Rent Losses in the Western and Central Pacific Tuna Fisheries

Presented by

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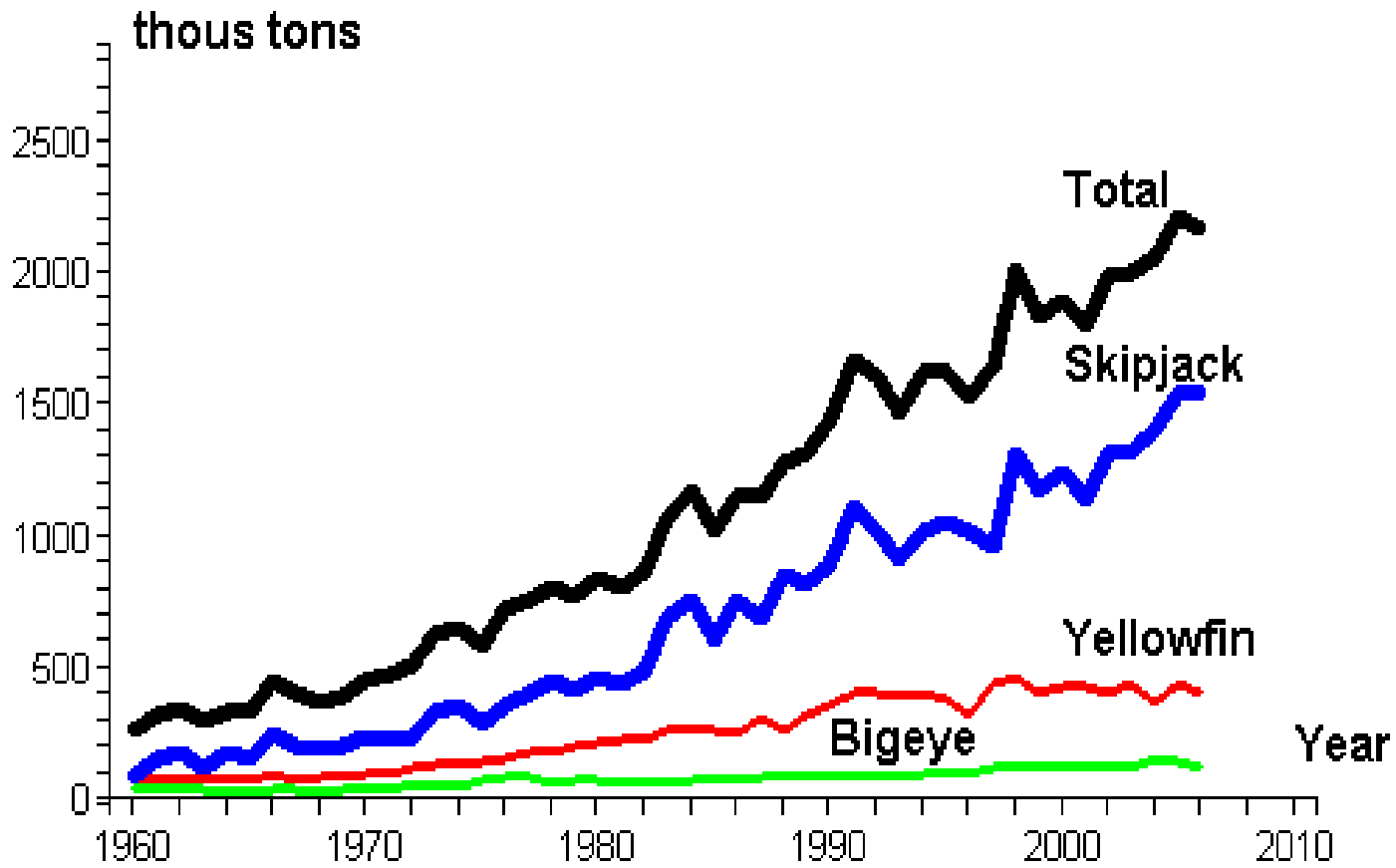
Western & Central Pacific Tuna

