Teh et al. Maritime Studies (2017) 16:1
DOI 10.1186/s40152-016-0055-z

Maritime Studies

RESEARCH Open Access

Having it all: can fisheries buybacks achieve capacity, economic, ecological, and social objectives?

Louise S. L. Teh[1*], Ngaio Hotte[2] and U. Rashid Sumaila[1]

* Correspondence: l.teh@oceans.ubc.ca
[1]Fisheries Economics Research Unit, Institute for the Oceans and Fisheries AERL 2202 Main Mall, Vancouver, British Columbia V6T1Z4, Canada
Full list of author information is available at the end of the article

Abstract

The objective of this study is to assess the performance of fishery buybacks so as to determine the conditions under which positive socio-economic outcomes can occur during the process of fisheries adjustments. We do this by conducting a desk top review and supplementing the literature with targeted interviews with experts who have direct knowledge or experience with the implementation of buybacks. We focus on four case studies: Australia, the United States, British Columbia (Canada), and Norway. The outcome of each buyback was assessed in terms of the extent to which it achieved its capacity, economic, ecological, and social objectives. Our results indicate that buybacks can be successful in achieving specific programme objectives, such as reducing fishing capacity and increasing economic profits, at least in the short term. However, none of the buybacks evaluated were a resounding success due to the presence of latent permits or licences, effort creep, and continued reinvestment in the fishery. Enabling conditions for positive social outcomes included a strong economy, accountable leadership, and social assistance programmes tailored to local fishing communities. This study is useful in informing future buyback programmes' design and implementation.

Keywords: Fisheries buybacks, Overcapacity, Fishing effort reduction, Fisheries adjustment

Introduction

Buybacks of fishing vessels, licences, permits, and gear are a management tool used to address overcapacity, overexploitation of fish stocks, and distributional issues associated with fisheries management failures (Squires et al., 2006). They have been implemented in fisheries worldwide, including in Canada, Australia, New Zealand, the United States (U.S.), Japan, Taiwan, Hong Kong, and European nations. In general, buybacks are implemented to reduce fishing capacity with the ultimate goal of achieving one or more of the following three goals: 1) restoring profitability of the fishery (i.e., addressing capacity and economic conditions); 2) conserving and/or rebuilding fish stocks (i.e., addressing ecological conditions); and 3) redistributing catch rights, and providing compensation to those who would otherwise lose out from fishery adjustment (i.e., addressing social conditions) (Holland et al. 1999). Other reasons for using buybacks include modernising and restructuring fleets, conserving biodiversity

and protecting ecological public goods, and providing disaster or crisis relief (Groves and Squires 2007).

Removal of vessels can lead to increased fish biomass, higher catch rates for remaining vessels, and lower vessel and industry costs (Martell et al. 2009). Politically, buybacks are a favoured tool by government for achieving these outcomes compared to fishery regulations because they are often acceptable to industry, making them important for progressing towards improved biological and economic conditions, at least in the short term (Weninger and McConnell 2000; Groves and Squires 2007). However, it has been noted that buybacks are of limited use for reducing fishing mortality on a long term basis if there is continued investment in newer, more efficient, and more powerful vessels and technology to replace exiting boats (Weninger and McConnell 2000).

Buyback schemes have not been unanimously successful at achieving the objective of removing fishing capacity (e.g., Spagnolo and Sabatella 2007; Sun 2007). Effort creep, whereby fishers who participated in buybacks re-enter the fishery once conditions improve, is a prime reason for the failure of buybacks in achieving long term reduction in fishing capacity. The effectiveness of vessel or licence buybacks may also be reduced when they create an expectation of future assistance by government. As the anticipated buybacks reduces the overall risk in the fishing industry, it can result in a higher level of investment in fishing boats than there would otherwise be, or encourage some fishers to hold onto inactive permits (Newby et al. 2004; Clark et al. 2005). In Norway, boat owners abandoned a preliminary plan for an industry financed buyback when they learned that government authorities were prepared to use public funds for a buyback (Hannesson 2007).

In addition, buybacks have not always succeeded in helping to rebuild fish stocks. A well-known example is from Newfoundland (Canada), where Northern cod stocks still have not recovered more than two decades after the 1992 fishing moratorium and vessel buybacks (Hamilton and Butler 2001; Schrank 2005). Evaluating whether buybacks are effective for rebuilding fish stocks is confounded by other physical and environmental variables affecting the stocks. The fact remains that seepage of fishing effort[1] back into the fishery undermines efforts to reduce fishing mortality, and this has led some to conclude that buybacks alone will not have a significant impact on resource conservation (Holland et al. 1999).

The collapse of fish stocks can have devastating effects on fishers and coastal communities (Charles 2006). Ironically, fisheries adjustments such as buybacks, which are intended to provide assistance to fishers, can sometimes produce the same devastating blows to fishing communities. Buybacks tend to disproportionally affect independent or smaller operators. In some adjustment programmes, such as one of the British Columbia (Canada) salmon buybacks, small communities lost most or all of their vessels, with economic consequences for their entire communities (Grafton and Nelson 2007). While some fishers have been able to adjust to other jobs, others have struggled to make the transition. The loss of cultural identity and the demise of a fishing lifestyle is another social concern with buybacks. The Great Barrier Reef Marine Park Structural Adjustment Programme in Australia (see Department of the Environment and Heritage 2004) resulted in a range of negative social impacts, including business losses, legal disputes, social and physical dislocation, marriage breakdowns, and local unemployment (Taylor-Moore 2006).

Buybacks can raise distributional or equity concerns, since they often target a select group of fishers, e.g., the most active fishers, or those with inactive licences. Some buybacks have also been used to transfer vessels to marginalized groups, such as to aboriginal fishers, as was the case in one of the British Columbia (B.C.) salmon buybacks (Gislason et al. 1998a). Such programmes have the potential to encourage industry dependency on government support, as fishers come to expect government funded bailouts (Holland et al. 1999; Hamilton and Butler 2001). Targeting buybacks toward select groups may also bring about inadvertent effects on fish stocks. For example, targeting the most active fishers may provide others with the incentive to increase fishing pressure before the implementation of the buyback in order to qualify for program benefits (Clark et al. 2005; 2007). Meanwhile, some buybacks penalize fishers who have reduced pressure on overfished stocks and moved away from the overfished fishery, thereby creating disincentives for future effort reductions.

Overall, it appears that buybacks do not always ease the socio-economic transition for fishing communities and industries as they leave the fishery. Yet, given the need for fisheries rebuilding worldwide (e.g., Worm et al. 2009; Sumaila et al. 2012), there is a need for fisheries adjustment policies such as buybacks to be designed so as to help minimise the socio-economic burden on fishers and their communities while rebuilding depleted fishery resources. Indeed, fishing vessel and licence buyback schemes continue to be used in fisheries worldwide. For instance, a Net Fishing Buyback Scheme was recently implemented by the Australian Queensland Government in August 2016 (The State of Queensland 2016). A buy-back scheme was also included as part of the reformation of Thailand's fishing licence regime in 2016 (Ministry of Foreign Affairs Thailand 2016), while in Hong Kong, fishing vessel buybacks may potentially be used in conjunction with the establishment of proposed Marine Parks. Thus, given that buybacks are still being used widely as an effort adjustment instrument, an important and timely question for fisheries management is: Under what circumstances can buybacks help ease the socio-economic impacts to fishing communities during adjustments to rebuild depleted fisheries?

