Overcoming inefficiencies in Small Pelagics Management: A Case Study Analysis

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Introduction

Small pelagics fisheries target some of the most highly productive stocks worldwide (e.g. anchovy, sardine, herring), but which are also known to experience large spatial and temporal fluctuations caused by environmental drivers as well as fishing mortality (Palomera et al. 2007). Throughout their history, many of these fisheries have faced serious declines or depletion that have prevented them to maximize long-term benefits (Beverton 1990, Cury et al. 2000).

Adaptive management practices as well as independent governance structures have been recommended in order to achieve the effective management and governance of small pelagics (Barange et al. 2008). The following case studies focus on the lessons learned from the implementation of different fishery management regimes, and how these may allow to overcome inefficiencies and boost the performance of small pelagics fisheries.

Anchovy and Common Sardine Fishery

V-X Regions, Chile


Common sardine, *Aqua 2014*

Background – The anchovy, *Engraulis ringens* and common sardine, *Strangomera bentincki*, fishery is currently one of the most important fisheries by volume in Chile[1]. The stocks of these small forage species coexist in the same region (administratively by V-X regions), living in waters up to 30 nm off the coast. Although these fish started to appear on landings records from the 1960's, the fishery became significant in the 1990's with annual catches between 500,000-800,000 tons (Cubillos *et al.* 1998).

The fishery has experienced several periods of decline and recovery in the past couple of decades. However, according to official, reports anchoveta would be currently collapsed, while common sardine would be at exploitation levels that can lead to its sustainable use (Subpesca 2014).

Industry and market – An large-scale industrial (122 vessels; 17 vessel owners) and a small-to-medium scale artisanal fleet (1294 vessels) have historically operated in the fishery (Subpesca 2012). Landings are turned into fishmeal and fish oil at processing plants, and a negligible amount is processed as canned or salted products (Subpesca 2014b). Products are destined mainly to the Asian market. The industrial sector is responsible of most of this fishery-related employment, with 278 jobs hired directly by fishing companies and processing plants employing more than 5000 people on 2010 (Subpesca 2014b).

For the artisanal sector, the fishery has generated in average revenues of US$60 million a year, since 2009. Processing plants pay in average a 12% of the FOB price of fishmeal for the anchoveta and sardine landings. Employment of this fishery contributes with about 20% of the total employment of the artisanal sector in the regions where the fishery operates.

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[1] Chilean Anchovy and Sardine (southern and central) Fishery Improvement Project [↗]

Management – This fishery has gone through a series of management regimes, transitioning from open access to restricted access, a catch limit and more recently to individual quota rights.

Catch limit: It started to operate in 2001. A Total Allowable Catch (TAC) is determined by the following process: 1) the fishery's independent scientific committee makes a recommendation to the government with a Biological Allowable Catch, according to initial spawning biomass surveys; 2) the Ministry of Economy uses this value to set a TAC at or below that level for the following year; 3) the TAC can be subsequently modified during the fishing season after biomass and recruitment surveys are completed; 4) The TAC is divided between the industrial and artisanal sectors, which is currently at 78% for the artisanal and 22% for the industrial fleets. This joint management policy allows to account for all legal sources of fishing mortality.

Quota rights: Industrial vessels are managed by an Individual Vessel Quota system (IVQ), where individual vessels owners hold a fixed share of the indusrial fraction of the TAC. On the other hand, artisanal fishers are assigned a portion of TAC through an Artisanal Extraction System (RAE). With RAE, quota is shared between regions and then to eligible rightholders. The RAE assigns anchovy and sardine quota only to local fisher organizations (DS 296-2004). Quota is further divided between the two annual fishing seasons, a norm however that would not be related to the biology of these species (Subpesca 2014b). Finally, leftover quota can be reassigned to other regions, upon the approval of the Undersecretary of Fisheries.

Rights allocation: After important declines in catches during the 1990's and early 2000's, the RAE system was implemented in 2004 to better account for artisanal catches and providing incentives for conservation of the resource (Subpesca 2014b). Under RAE, fishers organizations that qualified for quota assignments were the ones that had both artisanal vessel types as mandated by law, and had an historical catch record of the fishery (DS 388-1995). Each organization needed to agree by majority vote to join the RAE system. Within these organizations, only fishermen with vessels registered in the fishery could receive a portion of the quota. During the last quota allocation process, artisanal quota rights were as until 2026 (RE 580-2013).

