

## Summary (500 Words)

Overfishing is a prime example of the tragedy of the commons and regularly listed as a top environmental concern. To counteract overfishing, policymakers worldwide have moved to systems that allocate shares of the overall catch quota to fishers. Catch shares have shown to be particularly effective for fishery management. However, the implementation of catch-shares systems poses several challenges. In particular, the allocation of catch shares to fishers is the central policy problem in fishery management.

New South Wales (NSW) Australia is a case in point. Some twenty years ago these shares were distributed evenly among more than 1100 commercial fishers but they were never effectuated, i.e. they were not limiting commercial catch. Under the government's recent "linkage program," however, shares became binding and are directly tied to catch (or effort). A consequence of the linkage program is that the top 20% most active fishers faced an immediate deficit of shares.

An electronic exchange market was needed in order to reallocate shares to those fishers who need them most. The design of electronic markets has been an important stream in the information systems literature for many years with dozens of papers about Internet-based markets, multi-unit and combinatorial auctions. However, unlike standard Internet markets the exchange required several design innovations. The exchange required "all-or-nothing" buy and sell offers for combinations, or packages, of shares. It is fair to say that the requirements for pricing and the allocation of these types of two-sided markets were clearly beyond established theory (see details below).

Based on an extensive design and implementation phase, a market was organized between May 1, 2017 and June 30, 2017. The market was designed in close collaboration between TUM and UNSW together with the Department of Primary Industries, NSW.

This market solved a long-standing policy problem in New South Wales. For at least 6 years there was a political struggle between fishers and the government about an appropriate way to reallocate catch shares. The proposed market design addressed all key concerns and was decisive to finally get all stakeholders on board and facilitate the reallocation of catch shares. To our knowledge, it was the largest combinatorial exchange to date.

The market completely reshaped the fishery industry in NSW. Close to 600 fishing businesses participated. Importantly, previously underutilized shares were transferred to active fishers: 86% of their buy bids were matched and their overall share deficit was reduced by 75% - 95%. Evaluating the outcomes, Minister Naill Blair wrote:

*"I feel very confident in stating that we have been able to achieve a result for the taxpayer of NSW and the shareholders in the commercial fishing industry that is far beyond what any traditional approach to industry reform would have achieved."*

The market design and the system developed for NSW can serve as a role model for hundreds of fisheries and also guide the design of other environmental markets (water, emission rights, ...). We think that the project can stimulate future research and open up a new line of research in IS.