To address this research question, we review the literature on buyback programmes (e.g., Read and Buck 1997; Holland et al. 1999; Clark et al. 2005; 2007; Curtis and Squires 2007; Squires 2010), and supplement this with expert interviews. We focus on four case studies from Australia, the United States, British Columbia (Canada), and Norway. For each case study, we assess whether the buyback has contributed to fisheries rebuilding while alleviating social and economic costs to the fishing industry. The value of this study lies in uncovering the lessons learned in how fishery buybacks can contribute to dual socio-economic and rebuilding goals so as to improve the design of future fisheries adjustment schemes.

Methods

Four case studies were chosen: i) The Australian southeast trawl; ii) U.S. Pacific groundfish trawl; iii) B.C. Pacific salmon; and iv) Norwegian purse seine. We first conducted a desktop review of existing literature on the selected case studies. This information was then supplemented with in-depth telephone interviews conducted between December 2007 and February 2008 with 9 experts who were either involved in the management, or had extensive knowledge and research experience about the respective

fishery buybacks. The experts were from Australia, Canada, and the United States, and included fishery managers, academics, and consultants. The purpose of the expert interviews was to obtain their opinion of how the buyback had performed in terms of four indicators: i) capacity - measured by number of licences, permits, vessels, or fishing concessions; ii) economic value - measured by ex-vessel revenue, profits, and quota values; iii) social value – measured by employment, perceptions and attitudes about safety issues and distribution of buyback benefits, and presence of social programmes; iv) ecological benefit – change in the status of fish stocks, discard and bycatch rates.

Requests for interviews with each expert were first done through email. If the interviewee agreed to an interview, LSLT and URS then conducted the interview through telephone. In general, each interview took around one hour to complete. We used an open-ended questionnaire format in order to allow the interviewee to elaborate on topics of interest.

We used the process outlined in Fig. 1 to identify enabling conditions under which positive socio-economic outcomes emerge from buybacks. First, we contextualised conditions prior to implementation of the buyback, including the drivers, goals, targets, and characteristics of the buyback (Table 1).

After buyback implementation, we determined its overall performance, including the ensuing social, economic, and ecological outcomes, and whether the buyback achieved its intended target. This enabled a comparison within (pre and post buyback) and between case studies, thereby allowing us to draw out the circumstances under which positive socio-economic outcomes may occur. Ultimately, these lessons learned can contribute to improving future buyback design (Fig. 1).

Case studies

Australian Southeast Trawl Fishery (SETF)

Background and context The SETF targets over 100 species of fish and invertebrates, and involves the use of otter board and mid-water trawl, and Danish seine (see Grieve and Richardson 2001 for a history on the SETF). An Individual Transferable Quota (ITQ) system was introduced to the SETF in 1992 as a means to address fleet

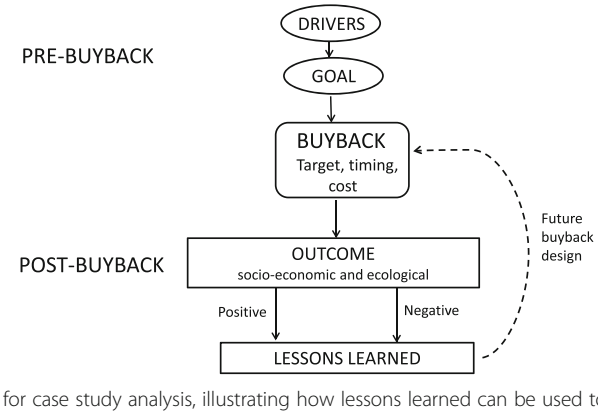

Fig. 1 Framework for case study analysis, illustrating how lessons learned can be used to contribute to improved design of future buybacks

Table 1 Summary of contextual information for each buyback case study

	Australia southeast trawl	U.S. Pacific Groundfish	B.C. salmon[a]	Norway purse seine
Goal	1) Reduce overcapacity of the fishery; 2) End ongoing litigation by the fishing industry over an ITQ system which was preventing the implementation of the fishery management plan.	1) Reduce capacity; 2) Increase productivity for the remaining operators; 3) Stabilize the fishery financially; 4) Conserve and manage groundfish.	1) Reduce size of salmon fleet; 2) assist fishers and communities to adjust to changes; 3) Protect and rebuild salmon habitat.	1) Reduce catch capacity by 25% and restore fleet profitability.
Drivers for buyback	Many fishers were unwilling to participate in, and support the new ITQ management system (Elliston et al. 2004; Meere 2006).	Fishery was declared to be in a state of disaster in 2002; 9 species of groundfish overfished; and profitability continued to decline (Shaw and Conway 2007).	Overcapacity in the fishery since 1960s (Sinclair 1960). Decline of the salmon industry starting in the late 1980s and continued concerns about salmon stocks, poor returns and prices (Walters 1995; Schwindt et al. 2000).	During the 1970s fleet capacity increased even though the fleet was already overcapitalised (Holland et al. 1999; Hannesson 2007).
Year of buyback	1998	2003	1998–2000	Starting 1979 to mid-1990s
Targeted capacity reduction	50 permits.	35% reduction in number of permits.	Voluntary buyback (vessel owners who wanted to retire licenses submitted a bid for the purchase of their licence).	Reduce catch capacity by 25%.
Cost of buyback	AUD 1.7 million (AUD 4.4 million set aside to buy out permits).	Buyback was financed by a USD 10 million grant and 20 year loan of USD 36 million from the Federal government (NMFS 2004).	CAD 200 million for buybacks, CAD 100 million for protecting and rebuilding salmon habitat, CAD 100 million for human resource assistance/development.	NOK 1038.2 million.

[a]The B.C. salmon buyback programme (BC Pacific Fishery Adjustment and Restructuring Programme, PFAR) consisted of 3 components: i) fishery buyback; ii) social assistance programmes, including retraining for employment outside the fishery and financial assistance to businesses and communities; iii) rebuilding the resource (protecting and rebuilding salmon habitat)

overcapacity (Elliston et al. 2004; Meere 2006). The ITQ system was not well received by the fishing community, who were unhappy with the method of quota allocation. Subsequently, a large number of litigation challenges were brought against the Australian government (Kaufman and Geen 1998; Meere 2006). Under the uncertainty over the stability and security of the ITQ management system in place, many disenfranchised fishers were not willing to participate in the quota market and support the new management arrangement. As a result, the autonomous adjustment (i.e., the process in which fishers voluntarily sell their quota to owners of more profitable vessels, without the need for government intervention) which had been anticipated with the introduction of ITQs did not happen. Consequently, the Commonwealth government introduced and funded a structural adjustment programme in 1998.