Also, there was a provision to include fishers with no history in the fishery, by allowing them to fish during the 2012-2013 seasons, which created a record for this particular group. Additionally, in the case of an increase in the percentages of artisanal quota, a 14% of that increase would be assigned on 2014 to these fishers according to the mentioned record.

Additional rules: There are no gear restrictions, and despite the precautions to avoid fishing the juvenile fraction of the biomass, neither there is a minimum legal size limit for anchovy nor sardine. For anchoveta and common sardine there are two types of temporal biological closures, which protect the reproductive and recruitment phases of these species. Closures can be extended or additional closures can be implemented due to high juvenile presence or anticipated reproductive period observed by the biological monitoring performed by IFOP.

Flexibility: There is some flexibility within the quota system. For example, industrial vessel owners can rent their quota or a portion of it to artisanal fishers, as long as the catch is landed in the same region. This allows fishing companies to catch quota that is out of the reach in the 5-nm exclusive zone reserved for the artisanal fleet or ARPA. Also, by law, a 1% of the annual TAC of quota-managed fisheries can now be bidded to be processed into direct human consumption products. However, human consumption quota can be used for bait in the case of small pelagic species (DS No 173-2013). Finally, there is a norm that aims to desincentivize discards of either ancchovy or sardine, when the quota of the other species has been reached. The rule known as "2x1" or "3x1", allows fishers to land fish over their quota of one species by using the quota for the other by a factor of 2 or 3.

Important considerations

The set of management tools occupied in this fishery (i.e. IVQ and RAE systems) would be providing better incentives for conserving resources and should help decrease the risks associated with the competition in open access regimes. However, this type of approaches should be taken with care, since anchovy and sardine have had contrasting outcomes during this period.

Allocation process: Although stakeholders have regarded RAE as a better alternative relative to open access and its associated "race-to-fish", there would be inherent problems with the initial allocation of rights, not closing access to registered vessels that didn't operate in the fishery and lack of surveillance in the important landing docks (Salgado, pers. comm.). The periodic renewal of the RAE between 2004 and 2012 allowed the entrance of many new actors to the artisanal sector, which had a permit but didn't participate in the fishery. This increase in effort ended up reducing the average catch of artisanal fishers as a group, threatening the provision benefits that are commonly associated with IQ systems (Arnason 2012).

Sustainability: A recent econometric analysis of RAE performance across 24 fisheries in Chile shows that this system increases average landings but with a negative trend in catches over time (Subpesca 2014b). It also has provided higher catch per trip, which could be associated to two distinct effects: 1) the increased abundance of the stocks or 2) the increased efficiency of the fleets in order to reduce costs. Although the satellite positioner prevents industrial fishing in the ARPA, fishing activity is still done by artisanal fishermen, which cancels any conservation effects over the stocks. This may be one of the drivers of the decreasing trend in anchovy abundance over time.

Social impacts: Although a high portion of the TAC is given to artisanal fishermen, this system incentivizes fishers to become employees of the big fishing companies, which also own the processing plants who buy their catch. In fact, 70% of the landings used by processing companies are bought to artisanal fishermen. However, it is common practice that processing plants will loan money to artisanal quota holders. Usually, the vessel would be given as collateral to obtain the loan. Then, fishing companies demand that artisanal fishers land exclusively at their facilities, which are paid a lower price than non-debtor fishers. Debt would be eventually paid by the payment of landings at this lower price. These kinds of interactions have been defined as patron-client relationships and are a very common situation for small-scale fishermen worldwide (Basurto et al. 2013). However, patron-client interactions could have important social implications for fishers and are believed to be less conducive to conservation behavior (Johnson 2010).

