

## Managing For Profit – Northern Prawn Fishery case study

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# Outline

- Northern prawn fishery
  - First fishery to have maximum economic yield (MEY) as explicit management goal
  - Bioeconomic model used to set effort targets and to be used to set TACs
- MEY in theory
  - The basics
- Implementing MEY in the NPF
  - Theory hits reality

# Northern prawn fishery

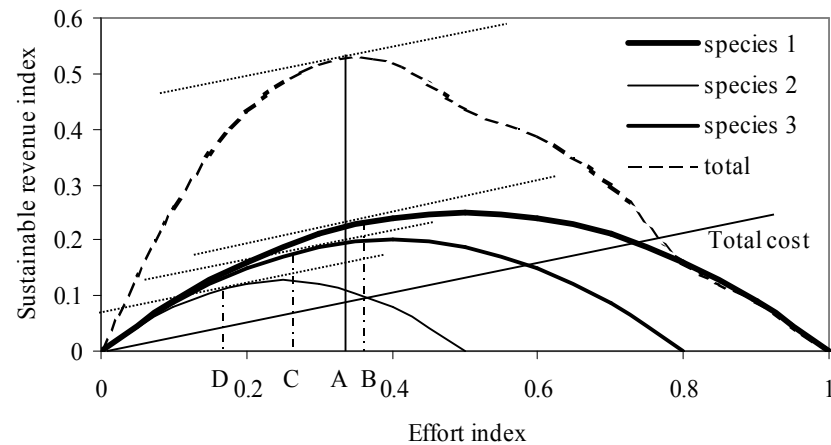
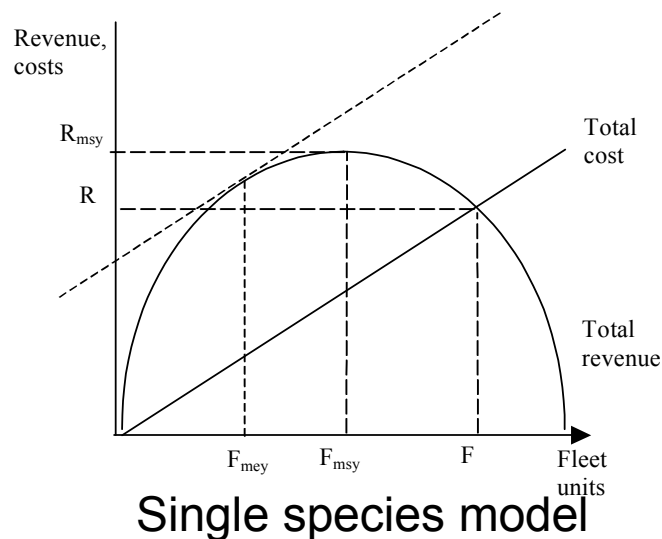


- One of Australia's most valuable Commonwealth managed fishery
  - \$64m-\$150m value of landings
  - Value fallen in recent years due to falling world prawn prices
  - Profits further impacted by increased fuel costs
- Currently around 51 boats
  - Peak of >300 vessels in early 80s
- Three main species (groups)
  - Banana prawns; tiger prawns; endeavour prawns
  - Plus king and other prawns
- Managed through seasonal closures and restrictions on headrope length
- Proposed to go to ITQs
  - Which species still to be decided
- Management has an explicit objective of maximum economic yield
  - First fishery in Australia and one of the only in the world



# Maximum economic yield (MEY)

- Theoretically a simple concept
  - MEY is a combination of both optimal catch AND effort
- Expounded by economists worldwide as THE objective of management
  - Maximum industry profits, (generally) higher stock sizes (more resilient), fewer environmental impacts (as lower levels of effort)
- Theoretical models based on a single species fishery, but some work also on multispecies fisheries



