the second sub-question of this thesis: *To what degree has the implementation of the vessel day scheme in PNA brought about greater stability of the Palau Agreement?* The chapter analysed the extent to which the early implementation of the VDS has been challenged by the willingness of member states to allow for a degree of deviation from the allocation of vessel days under this arrangement. The results showed that the apparent laxness in VDS rule enforcement derives in part from both loopholes in pre-existing regional treaties, as well as pressure from distant water fishing nations (such as the US and EU) when negotiating new access arrangements. But the analysis also showed that this deviation (or partial compliance) with VDS rules, contrary to what was expected, play a role in stabilising the VDS and PNA. Furthermore the results indicate that requiring full compliance with VDS rules may in fact present strong incentives for PNA members to deviate from the VDS regime and undermine long term cooperation between member states under the Palau Agreement.

Building on game theoretic notions of the strength of coalition formation, the analysis demonstrates that successful regional cooperation is not just about strict compliance. It is also about what is termed 'pragmatic tolerance' – allowing small deviations to facilitate stable international agreements. By identifying pragmatic tolerance as a key dimension of the apparent success of the VDS (at least over the short term), the chapter demonstrated that state cooperation cannot be isolated from external political and economic influences. It also raised questions over how incentives and cooperation for sustainable management that are not delivered by the VDS can be filled by other instruments such as MSC certification.

Chapter 4 therefore addressed the third sub-question: *To what extent does third party certification increase transparency through improved monitoring and control and, in doing so, address misaligned interests between states and private sector actors in the fishery?* Underlying this question is an ambition to consider how new tuna regimes can also facilitate improved engagement by the state (both individually and collectively at the PNA level) with private sector fishery actors. Using a double principal-agent framework the chapter explored how incentive gaps between the state (at both national and regional levels) and private actors were closed using the MSC principles to increase transparency and disclosure of how purse seine fishing is performed in the waters of the PNA. The results showed that within complex regional settings like the WCPO new economic instruments like the MSC can address some, but not all of the apparent incentive gaps. The MSC is successfully applied to this end by setting demands for greater transparency on the PNA implementing measures around its three principles - stock status, ecosystem conditions, management system, and the chain of custody.

The results also demonstrate that the MSC program facilitates improvements to fishing practices in ways that the states cannot. This is most directly observed through the creation of the Pacifical joint venture model. Because this model forces member states to maintain a direct relationship with fishing fleets and as a result monitoring and control in the collective waters of the PNA are enhanced. In other words, the PNA's use of the MSC certification acknowledges the limited capacity of the member states' to enforce the conservation and management measures set at the

regional level and instead strengthens state control by better aligning the objectives of the PNA (as principals) and fishing fleets (as agents). Over the long term this may mean that the PNA level assumes ever greater control over fishing activities in behalf of (but still constituted by) Pacific islands states.

The fourth and final sub-question, addressed in chapter 5, asked: *Can private institutions such as third party certification facilitate improvements to conservation and management measures at the RFMO level?* This question moves beyond the WCPO, to seek a more general understanding of the role of economic institutions, in this case the MSC certification, in incentivising change in political institutions to establish key management measures such as harvest control rules (HCRs) and target and limit reference points. The chapter compared three RFMOs in the Pacific, Indian and Atlantic oceans.

The results of this final empirical chapter show that the MSC engages with RFMOs in different ways leading to multiple pathways of improvement. In doing so the results confirm that market institutions like the MSC have a positive effect on regional management organisations especially when conditions are set for RFMOs to respond to in a given period to avoid sanctions such as losing the certification. The analysis indicates that change at the RFMO level is more likely to occur when it is the state (i.e. one or more member countries of an RFMO) that is the client of certification, rather than private actors. What also emerges from this analysis is that the application of the MSC is closely related to the specific structure of the RFMOs as political institutions. But it is also apparent from this chapter that the effectiveness of the MSC is determined by the response of these political institutions. For instance, the MSC appears to be more effective when including rather than excluding fisheries from the certification MSC process. This means that including fisheries in a pathway of change rather than immediately setting the bar so high as to comply and enter the programme is more likely to lead to positive outcomes in the long term. Conversely, if a fishery is excluded from certification until it has reached requisite level of a priori improvement, the influence of the MSC to contribute to overcoming political resistance is greatly diminished.

6.3 Overcoming the challenges of old tuna regimes

Based on the results of the four empirical chapters, we now turn to a discussion of how new tuna regimes are able to address key challenges of old tuna regimes. As outlined in the introductory chapter of the thesis these are: (1) the weakness of international political institution in setting and enforcing property rights; (2) their inability to effectively enforce compliance to conservation and management measures; and (3) problems of asymmetric information and misalignment among participating actors. Overall it appears the results provide evidence of different strategies and pathways that can facilitate movements toward long term outcomes for both sustainability and equity in the context of dynamic regional institutions. It also appears that both sustainability

and equity are not mutually exclusive goals as long as institutional change incorporates both goals over the long-term.

6.3.1 Reinforcing property rights, control and economic gains

Given the trans-boundary nature of tuna fisheries, management sub-regional and regional levels are required to set conservation and management in areas beyond national jurisdiction (Lindroos 2008, Bailey et al. 2010, Pintassilgo et al. 2010). To date this has proven a central challenge of RFMOs in the absence of high sea property rights, which in turn means they have offered inadequate incentives to coastal and fishing nations to voluntarily comply. But given the divisive nature of access agreements between DWFNs and individual coastal states, compliance to RFMO rules within their waters has also proven less than perfect.

The two economic institutions covered in this thesis, the MSC and VDS, demonstrate the significant role of the PNA as a political institution in creating and innovating new economic institutions towards the late 2000s. Both of these institutions are representative of level 4 of the NIE hierarchical framework, and as such reflect institutions that structure incentives and motivations for strategic decisions making (Williamson 2000). The analysis of the MSC and VDS show that the PNA, as a new tuna regime, has strengthened these economic institutions to reinforce the strength of cooperation and international credibility as a political institution responsible for reinforcing property rights over their fisheries resources through collective participation. Seen through an NIE lens, the implications of new tuna regimes are linked to the interplay between *de facto* controls of the PNA states and *de jure* control of firms and distant water fishing nations driven by the interactive feedback between political and economic institutions (Pacheco et al. 2010, Squires et al. 2016). Specifically the analyses of the VDS and MSC program show that the implication of these new regimes is a change in incentives related to resource and market access for distant water fishing nations. In doing so the PNA are able to directly reinforce the formal political institutions responsible for conservation and management of tuna resources opening up for new outcomes that brings back better economic returns to small island coastal states while restricting fishing rights in their collective waters.

The specific goal of reinforcing property rights is primarily seen through the design and implementation of the VDS. Before the implementation of the VDS, the Palau Agreement allocated rights to a limited number of 205 vessels. However, this arrangement failed to allocate rights to member states and therefore failed to give states the freedom to exercise their sovereign rights over fishing activities in their individual waters. By allocating exploitation rights using limits on fishing days, the PNA member states are given the possibility to re-negotiate access with fishing nations and companies alike based on the number and price of fishing days in their waters. This has allowed the PNA members to leverage their limited fishing days by either, (1) allocating it to domestic vessels or (2) selling to distant water fishing nations in return for access

fees. These measures have increased PNA's control over the level of fishing effort with limited fishing days to support both conservation and economic goals set by the WCPFC and the PNA member states.