North Sea Herring Autumn-Spawners Fishery

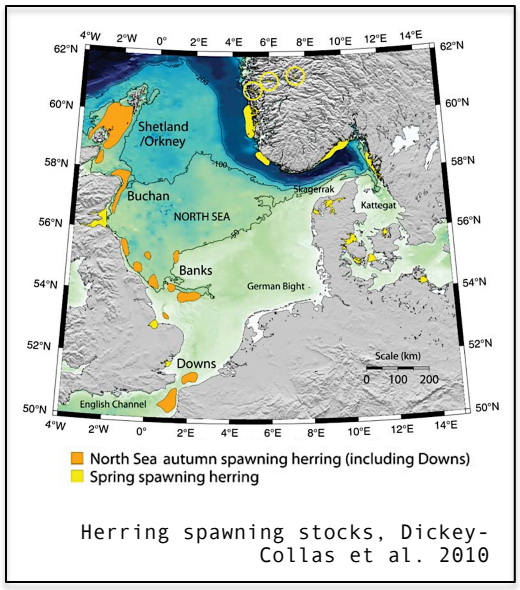
North Sea, Multiple countries


Atlantic herring, *David Fenwick*

Background – The Atlantic herring, *Clupea harengus* is caught in a directed fishery by purse-seiners and trawlers and as by-catch in the industrial fishery in the North Sea. The main fleets come from Norway, Denmark, UK, The Netherlands, France, Germany, and Sweden (Piet et al. 2011). The fishery is most intense in the second half of the year, aiming at the mature and spawning stock component[2]. The North Sea autumn-spawning stock is thought

[2] The Norwegian Ministry of Trade, Industry and Fisheries website [↗]

to constitute a complex of spawning components, which mix outside of spawning seasons[3]. This is a feature that can complicate the assessment and management of the stock.



Herring spawning stocks, Dickey-Collas et al. 2010

The history of the fishery is an example of recruitment overfishing that resulted in the collapse of the stock in the mid-1970's (Dickey-Collas 2013). Failed recruitment periods would have contributed to stock collapse, and climatic variations in the north atlantic along with regional, local ecological drivers (Cury et al. 2000) and even political and industry pressures (Dickey-Collas et al. 2010) may have played a role in its decline. Thanks to strong administrative measures during the following decades such as a 5-year fishery after the collapse and favourable market for high-value products, the stock is now close to levels associated with MSY (ICES 2014). Now, 6 out of 7 fisheries are MSC certified and stock health and management are catalogued to be in good condition (Veiga et al. 2014).

Industry and Market – The first collapse of the herring population and the total fishing ban that followed made many fishing companies go bankrupt during that period (Dickey-Collas et al. 2010). After the ban, the markets for many of the human food products were lost, which forced the industry to look for new markets.

Historically, there have been no restrictions or controls to the sale of herring to either the human food or the fishmeal industries. Production has been driven by high demand of fresh, frozen and cured herring by Eastern European countries and Russia. Prices are sometimes set in collaboration between industry and government. In Norway, the highest participant in the fishery, minimum prices are set higher for DHC products (i.e. fresh and frozen) and vary depending on fish weight (US$330-405 per ton, 2014). Fishmeal herring receives the lowest prices in the market (US$135 per ton, 2014)[4]. Recently, a decline in demand from these nations has forced the fishing industry to reduce prices in 2014.

Management – The North Sea Atlantic herring fishery is currently managed by the EU and Norway through a joint management plan known as Common Fisheries Policy, that includes a shared quota system and set TACs.

> Regime transition: North Sea herring fishing history goes back as far as to the 9th century[5]. Previous to the collapse in 1977, the fishery was managed in an open access regime, being exploited by fleets from 14 nations (Dickey-Collas et al. 2010). Thus, agreeing on catch reductions between countries was very difficult to achieve, and no management actions were taken to prevent the plumeting of the stock. When a second episode of herring overfishing occurred in 1995, this time it resulted in an EU/Norway agreement on management actions introduced in 1997. With the implementation of TACs and drawing on ICES advice to improve

3 Sustainable Fisheries Partnership. FishSource Profile for Atlantic herring - North Sea Autumn spawners. World Wide Web Electronic Publication [↗]

4 Undercurrent news, 2014 [↗]

5 The history of the herring fishing in the North Sea [↗]

managerial decisions, by 2003 the stock had recovered without requiring temporal closures (Simmonds 2007).