# Extending it to a dynamic concept

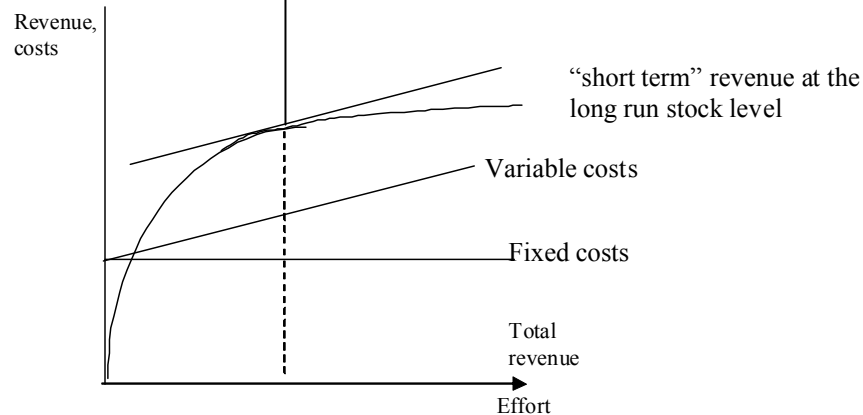
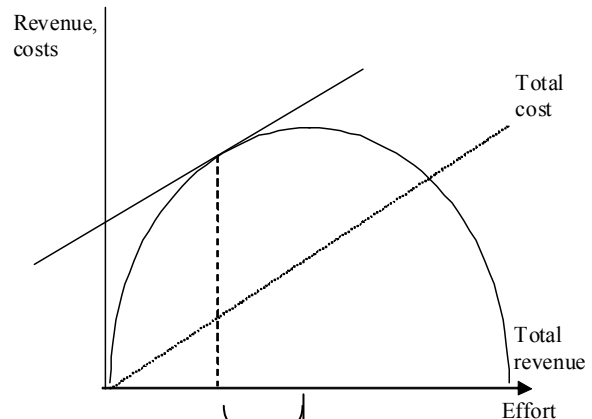


- **Mathematical (theoretical) modelling in the late 1970s and 1980s extended the theoretical context to a dynamic framework**
  - Took into account the time stocks take to recover
  - Essentially estimated the effort and catch trajectory that maximised profits over time
  - Still assumed a single fleet and single species fishery
  - Considered effects of changing prices over time and also problems of lack of alternative uses of vessels
- **Relatively few dynamic bioeconomic models developed over the last two decades**
  - Those that did maximised discounted profits over time
  - Generally assumed prices and costs remained constant in real terms
    - Generally assumed all costs variable (including capital costs)
  - Not really used for direct policy advice, more illustrative

# Theory hits reality – implementing MEY in the NPF

- MEY is a long term concept, yet management planning horizons are – at best – medium term (and often relatively short at that)
  - management object to achieve MEY by 2014 in the NPF
- Theory (and most previous models) assume all costs are variable
  - In the short to medium term have a mix of fixed, variable and “quasi-fixed” costs (i.e. that have a mix of both fixed and variable attributes).
  - The theory doesn’t give guidance on how to deal with these
- The optimal effort trajectory and catches depends on future prices and costs
  - But these are lively to change so need accurate forecasts
- We are “stuck” with the fleet we have, and they are stuck in the fishery
  - No alternative use, so can not dramatically cut fishing effort even if it appears desirable

