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# Implications of quota reallocation in the Torres Strait Tropical Rock Lobster Fishery

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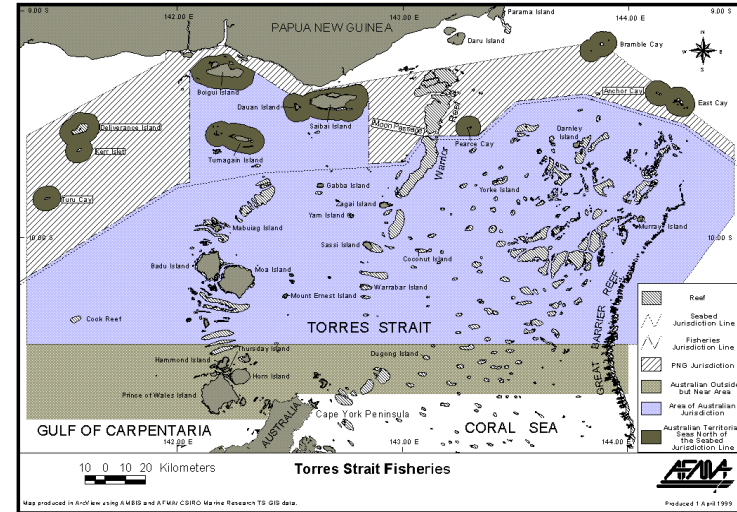


# Outline

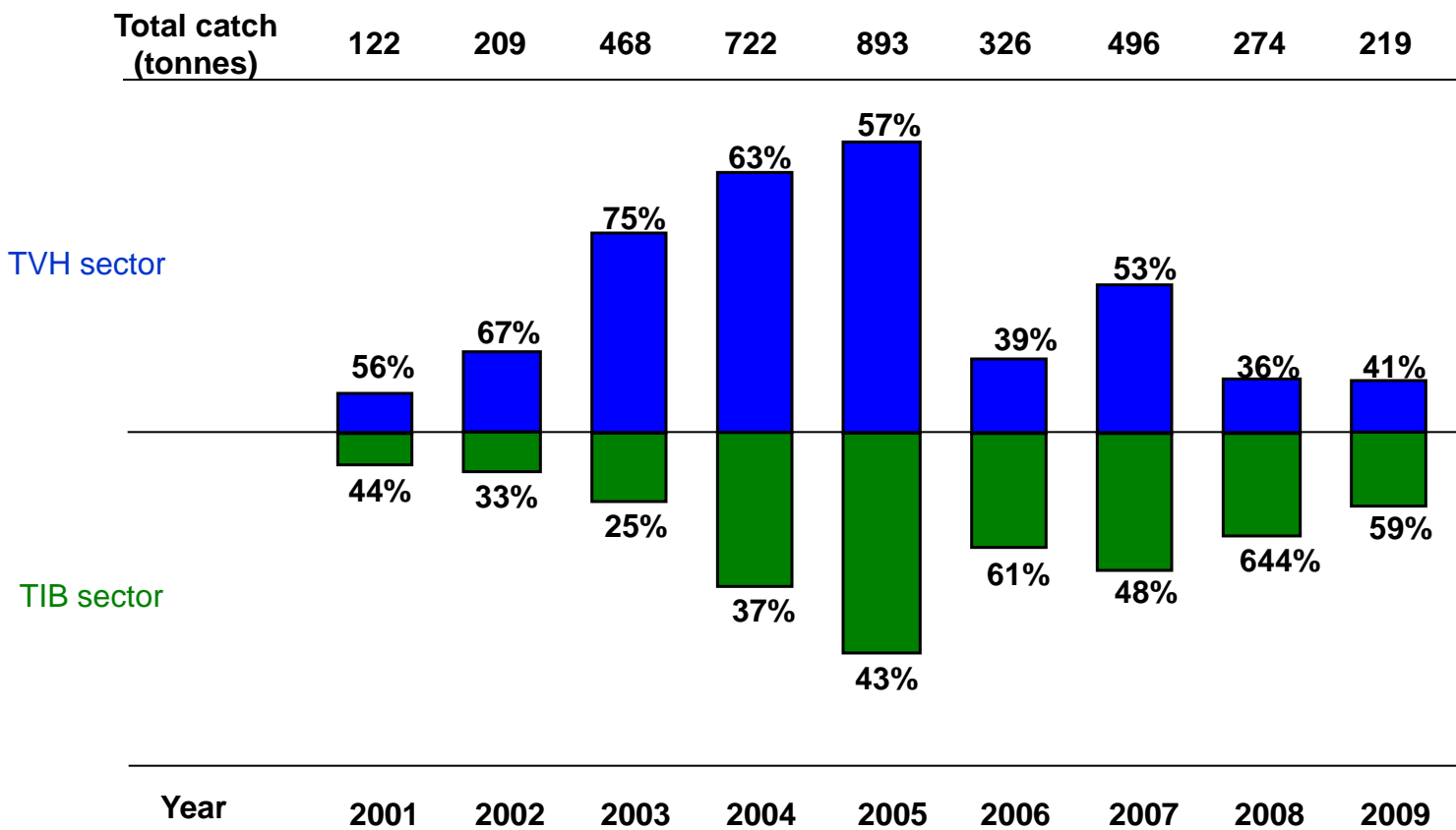
- Background to issue
  - Objectives of the study
- Basic principles for efficient allocation of the resource
- Methodology
- Data
- Some preliminary results
  - Production frontiers
  - MVP for the different fleet segments
  - Efficiency distributions
  - Potential production increases in Islander fleet
- Conclusions

