



Rent generation and dissipation in the Western Central Pacific tuna fishery

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Outline

Overview of the WCPO tuna fishery

PNA purse seine vessel day scheme

Bioeconomic model of VDS

Rent creation and dissipation

Take home messages



WCPO tuna fishery

The Western and Central Pacific Ocean (WCPO) tuna fishery is the largest and the most valuable tuna fishery in the world:

- 60% of 4.8 million tonne global tuna fishery (2014)
- 2.9 million tonne harvest is worth US\$ 5.8 billion (2014)

By gear type (2014)

- Purse seine - 2.1 million tonnes worth US\$ 3.2 billion
- Longline - 269,000 tonnes worth US\$ 1.7 billion
- Pole and line - 204,000 tonnes worth US\$ 400 million

By species (2014)

- Skipjack – 2 million tonnes worth US\$ 2.9 billion
- Yellowfin – 600,000 tonnes worth 1.8 billion
- Bigeye – 160,000 tonnes worth \$755 million



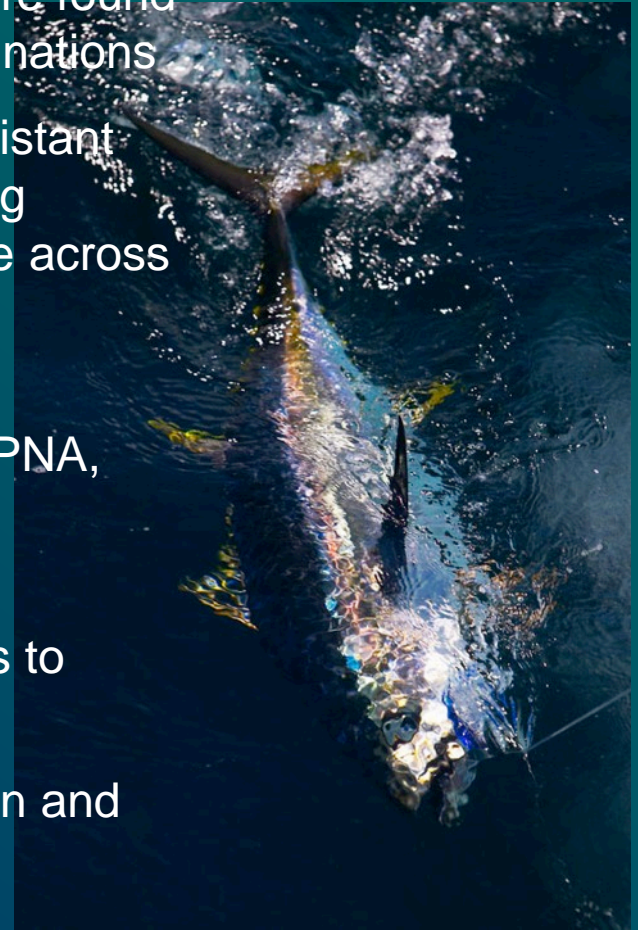
The WCPO management challenge

WCPO tuna fishery is one of the most complicated in the world:

- Tuna are spread over a huge ocean area and are found in the EEZs of more than a dozen independent nations
- They are exploited by numerous regional and distant water fishing fleets employing a variety of fishing methods, and landing their catches far and wide across the Pacific
- Overlapping regional and sub-regional fisheries agreements and organization – WCPFC, FFA, PNA, FSMA, UST etc.

Effectively managed, the WCPO tuna fishery can sustainably generate 100s of millions in net benefits to Pacific Island countries

This requires international collaboration, cooperation and shared governance – simple!