Control over fishing activity is also extended through the MSC program. But importantly the MSC is 'additional' in the sense that it has reinforced the capacity of the PNA to also extend control over market access. It does so by reinforcing or validating coastal states regulations to land and sell MSC eco-labelled fish to export markets. As such the MSC also facilitates greater *de jure* power by the PNA over tuna resources by reinforcing greater *de facto* control over tuna resources (Yeeting et al. 2016). Moving forward the PNA, as a new tuna regime, anticipates that greater credibility of its implementing arrangements can reinforce sustainability goals set out under the Palau Agreement, as well as address equity such as the domestic development aspirations under the Federated States of Micronesia Arrangement.

6.3.2. Regime effectiveness and stable regional institutions

As outlined in the introduction of this thesis, cooperation for achieving the obligations for trans-boundary fisheries management set out under the UNFSA has historically been slow and ineffective. In old tuna regimes it is apparent that cooperation is undermined by the diversity and dynamism of the actors involved – the more diverse and dynamic the less effective it can become in achieving its (conservation) goals (Wangler et al. 2012). The WCPO, with its many regional treaties has been a case in point: weak cooperation has led to weak compliance (see also Cullis-Suzuki and Pauly 2010; Aranda et al. 2012). But building on the work of Havice (2010, 2013) the results also show that the VDS has been central to creating improved cooperation by delivering incentives to the PNA states, which has in turn brought about greater stability of the sub-regional PNA as a new tuna regime.

While the results of this thesis demonstrate the role of VDS regime in strengthening the PNA political institution, it is also evident that full cooperation and compliance has not been reached. As outlined in chapter 3 the political processes that often challenge international fisheries agreement by applying coalition theory is also seen in the PNA waters. What this points to is that regional fisheries agreements are by no means isolated from the political interests and external influences of DWFNs (see De Fontaubert 1995; Parris 2010; Hanich et al. 2010). Instead these external influences affect the stability of PNA countries whose fisheries agreements are highly influenced by the interest of distant water fishing nations (DWFN), especially from the US and EU. These DFWNs protect the commercial interests of their fishing industries by negotiating fisheries agreements to secure fishing rights of their vessels (Havice 2010, Campling 2016, Yeeting et al. 2016). As outlined in the previous section, pragmatic tolerance of the PNA states recognises the political problems associated with diverse participating actors in the PNA, thus

currently plays a role in stabilising the PNA coalition. But it is unclear for how long pragmatic tolerance is able to maintain the PNA coalition.

Following chapter 4, the stability of the PNA is also affected by the credibility of the implementing measures attributed by the MSC certification process. By establishing this credibility in the market the PNA has not only consolidated greater access to information on the fishery as a whole, but also a social licence to continue managing tuna fisheries at the sub-regional level (see for example Miller and Bush 2014). This credibility again represents a feedback from the market, through the MSC as an economic institution, to reinforce the stability of the PNA as a political institution. And, following this logic, this credibility also extends to the reinforcement of the PNA implementing measures that over the long term are likely to be more effective as a result.

6.3.3 Aligning incentives through market instruments – transparency

Monitoring and enforcement of private actors is a considerable challenge for states who do not have the capacity and incentive to monitor fishing activities in their waters (Jensen et al. 2013). All of the empirical chapters present evidence of how states can address monitoring and control through transparency and disclosure using economic institutions. Transparency and disclosure directly point to improvement pathways for the development of more effective governance institutions (corresponding to level 3 of the NIE hierarchical levels; see Figure 1.4, 2.1 and 2.3).

The NIE framework demonstrates the role of MSC program as an economic institution in restructuring incentives and the governance institutions that follow. The principal-agent theory builds on this application by focusing on the management control problems driven from incentive gaps between participating actors, and the role of new regimes in closing these incentive gaps through improved transparency and disclosure in the fishery. Aligning incentives and closing of incentive gaps is a management objective that could potentially address information problems in the fishery (Bailey et al. 2016, Bailey et al. 2017). For example, the MSC program has enabled the PNA to facilitate goal alignment through improved transparency and disclosure by both states and the private sector. In NIE terms, if economic institutions can provide appropriate incentives they can facilitate institutional change for long term outcomes. The incentive lies in the eco-labelling program, but perhaps more important to the change process is the independent third party comprehensive assessment that is carried out in order to assess their capacity to manage and maintain healthy tuna stocks.

While the NIE framework provides space for public (political and state) and private (economic) interaction to improve fisheries governance, the application of the double principal-agent framework shows that there are multiple participating actors, with multiple incentive gaps in regional fisheries settings like the PNA. Specifically the double principal-agent framework provides a structured approach for analysing the regional PNA fishery and, in doing so, broadens

the understanding of the complexity of multilateral fisheries agreements. By understanding how such gaps can be closed by complying to the demands of third party programs like the MSC it is clear that greater transparency can drive change in institutions to create more effective management outcomes (cf. Auld and Gulbrandsen 2010), as well as by actors who had previously not been willing to cooperate.

This result goes far beyond the PNA and WCPFC. It holds an important insight for understanding that in complex regional settings, like RFMOs, simple cause and effect is complicated by the scope of control states have over fishing activity, while also being answerable to international law. While incentive based mechanisms remain 'suasive' or soft instruments, this thesis has shown they can play a central role in creating new modes of transparency and therefore pressure for change.

This conclusion is further supported by the findings in chapter 5, which also argues that the MSC can facilitate progress towards the implementation of precautionary management approaches at the RFMO level. Indeed, both chapters 4 and 5 are consistent in demonstrating the leading role of the state in using the market instruments in making changes to improve transparency and goal alignment between participating actors. The mix state-private or market approach re-emphasised the interplay between *de facto* controls of the states and *de jure* control of firms driven by the interactive feedback between political and economic institutions as a way forward to improve governance institutions (Pacheco et al. 2010, Squires et al. 2016). Here improvement in governance institutions refers to transparency and goal alignment in a diverse regional and international setting for trans-boundary stocks.

6.4 Reflections on an integrated NIE theoretical findings

We now turn to a discussion of how the results of this thesis contribute to the wider theoretical goal of integrating NIE with coalition and principal-agent theory. In the introduction of the thesis it was argued that such an integrated framework can provide a means of assessing how different institutional arrangements drive or hinder cooperation to develop management measures for resources such as fisheries - both among and between states and privates using market incentives. The integrated NIE framework was proposed to examine current institutional arrangements and help provide a deeper understanding of how more efficient and effective governance institutions could emerge for the management of trans-boundary stocks under varying degrees of public and private international cooperation.

A primary theoretical insight of this thesis is that the NIE framework is both relevant and insightful in the context of *trans-boundary* common pool resources. The application of NIE to common pool resources has focused primarily on the transaction costs associated with moving to a private resource regime. For instance, Liebecap (2008) argues that such shifts to closing the commons emerges in contexts where the cost of setting boundaries and monitoring rules exceed

the benefits of doing so. Inherent to this argument, Liebecap argues, is an assumption that maintaining common pool resources is an inefficient and ineffective second best outcome. But as information becomes clearer (and incentives are created) these transaction costs can be assessed in terms of whether they support or hinder the creation and maintenance of common pool management (see also Ostrom 1990, 1992). This in turn opens up the possibility to come to agree upon modes of resource use that can take place with relatively lower transaction costs, and that can reduce the degradation of common pool resources.

Such a transaction cost rationale to NIE fits directly with the results of this thesis. The role of incentive mechanisms such as the VDS and MSC have both reduced net transaction costs by offering greater economic returns for cooperation around common pool resource management. It also plays into the 'bounded rationality' logic of NIE that assumes that (1) actors have a finite capacity to take on information and (2) institutions (both the state and market) are central to the provision of such information (see Dequech 2006). The MSC is particularly instructive in this sense. As information is made more transparent through the MSC assessment process common pool resource managers are able to better understand the benefits that are derived from such transparency (cf. Ménard and Shirley 2014). There is naturally a cost to the monitoring, control and surveillance required by such systems. But by having the information at hand key actors can make decisions over the cost and benefits of management.