# Torres Strait lobster fishery

- Major commercial fishery for TS Islanders
  - Also cultural significance
- Joint management arrangements with PNG
  - 2009: Australia: 228 t live weight; Papua New Guinea: 114 t live weight
- 470 Traditional Inhabitant Boat (TIB) licences with TRL endorsements
  - only 293 are active (2010) but most catch taken by small number of these
  - There is no limit on the issue of TIB licences.
- Transferable Vessel Holder (TVH) licenses
  - Non-Indigenous commercial vessels
  - 13 licensed primary vessels (2010)
    - 34 attached dinghies



# Historic catch shares



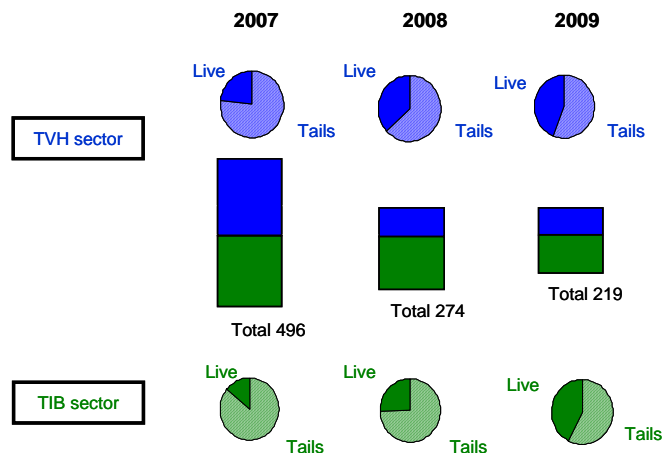
Preliminary results – not for citation as may change

# Products and management arrangements

## Two main product forms

- Whole live lobster
  - Caught by hookah diver
  - Higher price (\$30/kg) but need to be kept alive
- Tails
  - Caught by free diving
  - Lower price (\$10/kg live weight) but easier storage, lower costs
  - Some hookah catch that dies becomes tails

- Currently input based
  - Limited entry (TVH)
  - Closed seasons
  - Dive-only fishery
    - Hookahs
    - Free dive
- Moving to output controls
  - ITQs for TVH
  - Unclear about TIB
  - Nominal quota allocation 2009
    - 46.5%:53.5% TVH:TIB
- Political pressure to allocate more of the quota to TIB sector
- Effort in TIB fleet also influenced by the Community Development Employment Projects (CDEP) Program
  - Creates group of semi-commercial fishers who earn up to limit imposed by CDEP



Preliminary results – not for citation as may change

# Research questions

- Are there efficiency arguments for transferring more quota to the TIB sector?
  - Quota should flow to the group with the highest gain to be made
- How much could the TIB sector realistically catch?
  - What potential is there for the sector to increase its catch?
  - What impact is the CDEP having on production in the sector?
    - What might happen when it is removed?