Economic and social outcomes Economic performance improved following the buyback (Fox et al. 2006), indicated by rising profits for all remaining vessel classes, although a rise in output prices may have accounted for some of the gains. Expected profitability and the value of vessel licences also rose from AUD 60,000 to AUD 85,000 (Fox et al. 2006) and productivity gains for all vessels increased by an average of 39% (Fox et al. 2006). However, recipients of the targeted financial assistance indicated that the payments were not sufficient to make up for their loss in quota value under the new ITQ system (Meere 2006).

Many fishers who left the fishery switched to other fisheries, retired, or shifted to shore-based activities, thus the blow to them was not as great. The hardest impact from the buyback was felt by crew in small ports, as it became difficult for them to maintain continuous employment. Instead, according to one interviewee, they had to relocate from port to port to find fishery-related work. Infrastructure and shore based services, such as operations of freezer trucks in these small ports, were also affected. However, there was a rapid change in these ports from working fishing ports to tourist or retirement towns. Due to the economic boom in Australia in the mid to late 2000s, fishers had little difficulty finding alternative employment because of the heightened demand for labour, particularly in the fields of truck transportation and mineral extraction (Australian marine scientist, pers. comm. 2007).

Despite the ease of finding alternative employment, some fishers chose to remain in the fishery due to the social context of fishing communities. In most cases, the fishers in Australia are of Mediterranean descent and have strong ties to their communities, and were more inclined to remain in the fishery to maintain their cultural identity. They also felt that there was prestige associated with being the best fisher in town (Meere 2006). Thus, these social aspects might have affected the buyback regardless of the compensation or economic alternatives available.

Overall performance The buyback was effective in ending litigation over the initial ITQ allocation (Meere 2006), one of its primary objectives; however, it failed to achieve its targeted effort reduction, and reduced a large amount of latent rather than active effort. Thus, the buyback did not achieve as large a reduction in effort as had been hoped (Professor of marine science in Australia, pers. comm. 2007). Moreover, the shift in

fishing effort to other fisheries may have led to a negative impact on shark populations in the southeast Australian trawl fishery (Table 2).

The lack of a market for the SETF's ageing vessels could have been a reason for the relatively low rate of adjustment (Elliston et al. 2004). Nevertheless, the buyback, in combination with ITQ management, is believed to have reduced effort in the SETF while increasing returns to the remaining operators (Newby et al. 2004). There was also evidence of improved economic performance (Fox et al. 2006). Overall, the buyback was useful as a transition strategy because it was needed to address the poor allocation system, and nudged the existing system toward autonomous adjustment (Fisheries consultant, pers. comm., 2007). However, the implementation of a second buyback for SETF boats in 2005 indicated that the 1998 buyback did not perform as well as intended.

U.S. Pacific Groundfish trawl fishery

Background and context The historical context and factors leading to the decline of the U.S. Pacific groundfish fishery has been examined by various authors (e.g., Hanna 2000; Mansfield 2001). In brief, the Pacific groundfish fishery (covering the states of Washington, Oregon, and California) was a relatively unimportant fishery until the late 1970s, when there was an upsurge in fishing effort, resulting in the fishery being brought under a limited entry system in 1994. Due to bycatch and species concerns, trip limits decreased throughout the late 1990s to early 2000s. During this period there was also growing concern about the economic viability of vessels. By the late 1990s the Pacific groundfish fishery was overcapitalized, and the industry began to experience resource scarcity and decline (Shaw and Conway 2007).

In 2000, the Pacific Fishery Management Council (PFMC), the management agency for Pacific groundfish, estimated that 70% of the groundfish vessels were redundant. The same year, the U.S. Department of Commerce declared the fishery to be in a state of disaster, and in 2002 the PFMC declared nine species of groundfish to be overfished. Following the declaration of the Pacific groundfish fishery disaster in 2000, there were numerous programmes implemented by state governments to help fishers and communities cope with the decline, the results of which are described in Shaw and Conway (2007). Facing continued declines in profitability, Pacific groundfish fishers turned to the National Marine Fisheries Service (NMFS) for help. In 2003, the NMFS introduced a buyback programme.

Economic and social outcomes Annual groundfish revenues per permit were expected to increase by 53% following the buyback (PFMC and NMFS 2004). Preliminary analysis suggests that profitability was positively affected by the new programme: combined revenue of the groundfish sectors was USD 54 million in 2011, compared to an annual average of USD 38 million during 2006–2010 (NOAA 2012). Average vessel landings were comparatively lower than during the previous five years and there was only a small decrease in the number of vessels during 2011 (NOAA 2012).

It was the opinion of interviewees that remaining fishers were in a better financial state than they would have been without the buyback. Some trip limits were increased, leading to a steadier stream of fish to supply the fresh market. According to one interviewee, there would have been more bankruptcies and vessels operating at the margins

Table 2 Summary of fishing capacity and ecological outcomes from buybacks

	Australia Southeast Trawl	U.S. Pacific Groundfish	B.C. Salmon	Norway purse seine
Capacity	Actual removal of 27 permits (50 targeted), 13 of which were inactive. Effective reduction in effort of <5% (AMC Search 2000).	35% reduction in number of permits. 91/263 vessels participated. Effective capacity was reduced but a large amount of latent effort remained. Fishery still deemed overcapitalised after buyback.	Total of 1406 vessels and licenses removed (DFO 2002); however, many of these were vessels with least effective power. Latent permits were a concern and some buyback participants shifted to other fisheries. Fishing effort was not substantially reduced (DFO official, pers. comm. 2008)	Total license volume decreased by about 30% between 1979 and 1985 (Flaaten et al. 1995). Buybacks effectively reduced total fleet capacity.
Ecological	Fishing effort largely displaced to shark fishery, potentially affecting the shark population.	Catches of many targeted species remained the same and some even declined (Fisheries economist, pers comm. 2008). Discards decreased after buyback.	Buyback facilitated the implementation of area-based licenses, which resulted in lower discard and bycatch rates following the buyback (Fishery consultant, per comm. 2008).	Improvement in fish stocks such as herring, capelin, and blue whiting in late 2000s (Fisheries economist, pers. comm. 2008). Spawning herring stock recovered to 1960s level in the early 2000s (Arnason et al. 2001).

without the buyback. Following the buyback, ex-vessel revenues rose by 20–30%, although the reason behind the increase in revenue is not yet fully understood. Repayment of the USD 36 million loan for the buyback began in 2005 and is ongoing. However, as of 2012, PFMC still considered eight species of groundfish to be overfished (PSMFC 2014), primarily due to bycatch.