By adopting Williamson's (2000) hierarchical levels of institutions this thesis has built on the transaction cost focus of NIE to emphasise processes of dynamic interaction and institutional change. The results show that new tuna regimes are subject to continuous review as a function of the actors, knowledge and resources that constitute each set of rules, as well as the modification of rules in each institutional level. In addition to transaction costs alone, the results also show that the transformation to a new tuna regimes requires new ways of incorporating knowledge, resources and interests of actors that are constantly changing overtime. This means that institutions of all levels are required to continually adapt to these changing conditions (Pacheco, 2010, Overdevest et al. 2014). However, seeing institutional formation in terms of transaction costs or as dynamic processes alone is insufficient to understand the extent to which new economic instruments can contribute to long term cooperation for sustainable common pool resource management.

The integrated NIE framework applied in this thesis drew upon game theoretic approaches of coalition and principle-agent theory to understand cooperation. This was done by integrating the degree and type of cooperation to understand the likelihood of reaching desired long term outcomes through the application of economic institutions given their interaction with political institutions. This means not only understanding how agents respond to economic incentives, but also how states' decision making conditions and voluntary collective action develop and implement new management rules (or governance institutions) for environmental stewardship (see also Gerber et al. 2009, Pacheco et al. 2010, Gulbrandsen 2013, Kozenkow 2013). Three

key theoretical insights emerge from the thesis that contribute to the development of NIE in the context of new regimes for trans-boundary resource management.

First, combining NIE and coalition theory opens up an understanding that states, as political institutions, are able to internalise the cost of rule setting in such a way as to reinforce the protection of their property rights. The goal of using economic approaches is partly connected to how NIE framework perceives the significant role of economic incentives and motivations in making changes. Coalition theory provides an explanation of how economic institutions reduce costs and produce economic benefits in such a way that stimulates long term and potentially full cooperation (see Finus 2008; Pintassilgo et al. 2010). By taking into consideration the pay-offs under cooperation versus non-cooperation insights are gained into how costs and benefits are rationalised within the state. But perhaps more importantly, it demonstrates how dynamic such decision making processes are. For instance, the coalitions of states that make up the PNA are subject to external pressures in the form of access treaties, which provide considerable transfers or benefits in return for partial deviation from the VDS. While short term pragmatic tolerance of deviations from these rules can deliver short term economic returns, long-term benefits will be derived from the strength of level two political institutions ability to set and enforce level three governance institutions for the management of resources.

Such an observation reinforces the dynamic nature of institutional interaction by pointing out how incentives are delivered over time. It also directly relates to the speed at which these institutions are likely to change. As outlined by Williamson (2000) and Pacheco et al. (2010), the slow speed of political institutional change is offset by faster moving economic institutions. However, short term economic incentives such as transfers from third parties (see Chapter 3), can be outweighed by recurrent and accumulating benefits delivered collectively (i.e. between all parties of a coalition) over a longer time period. Theoretically speaking, this demonstrates that cooperation around common pool resources can be undermined by external parties wishing to gain access rights (e.g. Holzer 2008; Acheson et al. 2015). But if recurrent benefits are internalised at a rate faster and with greater certainty than these externally derived benefits then the coalition can in fact be maintained. Said differently, the dynamic interaction between all institutional levels are as robust as their ability to build internally reinforcing incentives at a faster rate than externally derived disincentives for cooperation.

Second, combining NIE and principle-agent theory opens up new insights to how information and transparency can also facilitate institutional interaction that reinforces the creation and enforcement of management rules. Following Pacheco et al. (2010), the more transparent governance institutions are the more they are likely to promote improved levels of cooperation. Such an observation was apparent in this thesis where, as an economic institution, the MSC was used by the PNA to enforce greater transparency on both the PNA member states and, in turn, enable these states to demand greater transparency from fishing fleets. Complicating this picture further, and representing the multiple incentive gaps outlined in this case, the PNA was also directly benefited from having a mandate through the MSC process to by-pass the states in

demanding greater transparency directly from fishing fleets also. The theoretical consequence of this observation returns us to some core insights in NIE, in that the agents (both the state and the fishing fleets) were 'bounded' by the requirements of the certification process combined with the access arrangements set out by the sub-regional state. Even though not all vessels are bound by MSC requirements, those that have provided the PNA with a means of extracting information that was previously resisted because of cost and 'privacy'. The outcome for states and vessels is a choice to bear the cost of cooperation or the cost of at least partial exclusion from the resource and/or potential wealth generated from the fishery over the long term.

In NIE terms, the application of the transparency and disclosure opens up insights on the dynamic interaction between institutional levels. Demands from political and governance institutions alone have historically not generated the level of information in common pool trans-boundary fishery resources. At face value economic institutions (like the MSC) are relatively simple 'price premium' market tools. But as outlined variously in this thesis, such tools offer far more in terms of promoting institutional change when strategically applied by political institutions in the design of governance institutions (see also Foley 2013, Gulbrandsen 2014, Adolf et al. 2016). That is, when tied to the opportunity cost of fleets exclusion from a fishery, or the fisheries exclusion from a market, the relative cost of information provision is reduced. The more states can integrate these costs in the design of the governance institutions, which directly set rules for the exploitation of a resource, the more returns they will have in terms of not only setting rules for access and (by default) property rights. But it also open up opportunities for monitoring, control and surveillance over the behaviour of those actors involved.

The findings of this thesis confirm that there has been a shift from old to new tuna regimes in the WCPO and beyond, all with the aim of addressing historical inefficiencies in achieving sustainability and equity. The analyses in all four chapters demonstrate the role of hybrid regulatory systems where the states uses market institutions in finding solutions to improve fisheries outcomes, governance and transparency in a fishery (Auld and Gulbrandsen 2010, Foley 2013). How these changes have progressed, are clearly demonstrated and explained by a clear interplay between *de facto* controls of the PNA states and *de jure* control of firms and distant water fishing nations, driven by the interactive feedback between political and economic institutions play a facilitative role in making significant changes at different and specific institutional levels (in line with Pacheco et al. 2010). Taking this perspective to a broader level, validates the importance of recognising the nature of dynamism in states' decision making conditions in enabling voluntary collective action in the domain of environmental resource use.

In summary, the application of the NIE integrated framework is particularly rewarding in not only providing direct response to questions on the role of new regimes on cooperation but also measure the extent of how cooperation has been achieved, how it can be sustained, and what needs to be done to further cooperation. Broadening the application of the NIE framework, this thesis also contributes to insights on the impact of public policy into the role of incentives created through economic institutions to achieve desired environmental outcomes (see for

instance Paavola 2007). However for trans-boundary environmental problems, such desired outcomes are based on the success of institutions to enhance cooperation both at the sub-regional and regional level, which have been demonstrated in this thesis.

6.5 Characterising new tuna regimes

New tuna regimes employ a mix of public and private institutions to enable a fishery to overcome political stalemates and reaching long term goals related to sustainability and equity. In the introduction it was argued that old tuna regimes are failing to affect change because of inappropriate incentives and the domination of command and control regulatory systems. As outlined in the above sections new tuna regimes specifically use incentive and market based approaches to promote mixed approaches or public-private engagement. But they are also characterised by four other key characteristics. By identifying these characteristics it is possible in the long term to determine their ongoing emergence as an effective means of stimulating cooperation for sustainable and equitable trans-boundary tuna management.