Preliminary results – not for citation as may change

# Equi-marginal principle

- Resource should be allocated between different users such that the marginal benefit to each is equal
  - If one group could can greater benefits from the use of an additional unit of a resource than another then the resource should flow to them
- Problem: we don't already have an individual quota system so can not determine the marginal value of an additional quota unit
  - But could estimate an average profitability per unit of catch
- Further problem: don't have individual cost data
  - But can use some micro-economic principles to estimate costs given some assumptions

# Methodology

- Stochastic Production Frontier analysis

- Estimate production frontier for the TIB and TVH fleets (separately)
- Estimate marginal value product (MVP) of the last day fished for each tender

$$MVP_x = p \frac{\partial y}{\partial x} = p \frac{\partial \ln y}{\partial \ln x} \frac{\hat{y}}{x}$$

- Profit maximising condition

- For an unconstrained fleet, the MVP (=marginal revenue) should equal the marginal cost of an additional day
  - Only the “commercial” TIB fleet is truly unconstrained so based MC on these vessels
- Assuming marginal cost per day = constant = average cost per day, can estimate an average profit/kg for each fleet type
  - Based on variable inputs only but indicative of the value (on average) of a unit of quota

# Data

## • TVH

- Daily logbook data from 1994-2009
  - For each tender
- Physical data on mother ship
- 60 vessels
- 262 obs

## • TIB

- Trip level voluntary logbook data 2004-2009
  - By fisher
- Processor data
  - Landings by fisher
  - Prices paid \$/kg
- Both data sets combined to provide final data set
  - 248 fishers
  - 1111obs
- Fleet segregated into:
  - Commercial (14)
  - Semi-commercial (65)
  - Casual (200+)

## • Aggregated data to annual level

- Catch (kg)
- Proportion tails vs whole
- Days fished (tender\*days for TVH)

## • Stock index

- Derived from annual surveys

## • Data normalised

- Mean  $\ln(x)=0$



# Results

- Common model

- Dependent variable
  - catch (kg live weight)
- Independent variables:
  - proportion tails (shifter)
  - Days fished (tender days for TVH) and stock
- Fixed effects

- Production frontiers

- TIB
  - Translog model
  - Monotonicity imposed following three step procedure of Henningsen, A. and Henning, C. (2009). Imposing regional monotonicity on translog stochastic production frontiers with a simple three-step procedure, *Journal of Productivity Analysis* 32, 217-229.
- TVH
  - Cobb Douglas model



# TIB results (three step procedure)

- Initial frontier model

Initial maximum likelihood estimates

	Estimate	Std. Error	Pr(> z )
a_0	-0.255	0.061	0.00%
a_1	0.832	0.017	0.00%
a_2	0.490	0.053	0.00%
b_1_1	-0.089	0.023	0.01%
b_1_2	-0.045	0.044	31.16%
b_2_2	1.450	0.332	0.00%
d_1	0.863	0.061	0.00%
sigmaSq	0.494	0.042	0.00%
gamma	0.490	0.049	0.00%

- Minimum distance

	Estimate	Min Distance	diff/Std error	Adjusted
a_0	-0.255	-0.225	-0.48	-0.212
a_1	0.832	0.828	0.24	0.829
a_2	0.490	0.458	0.60	0.459
b_1_1	-0.089	-0.095	0.26	-0.095
b_1_2	-0.045	0.000	-1.01	0.000
b_2_2	1.450	0.790	<b>1.99</b>	0.791
d_1	0.863	0.863	0.00	0.864

