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Simulation Modelling of ITQs on the Great Barrier Reef Line Fishery

Rich Little
DEST workshop
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Coral Reef Fin Fish Fishery GBR



- **Multi-species (>100)**

- >50% catch
- Secondary target

- **Rod and hand-line on baited hooks**

- **3 Fleets**

- Commercial ~400 vessels (1300t CT, 700t RTE)
- Charter (70t, 50t)
- Recreational (550t, 450t)

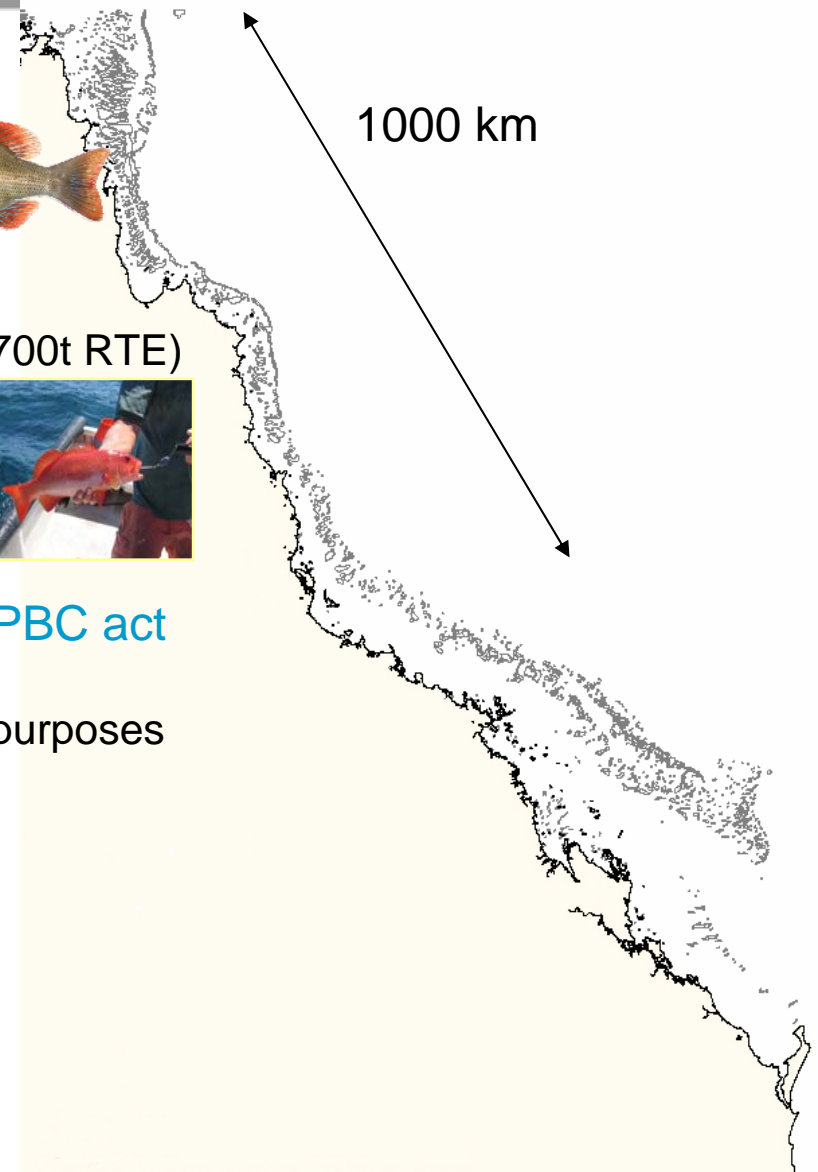
- **50 M AU\$**

- **Fishery is in the GBR WHA – federal EPBC act**

- GBRMPA
- System of MPAs used for conservation purposes
- Prior 2003 ~16%
- After 2003 ~ 32%