The first characteristic of new tuna regimes are their *use of incentive and market based approaches*. The key determinant of the success of new tuna regimes is the degree to which they integrate political, governance and market institutions to develop and apply incentives for change (Hilborn et al. 2005, Grafton et al. 2006, Pacheco et al. 2010, Vestergaard 2010). Political institutions must first promote collective participation by both national governments and fishing fleets alike. Market institutions then have to be developed to operate either in conjunction with the state, or through the input markets for property and access rights (such as the VDS) or output markets for final products (such as the MSC). Finally, governance institutions need to build on participation and market incentives to set and achieve specific sustainability and wealth equity goals which in turn are recognised and agreed upon at both market and political institutional levels.

Second, new tuna regimes utilise a *mix of state and market* based incentive mechanisms that recognises the multiple interests and actors in formulating management decisions for sustainability. The findings of this thesis demonstrate that the success of these regimes is driven from such interaction at different levels – from the fleet to the nation state, to sub-regional and finally regional level. States engaging with programs like the MSC have a chance of affecting change at the RFMO level compared to the private fisheries. Economic institutions then set multiple *de facto* incentives for state action that go beyond market pay-offs to also consider long term conservation gains. Seen as such, and building on the work of Foley (2012, 2013), we observe that state plays a directly facilitative role in the adoption and application of certification. This appears to be all the more important in the context of RFMOs where only member states have the right to negotiate and ratify harvest control measures and reference points.

Third, new tuna regimes need to effectively *govern dynamic political interests and actors* that continue to undermine regional cooperative agreements for trans-boundary tuna resources. Hence there is a need for a strengthened, more effective and more coherent institutional framework for global environmental (fisheries) governance (Biermann et al. 2008, De Young et al. 2008, Young 2011). This can be achieved through better coordination of multi-lateral agreements and treaties in regional settings with diverse participating actors and interests. New tuna regimes do this. They complement old regimes by driving improvement in governance and transparency in the fishery through innovative measures that promotes long term outcomes. New tuna regimes also play a role in facilitating institutional change – such as developing new policy instruments or management measures. They as such provide a forum for deliberation over the design and/or application of these measures. Again, reflecting the NIE framework, they do this through step-wise interactions between, political (state) and economic (private and market) institutions, or as NIE theory stresses, the interplay between *de jure* and *de facto* powers as pathway towards cooperation for sustainability and better economic returns for coastal states.

Fourth, the *scale of jurisdiction* of a new tuna regimes is also significant for their success. New tuna regimes are closely related to what has been termed 'new regionalism' (Keating 1998, MacLeod 2001, Miller et al. 2014). New regionalism emerged against the backdrop of increasing the dynamic geo-political and geo-economic landscape, to address the challenges faced by nation states in managing trans-boundary resources (Tarte 2014, Aqorau 2015). In new regionalism, the private actors representing the industries, private institutions and even the market are encouraged to participate in institutionalised cooperation. In doing so, new regionalism move beyond the state by adopting integrated approaches that also include non-government actors and incorporate mixed approaches by the state, market and civil society (MacLeod 2001, Biermann et al. 2009, Gulbrandsen 2010, Foley et al. 2016). The thesis argues that new economic institutions like the VDS and the MSC program represent new forms of fisheries regionalism that integrate incentive and market based approaches and promote public-private engagement in addressing governance and management issues for trans-boundary tuna resources (Miller et al. 2014, Yeeting et al. 2016).

6.6 Policy recommendations and future research

6.6.1 Policy recommendations

New tuna regimes do not emerge overnight. They instead come about through an evolving, step-wise set of progressive improvements of political, market and governance institutions. This implies that change is inherent to new tuna regimes and that there is continued effort to ensure that long-term sustainability and equity goals are set and reached in all tuna fisheries. While the case of the WCPO opens up the possibility of new tuna regimes, its status is far from secure. Furthermore, the development of new tuna regimes in other RFMOs and sub-regional

organisations is only starting. How to ensure the transfer of new tuna regimes' elements to other (old) tuna regimes and fisheries management bodies more generally requires further attention from policy makers, NGOs and researchers alike.

An overarching finding of this thesis reflects the role of member states of (sub-) regional institutions as having the authority to choose and influence decisions at relevant institutional levels in order to facilitate change. This does not mean that private actors do not have a significant role in designing and developing fisheries improvement programs that can be used by the state in helping them promote regulatory systems in-line with long term outcomes. What needs to be recognised is that states and private organisations need to align incentives with the conditions of the fishery - identifying and including potential incentives and benefits that can be received from market incentives. In light of improved benefits from these new approaches, this study recommends the expansion of incentive and market based approaches, such as the MSC and VDS, to other tuna RFMOs and sub-regional management programmes. It is also recommended that these organisations learn from the PNA case to ensure that their own design process can set effective incentives that would suit the conditions of their own fisheries.

However, it is important to emphasise that these benefits can only be gained through a collective effort of the constituent member states of sub-regional or regional groups. As evident in this thesis, regional arrangements like the Palau Agreement and the third implementing arrangement of the PNA do not only set standards for the coordination of purse seine fishery in the collective waters of its members. They also strengthen coastal states' sovereign rights over their shared tuna resources. Learning from these collective arrangements and their implications for long-term outcomes, this study recommends that the PNA states maintain their coalition to work together as a group in negotiating future tuna treaties. Only through this sub-regional coalition are the PNA states able to improve their share of the benefits from their tuna resources. Furthermore, it is clear from the findings of the thesis that work remains to be done for further improvements. While improvement pathways are seen through the innovative approaches of the PNA, these innovative approaches need to be further strengthened and expanded to improve its coverage. This can be only done through improved joint efforts and support of all PNA member states.

External influences, such as the US and EU, will remain key and important players in the Pacific tuna fishery. The political economic challenges associated with trans-boundary tuna resources are therefore inevitable and will continue to be part of the challenges for decision making processes. This thesis recommends that full compliance is not always an ideal first-best solution, but rather some deviations or less than full compliance is. Though game theory scholars suggest full compliance and full cooperation as ideal for the benefits of all, achieving full compliance and cooperation is difficult in real life. Therefore this thesis recommends that short term partial compliance can be an important stepping stone in moving towards full compliance and cooperation. Therefore regimes should allow some flexibility to accommodate dynamic political interests in order to be effective.

The findings of the RFMO-MSC interaction demonstrates the role of MSC in promoting precautionary approaches for sustainability. This is exciting for fisheries scientists and managers who have long been asking for the establishment and adoption of precautionary approaches with clear reference points and harvest control rules for all species. Movement into this path is seen in different RFMOs who have direct engagement with the MSC certification program. This finding should be sufficient to confirm the need to further expand the application of MSC certification program to other areas and fisheries for a widespread fisheries improvement across different fisheries sectors.

Overall the findings of the thesis stress the role of new tuna regimes in facilitating improvements at the management level. While it is well understood that institutional inefficiencies are driven by the political challenges associated with diversity, this thesis emphasises the role of new tuna regimes in breaking through these historical inefficiencies driven from political challenges.

6.6.2 Future Research

This study demonstrates useful analyses of the emergence and implications of new tuna regimes for reaching long term outcomes. However, as new tuna regimes continue to evolve, further research is needed to advance our understanding of their role in advancing sustainability and equity in tuna fisheries.

Although the PNA is applauded for the successful implementation of the VDS, it has also faced criticism from non-PNA participants (including DWFNs with fishing interest in the Pacific). Others like New Zealand and Canada, turn to catch quota systems by putting limits on tuna catches while VDS puts limit on efforts (fishing days). This raises the obvious question of how VDS could potentially contribute to sustainability as effort creep is seen to emerge as a result. Further research is needed to provide a direct response to this question. A comparative analysis at different scales and in difference regions, including other RFMOs or international regimes could provide useful information. Such research would provide a better understanding of the economic and political linkages between states and their role in structuring region-building based on the stewardship of valuable and disputed natural resources.