The WCPO management challenge

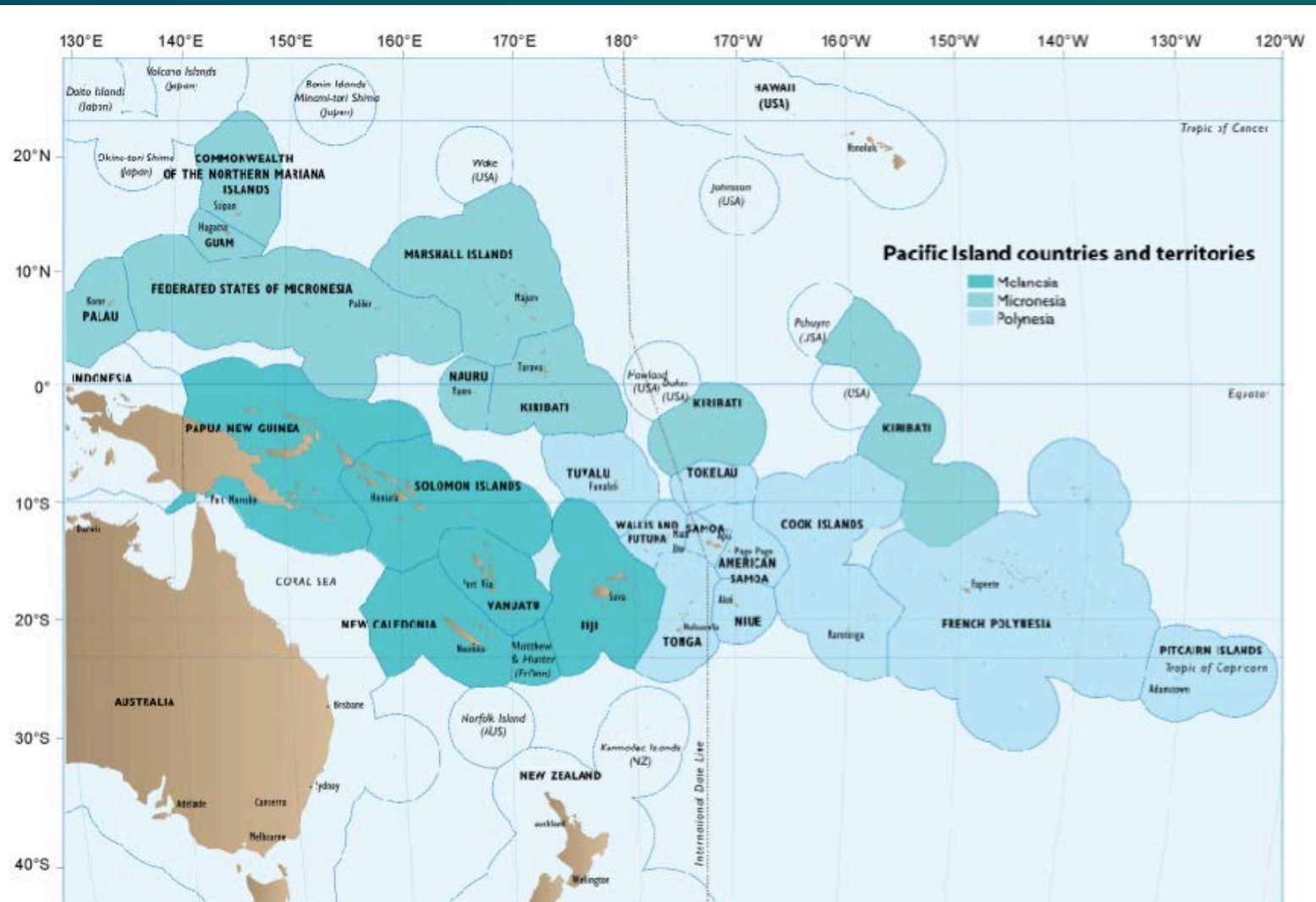


Figure 1.1 The exclusive economic zones of Pacific Island countries and territories. The subregions of Melanesia, Micronesia and Polynesia are also shown.

PNA VDS

The Parties to the Nauru Agreement (PNA)¹ purse seine Vessel Day Scheme (VDS) is a partnership between eight Pacific state

Their EEZs cover a large fraction of the WCPO tuna stocks

The VDS creates a common rights-based management system to conserve the resource and secure sustainable economic benefits

PNA members agree on a limited number of fishing days for the year, based on scientific advice

Fishing days are then allocated to PNA countries and sold to distant water fishing fleets

Given the complexity of the fishery this may be the single most ambitious attempt of this kind seen in the world so far

¹ The Parties to the Nauru Agreement (PNA) are the Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. Tokelau also participates in the VDS

PNA VDS: Key economic data¹

Purse seine share of catch value in PNA waters
78%, 17% other nations waters, 5% high seas