Despite the absence of an explicit social objective, the buyback programme did bring greater stability and economic viability for those operators remaining in the fishery. This enabled operators to pay more attention to vessel maintenance, thus increasing safety (Fisheries economist, pers. comm. 2007). At the same time, the buyback helped to create more positive attitudes and improve working relations between the fishing industry and management (Curtis and Squires 2007). However, it also had a disproportionate effect on some communities, notably, Crescent City, Eureka, and Bellingham saw the biggest percentage reductions in vessels (88%, 61% and 100%, respectively) (NMFS 2004: The After effects of the Pacific Groundfish Limited Entry Trawl Buyback Program A Preliminary Analysis, Unpublished).

Although economic assistance was provided following the 2000 groundfish disaster declaration (Shaw and Conway 2007), interviewees were not aware of financial assistance being provided to the displaced fishers and communities during the 2003 buyback. A study conducted in two western fishing communities, Astoria and Newport, found that the buyback raised several concerns from community members, including the following (Langdon-Pollock 2006):

- There was a shift in effort from the groundfish fishery to other fisheries, as fishers were able to buy inactive permits, new boats, and gear with the payments they received from the vessel buyback. For instance, some fishers used the buyback fund to purchase more crab pots;
- Jobs of captains, skippers, and crew were affected for those boats that were not owner-operated;
- The buyback did not benefit the local fishing community in situations where the owner of the purchased vessel did not live in the Astoria and Newport area; and
- There was a flood of surplus fishing gear and equipment in the market, as purchased vessels were stripped because they could not be used as fishing vessels anymore, which affected shipyards and gear and electronic suppliers.

Overall performance Overall, the buyback was considered successful in terms of capacity reduction. It also led to ecological benefits, as the buybacks appeared to facilitate a decrease in bycatch and discard rates (NOAA fisheries official, pers comm. 2008). However, the buyback did not remove all the excess capacity. In fact, the level of remaining capacity in the trawl fleet could have been reduced by another 30% without harming the ability of the fleet to harvest the quota (Fisheries economist, pers. comm. 2007). Operators remaining in the fishery benefited from increased revenues, although the effect on net profitability was not determined. On the other hand, some communities suffered disproportionately with the removal of almost all of their vessels.

From the industry's standpoint, the gains from the buyback were not as great as expected because restrictions were tightened (i.e., lower trip limits) after the buyback.

Nevertheless, they were better off than they would have been without the buyback. One issue which was also noted in other fisheries (e.g., Australian SETF), was the effort creep back into the fishery due to the reactivation of latent permits. However, one interviewee still felt that effective capacity had declined, and was less than it would have been without the buyback. This was because the buyback was structured such that vessels were rated by catch history, thus leading to the removal of the most productive vessels and a decrease in effective capacity. In this regard, the programme was successful.

British Columbia salmon fishery

Background and context Concerns about the excessive size of the British Columbia salmon fleet (consisting of troll, gillnet, and purse seiners), and its effects on the fishery's sustainability and financial viability were raised as far back as the 1960s (Sinclair 1960). A province wide vessel licensing system, which included a buyback component, was first introduced in 1969. The first vessel buyback took place in 1970, with subsequent buybacks in 1981, 1993, 1996, and 1998–2000 (Grafton and Nelson, 2007). Some of these buybacks were funded by industry, whereas others were by the federal government. Despite these buybacks, the salmon fishery was still considered to be overcapitalized in the late 1990s, with a cost-benefit analysis by Schwindt et al. (2000) showing that the cost of harvesting salmon exceeded its value. Indeed, it was found that benefits arising from the multiple buybacks were short-lived due to capacity and effort creep back into the fishery over time (Grafton and Nelson 2007).

Starting in the late 1980s, an increase in farmed salmon supplies globally, a breakdown in trade barriers, and lowered salmon returns contributed to the decline of the salmon industry (GSGislason and Associates 2001). Due to continued concerns about salmon stocks (Walters 1995), poor returns and prices, and the effects of the reforms from the 1996 buyback, the government saw a need to further rationalize the salmon fishery, leading to the introduction of the Pacific Fishery Adjustment and Restructuring Programme (PFAR) in 1998.

Economic and social outcomes Landings declined after the buyback, possibly due to poor marine productivity, although it is difficult to formally attribute this cause (Department of Fisheries and Oceans official, pers. comm. 2007). At the same time, salmon prices declined, driven by poor market demand for wild salmon due to aquaculture. Grafton and Nelson (2007) indicated that the buybacks were beneficial to fishers who remained, although it was uncertain whether the benefits were large enough to maintain the industry at a financially viable state. In contrast, one interviewee, a Department of Fisheries and Oceans (DFO) official, suggested that fishers' profitability was likely negatively affected due to the combined effects of lower fishing opportunities and depressed salmon prices. In addition, Grafton and Nelson (2007) found that many fishers felt that they had not gained the full potential benefits from the reduction in vessels. At the same time, it was thought that the fleet would have been much more unprofitable without the buyback (Fisheries consultant, pers. comm. 2008). Interestingly, licence value increased after the buyback, with the nominal price of salmon licences more than doubling for seine licences and tripling for gillnet and troll licences despite large declines in salmon prices and landings (Grafton and Nelson 2007).

It was initially anticipated that PFAR would lead to improved economic viability. However, a survey of fishers who participated in the buyback indicated that the majority of both successful and unsuccessful bidders felt that the PFAR had not helped the community (DFO 2002). The buyback suffered from distributional issues: First, it did not benefit all members of the fishery – crew members, shore workers, packers, and seine net owners were not eligible for any of the buyback payments (Grafton & Nelson 2007). Second, a higher proportion of those who exited the fishery were smaller boats and independent operators, resulting in severe employment problems in small northern communities where these boats were based (Gislason et al. 1998a). GSGislason and Associates (2001) estimated that the number of jobs in the salmon industry was reduced by half between the early 1990s and the end of the 1998–2000 buybacks. The loss in fishing jobs had repercussions in other sectors as well, as the buyback also affected the fishing supply sector (e.g., gear makers and processors).

The impacts of the social component of PFAR had mixed results (Gislason et al. 1998b; Gislason and Lam 1999; GSGislason and Associates 2001; GSGislason and Associates 2002a;b). Overall, the financial assistance programme was considered to be a success, whereas the retraining programme did not achieve its intended results (Fisheries Consultant, pers. comm. 2007). The success of the financial assistance programme was due mainly to managerial competence – the programme was led by a strong executive director, and run by local people (mayors) rather than government bureaucrats, thus instilling a sense of accountability for the programme's performance. On the other hand, the retraining programme had limited success because many of the people it aimed to retrain had low education, no interaction with mainstream society, and were simply not job ready. These factors hindered them from integrating into jobs in wider economy. Furthermore, the retraining programme was based on a model used for retraining workers in the central manufacturing industry, which did not cater to the needs of the fishing industry.

Overall performance The biggest achievement of the B.C. salmon buyback was removing the targeted 1,400 licences from the fishery. An unanticipated ecological benefit of the buyback was the substantial reduction in bycatch. This was probably because the buyback removed a lot of the less effective fishers who did more searching and therefore had increased chances of getting bycatch (DFO official, pers. comm. 2008).