Second, it is clear from this thesis that the VDS addresses the equity question but remains unclear how it may contribute to sustainability. It is acknowledged in this thesis that the limitation of the VDS to address sustainability issue is due to political dynamics which are reflected in non-VDS regimes that are also in operation along the VDS. These non-VDS regimes are putting limitations to the full implementation of the VDS and as tuna is a trans-boundary resource, one cannot determine the effectiveness of the VDS for tuna stocks. Until the VDS reaches its full potential, it would be more appropriate to analyse how the VDS contributes in rebuilding the tuna stocks. The proposal for VDS to improve its coverage is not new as it is also among the MSC conditions for PNA fisheries improvement. However, it is unclear how this will be done. Two recommendations for future research are as follows. First, an in-depth political

dynamic analysis of how to integrate these multiple regimes with hopes to close VDS loopholes and improve VDS coverage, without disadvantaging participating actors would enable the VDS to reach its full potential. Second, an analysis of the implication of the full implementation of the VDS would advance our understanding on the effectiveness of VDS not only for equity but also for sustainability.

Further study is also needed to estimate the degree to which incentive gaps have been closed as a result of the MSC certification program. Measuring and comparing the incentive gaps before MSC programs and incentive gaps after the MSC programs could provide useful economic information for politicians to further understand the extent of how much incentive gaps is closed, the motivation and the potential next steps to be taken to close the remaining gaps. Furthermore, while the new economic instruments like the MSC program appear to improve cooperation and the formulation of governance institutions it remains unclear how this institutional change affects fleets i.e. fishing activities and patterns. A study or review of the MSC program itself is needed to examine the potential of the MSC in incentivising change at the fleet level in different RFMOs. Knowing this could potentially help the MSC certification program review its incentive schemes in order to effectively affect change towards sustainability at the fleet level.

It also remains unclear how new regulations can in turn be transformed into economic benefits for fisheries and what impact these incentives will have on the status of the tuna stocks. Further research is needed to provide more insight into the long term viability of the MSC program as well as for participating agents to understand the economic incentives associated with the MSC program. This could help to improve the MSC or similar incentive based mechanisms in the context of trans-boundary common pool resources.

The MSC program has developed from both state and private clients in tuna fisheries. Yet this thesis demonstrates the successful implementation of MSC processes by the state but limited success is seen with the private companies. A closer look at the MSC procedural process in view of balancing the role of the private and state clients in closing out the MSC conditions is needed. The results would improve the potential of private clients to participate in the MSC program, for the wider engagement in certifying tuna and to stimulate a further shift to ‘global tuna governance’ beyond the state.

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Supplementary Materials for Chapter 3

The following are supplementary materials used to calculate VDS outcomes and countries' payoffs under full compliance and partial compliance reported in Tables 3.3. Transfers from third parties, non-fishing days and high seas efforts are also provided and used to support calculations and estimates for short term and long term incentives reported in Table 3.4. The Appendix explains how we assess the reduction of stock and the sustainable level of harvests due to overfishing.

Appendix:

Estimating the value of future lost resources

List of Supplementary Tables:

Appendix: Estimating the value of future lost resources

To arrive at an estimate of the value of the resources lost due to excess fishing (declared non fishing days) we assume that the fishery can be described by a simple Gordon-Schaefer model and the total number of vessel days currently distributed to PNA members reflects the maximum sustainable yield. Excess effort is associated with lower (steady state) harvests. Denote fish stock by *S*, effort by *E* and *g* (growth rate), *k* (carrying capacity) and *e* (catchability) are parameters of the model. In the steady state growth equals harvest.

(1) $gS\left(1-\frac{S}{k}\right)=H$; and (2) $H=eES$

$=> g\left(1-\frac{S}{k}\right)=eE$

(3) $=> S=k\left(1-\frac{e}{g}E\right)$

Using $H=eES$ and substituting for *S*, we get

(4) $H=eEk\left(1-\frac{e}{g}E\right)$

The first order condition for optimal effort $\frac{dH}{dE}=0=ek\left(1-\frac{e}{g}E\right)-\frac{e^2k}{g}E => E^*=\frac{g}{2e}$

Excess effort is expressed as $\alpha\frac{g}{2e}$ with $1\leq\alpha$. Substituting excess effort into (4) we can derive the resulting harvest with excess ($1<\alpha$) efforts.

$H=ek\,\alpha\frac{g}{2e}\left(1-\frac{e}{g}\alpha\frac{g}{2e}\right)=\alpha\frac{kg}{2}\left(1-\frac{\alpha}{2}\right)$

$H=\frac{kg}{2}\left(\alpha-\frac{\alpha^2}{2}\right)$

We can see that *H* is decreasing in the excess effort α. Using the 15% overfishing $\alpha=\frac{excess\ day}{total\ days}+1=1.1495$, harvest will be reduced to 97.8% of the optimal harvest. This implies a loss of $43480*0.978=957\ days$. Since these days are lost in all future years, using discount rate $i=0.05$, the net present value of the lost resources using the benchmark price is $US\$\ 6{,}000*\frac{1}{0.05}*957=US\$\ 114.8\ million$. For $i=0.1$, the estimated value of lost resources is around US$ 57.4 million.

Supplementary Table 1 – Transfers from third parties 2014 (millions US$)

Country/Agreement type	Dividends from joint venture - FSMA	Fisheries employment benefits	Grants from FSMA	Grants from UST	Grants from EU	Access fees from EU	Total transfers from third parties
	A	B	C	D	E	F	G=A+B+C+D+E+F
FSM	2	1	na	0.5	0	0	3
Kiribati	2	6	na	0.5	7	1	16
Marshall	na	9	na	0.5	0	0	9
Nauru	na	na	na	0.5	0	0	1
Palau	na	0	na	0.5	0	0	1
PNG	2	65	na	0.5	0	0	68
Solomons	na	12	na	0.5	0	0	13
Tuvalu	2	3	na	0.5	0	0	5
Totals	**8**	**95**	**0**	**4**	**7**	**1**	**116**

(Source – fieldwork)

Notes for supplementary table

- na - data not available
- Supplementary table 1 provides data and calculation for transfers from third parties estimate by countries presented in table 3.3 column D in the main paper.
- Data used for this table is provided in supplementary tables 1.1 to 1.4

Supplementary Table 1.1 – PNA tuna employment in 2013-2014 (number of people)

PNA Countries	Processing plants crews	Local fishing crews
FSM	65	49
Kiribati	75	720
Marshall	588	678
Nauru	na	na
Palau	36	na
PNG	7536	1776
Solomons	1470	274
Tuvalu	2	363
Totals	**9772**	**3860**

(source : FFA (2014). Economic Indicators Report - October 2014))

Notes for supplementary table

- employment is reported for 2013, as 2014 data was not available during data collection; wage rate is estimated at average US$ 7,000 per annum
- na – not applicable

Explanatory notes:

- Supplementary table 1.1 provides employment data for PNA countries in both processing plants and fishing fleets.
- The data is used to calculate employment benefits in supplementary table 1, column B and part of transfers from third parties estimate in supplementary table 1 and for Table 3.3 in Chapter 3.