Benchmark minimum price for foreign vessels US
\$8,000 per VD

2015 VDS fees US \$250 million, UST fees US\$90
million

10,000 employed in processing (over 90% PNG and
Sol Is); over 4,000 as crew and observers (1,700
PNG)

¹ Forum Fisheries Agency, 2015 Economic Indicators Report



Bioeconomic model

Biomass growth: $\dot{x}(i) = \alpha(i) \cdot x(i) - \beta(i) \cdot x(i) \cdot \ln(x(i))$

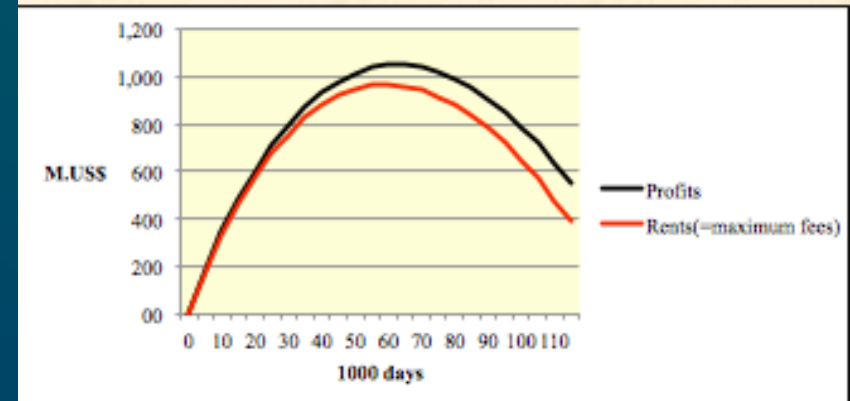
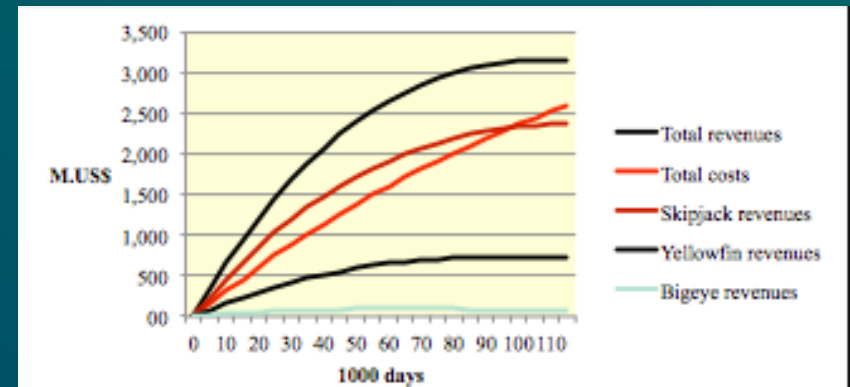
Stock diffusion: $z(i) = \varphi(i) \cdot (x(i) - b(i) \cdot x(i, out))$

Harvesting: $y(i) = q(i) \cdot d(i) \cdot x(i)^{\delta(i)}$

Costs: $c(i) = \lambda \cdot p(i) \cdot y(i) + \mu(i) \cdot d(i)^{\eta(i)}$

Price of landed tuna: $p(i) = A(i) \cdot y(i)^{\epsilon(i)}$

i : index for tuna species; $i=1,2,3$



Biological parameters	Symbol	Skipjack	Yellowfin	Bigeye
Alpha	a	6.6089	3.2430	1.4066
Beta	β	0.7528	0.3934	0.1942
Diffusion parameters				
Diffusion speed	φ	0.2	0.2	0.2
Equilibrium ratio	b	10	10	10
Reference stock	$x(i,4)$	500	200	80
Harvesting function				
Catchability	q	0.029968	0.016550	0.008994
Schooling	δ	0.8	0.8	0.8
Other harvests				
Proportion of biomass	a	0.1334	0.1384	0.1371
Price of landings				
Price coefficient	A	3.2288	2.5963	2.0920
Elasticity	ϵ	-0.1	-0.05	-0.02
Costs				
Value of landings	λ	0.3	0.3	0.3
Vessel days	μ	8.92295	8.92295	8.92295
Vessel days exponent	η	1.1	1.1	1.1

Model outcomes... .