- **Managed by state of Queensland**

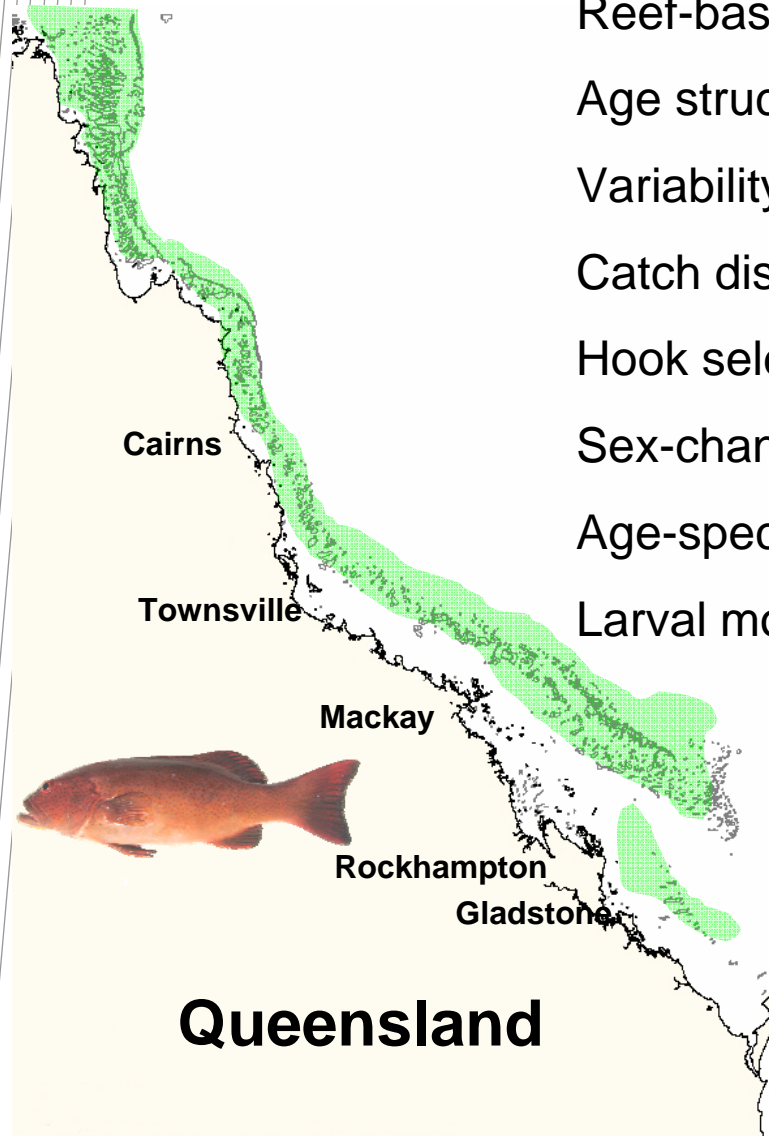
- Management by Queensland DPI&F
- Prior 2004 input controls
- After 2004 ITQ system



Management Strategy Evaluation

- ELFSim :
- Effects of Line Fishery Simulator
 - model to explore and evaluate management strategies for coral trout and red throat emperor
 - main submodels: biology, fishery, management intervention
 - time step: variable, currently one month due to data limitations