Supplementary Table 1.2 - Estimated fisheries employment benefits 2013-2014

Country/Employment benefits	Processing plants (million US$)	Local fishing crews (million US$)	Total employment benefits (million US$)
	A	B	C=A+B
FSM	0.46	0.34	0.80
Kiribati	0.53	5.04	5.57
Marshall	4.12	4.75	8.86
Nauru	0.00	0.00	0.00
Palau	0.25	0.00	0.25
PNG	52.75	12.43	65.18
Solomons	10.29	1.92	12.21
Tuvalu	0.01	2.54	2.56
Totals	**68.40**	**27.02**	**95.42**

(Source : estimated from supplementary Table 1.1)

Explanatory note

- Supplementary table 1.2 provides estimated employment benefits for PNA countries in both processing plants and fishing fleets using an estimated average wage rate per annum of US$7,000. The data is used to calculate employment benefits as part of transfers from third parties estimate in supplementary table 1 and Table 3.3 in Chapter 3.

Supplementary Table 1.3a - Distribution of the US Tuna (UST) Treaty fund 2014

UST Treaty	Distribution of UST funds in percentage	UST fund (million US$)
Fishing Access distribution by catch/effort	85%	54
Fisheries related projects distributed equally	13%	8
Administrative fee	2%	1
Total	**100%**	**63**

(Source - US Treaty data are obtained from interview with FFA Official (US Treaty Manager) (2014). Honiara, Solomon Islands)

Footnote

- a- Fisheries related projects distribution to PNA countries is reported in Supplementary Table 1.3b

Explanatory note

- Supplementary table 1.3a provide data for US tuna treaty funds used to calculate UST contributions as part of transfers from third parties estimate in supplementary table 1 column F, and support table 3.3 in Chapter 3.

Supplementary Table 1.3b – UST funds distribution of fisheries related projects 2014

PNA countries	**UST fisheries related projects (million US$)**
FSM	0.51
Kiribati	0.51
Marshall	0.51
Nauru	0.51
Palau	0.51
PNG	0.51
Solomons	0.51
Tuvalu	0.51
Total PNA	**4.10**

(Source - fieldwork : calculated from Supplementary Table 1.3a)

Note for Supplementary Table

- US$ 8 (Supplementary Table 1.3a) distributed equally among 16 members of the Forum Fisheries Agency (FFA), of which 8 out of the 16 members are PNA members.

Explanatory note

- Supplementary table 1.3b provide details of US tuna treaty funds used to calculate US contributions as part of transfers from third parties estimates in supplementary table 1 column F, and support table 3.3 in Chapter 3.

Supplementary Table 1.4a KIR-EU Fisheries Partnership Agreement 2013-2014

Details of agreement	**Amount in million EURO per year**	**Amount in million US$ per year**
EU financial contribution[a]	1.33	1.43
Breakdown of EU financial contribution (1.33 million EURO)		
Kiribati sectoral fisheries policy	0.35	
Fee for purse seine vessels (per vessel)[b]	0.13	
Fee for long line vessels (per vessel)[c]	0.02	
Special contribution from purse seine owners (per vessel)	0.30	
Remaining fee is charged to vessels depending on catch[d]	0.53	
Other EU contributions		
Kiri-EU 11th ADF project[e] subject to request	6.40	6.91
Estimated Kiribati revenue from EU per year		**8.34**

(Source : EU-Kiribati Partnership Agreement, 2012)

Footnotes
a-EU financial contribution for 15,000 tonnes of catch per year
b-4 purse seine vessels; 3 Spain and 1 France
c-6 long line vessels; 3 Spain and 3 Portugal
d-depending on catch per vessel; see Supplementary Table 1.4b for estimated license fees
e-extracted from the KIR-EU 11th ADF project for social development projects at the value of EURO 32 million over 5 years

Note for Supplementary Table

- Converted fishing days in the Kiribati waters - 484 is calculated from the agreed catch tonnes of Spanish vessels a year and average catch per fishing day i.e. 31MT (source- PNA report of the Purse Seine VDS Administrator, 2015)

Explanatory note

Supplementary table 1.4a provide data and details for the EU-Kiribati Partnership Agreement and the data is used to calculate EU contributions as part of transfers from third parties in supplementary table 1 column F and G, and also to support table 3.3 in Chapter 3.

Supplementary Table 1.4b - Data used to estimate VDS value by EU vessels

Details of agreement	Amount	Unit
EU expected annual catch per year[a]	15,000	Tonnes
Ave. catch per fishing day[b]	31	Tonnes
EU fishing days[c]	484	Fishing days
Estimated price of fishing day for Spanish vessels[d]	2,015	EURO
Additional catches	2500	Euro per tonne for additional 2500

(Source: EU-Kiribati Fisheries Partnership Agreement, (EU,2012))

Footnotes
a- EU-Kiribati catch per year agreement
b- extracted from PNA report for average catch per fishing day in 2014
c- calculated from annual catch per year/ave. catch per fishing day
d- estimated from 15,000 MT per year/31 MT per year

Explanatory note

- Supplementary table 1.4b are data and details for the EU-Kiribati Partnership Agreement, and the data is used to calculate EU contributions as part of transfers from third parties in supplementary table 1 column F and G, and also to support table 3.3 in Chapter 3.

Supplementary Table 2 - Countries' Payoffs under status quo (Partial Compliance) 2014

PNA revenue in access fees	VDS revenue (million US$)	FSMA revenue (million US$)	UST revenue (million US$)	Lost revenues from high seas fishing (million US$)	Total revenue (million US$)
	A	B	C	D	E=(A+B+C+D)
FSM	27	2	1	0	30
Kiribati	21	3	26	0	50
Marshall	11	4	2	0	18
Nauru	8	0	4	0	12
Palau	3	0	0	0	3
PNG	69	7	0	0	76
Solomon	15	0	1	0	15
Tuvalu	4	0	4	0	8
Total	**158**	**15**	**38**	**0**	**211**

(Source - payoffs estimated from data in Supplementary Table 2.1)

Explanatory note

- Breakdown of countries payoffs under partial compliance with VDS.
- Supplementary table 2 is an estimated calculation for countries' payoffs under partial compliance which is the status quo. We use the benchmark price for days sold under VDS, reduced day prices for days to FSMA and UST, and the days in the high seas are free of charge.
- Lost revenues from fishing in the high seas is included under partial compliance as, a day fished in the high seas is less a day fished in the PNA EEZs.

Supplementary Table 2.1 – VDS (adjusted) operation under partial compliance 2014

PNA Countries	Days to Bilateral Agreements[a]	Days to FSM Agreement [b]	Days to UST [c]	Days in the high seas	Total allowable effort in days
	A	B	C	D	E=(A+B+C+D)
FSM	4530	462	243	900	6135
Kiribati	3499	627	4737	2324	11187
Marshall	1887	992	413	0	3292
Nauru	1354	0	670	268	2292
Palau	495	0	0	15	510
PNG	11435	1732	54	2274	15495
Solomon	2466	0	11	328	2805
Tuvalu	700	0	699	365	1764
Total PNA TAE	26366	3813	6827	6474	43480
Tokelau[d]	812	0	0	0	812
Total PNA and Tokelau	27178	3813	6827	6474	44292

(Source: compiled from PNA meeting papers and documents)

Footnotes

a – bilateral agreements assumed to fully apply VDS

b and c - FSMA and UST days in 2014, extracted from PNA, 2015, Purse seine VDS PAEs for 2015, 2016 and 2017, 20th meeting of the PA, FSM, 2015)

d - Tokelau is included here as a member of the Palau Agreement but not a members of the PNA

Notes for supplementary table

- Adjusted 2014 PAEs from VDS outcomes, extracted from PNA 2015, Report of the Purse seine VDS Administrator to the 20th Meeting of the Palau Arrangement, FSM, 2015
- Price of fishing days data; US$6,000 for VDS, US$4000 for FSMA, US$5,500 for US treaty

Explanatory note

- Supplementary Table 2.1 are VDS (adjusted) allocations by countries. The data is used to estimate expected countries' payoffs under partial compliance that is reported in Table 3.3 in Chapter 3.