Nevertheless, effective effort was not reduced substantially, and the anticipated improvement in economics did not materialize (DFO official, pers. comm. 2008). It cannot be said that the PFAR improved the economic performance of the fishery; in particular, profitability was likely negatively affected due to reduced fishing opportunities and declining salmon prices. Socially, the buyback led to negative impacts such as loss of jobs, cultural identity, and way of life. The community assistance component of PFAR helped to a certain extent, but was largely found to be ineffective.

Overall, the buyback was not considered to be a success in terms of achieving its intended objective of reducing effort, despite producing some positive social gains. Indeed, Schwindt et al. (2003) concluded that the buybacks in the late 1990s did not solve the fundamental problems of the fishery. In particular, interviewees viewed buybacks as a short term measure that was incapable of addressing the long term structural

adjustment required in the fishery. Instead, buybacks merely reduced the severity of the problems facing the salmon fishery, but did not address the underlying incentives to fish. After the buyback, fishers still faced the same incentives to upgrade vessels and gears (Grafton and Nelson 1997). In light of declining stocks, this led to the situation where more and more vessels and licences had to be removed from the fishery, as evidenced by the five buybacks the salmon fishery required over two decades.

The Pacific salmon fishery continues to be managed using area-based licensing by gear type. Due to continued concern about salmon populations, Coho and Chinook catches have been highly restricted since the mid-1990s; by 2004, salmon only accounted for 15% of the total landed value of the Pacific commercial fishery, down from 50–70% in the 1980s (Parsons 2010). An indication that the previous set of buybacks was not as effective as anticipated was the allocation in 2011 of another CAD 28.5 million, provided by the U.S. Government, to decrease the size of the Pacific troll fleet along the West Coast of Vancouver Island through licence buybacks (DFO 2011,Aboelsaud 2012; PSC 2013).

Norway purse seine fishery

Background and context The Norwegian purse seine fleet targets pelagic species such as herring, capelin, mackerel, and blue whiting. There was free access into the Norwegian purse seine fishery until the late 1960s, when the Norwegian spring spawning herring stock collapsed (Bjorndal and Gordon 2001), likely due to a combination of overfishing and deteriorating environmental conditions (Arnason et al. 2001). A series of buyback programmes targeting different vessel types have been implemented in Norway since 1979. Norway's buyback programmes from 1979 to the mid-1990s were in most part used for large vessels (purse seiners and trawlers), while those since the mid-1990s have been spent on small boats normally less than 28 metres long.

Economic and social outcomes Profitability of the purse seine fleet, measured in terms of wage potential per boat, did not appear to increase until the mid-1990s, after the buyback programme had ended and fleet capacity flattened out. Total catches of pelagic fish, the majority of which were taken by purse seiners, showed a declining trend from 1979 to the early 1990s, but total value of the catch increased during this period. Total catch value was around 70% higher in 2001 than in 1979, mainly due to higher prices. At the same time, Hannesson (2007) noted that costs (excluding labour but including capital costs) were around 15% lower in 2001 than in 1979, which may have been due to the buyback programme and trading of concessions. Overall, the buyback seems to have had a positive effect on profitability.

Although the buyback did not have an explicit social objective, the aim of maintaining a balanced distribution of the fishing fleet had an underlying social objective in the north, as northern Norway is the most fishery-dependent region in the country. There were several financial aid avenues for fishers who became unemployed due to fisheries capacity adjustment. The first was the Fishermen's Guarantee Fund, which provided fishers with partial pension from age 60–67. Fishers who become unemployed due to buybacks or fleet downscaling could also apply for unemployment payments (Hersoug 2006).

Hersoug (2006) examined the wider social context of fishers and fishing communities and how they were affected by changes in Norwegian fisheries policies. According to one interviewee, it was not difficult for fishers to find jobs outside fisheries once they left the industry. Similarly, Hersoug (2006) found that there had been no significant increase in the number of unemployed in northern Norway since the late 1980s. For the period 1980–2005, the unemployment rate in the most fishery-dependent counties was higher than the national average, but below that of The Organisation for Economic Co-operation and Development (OECD).

Overall performance The buybacks could be considered an economic success as measured against their main objective of improving profitability. Ecologically, the buybacks also allowed for a recovery in spawning herring (Table 2). The fishery continues to be profitable and operate in the absence of subsidies or other economic instruments to support rebuilding of stocks (OECD 2012). As fleet productivity continues to increase, fishery managers expect the number of fishers and vessels to continue to decline due to further adjustments in fleet capacity (OECD 2012).

One of the general concerns about government-funded buyback programmes is that they create a moral hazard situation, whereby the industry becomes accustomed to depending on government support (Hamilton and Butler 2001) and being bailed out of unprofitable conditions (Clark et al. 2005; Squires 2010). According to Hannesson (2007), it is possible that money from the purse seine buyback may have been reinvested in the fishery. Thus, one interviewee felt that Norway's experience highlighted that government should not become involved in the buybacks, particularly since the industry recognized the need to reduce the number of boats and had been willing to finance its own buyback back in 1979. This highlights the message from Clark et al. (2005) regarding the problem of vessel owners anticipating buybacks. In addition, it was emphasized that government-funded buybacks should be one-time events, used as a means of paving the way for self-rationalization in the industry (Fisheries economist, pers. comm. 2008). It was felt that ITQs would have been a better option for rationalising the purse seine fleet.

Lessons learned

We found that buybacks can be successful in achieving specific programme objectives such as reducing capacity and increasing economic profits, at least in the short term. However, none of the case studies can claim to be a resounding success due to factors such as the presence of latent permits or licences, effort creep, and continued reinvestment in the fishery, which undermine the initial nominal reduction in fishing effort. In terms of rebuilding fish stocks, interviewees indicated that it is difficult to attribute changes in ecological conditions (e.g., fish stock status) to the buyback alone due to the presence of other environmental factors. Similarly, Hannesson (2007) contended that controlling the capacity of fishing fleets will not necessarily be sufficient to control the exploitation of fish stocks, due to environmental influences.

Nonetheless, based on the available literature and expert interviews, it is justifiable to say that buybacks can be useful to achieve goals of capacity reduction and increased profitability within fisheries (Groves and Squires 2007). Several interviewees expressed the view that fishers and the fishing industry were better off after buybacks than they

would have been otherwise, although in many cases the benefits received were not as great as had been expected (e.g., Australian SETF, U.S. Pacific groundfish trawl). At the same time, buybacks can have negative repercussions for fishers at personal and community levels, as well as induce behaviours which ultimately lead to more costly, less efficient buyback results (e.g., time inconsistency problem noted by Clark et al. 2005, and moral hazard noted by Hannesson 2007).