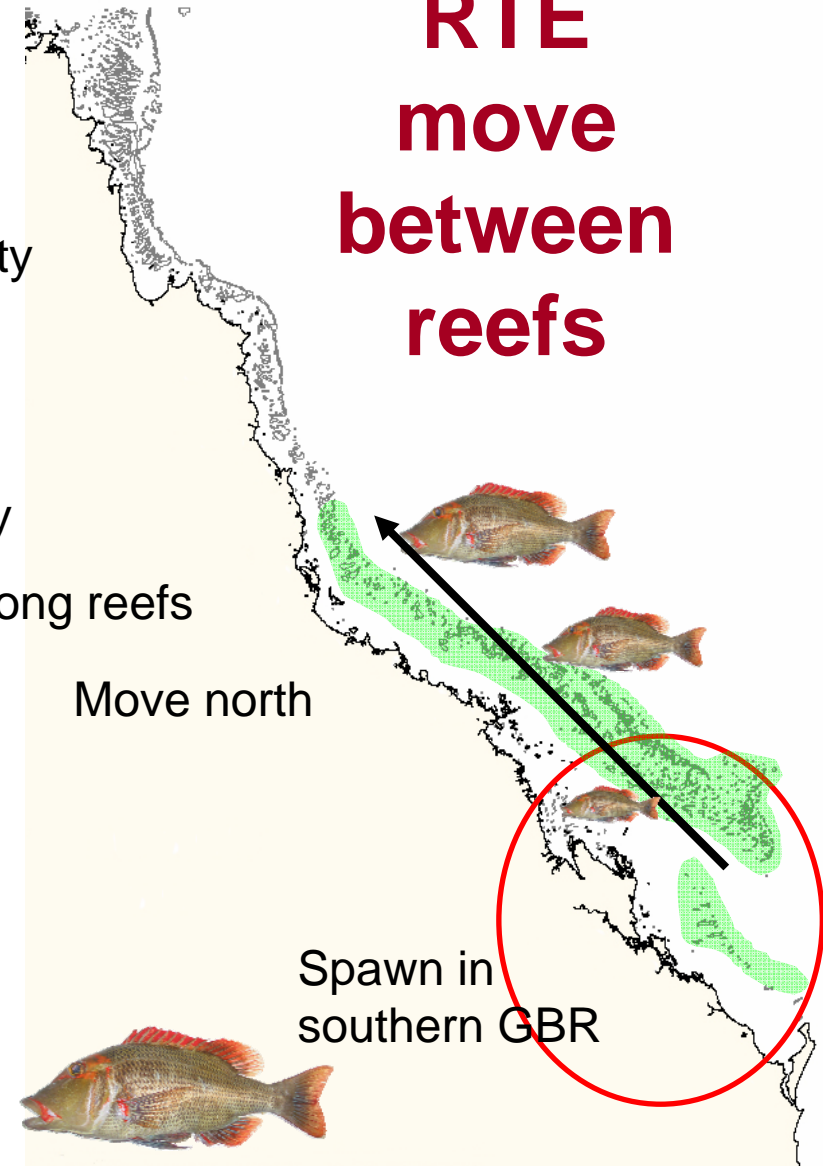
Biological models



Queensland

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- Reef-based
- Age structured
- Variability in growth
- Catch discard mortality
- Hook selectivity
- Sex-change
- Age-specific fecundity
- Larval movement among reefs



**RTE
move
between
reefs**

Move north

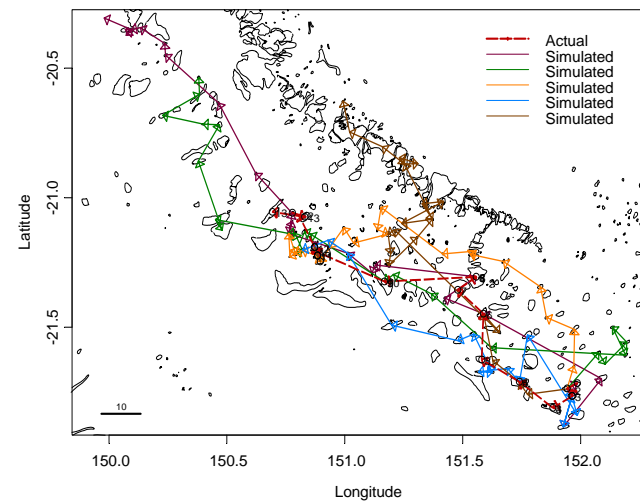
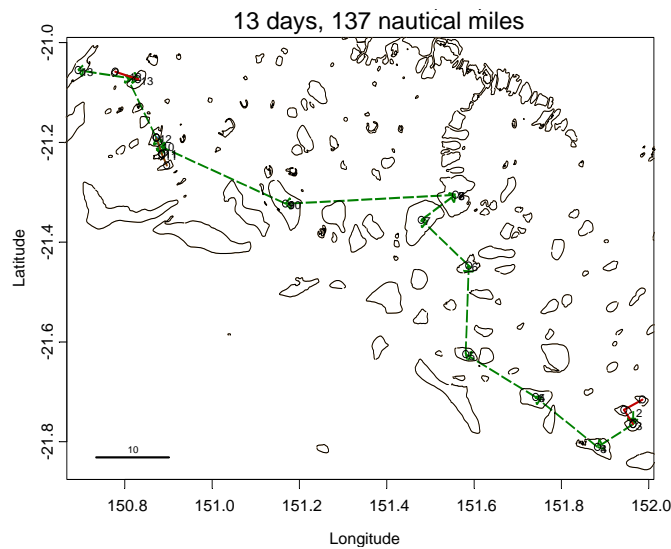
Spawn in
southern GBR