Supplementary Table 3 - Non Fishing Days data and estimating the effort in the archipelagic waters by country

PNA countries	Non-Fishing Days (NFDs)	%share of NFDs by country	Distribution of days in the archipelagic waters [b]	Days fished by EU [a]	Total non-fishing days	Lost revenues from fishing in the domestic and archipelagic waters [c] (million US$)
	A	B	C	D	E=C+D	F=E*6,000
FSM	771	10	721	0	721	4
Kiribati	4396	57	4109	484	4593	28
Marshall	496	6	464	0	464	3
Nauru	596	8	557	0	557	3
Palau	132	2	123	0	123	1
PNG	1154	15	1079	0	1079	6
Solomons	86	1	80	0	80	0
Tuvalu	29	0	27	0	27	0
Total PNA	**7660**	**100**	**7160**	**484**	**7644**	**46**

(Source- PNA 2015, Report of the Purse seine VDS Administrator to the Parties to the Palau Arrangement, FSM, March 2015)

Footnotes

a - EU Spanish vessels are exempted from VDS - therefore treated as NFDs in Kiribati waters

b - total effort in archipelagic waters is available in WCPFC (2015). Purse seine fishing activity in PNA waters. This is used to estimate effort in AWs in each country

c- estimated lost revenues = total non-fishing days * benchmark price of fishing day (US$6,000)

Explanatory notes

- 500 non-fishing days (7660 (A) -7160 (C)) are assumed transits days and not fished
- Efforts in the archipelagic waters in column C is reported non fishing days assumed fished. This data is reported in Table 3.2 in the main paper.
- Supplementary table 3 provide estimated lost resources from fishing in the archipelagic waters and is reported in Table 3.3 column G).

Supplementary Table 4 – Cost of overfishing (excess effort) distribution by country in 2014

PNA countries	TAEs in days	Share of TAEs (percent)	Value of loss of resources in the long term (i = 10%) (million US$)	Value of loss of resources in the long term (i = 5%) (million US$)
FSM	6135	14	8.1	16.2
Kiribati	11187	26	14.8	29.5
Marshall	3292	8	4.3	8.7
Nauru	2292	5	3.0	6.1
Palau	510	1	0.7	1.3
PNG	15495	36	20.5	40.9
Solomon	2805	6	3.7	7.4
Tuvalu	1764	4	2.3	4.7
Total PNA	43480	100	57.4	114.8

Note for supplementary table

- See appendix for details of calculating value of loss of resources in the long term.
- Cost of overfishing is borne by all so we distribute the value of 15% overfishing based on countries TAEs.

Explanatory note

- Effort in the high seas is reported in Table 3.2 column E.
- The estimated loss of resources in the long term is reported in table 3.3, column H and used to estimate the real payoffs under partial compliance from a long term perspective.
- Value of loss of resources in the long term depends on the future discount rates.

Supplementary Table 5 – 2014 estimated fishing efforts in the high Seas

PNA countries HS efforts and loss revenue	Efforts in the HS pocket 1 (days)	Efforts in the HS pocket 2 (days)	Efforts in the HS pocket 3 (days)	Efforts in the HS pocket 4 (days)	Efforts in the HS pocket 5 (days)	**Total Estimated efforts in the high seas (fishing days)**
	A	B	C	D	E	**G=A+B+C+D+E**
FSM	182	718	0	0	0	**900**
Kiribati	0	1309	0	9	1006	**2324**
Marshall	0	0	0	0	0	**0**
Nauru	0	268	0	0	0	**268**
Palau	15	0	0	0	0	**15**
PNG	460	1814	0	0	0	**2274**
Solomons	0	328	0	0	0	**328**
Tuvalu	0	206	0	0	159	**365**
TOTAL PNA HS EFFORT	658	4644	0	9	1164	**6475**

(Source – fieldwork – PNA Office data)

Note for supplementary table

- Efforts in the high seas by country is estimated using the total high seas efforts data and distributed to countries using the share of fishing days by country.
- Lost revenue from high seas fishing is estimated from high seas efforts and benchmark price to calculate the value of current loss of revenue due to high seas fishing as a day fished in the high seas is a day less fished in the PNA EEZs, but no access fees collected by PNA countries for fishing in the high seas.

Explanatory note

- Effort in the high seas is reported in Table 3.2 column E.
- The estimated loss revenue is part of estimated revenue from access fees under partial compliance in Table 3.3 column C.

Summary

Overfishing and overcapitalisation of fisheries is an international management problem causing a downward trend in the share of sustainable fish stocks over the last four decades. The share of fish stocks within biologically sustainable levels has declined from 90% in 1974 to 69% in 2013. Tuna has fared no better with 41% of stocks estimated by the FAO to be fished at biological unsustainable levels. Despite the declining share of sustainable fish stocks, demand for tuna is still high and the significant overcapacity of tuna fishing fleets remains. Nearly all of the tuna regional fisheries management organisations are under pressure to implement harvest control rules for tuna, as required by them under the United Nations Fish Stocks Agreement, but progress has been slow. In the Western and Central Pacific scientific advice has also called for a reduction of at least 32% in fishing mortality from the average 2006-2009 levels. To succeed to achieve these goals new mechanisms that can incentivise states to cooperate to make these changes are needed.

The eight tuna rich countries of the Parties to the Nauru Agreement (PNA) have incorporated incentive based mechanisms to push both state and non-state actors to collaborate in achieving a common goal for sustainability and equity. These mechanisms are (1) the vessel day scheme (VDS) - a state-led incentive scheme designed to manage access to the tuna fishery by domestic and distant water fishing fleets implemented in 2007 and (2) the Marine Stewardship Council - a private certification program which certified the portion of the fishery not fishing on fish attraction devices in 2011. In integrating these incentive based mechanisms to promote improved state-based regulation this thesis argues the PNA represents what can be labelled a 'new tuna regime'. It is conceived of as new because by integrating these mechanisms the PNA holds the potential to overcome the political stalemate that plagues so many other so called 'old' regional fishery management organisations that have not incorporated such tools.

Using a multiple inductive case study approach this examine the PNA case thesis asks: *What characterises the shift from old to new regimes for trans-boundary tuna management, and to what extent is the emergence of a new tuna regime able to achieve sustainable and equitable outcomes in the Western and Central Pacific?* To answer this question the thesis combines New Institutional Economics with game theoretic approaches to analyse the role of economic institutions in incentivizing change towards sustainable and equitable trans-boundary tuna management. The analysis of the apparent shift to new tuna regimes is carried out under four sub questions, each corresponding to a chapter of the thesis.

Chapter 2 addresses the question: *How has the shift from an old to new tuna regime come about and what institutional changes implemented in the PNA have facilitated this shift?* Central to the analysis in this chapter is the design, allocation and exercise property rights by weak political institutions. In doing so the chapter asks how the shift from old to new tuna regimes has come about and what institutional changes have been implemented to strengthen the political

institutions (government, (sub) regional and international institutions) in protecting its property rights. To understand the emergence and implications of new tuna regimes in the WCPO, the analysis uses the New Institutional Economics (NIE) literature and framework to examine the implications of new tuna regimes (labelled as new economic policy instruments) on institutional change. The results shows the driving role of the political institutions of PNA in creating and innovating new economic instruments towards the late 2000s. They also indicate that these new regimes have helped the PNA countries to reinforce their property rights and in doing so negotiate new deals that brings greater economic returns to small island coastal states.