The case studies indicated that positive socio-economic outcomes emerged under conditions such as the presence of a strong, broader economy, sound and accountable leadership, and social assistance programmes tailored to the needs of local fishing communities, among others (Table 3). These 'lessons learned' highlight the importance for future buybacks to incorporate management tools and approaches that develop and strengthen coastal community resilience and adaptive capacity so that fishers themselves have the ability to respond to changes and uncertainties in their socio-economic and natural environment (e.g., Hanna 2000).

Discussion and conclusion

The four case studies demonstrated that post-buyback conditions can sometimes be improved in terms of better profitability and ecological status of exploited fish stocks.

However, while capacity reduction or profitability targets can be fully or partially achieved, buybacks may also simultaneously create social issues. For instance, consolidation effects similar to that experienced by ITQs, wherein the hardest impact is felt by crew in small ports, arose in the Australian Southeast Trawl fishery.

Table 3 Lessons learned from buyback case studies

Category	Description
Implementation method	-A trade-off must be made between removing expensive, powerful vessels versus cheaper, less efficient vessels. The potential for remaining low-efficiency or latent vessels to be converted into actual fishing effort should be considered. - Having buybacks occur over multiple rounds might be more effective as they reduce strategic behaviour by fishers in terms of asking prices for their vessels, offer more information about vessel characteristics, and aid in the process of price discovery. However, a single round reduces the potential for strategic behaviour among bidders. - Ample financial resources are required to remove the most powerful vessels.
Minimising economic impact	- Socio-economic impact on displaced fishers can be mitigated by broader economic conditions e.g., Australia's strong economy offered many alternative employment opportunities for displaced fishers. - The presence of flexible labour market policies increases the changes of successful adjustment for fishers, e.g., Norway's experience.
Social considerations	- Social drivers can have a strong impact on individuals' decision to participate in a buyback, e.g., individuals' proximity to retirement, cultural ties to fishing. - Social assistance programmes (e.g., retraining, skills upgrading) must be tailored to suit the needs of local fishing communities. Ideally, the programme should be led by someone who is familiar with, and accountable to, the local community. - If certain fishery groups or communities are going to face large scale unemployment, gradual, rather than sudden, implementation will work better.
Fisher behaviour	- Fishers' responses to policies must be considered when designing adjustment programmes. - To prevent operators from obscuring their catch history (e.g., by increasing catch limits after the announcement of a buyback), there is a need to have baseline catch levels for vessels that were latent or had low levels of activity.
Timing of buyback	-Timing of a buyback is important e.g., it would have been more useful to have a buyback prior to implementing an ITQ system for the Australian SETF. - If there is no effective output control in the fishery, the deliberation period between announcing and implementing the buyback should be kept short. This is necessary to curb fishers from trying to increase their catch limits.

Buybacks can be considered to be part of crisis or disaster relief packages, such as in the U.S. Pacific groundfish buybacks, but the "relief" ends up in the form of financial compensation to fishers for leaving the fishery, whereas social programmes for fishers and fishing communities have been provided separately (e.g., Hanna 2000; Shaw and Conway 2007). In the case of B.C. salmon, where buybacks were part of a broader adjustment assistance package, there was mixed success in helping fishers acquire new skills and adjust to new non-fishing livelihoods (Gislason and Lam 1998). One contributing factor was the assistance programme failed to take into account the socio-economic context of the fishing communities.

It is noteworthy that many interviewees viewed incentive programmes such as ITQs as better options compared to buybacks because ITQs address the underlying incentives driving fishers to increase their fishing power (Arnason 1998). At the same time however, it is acknowledged that ITQs are not a panacea (Clark et al. 2010; Sumaila 2010; Soliman 2014). Indeed, despite showing inconsistent success in terms of social benefits, the use of buybacks may be less likely to give rise to problems such as 'armchair fishing' and the concentration of power, which are often seen as negative social consequences of other fisheries adjustment instruments such as ITQs (Pinkerton and Edwards 2009).

Although the main purpose of fishery buybacks is to address overcapacity and overexploitation of fishery resources (Squires 2010), the buyback process invariably has a socio-economic impact upon the fishers who leave, and those who remain in the fishery. Yet, social considerations do not appear to be a priority of buybacks; only one case study (B.C. salmon) had an explicit social objective to help fishers and communities adjust to non-fishing lifestyles after they left the fishery. Yet, as buybacks continue to be used worldwide, identifying the conditions under which they can be socially beneficial for fishers and fishing communities is crucial for improving the success of future fisheries adjustment schemes.

The enabling conditions identified in 'lessons learned' draws attention to the need for improving communication and trust between the fishing sector and governance institutions in order to mitigate negative social consequences. Further, understanding the heterogeneity within the fishing community is also essential for ensuring the equitability of the buyback. In this respect, adaptive co-management, which emphasises collaboration, learning, and power sharing in ecosystem management (Armitage et al. 2007), may be a potential tool for fostering the cooperation and knowledge sharing necessary to help ease the moral hazard issue with regards to fisher behaviour, as well as aid in creating a more cost-efficient and smoother process for the buyback implementation itself.

It is noted that most of the case studies here and in the literature tend to focus more on assessing the economic aspects of buybacks, e.g., the impact on fleet capacity and cost effectiveness, and less so on social aspects. This is likely due to the majority of buybacks lacking social objectives in the first place. As such, the value of our study is in showing the conditions under which positive social outcomes can arise from buybacks, even though these may not be targeted outcomes. By doing so, this study contributes to the ongoing discourse in designing fisheries management strategies to achieve conservation objectives as well as being socio-economically acceptable.

Endnotes

[1]Seepage, or effort creep, refers to the tendency for effective fishing effort to move back into the fishery after nominal effort has been reduced (Squires et al. 2016).

Acknowledgements
We thank the following expert interviewees for participating in our study: S. Bose, M. Burden, S. Freese, G. Gislason, R. Hannesson, P. Leipzig, F. Meere, B. Riddell, and K. Sainsbury. This study was part of a larger project funded by the Natural Resources Defense Council. LSLT and URS acknowledge the Social Sciences and Humanities Research Council of Canada for funding the OceanCanada Partnership.

Funding
This study was part of a larger project funded by the Natural Resources Defense Council. The funder did not play a role in writing this paper.

Authors' contributions
URS conceived the study. URS and LT developed the questions for expert interviews, conducted the interviews, and wrote the manuscript. LT conducted the literature review while NH contributed to writing the paper. All authors read and approved the final manuscript.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Fisheries Economics Research Unit, Institute for the Oceans and Fisheries AERL 2202 Main Mall, Vancouver, British Columbia V6T1Z4, Canada. [2]Faculty of Forestry 2424 Main Mall, Vancouver, British Columbia V6T 1Z4, Canada.