- Final stochastic frontier

	Estimate	Std. Error	Pr(> z )
(Intercept)	0.014	0.040	73.65%
lcFitted	1.002	0.018	0.00%
sigmaSq	0.495	0.042	0.00%
gamma	0.489	0.049	0.00%

- Performance

Monotonicity

	initial	adjusted
Days	100%	100%
Stock	79%	100%

Quasiconcavity

	initial	adjusted
	44%	55%

- Initially ran as TL but Cobb-Douglas the more appropriate model

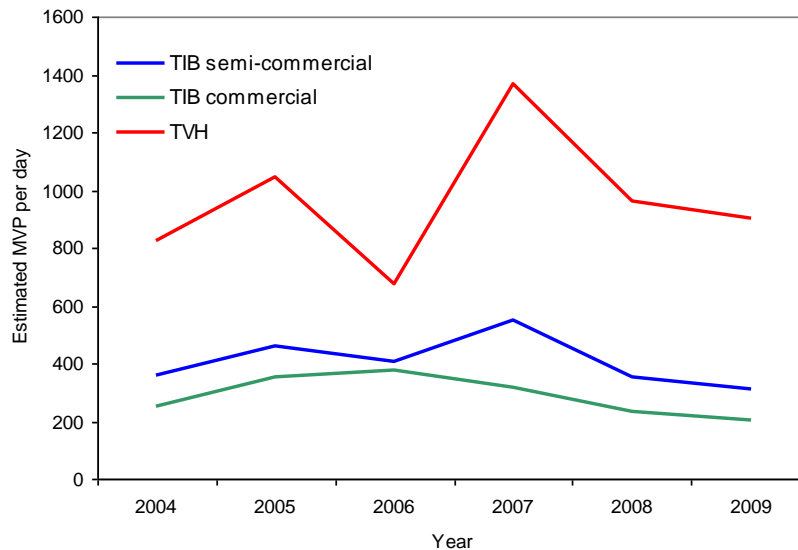
## Initial maximum likelihood estimates

	Estimate	Std. Error	Pr(> z )
a_0	-0.115	0.098	24.48%
a_1	0.992	0.025	0.00%
a_2	0.489	0.043	0.00%
d_1	0.797	0.093	0.00%
sigmaSq	0.758	0.155	0.00%
gamma	0.825	0.040	0.00%

# Some key results

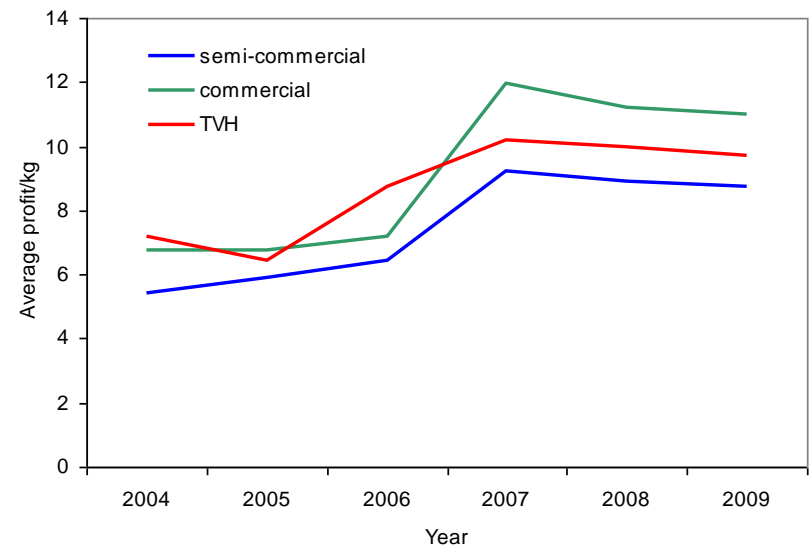
- Estimated average MVP (\$/day)

- TVH fleet more constrained
  - Higher op cost (Qld fishery)
- TIB semi-commercial also higher opportunity cost
  - CDEP program



- Average profit/kg (\$/kg)