Vessel dynamics model



Effort is assigned to reefs by individual vessel

- Vessel fishing behaviour is governed by a Random Utility model



Vessel decision factors

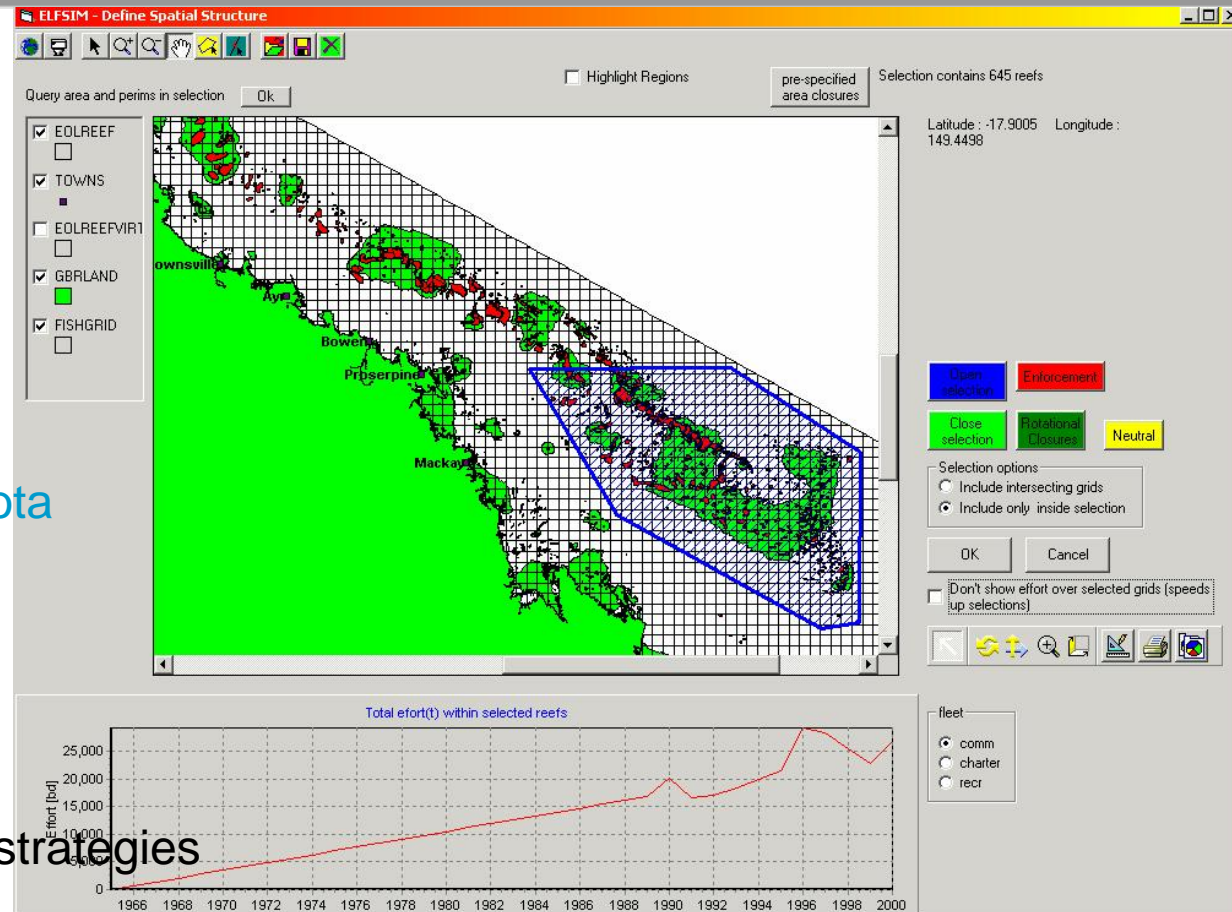


- Deciding to move
- **Daily catch**
- **Reef size (perimeter)**
- Selecting a reef
- **Distance to the reef**
- **Bearing**
- **CT and RTE catch in same month previous year**
- **CT and RTE catch in last month**
- **CT and RTE CPUE in same month previous year**
- **CT and RTE CPUE in last month**

