Reducing Greenhouse Gas Emissions from Fishing

Conor Byrne (PhD Student), Professor Brynhildur Davíðsdóttir (Supervisor)

UNIVERSITY OF ICELAND

GreenMAR
GREEN GROWTH BASED ON MARINE RESOURCES: ECOLOGICAL AND SOCIO-ECONOMIC CONSTRAINTS

Goals

The project aims to analyse the drivers of Greenhouse Gas (GHG) emissions and identify policy options to reduce them.

The project comprises three elements:
1) Study of historic oil consumption by the Icelandic fleet, at the vessel and catch level, to quantify trends and drivers of oil use.
2) Evaluation of specific policies to improve efficiency (fuel-specific and general) within an ITQ-based fishery.
3) Viabliity study of a sustainably-fueled fishing industry, based on a stylised economy without fossil fuels.

Oil Consumption of Icelandic fishing vessels

Fleet fuel efficiency will be analysed at the vessel and catch level in order to quantify the relative importance of a range of influencing factors. The study will be based on data from a representative sample of vessels over a 5-year period.

Data

Public
- Vessel registry
- Trip catch, gear, quota
- Stock levels
- Fish, oil prices

Confidential
- Oil Consumption
- Haul catch, gear
- Location, conditions

Fuel Per Unit Catch
- **by species, gear**
- **Mass, Value**
- **FPUE x EPUC**

Questions
- Benchmark other fleets.
- Vessel effects including vintage, ownership, engine refit.
- Annual trends – stock effect, technical creep
- Seasonal effects – race to fish, stock, avoidance.
- (Search behaviour)
- (Infra-marginal rent)

Green growth relevance: highlight pressure points to reduce GHG

Policy (1): Fuel efficiency and rebound under ITQ

A criticism of fuel efficiency policies is the Rebound Effect, whereby efficiency gains are offset by increases in throughput:
- **Price effect – lower unit costs lead to higher industry output**
- **Substitution – change production process to use more fuel**
- **Macro effect – savings are spent elsewhere in the economy**

This study asks if ITQ fisheries are relatively immune to rebound effects, and therefore attractive targets for fuel efficiency policies:
- **Fuel-intensive ➔ significant potential saving**
- **Fixed total output ➔ low price effect**
- **Fixed vessel share ➔ low price effect, less competitive pressure**

The study will use the following methods:
- **Analytical model of rebound effect with and without ITQ system**
- **Empirical analysis: impact of engine refits on efficiency/consumption**
- **CGE model: quantitative estimation of net gains**

Green growth relevance: Policy to reduce GHG impact

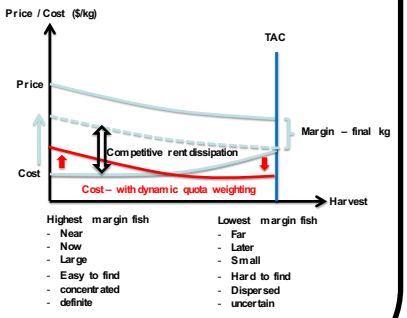
Policy (2): Dynamic quota weighting and race-to-fish

The study will evaluate a policy to reduce rent dissipation in ITQ systems due to incomplete delineation of property rights. The dissipation takes the form of an intra-season race to catch the most profitable fish.

The proposed solution involves scaling quota according to time and/or cumulative harvest.

A theoretical model will be explore the relevance of this policy for different types of fishery.

If possible, the model will be extended to 2 interacting (predator/prey) stocks.



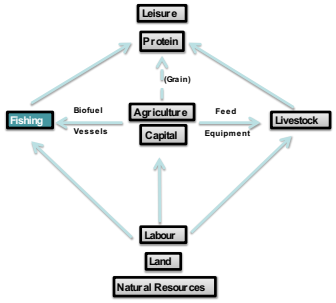
Green growth relevance: Policy to reduce GHG, grow rent

Viability of sustainably-fueled fishing industry

A model economy will be used to establish the circumstances under which a fleet powered by biofuels can compete with land-based sources of protein.

A social planner maximises utility given certain resource endowments and production functions, yielding an optimal mix of production sectors.

The impact on sector mix of different relative endowments, marginal productivity, and preferences will then be assessed and compared to actual cases.



Green growth relevance: Long-term routes to sustainability

Policy (3): Public catch data and information efficiency

Fish presence data is a public goods problem which can lead to reduced fleet efficiency through duplicated effort or free-riding. Typical solutions only partially eliminate duplication (clubs) or require central co-ordination (co-operatives).

The study presents compulsory sharing as a policy alternative:
+ fully eliminate duplication
+ decentralised
+ enables other approaches to prediction (non-local, X-species)
+ Specialisation
- disincentive to search
-/+ increased congestion

A multi-player, two-species, stochastic ITQ fishery will be modeled. Players will optimise expected profits based on knowledge of historic catch data. Efficiency will be evaluated under three information regimes (1) private, (2) club, and (3) compulsory sharing. Sensitivity of the results to differing stock characteristics will be tested.

Green growth relevance: Policy to reduce GHG, grow rent

How realistic are expectations of ITQ profitability ?

The potential reward for efficient fishery management has been estimated at 60-70% of revenue. In contrast, one of the most frequently cited examples of efficient management, the Iceland ITQ system, has delivered EBITDA margins of 20-25% in recent years.

The study will investigate potential reasons for this apparent gap in performance by comparing the assumptions supporting the above estimates with historic data:
- **Operating Environment (regulatory, biological, macro, market)**
- **Industry Dynamics (value chain, competitive pressure, barriers)**

Based on this analysis, the study will suggest if there is indeed a performance gap and, if so, how it could potentially be bridged.

Green growth relevance: insight into key management option