Hind-casting the quantity and composition of discards by mixed demersal fisheries in the North Sea

Michael Heath and Robin Cook
Department of Mathematics and Statistics, University of Strathclyde
Discarding: the evidence

Campaign Impact: Campaign impact on decision makers

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Half of all fish caught in the North Sea are thrown back overboard.
Most discard studies limited to a few years, fleets or areas

Comprehensive data exist for a few abundant species e.g. cod, haddock, whiting, plaice, and sole [the “reference species”]

Can we get estimates for other species over a long period using survey data?
Biomass index ~ Catch

Discards = Blue + Red
Landings = Green
Model outline

\[ d_{i,t} = q_t c_{i,t} + (1 - q_t)(1 - r_{i,t})c_{i,t} \]

\[ c_{i,t} = F_t B_t s_i \pi_{i,t} \]

\[ D_t = u_t Q_t \left( \sum_{l_{\min}}^{l_{\max}} s_{l} \pi_{l,t} + (q_t - 1) \sum_{l_{\min}}^{l_{\max}} r_i s_{l} \pi_{l,t} \right) \]

- \( d \): discard at length
- \( c \): catch at length
- \( q \): bulk proportion discarded
- \( r \): proportion retained
- \( i \): length class
- \( t \): year

\( F \): harvest fraction
\( B \): biomass
\( \pi \): proportion of biomass at length
\( s \): fleet selectivity

\( D \): total discards
\( u \): biomass index
\( Q \): survey catch ratio
Parameters to estimate

- Commercial selectivity, $s$
- Discard size selection, $r$
- Bulk discarded, $q$
- Survey catch ratio, $Q$

Data available

- Survey index of biomass at length
- Total landings in weight
- Total discards in weight (reference species only)
Methods

1. Fit model to reference species and estimate $s, r, q$ and $Q$
2. Using parameters from reference species fit model to biomass index and landings data for other species to estimate discards
3. Cross validate model on reference species omitting discard data (i.e. re-estimate discards from landings and biomass index only)
4. Compare the estimated proportion discarded with ad hoc studies to ground truth the model
Cross-validation with no discard data
Comparison with *ad hoc* studies

- Reference species
- Other species
- ± standard deviation
- One-to-one line
Total Quantity related
Summary

- Total discards are declining and currently in the region of 150,000t.
- Proportion of catch discarded relatively unchanged since 1985 and represents about 35% of the catch.
- Declining weight discarded is a reflection of declining catches, not a change in discarding behaviour.
- Most discarding can be explained by size selection rather than bulk discarding.
- Plaice and dab are the most heavily discarded species followed by cod, haddock and whiting.
- Gurnards form an increasing fraction of total discards.
Model fit to reference species