Management model



- Management tools:
- Area closures
- Effort levels
- Min. Legal Size
- Gear Selectivity
- Spawning closures
- Commercial catch quota with I(T)Q



Feedback management strategies being developed.

Assessment model is implemented.

ITQ model



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Quota:

Profit:

$$\text{\$10 / fish} - \text{\$8} = \text{\$2 / fish}$$

$$\text{\$10 / fish} - \text{\$5} = \text{\$5 / fish}$$

Net Profit:

from catching quota

$$5 \text{ fish} \times \text{\$2 / fish} = \text{\$10}$$

$$1 \text{ fish} \times \text{\$5 / fish} = \text{\$5}$$

Decision:

Would make more profit
by selling quota at $> \text{\$2}$

Would still make money
by buying quota at $< \text{\$5}$

Agreed price:

$\text{\$3.25}$

Quota:

0

6

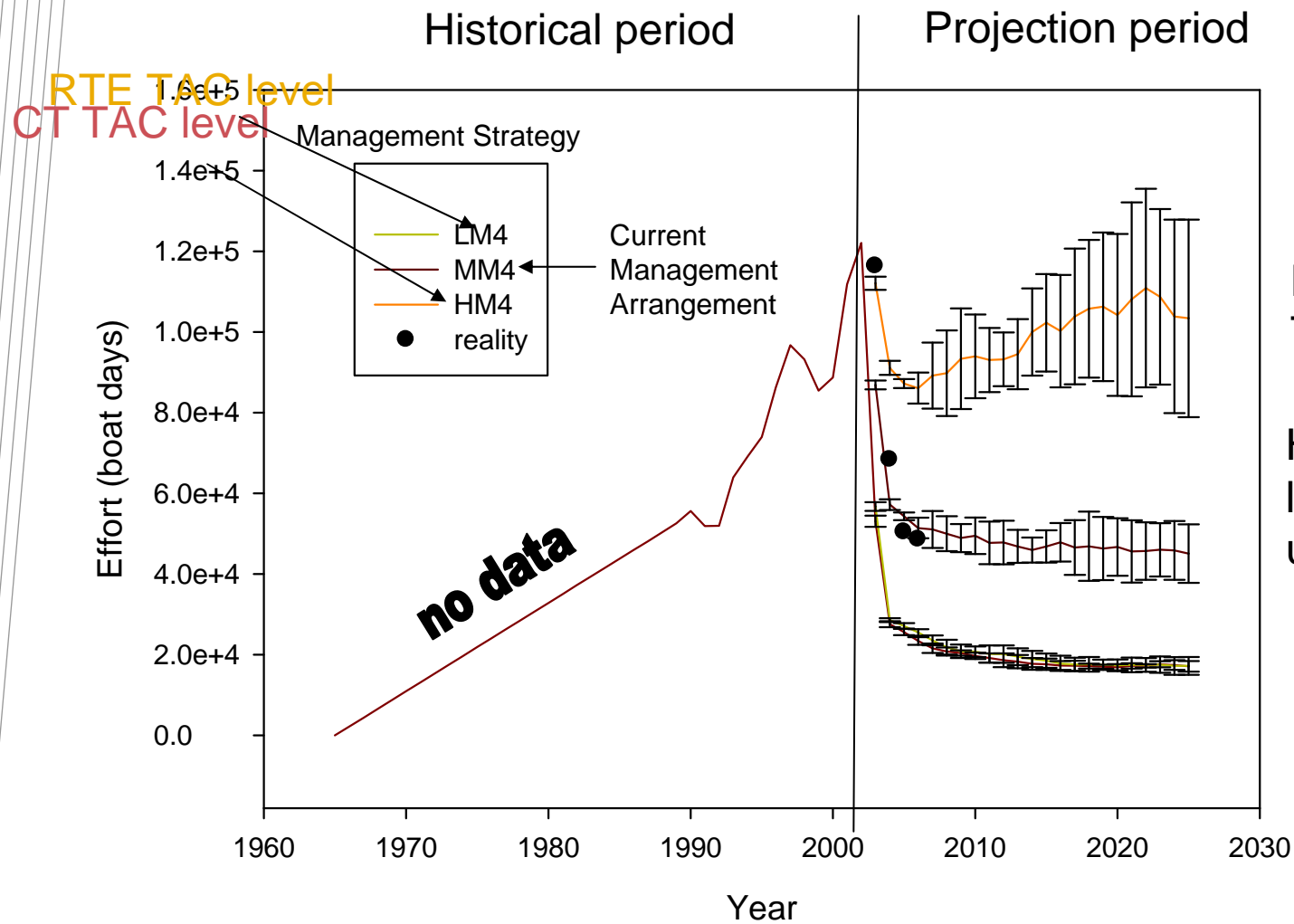
Net Profit:

from trading

$$5 \text{ fish} \times \text{\$3.25 / fish} = \text{\$16.25}$$

$$6 \text{ fish} \times \text{\$5 / fish} - \text{\$16.25} = \text{\$13.75}$$

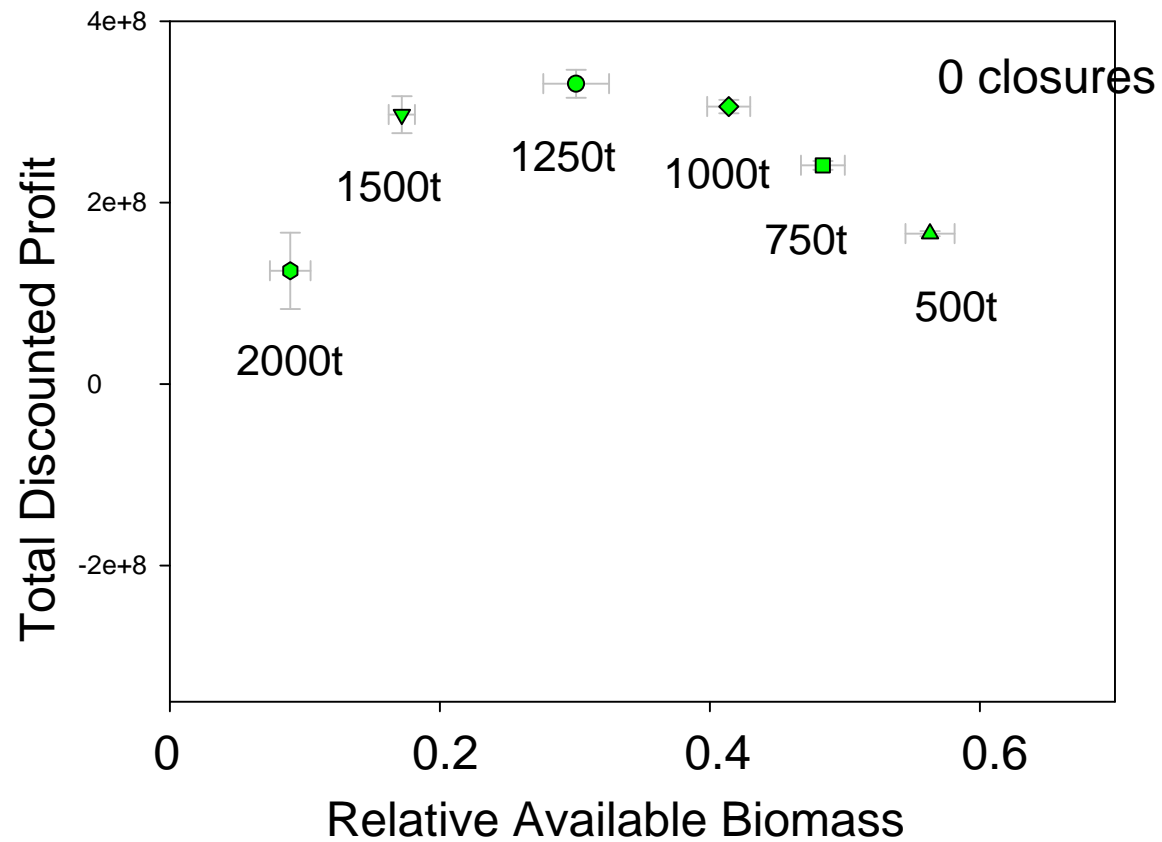
Long term projected effort