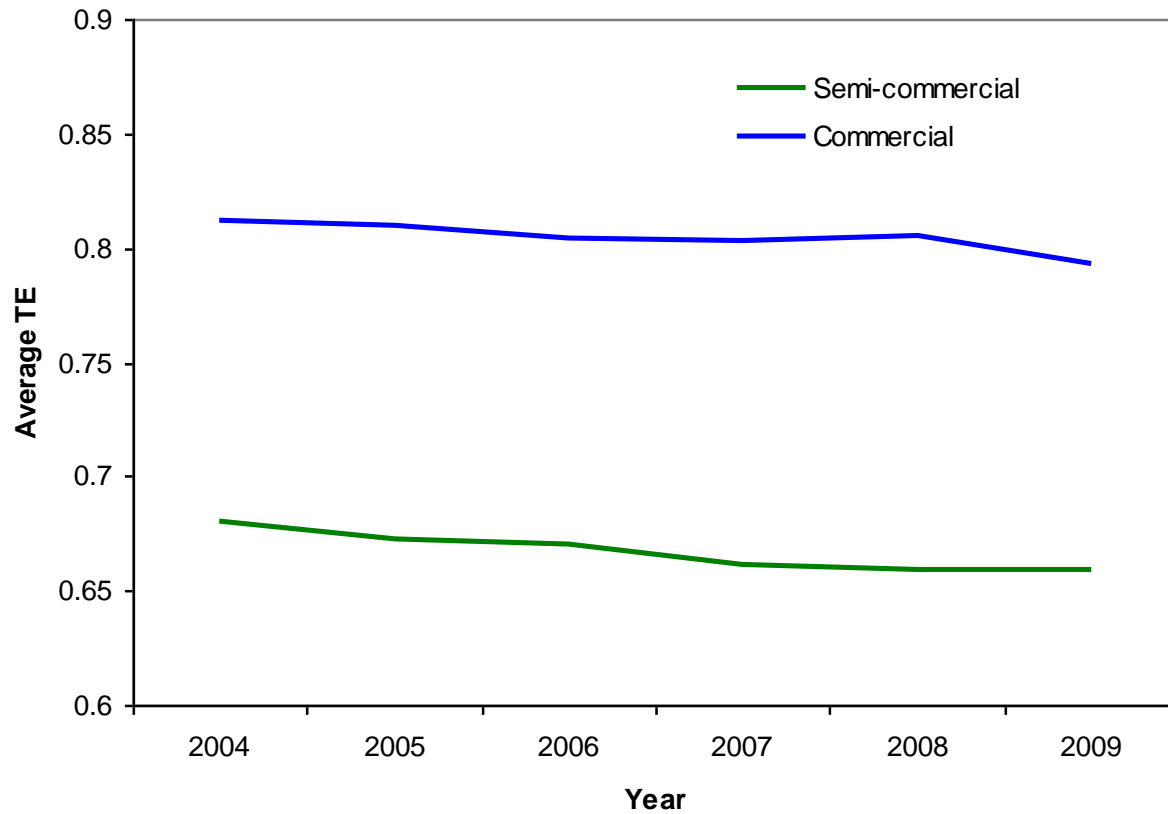
- Assume cost per tender day of TVH same as estimated cost per day of commercial TIB tender (and ignoring fixed/capital costs)
- Av price 2009 \$19.30/kg for TIB semi and \$19.80 for TVH and TIB commercial



# Marginal value of quota?

- Given effectively constant returns to fishing effort of the TVH (and constant marginal costs), then the marginal value of quota could be similar to the average value
- TIB commercial fleet currently unconstrained so marginal value of additional quota likely to be zero
  - TVH boats likely to want to buy/lease quota from TIB fleet if quota is constraining
- But more semi-commercial could become fully commercial
- Based on average value of quota, more catch taken by more commercial TIB boats could potentially produce greater benefits than more TVH boats
- Potential for further (technical) efficiency increases in semi-commercial fleet which would also increase profitability

