Rays of Hope - Discard survival in North Sea Skates and Rays

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Summary
To advance the knowledge needed for the management of skate and ray species, the Dutch Elasmobranch Society has started a cooperative research project involving fishing operators in the Dutch demersal fleet. The project aims to bridge the knowledge gaps on ray demographics, catch and bycatch, as species specific landings data for rays is lacking for most areas, as well as developing a set of measures based on spatial/ temporal information, gear selectivity and best practice for on board handling to optimize discard survival. Cooperation between scientist and fishermen is a key part of the project as this will be essential for successful implementation of the proposed measures.

Introduction
Rays (Rajidae) are vulnerable to fishing pressure and slow to recover from population depletion due to their specific life history characteristics, which include slow growth, late ages at maturity, and the production of a limited number of young. These properties, combined with the bad state of ray stocks or limited data available on North Sea stocks, have led policy makers to apply a precautionary approach in setting catch limits and systematically reduce the Total Allowable Catch (TAC) for rays by approximately 10% each year (Council of the European Union 2014).

As of January 2016 the North Sea demersal fisheries will fall under the landing obligation. Rays are taken as bycatch in these fisheries and the restrictive ray TAC makes these species potential 'choke species'. As elasmobranchs are considered to be among the most resilient species when it comes to discarding they could be exempt from the landing obligation. At this time however, data on discard survival from commercial operations is too limited to give clear recommendations on the survivability of these species. Information from the Bristol channel and NW Atlantic commercial otter trawl fisheries shows a 10-65% mortality rate of skates, depending on duration of tow and on-board handling (Mandelman *et al* 2012; Enever *et.al*. 2009).
For the North Sea data on both distribution and abundance and on bycatch and discard survival is limited. To address this the Dutch Elasmobranch Society has started a research project in cooperation with commercial operators and other stakeholders to address the knowledge and data gaps and develop a suite of measures aimed at maximizing discard survival in North Sea rays.

Materials and Methods
To get an accurate overview of the distribution of rays in the North Sea extensive tagging experiments, using both basic tags and telemetry, will be combined with improved catch documentation through digital media such as a purposely developed app. Some work has been done interviewing fishermen to use their knowledge on distribution and abundance (Overzee *et. al.* 2014). The current project will aim to build on this information. The information gathered will be used to develop methods to (a) improve discard survival focusing on spatial/temporal measures, (b) gear selectivity measures and (c) improve on-board handling.

a) Recent studies have shown a high site fidelity for batoid species (Leblanc *et al*, in prep), even migratory species like the common skate return to the exact same bays every year (Neat *et al*, 2014). This characteristic will make it possible to map distribution of these species and pinpoint specific areas which have a high densities of ray species at certain times of year.
b) Most ray bycatch in the North Sea occurs in trawl mixed fisheries and shrimp/nephrops trawl fisheries. In these fisheries numerous experiments with gear modification aimed at increasing selectivity have been conducted (Quirijns *et al*, 2008). While not developed for them some of these have shown good results in reducing unwanted catches of skates and ray (Catchpole *et al*, 2008).
c) All elasmobranchs have the potential for high survival after discarding, the handling both in the nets and on board has shown to be key in maximizing this (Revill *et.al.* 2005; Enever *et.al.* 2009). By using existing knowledge of anglers, fishermen and aquarium staff we will develop best practice guides for on board handling.

Results and Discussion

The project will deliver a suite of measures aimed at optimizing survival in skates and rays, aimed changing fishermen's behaviour when encountering these species. As there is no legislative pressure behind it commitment from stakeholders will be a key issue. The method for stakeholder involvement developed for making a recovery plan for sharks and rays in the Dutch North sea (Walker *et.al*, 2014) will maximize the effectiveness of stakeholder input and knowledge. Fishermen, anglers and other stakeholder will play an active role for example by providing data through tag recaptures, reporting catches in more detail and experimenting with on-board adaptations to gears and handling. Their input and expertise will be sought when assessing the feasibility of proposed measures. One of the overarching aims will be to create a knowledge and information sharing platform between scientists, fishermen and other stakeholder aimed at fruitful collaboration in the long term, which will facilitate effective management for skate and ray stocks.

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