In “normal” operating conditions (e.g. 2011-13)

- Fee revenues can be substantially increased:
 - Likely annual fee revenues: US\$360-1150
 - Fee revenue maximizing
 - Fee per VD: US\$11-17,000
 - Total VDs (TAE): 32,000-67,000, currently around 46,000



To maximize rents: Set an access fee

The VDS essentially does two things:

- (i) it restricts the number of VDs (vessel days) and
- (ii) it imposes a fee on each VD

Just managing VDs will lead to an expansion in other components of fishing effort to counteract the restriction

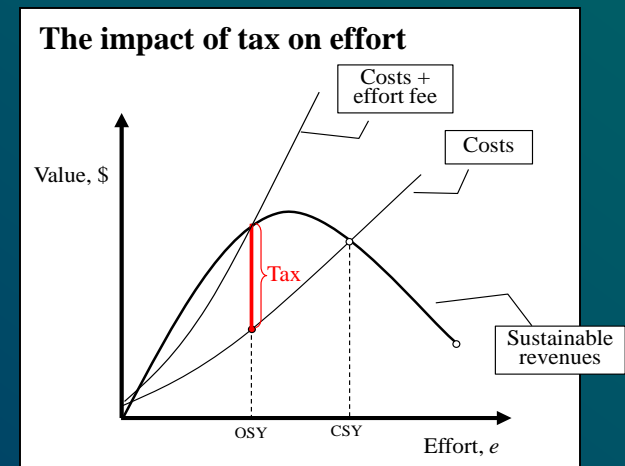
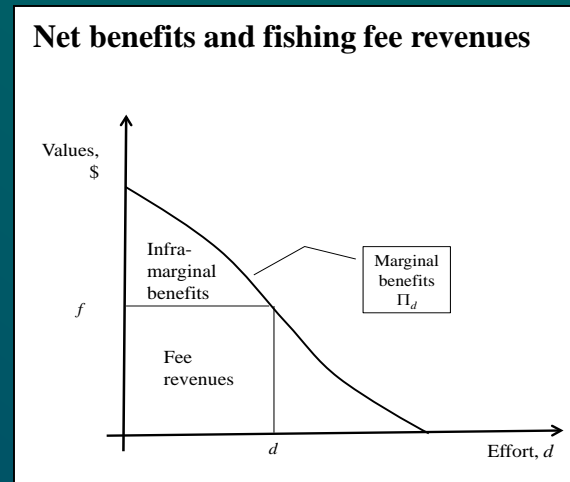


Access fee...

The potent fisheries management component of the VDS system is not the limitation on VDs per se but the fishing fee per VD

Contrary to arguments sometimes made by representatives of the distant water fishing fleets, the fishing fee is the crucial part of the VDS

The higher this fee, the more efficient will the tuna fishery be and the greater its net contribution to the global economy



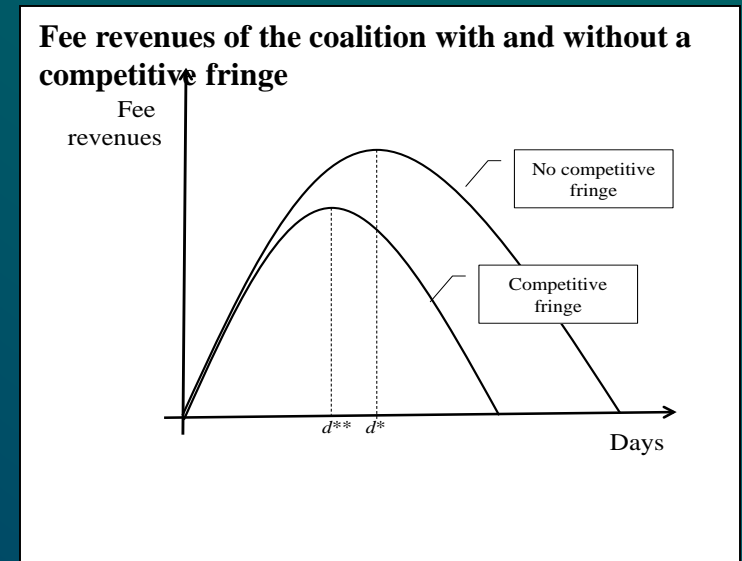
To maximize rents: Minimize the competitive fringe

External:

- Tuna fishing elsewhere (other nations' EEZs & high seas)

Internal:

- Other tuna fisheries (gear, archipelagic, territorial); VDS exemptions, fee exceptions for landings for domestic processing



The competitive fringe... .