Chapter 3 addresses the second sub-question of this thesis: *To what degree has the implementation of the vessel day scheme in PNA brought about greater stability of the Palau Agreement?* The analysis focuses on the extent to which the VDS has brought about greater stability to the member countries of the Palau Agreement for purse seine tuna fisheries management. The analysis employs coalition theory to examine the effectiveness of the PNA agreement for purse seine effort control, and in doing so, investigate how VDS facilitates strengthening of the PNA political institution for collective participation. The results show that full implementation of the VDS is undermined by the influence of DWFNs and that instead of strict enforcement of the rules a degree of pragmatic tolerance between the PNA members has in fact strengthened the coalition. However, it remains unclear for how long pragmatic tolerance is able to maintain the PNA coalition. The findings of this chapter also provide further insights on the role of dynamic interactions between economic and political institutions to reach long term sustainability and equity outcomes for tuna fisheries.

Chapter 4 addresses the third sub-question: *Can third party certification increase transparency through improved monitoring and control and in doing so address misalignment in the fishery?* In answering this question the chapter examines how the MSC program has increased transparency in the PNA through improved monitoring and control. It also examines how, in doing so, goal misalignment between the state and private actors in the fishery are overcome. The analysis uses the principal-agent framework to examine this (mis)alignment between the state (principal) and private firms (agents) and how the MSC certification process, rather than market incentives and outcomes, plays a role in closing these incentive gaps. The findings suggest that (1) there are multiple-levels of incentive gaps in trans-boundary resource management and (2) that the MSC program has a role in closing some but not all of these gaps. The chapter concludes that within complex regional settings like the WCPO market-based mechanism like the MSC set demands for greater transparency on the PNA implementing measures around its three principles - stock status, ecosystem conditions, management system, and the chain of custody. In doing so the MSC can play an important role in setting new incentives for international cooperation towards reaching sustainability and equity outcomes in trans-boundary fisheries management.

Chapter 5 addresses the fourth and final sub-question of the thesis: Can private institutions such as third party certification facilitate improvements to conservation and management measures at

the RFMO level? This chapter investigates the role of the MSC program in other tuna regions beyond the PNA and WCPFC and in doing so focuses on the role of such as third party certification in facilitating the alignment of RFMOs with UNFSA requirements. By comparing RFMOs of the Indian, Pacific and Atlantic Oceans the analysis confirms the facilitating role of MSC in helping RFMOs progress towards precautionary measures for sustainability. In doing so the analysis advances our understanding on the different and multiple ways in which the MSC is used to create change at the RFMO level. This in turn challenges the notion of a single improvement pathway of 'improve-first-certify-second'. Instead it a more progressive application of the MSC could be to 'certify-first-improve-second'. This insight also indicates the effectiveness of the MSC is also determined by the response of these RFMOs as political institutions. In short, if a fishery is excluded from certification until it has reached requisite level of a priori improvement, it is less likely to overcome political resistance to change.

Overall this thesis advances an understanding of institutional change as a process of dynamic and progressive improvement built on the interaction between political (state) and economic (private and market) institutions. Recognising this interplay opens up potential pathway to achieving cooperation for sustainability and better economic returns coastal and fishing nations alike. The analyses in all four chapters demonstrates the role of hybrid regulatory systems where the state uses market institutions in finding solutions to improve fisheries outcomes, governance and transparency in the fishery. While all four empirical chapters focus on different research questions and use different theoretical frameworks and approaches, they are all interlinked by providing answers to questions about sustainability and equity. They do so by demonstrating the role of new tuna regimes in facilitating institutional change for these long term outcomes.

The thesis also characterises new tuna regimes as having four key elements. First, the success of new tuna regimes is the degree to which they integrate political, governance and market institutions to develop and apply incentives for change. Second, new tuna regimes utilise a mix of state and market based incentive mechanisms that recognises the multiple interests and actors in formulating management decisions for sustainability. Third, new tuna regimes need to effectively *govern dynamic political interests and actors* that continue to undermine regional cooperative agreements for trans-boundary tuna resources. Fourth, the *scale of jurisdiction* of a new tuna regimes is also significant for their success. New tuna regimes are closely related to what has been termed 'new regionalism'. If all of these characteristics can be identified and transformed into strategies it might be possible for tuna regimes to develop progressive improvements of political, market and governance institutions. This implies that change is inherent to new tuna regimes and that there is continued effort to ensure that long-term sustainability and equity goals are set and reached in all tuna fisheries.

Further research is required to provide further insights into how new tuna regimes emerge in other regions around the world and at different scales. These could include RFMOs, but also new forms of sub-regional cooperation between states and/or between states and the private sector. Such research could build on this thesis by further elaborating on the kinds of economic

institutions that can incentivise the dynamic interaction with political institutions and positive outcomes in the design and implementation of the UNFSA. Further research is also needed to examine the effectiveness of these institutional improvements in improving fishing patterns and practices at the fleet level and how they in turn affects improvement of the stocks.

About the Author

Agnes D. Yeeting is from the Islands of Kiribati and was born in Suva, Fiji. She obtained a bachelor degree in Public Administration and Economics from the University of the South Pacific in Fiji in 2004. She then went to Lincoln University in Christchurch, New Zealand where she obtained a Master of Commerce and Management in Economic Development in 2010. In fulfilment of her master degree she wrote a thesis on the domestic tuna industry in Kiribati.

In 2005, Agnes joined the government of Kiribati. Her work focused on policy matters related to tuna fisheries and the importance of tuna resources for the Kiribati economy. This has inspired her to further investigate how current tuna policies are benefiting small island developing states like Kiribati.

In 2010, after completing her Master Degree, Agnes returned and continued working with the Kiribati government until 2012. In 2013, she began her PhD within the BESTTuna project where she has been active until her graduation.

Agnes David Yeeting
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the learning activity	*Department/Institute*	*Year*	*ECTS**
A) Project related competences			
Besttuna course	*SSG, WUR*	*2013*	*3*
Writing research proposal	*ENP*	*2013*	*6*
Besttuna workshops and annual meetings	*WUR-UP-IBR-USP*	*2013-2016*	*4*
Cooperation and Conflict conference	*ENR*	*2013*	*1*
B) General research related competences			
Introduction course	*WASS*	*2013*	*1*
Techniques for writing and presenting a scientific paper	*WGS*	*2013*	*1.2*
Information literacy including endnote introduction	*WGS*	*2013*	*0.6*
Reviewing a scientific paper	*WGS*	*2013*	*1*
International Environmental Policy, ENP30306	*WUR*	*2013*	*6*
' Moving towards market based and incentive based approaches for tuna management in the WCP'	*7th International Conference of the International Institute of Fisheries Economics & Trade (IIFET), QUT, Queensland, Australia.*	*2014*	*1*
'An economic analysis of the Vessel Day Scheme (VDS) and its implications on cooperation and fisheries regionalism among the Parties to the Nauru Agreement (PNA) group'	*6th International Conference on Agribusiness Economics and Management, Davao, Philippines.*	*2014*	*1*
C) Career related competences/personal development			
Information research skills	*University of the South Pacific (USP)*	*2014*	*1*
Assisting with course at School of Marine Studies at USP semester	*USP*	*2014*	*3*
Qualitative methods in social research	*USP*	*2015*	*1*
Pacific tuna forum	*INFOFISH*	*2015*	*1*
Guest lecturer (Ocean and coastal governance)	*ENP*	*2016*	*1*
Total			***32.8***

One credit according to ECTS is on average equivalent to 28 hours of study load

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