Received: 21 May 2016 Accepted: 14 December 2016
Published online: 11 January 2017

References

Aboelsaud, Y. 2012. *License buyback plan disappointing for local commercial salmon fishery.*. Tofino-Ucluelet Westerly News, http://ukees.com/blog/2012/01/salmon-license-buyback-dissapointing/. Accessed 20 Mar 2016.
Armitage, D., F. Berkes, and N. Doubleday (eds.). 2007. *Adaptive co-management: collaboration, learning, and multi-level governance*. Vancouver: UBC Press.
Arnason, R. 1998. Ecological fisheries management using individual transferable share quotas. *Ecological Applications* 8(1): 151–159.
Arnason, R., G. Magnusson, and S. Agnarsson. 2001. The Norwegian Spring-Spawning Herring Fishery: A Stylized Game Model. *Marine Resource Economics* 15: 293–319.
Bjorndal, T., and D.V. Gordon. 2001. The Economic Structure of Harvesting for Three Vessel Types in the Norwegian Spring-Spawning Herring Fishery. *Marine Resource Economics* 15: 281–292.
Charles, A. 2006. *The Human Dimension of Fisheries Adjustment: An Overview of Key Issues and Policy Challenges. Paper prepared for the OECD Expert Meeting on the Human Side of Fisheries Adjustment*. Paris: OECD. http://www.oecd.org/tad/fisheries/37577519.pdf. Accessed 14 July 2014.
Clark, C.W., G. Munro, and U.R. Sumaila. 2005. Subsidies, Buybacks, and Sustainable Fisheries. *Journal of Environmental Economics and Management* 50: 47–58.
Clark, C.M., G. Munro, and U.R. Sumaila. 2007. Buyback, subsidies, the time consistency problem and the ITQ alternative. *Land Economics* 83: 50–58.
Clark, C.W., G. Munro, and U.R. Sumaila. 2010. Limits to the privatization of fishery resources. *Land Economics* 86: 209–218.
Curtis, R., and D. Squires (eds.). 2007. *Fisheries Buybacks*. Iowa: Blackwell Publishing.
Department of Fisheries and Oceans Canada (DFO). 2002. *Evaluation of the Canadian Fisheries Adjustment and Restructuring Program Licence Retirement Programs*.
Department of Fisheries and Oceans Canada (DFO). 2011. *Federal Fisheries Minister Announces Licence Retirement Program for B.C.'s West Coast Chinook Salmon Fishery*. http://nouvelles.gc.ca/web/article-en.do?nid=649119. Accessed 14 July 2014.
Department of the Environment and Heritage. 2004. *Great Barrier Reef Marine Park Structural Adjustment Package 2004*. Brisbane: Queensland Government.
Elliston, L., P. Newton, D. Galeano, P. Gooday, T. Kompas, and J. Newby. 2004. *Economic Efficiency in the South East Trawl Fishery*. Canberra: ABARE eReport 04.21 Prepared for the Fisheries Resources Research Fund.
Flaaten, O., K. Heen, and K. Salvanes. 1995. The Invisible Rent in Limited Entry and Quota Managed Fisheries: The Case of Norwegian Purse Seine Fisheries. Marine Resource Economics 10:341–356.
Fox, K., Q. Grafton, T. Kompas, and T. Che. 2006. Capacity Reduction, Quota Trading and Productivity: The Case of a Fishery. *Australian Journal of Agricultural and Resource Economics* 50: 189–206.
Gislason, G., and E. Lam. 1999. *HRDC Fisheries Adjustment Programs An Initial Review*. Ottawa: Prepared for Human Resources Development Canada.
Gislason, G., E. Lam, and E. Battle. 1998a. *Fishing for Direction Transition Support for BC Fishermen and their Communities*. Ottawa: Report prepared for Fisheries and Oceans Canada.
Gislason, G., M. Mohan, E. Lam, S. Anderson, and E. Battle. 1998b. *Fishing for Money Challenges and Opportunities in the BC Salmon Fishery*. Victoria: Report prepared for BC Job Protection Commission.
Grafton, Q., and H. Nelson. 1997. Fishers' Individual Salmon Harvesting Rights: An Option for Canada's Pacific Fishers. *Canadian Journal of Fisheries and Aquatic Sciences* 54: 474–482.