As the competitive fringe increases, the optimal number of fishing days goes down

As the competitive fringe increases, the maximum attainable rent to goes down

Under individual (un-coordinated) revenue maximization, the number of fishing days be higher and rents lower than under the joint maximization

Total resource rents are maximized by cooperating parties and the competitive fringe acting in unison



Managing the competitive fringe... .

1. Actively expand the VDS-coalition
 - At least get potential competitors to act co-operatively
 - Develop formal and legal procedures for the entry of new members into the VDS
2. Try to end “free” fishing from high seas
3. Bring all tuna fishing within members’ EEZs under a uniform expanded VDS

New U.S. fishing rule attempts to evade regional conservation measure

Majuro, Marshall Islands 12 June 2016: A new U.S. government fishing regulation that went into effect late last month violates a conservation measure for high seas fishing approved last year by the Western and Central Pacific Fisheries Commission (WCPFC), said the Parties to the Nauru Agreement Chief Executive Officer.

“This new U.S. fishing rule

PNA-ISSF cooperation hailed for domestic development options

Majuro, Marshall Islands 18 June 2016: A recently signed cooperation agreement between the Parties to the Nauru Agreement (PNA) and the International Sustainable Seafood Foundation (ISSF) allows the two entities to cooperate on FAD tracking, the Vessel Day Scheme, purse seine vessel registry and other areas.

As part of this closer cooperation between ISSF and PNA, ISSF is to allow PNA nations an exemption to bring new fishing vessels into service to develop their domestic fisheries industries.

Maximizing rents means optimizing the distribution of fishing effort

A VD in a given EEZ will generally not yield the same harvest as a VD in another EEZ.

Trading of VDs between VDS-partners will make the various VD prices more equal.

The more equal the VD prices the closer is the geographical pattern of fishing to the optimal one

Free trading of VDs between partners is conducive to more optimal geographical distribution of the fishing effort

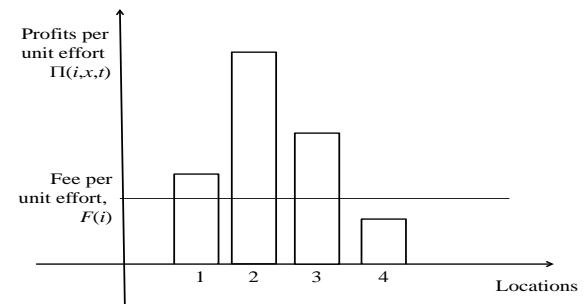


Optimizing the distribution of fishing effort...

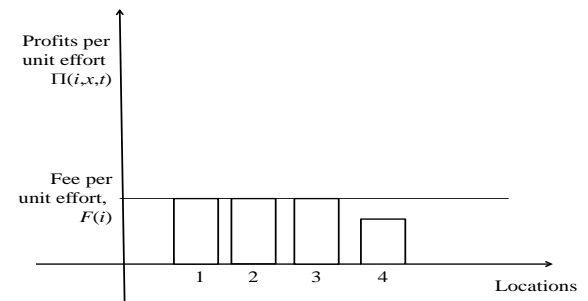
Rents are maximized when fishing effort is spatially optimal. In practice this means:

- VDs are homogeneous and can be used in all of the VDS-partners' EEZs (pooling)
- There is free trading of VDs between partners
- Fishing companies are allowed to switch their VDs between EEZs of PNA members

Profitability of different fishing locations under an equal fee regime



Realized profits in equilibrium under an equal fee regime



Take home messages

The creation of the VDS by the PNA provides a real world case for exploring the benefits of cooperation in the management of high migratory and trans-boundary fisheries:

- The greater the proportion of stock controlled by a coalition, the higher the rents generated
- The greater the external competitive and or internal fringe, the lower the rents generated and available to all – collective or fringe
- The greater the transferability of days/fishing rights across coalition EEZs, the higher the rents created
- It is the access fee, rather than any other factor that drives both biological conservation and rent generation in the WCPO tuna fishery

Thank you

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