# Impact of cost assumptions – an example



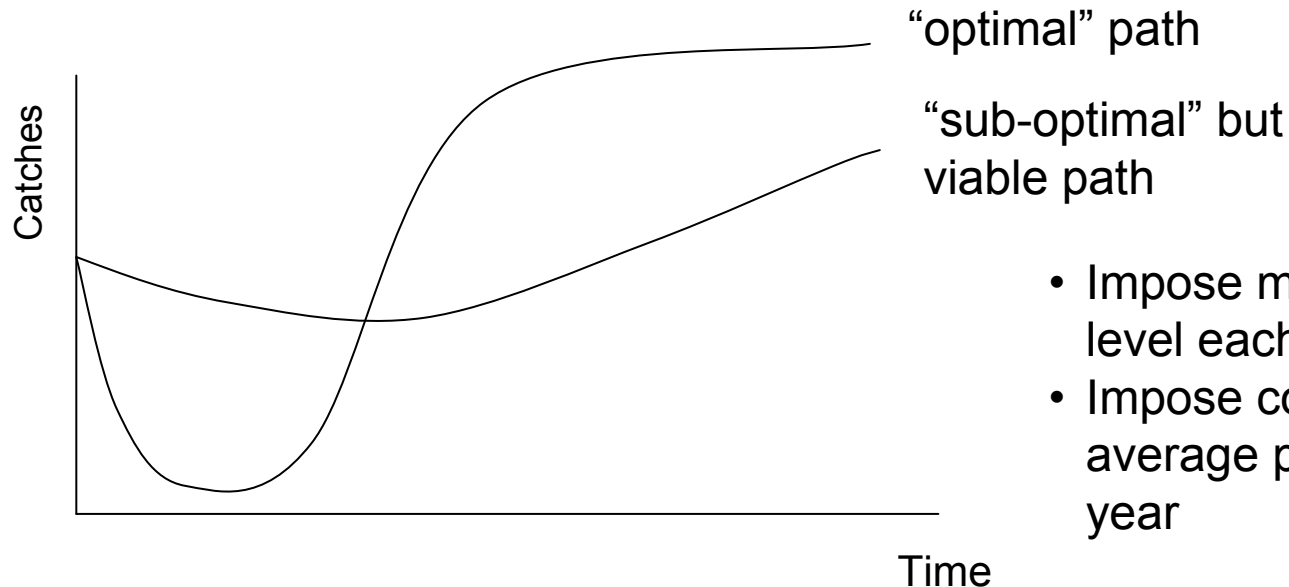
In the longer term may be optimal to have a smaller fleet

- Assumes fleet can fully adjust

But in the short to medium term (when the fleet is less flexible), it may be optimal to have a larger fleet – even given the same stock conditions

# Maintaining short term viability of the fleet

- Most vessels do not have an alternative use in the short to medium term
- While the short run viability condition is that revenue exceeds the variable costs, having a whole fishing fleet making losses is undesirable in the short term
  - Particularly if the losses are expected to accrue for several years



- Impose minimum effort level each year (ad hoc)
- Impose condition that average profits  $> 0$  each year

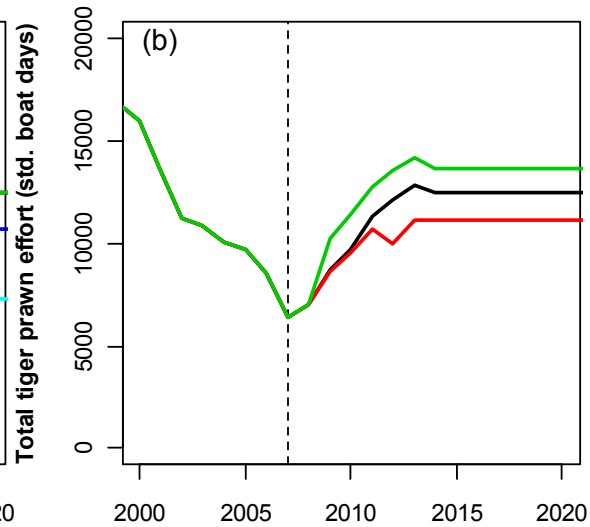
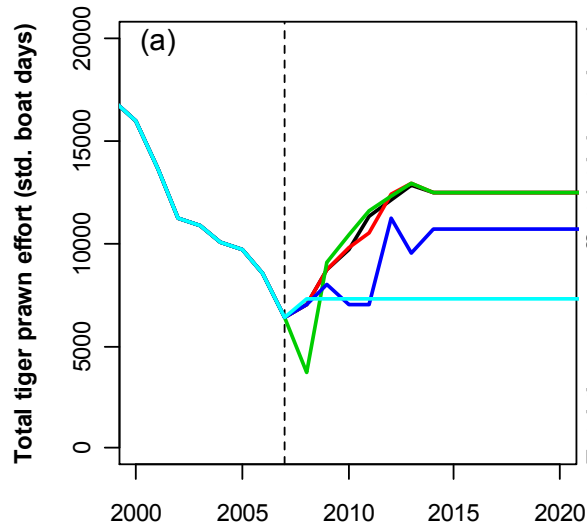
# Bioeconomic model overview