- Four key species (skipjack, yellowfin, bigeye and albacore) and multiple fleets.
- One of world's biggest fisheries — 2.2 million metric tonnes harvest/year with gross value of production in excess of $US 3 billion.
- Evidence that fishery is being mismanaged with economic overfishing of bigeye and yellowfin tuna.
- Evidence of biological overfishing of yellowfin ($B_{CUR} < B_{MSY}$) and bigeye ($FM_{CUR} > FM_{MSY}$) .

Harvests 1960-2006



Rent Drain & Gain

- Maximising net economic returns from fishing is a major consideration of Pacific Island States and Distant Water Fishing Fleets.
- Using stochastic optimal control methods calculate the optimum trajectory to a B_{MEY} target or biomass level that maximises the discounted net profits from fishing over a 50 year horizon.
- Solutions are obtained through a finite difference algorithm, using parallel processing software allowing for a nonlinear ‘stock effect’.

Bio-economic Model

Profit function:

$$\Pi_{ijgt} = p_{it}\left(q_{ijg}^{0} E_{ijgt}^{\alpha_{ijg}} B_{igt}^{\beta_{ijg}}\right) - \left(\gamma_{jg}^{0} + \gamma_{jg}^{1} E_{ijgt}\right)$$

Objective function

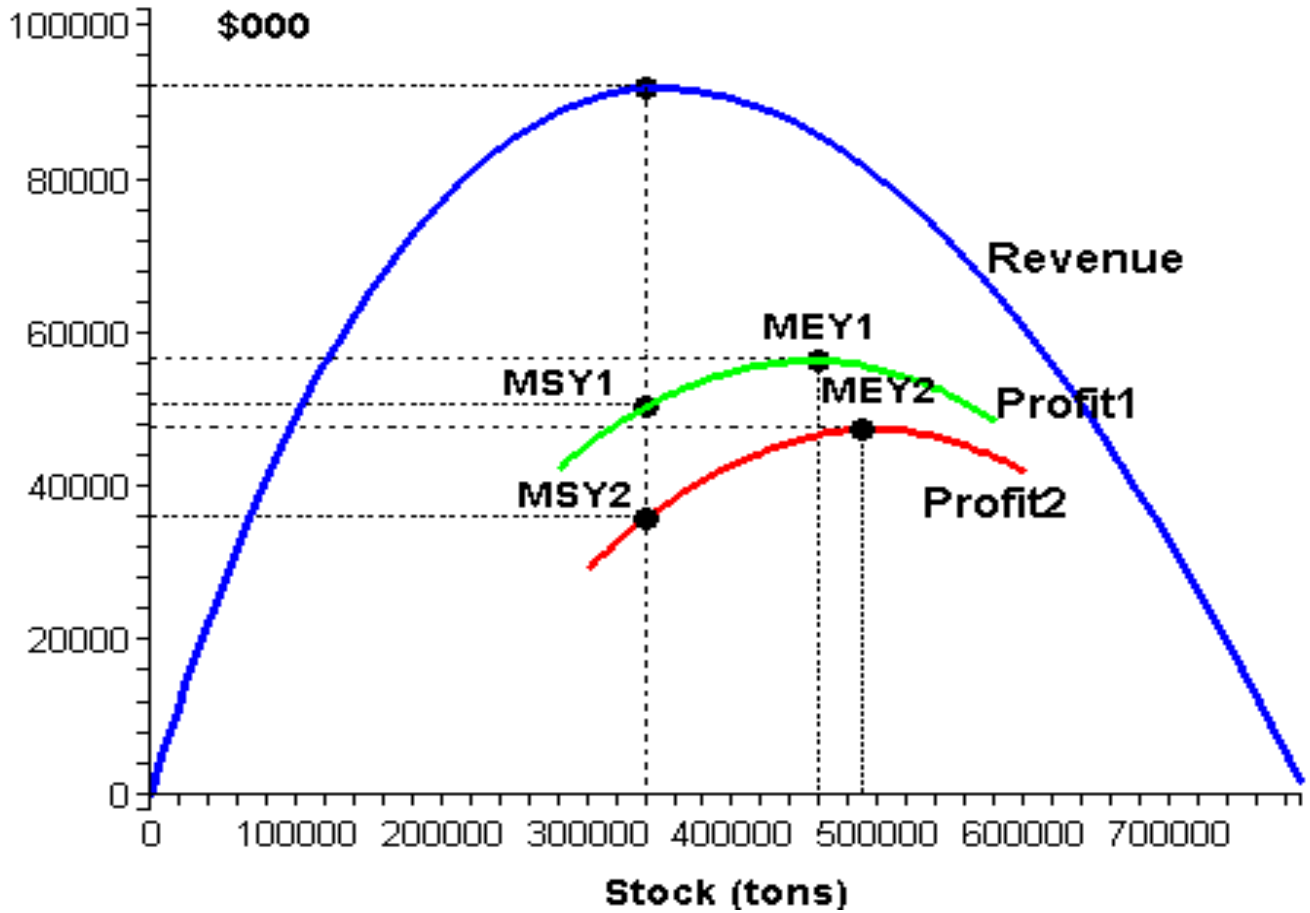
$$\max_{E_{jt},\theta_{jg},\theta_{ij}} \Pi_t =$$