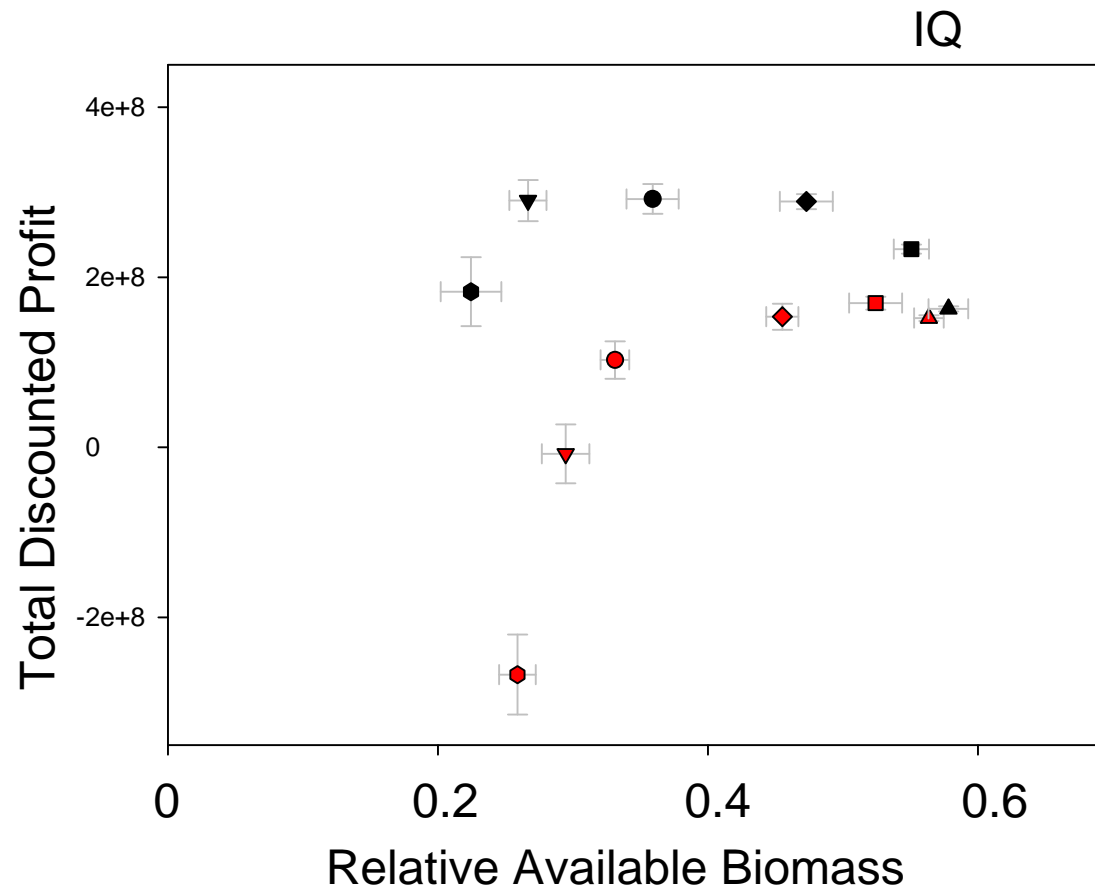
No effect of RTE TAC level

Higher CT TAC leads to higher uncertainty

ITQs and spatial closures



ITQs and spatial closures



Collaborators



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