# Average technical efficiency of TIB fleet



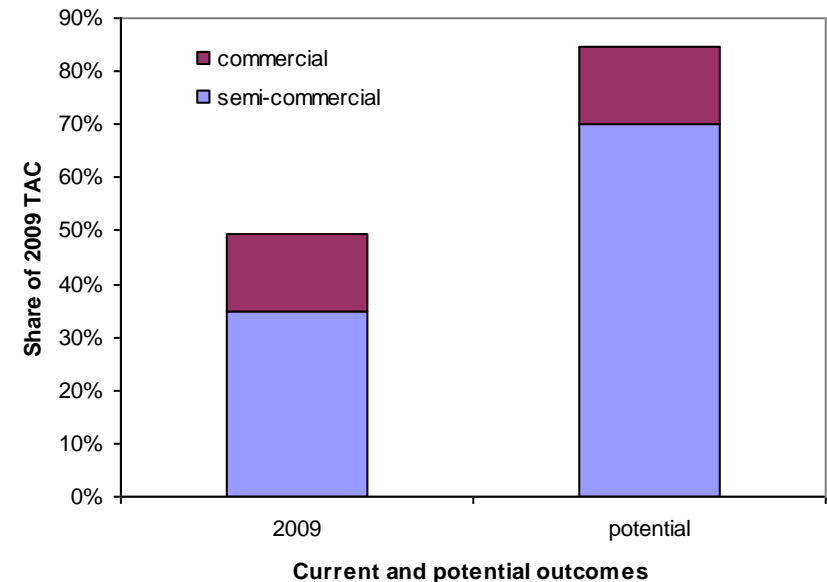
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# How much more could the TIB fleet take?

- Increased the days fished of the semi-commercial by

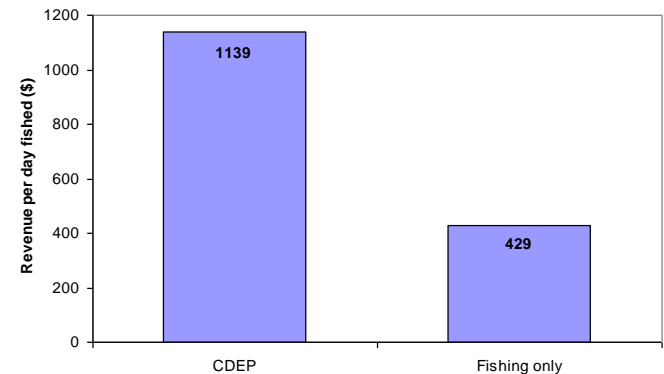
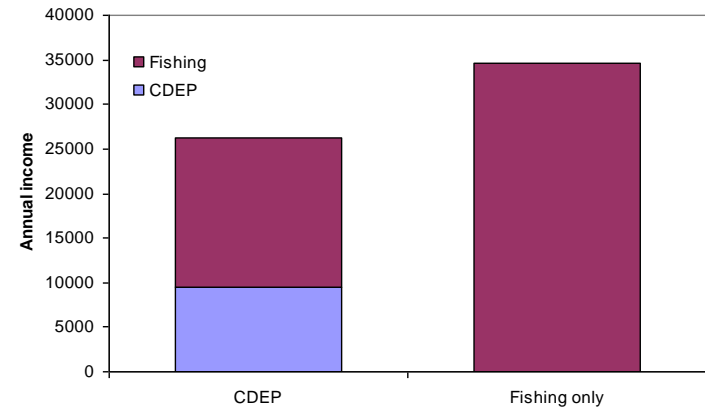
$$newdays_{semi} = days_{semi} \frac{av.days_{commercial}}{av.days_{semi}}$$

- Re-estimate the catch of each vessel given increased effort
- Assumes no additional boats enter the fishery
- Ignores potential efficiency increases by semi-commercial fishers
  - If this also increases then TIB fleet could potentially take the entire quota