$$\sum_{t=1}^{T} \frac{1}{(1+r)^t} \sum_{j=1}^{M} \sum_{g=1}^{R} \sum_{i=1}^{N} p_{it}\left(q_{ijg}^{0} (\theta_{ig}\theta_{ij}E_{jt})^{\alpha_{ijg}} B_{igt}^{\beta_{ijg}} - \left(\gamma_{jg}^{0} + \gamma_{jg}^{1} (\theta_{ig}\theta_{ij}E_{jt})\right)\right)$$

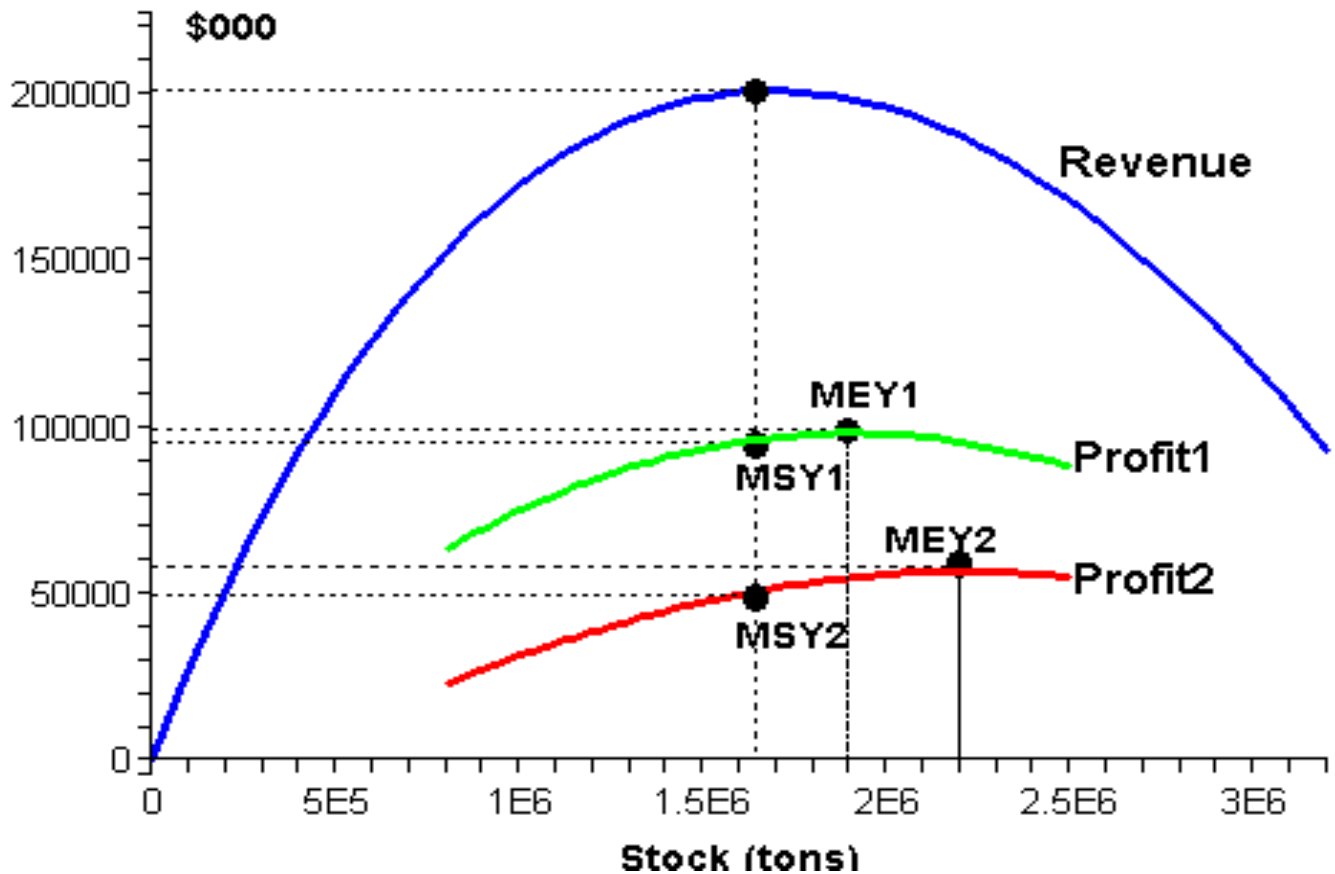
Data & Parameter Sources

- Secretariat of the Pacific Community (SPC), 2007 (Database).
- Bertignac, Campbell, Hampton and Hand, 2000.
- Reid et all 2003a and b.
- Hampton, Langley, Harley, Kleiber, Takeuchi and M. Ichinokawa, 2005 .
- Reid, Bertignac and Hampton 2006.

