Real-case exploration of the RTI (Real-Time Incentive) tariff-based fisheries management approach for the mixed groundfish trawl fishery in the Western Baltic Sea

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Summary
The recently proposed ‘Real-Time Incentive (RTI)’ fisheries-management instrument replaces catch/landings quotas and days-at-sea limitations with a single ‘quota’ of fishing-impact credits (‘RTIs’). According to this concept, fishing mortality rates of multiple species and impacts on the ecosystem are regulated through a single ‘currency’. Fishers can fish where and when they want and spend their allocated RTIs according to spatio-temporally varying tariffs. Managers set the tariffs based on agreed target mortality rates of multiple species, using knowledge of the spatio-temporally varying catchabilities of the various species caught/impacted in a mixed fishery. Previous studies proved conceptual RTI performance under various simulation scenarios. We now propose real-case exploration of the RTI approach as a fisheries-management tool in the specific case of the German mixed groundfish trawl fishery in the Western Baltic Sea. The concept is explored for its capability to fulfil the requirements of ecosystem-based fisheries management (EBFM): maximization of sustainable yield while maintaining good environmental status (GES) according to the Marine Strategy Framework Directive (MSFD). Since RTI performs at a fine spatio-temporal scale and incorporates ecosystem targets it is able to meet these criteria more appropriately than traditional single species fisheries management focusing on relatively large management units and time scales.

Introduction
RTI (Real-Time Incentives) has been proposed as simple fisheries management system integrating multispecies fisheries targets and ecosystem objectives into one spatiotemporal ‘currency’ for management measures (Kraak et al. 2012). In this approach, fishers would be allocated fishing-impact credits, called RTIs, to spend according to spatio-temporally varying tariffs, replacing the conventional landings quotas and days-at-sea limitations. RTI-quota could be based on multiple commercial stock and ecosystem targets while tariffs could be updated, e.g. based on real-time data from vessel monitoring system (VMS) and logbooks. The approach does not prescribe and prohibit since fishermen could dynamically choose how to spend their RTIs. But since the costs of fishing are internalized and have to be “paid” by fishers this creates incentives for “good behaviour”. The current real-case exploration of RTI focuses on the specific case of the groundfish trawl fishery in the Western Baltic Sea. This is a mixed fishery with cod as target species and flatfish as a (sometimes valuable) bycatch. The most important flatfish bycatch species is plaice, a potential choke species, and flounder, the most abundant flatfish in terms of biomass but without quantitative assessment. In the data exploration work package (WP1) it will be investigated if spatial patterns of the fishery’s catches are recognizable and if consistent seasonal patterns are present. This will be compared to species distribution from survey data to see if catches match species occurrence. If not this might be an indication for high unreported bycatch rates. The multispecies work package (WP2) will explore how RTI might cope with the potential choke species problem of Baltic plaice, how it might change current discard practices, and how adaptive spatio-temporally resolved management of the two Western Baltic cod sub-stocks and its reproductive units could be carried out by RTI. Within the application-oriented work package (WP3) the potential of RTI to deal with case-specific details will be discussed in consultation with the fishing sector. Furthermore the merits of RTI will be analysed as a full Management Strategy Evaluation (MSE)-type simulation study.
Materials and Methods

We are at the start of this project (WP1); WP2 and WP3 are not planned in detail yet. As a basis of the RTI concept the management area is divided up into “cells” each having a certain “cost” applied to fishing in that cell. These tariffs are shown on colour-coded tariff maps. They are set by managers based on agreed targets for fishing mortality using knowledge on spatio-temporally varying catchabilities. This knowledge could come from historical information of landings per unit of effort (LPUE). Therefore in a first step an initial “heat map” is created using data from the last years showing mean LPUE per grid cell relative to the mean LPUE of all grid cells fished with a defined minimum amount of effort. The relative LPUE is divided into six arbitrary classes, e.g. 0–0.1, 0.1–0.5, 0.5–1, 1–2, 2–5, and >5 times the mean LPUE, which can be translated into RTI tariffs, e.g. of 0.1, 0.5, 1, 2, 5 and 10 RTIs per day. Baseline RTI-tariff maps are created from the relative LPUE maps, reflecting historical spatial patterns of the (landings) catchability of the species. On this basis RTI tariffs might be updated in “real time”, e.g. weekly, according to updated LPUE values, given that the values of one week are predictive for those of the next week. For multiple species in a mixed fishery tariffs could be determined by setting always the highest species-specific tariff per cell. Fishermen can spend their RTI quota (e.g. 200 RTIs per year) according to these regularly updated tariffs. Total amount of RTIs yearly available for each vessel is calculated based on estimates from historical data of how many average fishing days it might take to fish an agreed total allowable catch (TAC).

All analyses require VMS and electronic logbook data to be merged at high temporal and spatial resolution. Fishing operations have to be identified by analysing the vessel’s speed profile. Following the methodology of Gerritsen and Lordan (2011) vessel speeds between 1.5 and 4.5 knots are assumed to provide evidence of fishing activity. In the next step individual landings are assigned to vessel positions, by searching for a temporal match between the recorded fishing trip and a given VMS trip. Thereupon the methodology of Gerritsen and Lordan (2011) vessel specific tariffs could be determined by setting always the highest species-specific tariff per cell. Fishermen can spend their RTI quota (e.g. 200 RTIs per year) according to these regularly updated tariffs. Total amount of RTIs yearly available for each vessel is calculated based on estimates from historical data of how many average fishing days it might take to fish an agreed total allowable catch (TAC).

Preliminary results and discussion

LPUE distributions in the Western Baltic Sea from international trawl catches indicate species-specific spatially distinct fishing grounds. This is promising for successful real-case application of the multispecies RTI approach in the Baltic, since strong spatial overlaps of the species weakens RTI performance in a mixed fishery as shown by Kraak et al. (2015). Problematic is the fact that landings data do not include any information about discards. Ideally, real catch data should be used, or alternatively, estimates of relative catchability. This is difficult in the case of Baltic flounder which is currently unquoted due to high uncertainties in discard estimates. Yet, the discards are considered to be substantial. Part of the investigation will be to analyse if and how RTI could cope with this issue by examining ways to estimate spatio-temporal patterns in flounder catchability. For quoted species, like plaice and cod, which are subject to the landings obligation real catch data should become available in the future. Here RTI could provide fishers with the knowledge and incentives to avoid bycatch.

Further positive implications of avoiding flatfish bycatches can be expected concerning the bycatch problem of undersized cod. These, usually escaping from the trawl through the “Bacoma” codend, are known to be retained in the net in case of too many flatfishes interfering with the selectivity of the net by clogging it. Regarding all these aspects further data exploration is necessary.

References