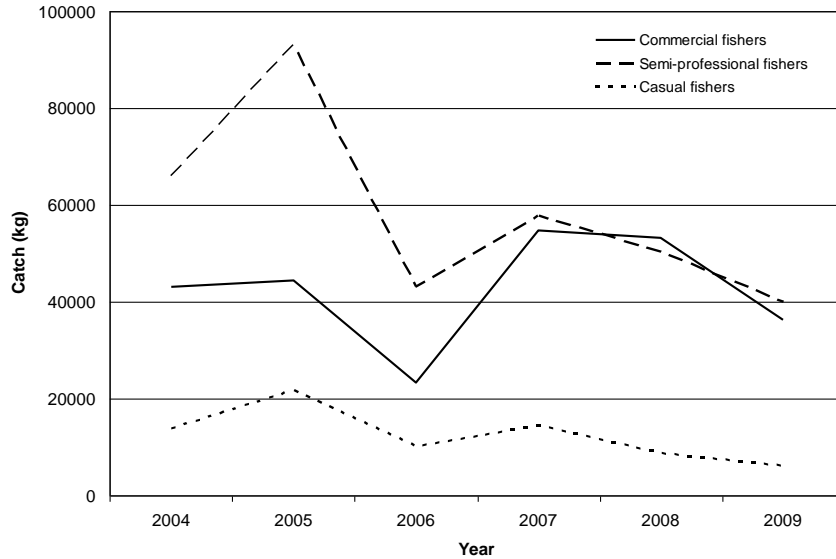


# Would the TIB fleet increase effort?

- Most semi-commercial fishers participate in CDEP Program
- Allows them to earn additional income (around \$20k) without loss of CDEP payments
  - Little incentive to fish full time
- CDEP being replaced in June 2011 with “normal” jobseeker allowance
  - Greater restrictions on additional earnings
  - Semi-commercial fishers will need to either give up fishing or go full time

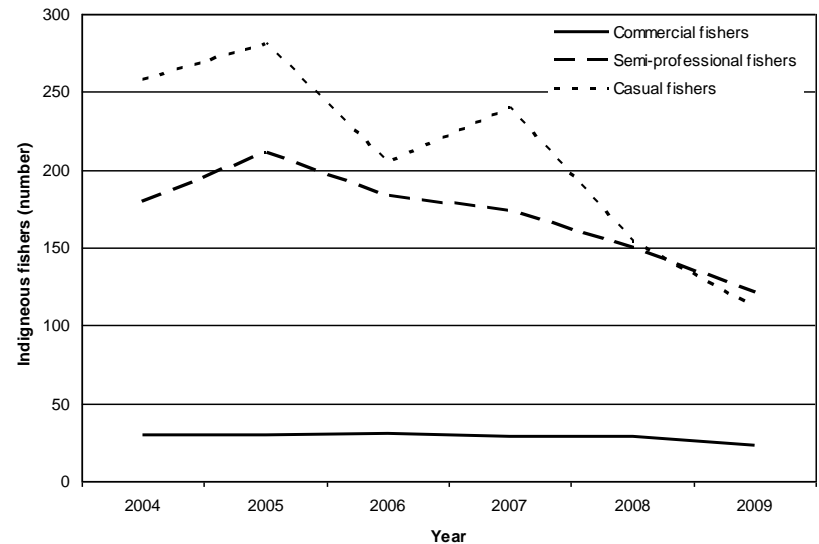


# Latent capacity in TIB fleet



## Total catch

## Participation



# Conclusions

- If the management system was based on effort controls (days fished) then allocating more days to the TVH fleet would be optimal
  - However, the system is moving to output controls
- Potential to increase total economic benefits if more quota is allocated to TIB fleet
  - But only if the semi-commercial vessels become fully commercial
  - No real benefit for current commercial vessels to have more quota
- Removal of the CDEP program likely to create incentives for more semi-commercial TIB vessels to become commercial
  - TIB fleet could potentially take 80% of the current TAC
    - More if increased efficiency
  - No control on this sector at present

# But ...

- **Caveats**

- Many processors linked to TVH vessels
- TIB fishers benefit from freezers and infrastructure provided by these processors
- Quite a few assumptions!!!
- Poor quality data

- **Other issues for further thought**

- Could an ITQ system work for the TIB fleet?
- Implications of a competitive TAC?