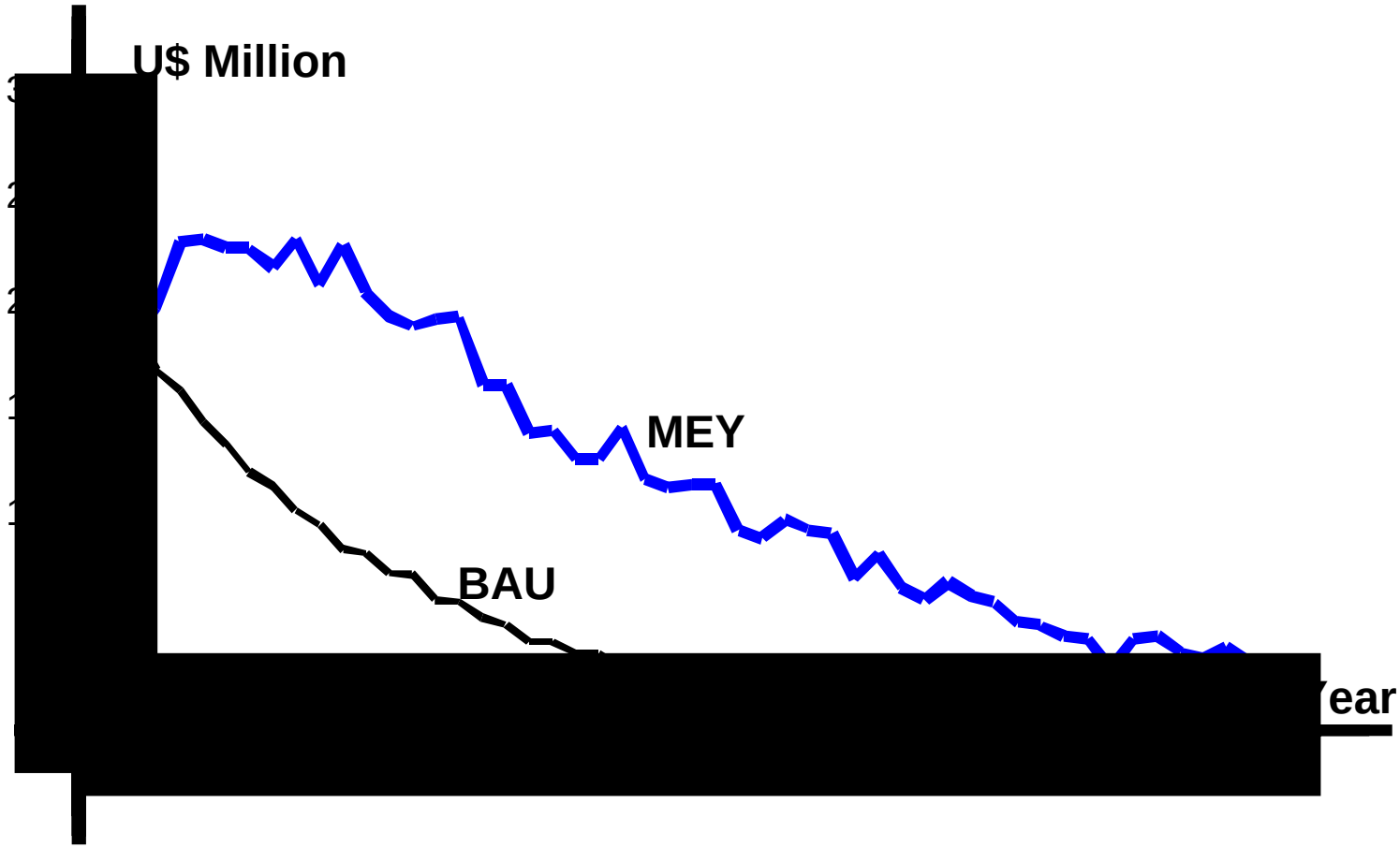
Dynamic B_{MEY}: WCP bigeye tuna



Dynamic B_{MEY}: WCP yellowfin tuna



Net Present Value B_{MEY} and BAU



Results: Effort Levels

- Results indicate that effort at B_{MEY} target in purse seine, frozen longline and fresh longline fleets would be 45%, 56% and 61% of 2006 effort levels (and slightly less in transition).
- B_{MEY} would increase profits in the fishery relative to BAU by roughly 45 per cent a year, or an average of $108 million/year.

Results: Rent Drain

- B_{MEY} would generate a net present value of $5.4 billion (50 years at 5% discount rate) — *at least* $3.4 billion more than Business as Usual.
- Dynamic B_{MEY} coupled with appropriate instruments/incentives & enforceable harvest limits will generate a much greater economic surplus and sustainable tuna fisheries in WCPO.

Results: Biomass

	Yfin	Bigeye	Skip
B_{MEY} / B_{MSY}	1.19	1.80	2.47
B_{MEY} / B_{CUR}	1.59	1.22	1.15

Conclusions

- Results provide both an economic and a biological justification for *reducing current fishing effort* and *increasing biomass levels* of all tunas in this fishery.
- Higher future profits can also be used to fully compensate fishers for initially lower harvests and provide ‘side payments’ to fleets and countries to move to B_{MEY}.
- Business as usual will cost WCPO tuna fisheries billions of dollars and will jeopardise the sustainability of yellowfin and bigeye tuna stocks.