Hyperstability in Fishery Dependent data

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FRDC 2017-026
Catch Rate is our index of Biomass

Fisheries worldwide:
• rely on catch rate as an index of stock abundance
• Acknowledge relationship might not be linear, but assume is linear

1 Unit Increase in Biomass = 1 unit increase in Catch Rate


Original Article

Correcting density-dependent effects in abundance from bottom-trawl data

A mechanistic understanding of hyperstability in catch per unit effort and density-dependent catchability in a multistock recreational fishery

Hillary G.M. Ward, Paul J. Askey, and John R. Post
Hyperstability in Catch Rates

Drivers of Hyperstable catch rates in Abalone fisheries?

- Increased swim rate
- More frequent movement – drops/day 

- Always mentioned
- Never Quantified
- Rarely accounted for (even conceptually)

Spatial properties
Consequences of hyperstability

Fisheries worldwide, if hyperstability acknowledged, is suggested to follow a power function e.g.

\[ \text{1 Unit Increase in Biomass} = \text{1 unit increase in Catch Rate} \]
Methods: e-Data project (10 year time-series)
Methods: Spatial metrics from dive polygon

Characterise each unique dive event (duration, area, length)
Methods: statistical model

Linear Mixed Effects Model(s):

\[ CPUE \sim Year + Month + SubBlock + Diver_{Id} \]

Effort \sim offset(catch) + Year + Month + SubBlock + Diver_{Id}

Where Effort is;
1. Dive area (hectares)
2. Dive length (metres)
3. Logger Dive time (hours)
4. Logbook Dive time (hours)

Fitted model used to predict relative effort required to harvest 100Kg
e-Data project – Hyperstability of effort

Case Study: Block 6
Case Study: Block 21

- CPUE
  - Method: Crude
  - Method: Standardised

- Relative increase
  - Factor (method): K_Area
  - K_Distance
  - K_Time
  - L_Time
Conclusions

1. Hyperstability occurs at both low and high stock level
   - high/low not symmetrical

2. GPS and Depth data logger program is capturing changes in fisher behaviour of a spatial nature

3. Geo-Spatial data capture the relative change in Search Time vs Handling Time
Outcomes

Geo-referenced fishery data provide;

1. A robust defence of precautionary measures built into the Tasmanian Empirical Harvest Strategy

2. An opportunity to adopt area based metrics for catch rates

3. Motivation for inclusion of hyperstability into MSE (see next talk by Haddon)