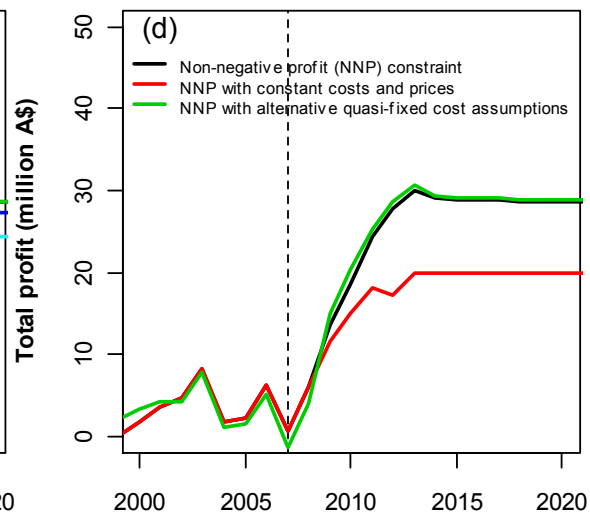
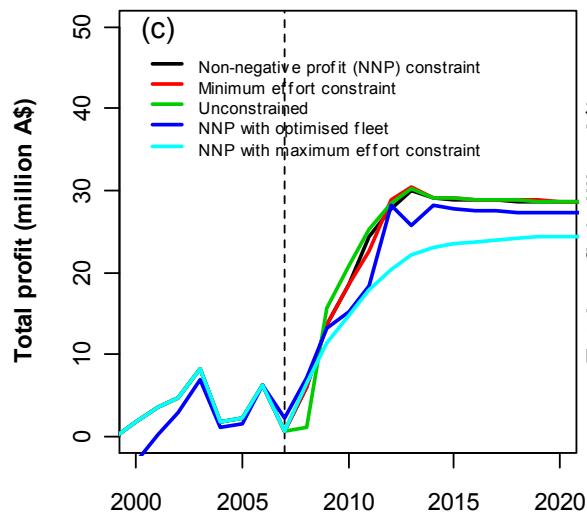
- Used to set effort levels and being modified to look at TACs
- Dynamic with an 8 year time frame
  - 2007-2014 based on management object to achieve MEY by 2014
- Limited to tiger prawn fishery only
  - Three species (two tiger prawn and one endeavour)
- Includes two fleets that apply effort differently to the two tiger prawn stocks
- Initial model has a single price for each species (that varies over time)
  - Latest version of the model is size based and has different prices for each size grade
- Both fixed and variable costs are included in the model
- Prawn prices and fuel costs forecast to 2014
- Minimum restrictions placed on fishing activity

# Which MEY? – not a unique yield or trajectory

Different assumptions about effort constraints



Different assumptions about prices and costs



# MEY in a changing financial environment



- Reliant on forecasts of prices and costs
  - Even the best forecasts are likely to be out due to unforeseen events (e.g. financial crisis)
- Achieving the trajectory is also difficult
  - If not on the optimal trajectory then a new trajectory will be necessary
- MEY will need to be constantly re-assessed as events and expectations about future events change
  - A constantly moving target
- NPF – decision to re-estimate the effort trajectory (and associated catches) every two years
  - Provide some “stability” in the fishery for short periods

# Other considerations



- **Industry buy-in is essential**
  - Greater uncertainty than under MSY-type targets
  - Agreement needs to be reached as to which assumptions to base the trajectory on
    - And how often it is to be re-estimated
  - Data requirements are also greater and requires industry cooperation in supplying price and cost data
- **Appropriate management instruments need to be available to help the fishery get onto the optimal trajectory**
  - Industry buy-in to this management system is also essential if it is to succeed.
- **A co-management environment is most likely to be successful for both these reasons**

# Key lessons



- **MEY introduces additional complexities**
  - It is a moving target that will depend on unknown future prices and costs
    - Work is continuing to look at harvest strategies that may reduce some of the uncertainty
  - It requires an appropriate set of management instruments to enable it to be achieved
- **It requires commitment by both managers and industry**
  - Co-management and a strong, unified industry commitment is essential
- **The NPF and CSIRO are pioneers to a large extent in going down this route and are all on a steep learning curve**
  - The lessons learned will be of great value to other fisheries
- **However, the potential pay-offs – economic and environmental – may be substantial**