Catch limit: TACs are set after recommendation from The International Council for the Exploration of the Sea (ICES), a global organization in charge of providing european fishery managers with fishery science. TACs are based on harvest control rules agreed by the European Commission and Norway for the different North Sea divisions, separately (ICES 2014). TACs are shared between participant countries in the form of national quotas. The misreporting of catches has reportedly decreased substantially in recent years, with area misreporting virtually eliminated (ICES, 2013).

Quota shares: Some countries use Individual Vessel Quota (IVQ) systems to distribute their national quota, while others only apply a combination of limited access and effort control rules. In Norway, participation in the fishery is limited by licenses in combination with individual vessel quotas (IVQ)[6]. Fish quotas are allocated to different vessel groups and the quotas are then distributed amongst the vessels holding the necessary licenses to participate in the groups. The authorities can withdraw permits and licenses if conditions are not met, and can also allocate new licenses and permits. As in many other fisheries, quotas are not tradable, as they are issued to and associated with a given vessel. When vessels are traded, the quota follows the vessel when permission has been granted – with certain restrictions - by the authorities. Nations are allowed to share portions of their TACs between them.

Important considerations

Ecosystem: Herring is a key species in the North Sea ecosystem, as a predator of other fish stocks and as a prey for fish, seabirds and sea mammals. A recent study suggests a strong connection between herring as a predator of cod eggs and larvae, hindering the North Sea cod stock recovery (ICES, 2013). Regarding the protection of herring habitat, pelagic gears are employed in the fishery so effects on benthic habitats are thought to be minimal (ICES, 2013).

Economics: Even though catch shares have been implemented in some countries participating in this fishery, this cannot be assessed since there are no estimations on the economic gains obtained from this system. However, the current management system was successful in recovering the stock with the implementation of a collaborative approach, and by focusing on developing high value human food products and creating lasting markets for them.

South Africa's Small Pelagics Fishery
South Africa

Background – South Africa's Small Pelagic Fishery (SASPF) is currently the largest fishery by volume and second largest in value in the country (Plaganyi et al. 2007). This fishery targets sardine, *Sardinops sagax,* and cape anchovy, *Engraulis encrasicolus*, and is mainly harvested by a large purse-seiner fleet (Fairweather et al. 2006). Anchovy fishery targets predominantly juvenile fish (~6 month old). As sardine shoal with anchovy, there is bycatch of juvenile sardine.

6 Norwegian Fisheries Agency website [↗]

Market and Industry – Sardine is mostly for human and pet consumption as canned or frozen, while anchovy are basically reduced into fishmeal and oil (Fairweather et al. 2006).

Management – SASPF is managed through a joined system for both resources called Operational Management Procedure (OMP) since 1994, which is used to address uncertainty issues and includes limitation on effort, through access rights and vessel licensing[7]. The SASPF currently has a TAC for each species and an IVQ system. Sardine has a TAC for adults, while the anchovy TAC has an associated bycatch limit for juvenile sardine or TAB. The use of pre-specified TAC calculation rules has allowed to reduce the issues and time spent by the scientific commitee in setting the TAC (Plaganyi et al. 2007). These rules have also resulted in a higher transparency and collaboration, allowing focusing research in other important management concerns.

Also, quota rights were allocated from 2006 to 2020, so each right holder has a fixed portion of the TAC (Nielsen and Hara 2006). An expensive enforcement program was implemented to ensure the compliment of the TAC (Fairweather et al. 2006).

Important considerations

Biology: The shift in distribution of the sardine stock from west to east during the early 2000's has imposed serious consequences to the industry, given that most processing facilities were located in the western coast of the country (Coetzee et al 2008). Thus, working with the industry to plan on where to locate and invest in processing infrastructure would be critical, specially in the face of climate change.

Rights allocation: The limited access system has worked to secure the stability of the fishing industry and relatively healthy stocks (Nielsen and Hara 2006). However, allocation of rights to a few companies at the beginning of the system has brought serious social and economic consequences to coastal fishing communities (Jarre et al. 2013). Efforts from the government to reallocate some these rights have not generated the expected changes (Isaacs et al 2007), since limiting factors such as economies of scale forced new entrants to sell their quotas to existing vessel owners (Nielsen and Hara 2006). Social and economic impacts of distributional effects of quota allocation should be taken into account when considering to assign these type of rights.

[7] The Southern African Sustainable Seafood Initiative [↗]

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