Grafton, Q., and H. Nelson. 2007. The Effects of Buyback Programs in the British Columbia Salmon Fishery. In *R Curtis and D Squires*, ed. Fisheries Buybacks, 191–202. Iowa: Blackwell Publishing.
Grieve, C., and G. Richardson. 2001. Recent history of Australia's South East Fishery; a managers' perspective. *Marine and Freshwater Research* 52: 377–386.
Groves, T., and D. Squires. 2007. Lessons from Fisheries Buybacks. In *Fisheries Buybacks*, ed. R. Curtis and D. Squires, 14–54. Iowa: Blackwell Publishing.
GSGislason and Associates. 2001. *Pacific Salmon fisheries restructuring evaluation of HRDC adjustment measures Technical report: Literature review*. Ottawa: Prepared for Human Resources Development Canada.
GSGislason and Associates. 2002a. *Pacific salmon fisheries restructuring evaluation of HRDC adjustment measures Technical Report: Community case studies*. Ottawa: Prepared for Human Resources Development Canada.
GSGislason and Associates. 2002b. *Western Economic Diversification and Pacific Fisheries Adjustment. An Evaluation*. Edmonton: Prepared for Western Economic Diversification.
Hamilton, L.C., and M.J. Butler. 2001. Outport adaptations: social indicators through Newfoundland's cod crisis. *Human Ecology Review* 8: 1–11.
Hanna, S. 2000. Change and Resilience in New England and Pacific Groundfish Fisheries. In *Change and Resilience in Fishing*, ed. S. Hanna and M. Hall-Arber, 13–21. Covallis: Oregon Sea Grant.
Hannesson, R. 2007. Buyback Programs for Fishing Vessels in Norway. In *R Curtis and D Squires*, ed. Fisheries Buybacks, 177–190. Iowa: Blackwell Publishing.
Hersoug, B. 2006. *Always too Many? The Human Side of Fishery Capacity Adjustment in Norway*. OECD, Paris, France: Paper prepared for the OECD Expert Meeting on the Human Side of Fisheries Adjustment. http://www.oecd.org/tad/fisheries/37612333.pdf. Accessed 10 July 2014.
Holland, D., E. Gudmundsson, and J. Gates. 1999. Do Fishing Vessel Buyback Programs Work: A Survey of the Evidence. *Marine Policy* 23: 47–69.
Kaufmann, B., and G. Geen. 1998. Quota Allocation and Litigation: An Economic Perspective. *Marine Resource Economics* 13: 143–157.
Langdon-Pollock, J.L. 2006. *A Pilot Study in Two West Coast Marine Fishing Communities, Astoria and Newport, Oregon: Perspectives from Fishing Community Members*. Portland: Report prepared for Pacific States Marine Fisheries Commission.
Mansfield, B. 2001. Property Regime of Development Policy? Explaining Growth in the US Pacific Groundfish Fishery. *The Professional Geographer* 53: 384–397.
Martell, S., C. Walters, and U.R. Sumaila. 2009. Industry funded license reduction good for both profits and conservation. *Fish and Fisheries* 10: 1–12.
Meere, F. 2006. *Structural Adjustment in the Australian South East Trawl Fishery. Paper prepared for the OECD Expert Meeting on the Human Side of Fisheries Adjustment*. Paris: OECD.
Ministry of Foreign Affairs Thailand. 2016. *Thailand's Reform of Fishing License Regime*.. http://www.thaiembassy.org/warsaw/en/information/64887-Thailand's-Reform-of-Fishing-License-Regime.html. Accessed 18 Oct 2016.
National Marine Fisheries Service (NMFS). 2004. The After effects of the Pacific Groundfish Limited Entry Trawl Buyback Program A Preliminary Analysis. Attachment C.17.b Supplemental NMFS. Unpublished report.
Newby, J., P. Gooday, and L. Elliston. 2004. *Structural Adjustment in Australian Fisheries*. Canberra: Australian Bureau of Agriculture and Resource Economics.
NOAA. 2012. *The West Coast Groundfish IFQ Fishery: Results from the first year of catch shares*. Boulder: NOAA. http://www.nmfs.noaa.gov/stories/2012/07/docs/catch_sharesyear1_report.pdf. Accessed 14 July 2014.
OECD. 2012. *Inventory of National and Regional Approaches to Fisheries Rebuilding Programmes – Norway*. Paris: OECD. http://www.oecd.org/tad/fisheries/Norway.pdf. Accessed 10 July 2014.
Pacific Salmon Commission (PSC). 2013. *Treaty between the Government of Canada and the Government of the United States of America concerning Pacific salmon*. Available: http://www.psc.org/publications/pacific-salmon-treaty/. Accessed 14 July 2014.
Pacific States Marine Fisheries Commission (PSMFC). 2014. http://www.psmfc.org/program/west-coast-groundfish-observer-program-wcgop. Accessed July 2014.
Parsons, S. 2010. Chapter 30: Canadian Marine Fisheries Management: A Case Study. In *Handbook of Marine Fisheries Conservation and Management*, ed. R.Q. Grafton, R. Hilborn, D. Squires, M. Tait, and M. Williams, 393–414. New York: Oxford University Press.
PFMC and NFMS. 2004. Amendment 16–3 to the Pacific Coast Groundfish Fishery Management Plan – Rebuilding plans for bocaccio, cowcod, widow rockfish, and yelloweye rockfish. Final environmental impact statement including regulatory impact review and initial regulatory flexibility analysis. http://www.pcouncil.org/wp-content/uploads/gfa16-3_a1630704.pdf. Accessed 10 July 2014.
Pinkerton, E., and D.N. Edwards. 2009. The elephant in the room: The hidden costs of leasing individual transferable fishing quotas. *Marine Policy* 33: 707–713.
Read, A.G., and E.H. Buck. 1997. *Commercial Fishing: Economic Aid and Capacity Reduction*. Washington DC: CRS Report for Congress.
Schrank, W.E. 2005. The Newfoundland fishery: ten years after the moratorium. *Marine Policy* 29: 407–420.
Schwindt, R., A.R. Vinning, and S. Globerman. 2000. Net Loss: A Cost-Benefit Analysis of the Canadian Pacific Salmon Fishery. *Journal of Policy Analysis and Management* 19: 23–45.
Schwindt, R., A.R. Vining, and D. Weimer. 2003. A Policy Analysis of the BC Salmon Fishery. *Canadian Public Policy* 29: 73–94.
Shaw, W, and FDL Conway. 2007. Responses to the West Coast Groundfish Disaster: Lessons learned for communities and decision makers. ORESU-G-07-006 Corvallis: Oregon Sea Grant.
Sinclair, D. 1960. *License Limitation – British Columbia*. Victoria: Report to the Department of Fisheries and Oceans Pacific Region.
Soliman, A. 2014. Duty of stewardship and fisheries governance: a proposed framework. *Maritime Studies* 13: 11.
Spagnolo, M., and R. Sabatella. 2007. Driftnets Buyback Program: A Case of Institutional Failure. In *R Curtis and D Squires*, ed. Fisheries Buybacks, 145–156. Iowa: Blackwell Publishing.
Squires, D. 2010. A review of fisheries buybacks. *Fish and Fisheries* 11: 366–387.

Squires, D., J. Joseph, and T. Groves. 2006. Tuna Resource Management Buybacks in transnational fisheries. *Pacific Economic Bulletin* 21: 63–73.
Squires, D, M Maunder, R Allen, P Andersen, K Astorkiza, D Butterworth, G Caballero, R Clarke, H Ellefsen, et al. 2016. Effort rights-based management. Fish and Fisheries. doi:10.1111.faf.12185.
Sumaila, U.R. 2010. A cautionary note on individual transferable quotas. *Ecology and Society* 15(3): 36.
Sumaila, U.R., W.W.L. Cheung, A. Dyck, K. Gueye, L. Huang, V.W.Y. Lam, T. Srinivasan, W. Swartz, D. Pauly, and D. Zeller. 2012. Benefits of rebuilding global marine fisheries outweigh costs. *PLoS ONE* 7(7), e40542.
Sun, J.C.H. 2007. Effectiveness of Vessel Buyback Programs on the Offshore Fishery in Taiwan. In *R Curtis and D Squires*, ed. Fisheries Buybacks, 203–214. Iowa: Blackwell Publishing.
Taylor-Moore, N. 2006. *Great Barrier Grief: a case study of the socio-economic impacts of the representative areas program for the Great Barrier Reef Marine Park on the Queensland seafood industry*. Perth: Paper presented at Sharing the Fish Conference. http://www.fishallocation.com/papers/pdf/papers/NoelTaylor-Moore.pdf. Accessed 14 July 2014.
The State of Queensland. 2016. *5 August: New round of commercial licence buybacks for net-free zones.*. http://www.qraa.qld.gov.au/news-and-events/Media-releases/new-round-of-commercial-licence-buybacks-for-net-free-zones. Accessed 18 Oct 2016.
Walters, C. 1995. *Fish on the Line: The Future of Pacific Fisheries*. Vancouver: David Suzuki Foundation. http://www.davidsuzuki.org/publications/downloads/1995/Fish_on_the_line.pdf. Accessed 20 Mar 2016.
Weninger, Q., and K.E. McConnell. 2000. Buyback programs in commercial fisheries: efficiency versus transfers. *Canadian Journal of Economics* 33: 394–412.
Worm, B., R. Hilborn, J.K. Baum, T.A. Branch, J.S. Collie, C. Costello, M.J. Fogarty, E.A. Fulton, J.A. Hutchings, S. Jennings, O. P. Jensen HK Lotze, P.M. Mace TR McClanahan, C. Minto, S.R. Palumbi, A.M. Parma, D. Ricard, A.A. Rosenberg, R. Watson, and D. Zeller. 2009. Rebuilding Global Fisheries. *Science* 325: 578–585.