

The Political Economy of the Chilean Nearshore Fisheries Reform¹

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¹ We are especially grateful to Jose Cancino, whose PhD dissertation (2007) provided much of our initial knowledge about the Chilean fishing industry and the nearshore Loco fishery. We are grateful for helpful information provided by Max Aguero, Juan Carlos Castilla, Carlos Chavez, Miriam Fernandez, Julio Pena-Torres, Alejandra Pinto, Dario Rivas, Edith Saa, Felipe Sandoval, and Carlos Techeira, to participant comments in a World Bank workshop, and to two helpful reviewers. We alone are responsible for errors.

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Chile is a long thin nation with 4,000 kilometers of coastline. The marine environment off Chile's coast supports rich ecosystems in both the nearshore and offshore environments, and Chile is among the top 10 producers of fish globally. The fisheries of Chile can be conveniently divided into three sectors: the offshore industrial fishery, the aquaculture industry; and the small-scale nearshore artisanal fishery. The offshore industrial fishery began in the 1950s with investments in seine vessels and processing plants in northern Chile designed to catch and process large volumes of pelagic species including mackerel, sardine and anchovy into fishmeal. An additional component of the offshore fishery developed in the southern regions of Chile in the 1970s to take hake, hoki and conger eel with trawl gear in factory-processor vessels and trawlers landing at shore-based processors. Offshore industrial production grew steadily, peaked in the early 1990s at over 7.5 million tons, and has leveled out at about 5 million tons.

The aquaculture industry began in the early 1980s as Japanese investors funded salmon aquaculture facilities to produce fish for export to Japan, mostly in the southern region. The industry grew explosively, peaking in 2007 when aquacultured fish represented 18 percent of total volume and 60 percent of the value of fish exports (Borquez and Hernandez 2009). In 2007, the industry began to experience infectious salmon anemia (ISA) and suffered a catastrophic collapse from which it is now slowly recovering. Salmon production fell from almost 400 thousand tons in 2007 to less than 100 thousand tons in 2010 (Asche et al. 2010). It is rebuilding after implementation of new regulation and industry reorganization. Chile's aquaculture industry also produces

² We are especially grateful to Jose Cancino, whose PhD dissertation (2007) provided much of our initial knowledge about the Chilean fishing industry and the nearshore Loco fishery. We are grateful for helpful information provided by Max Aguero, Juan Carlos Castilla, Carlos Chavez, Miriam Fernandez, Julio Pena-Torres, Alejandra Pinto, Dario Rivas, Edith Saa, Felipe Sandoval, and Carlos Techeira, to participant comments in a World Bank workshop, and to two helpful reviewers. We alone are responsible for errors.

mussels and scallops, the former started by Spanish producers looking for a production source for the Spanish home market.

The final sector is the small-scale nearshore artisanal sector. The artisanal sector is comprised of about 86,000 fishers and seaweed (kelp) farmers (2012), who are the only fishers permitted to operate in the “nearshore” zone, which extends out to 5 miles from shore.³ About 38,000 fishers harvest upwards of one million tons of small finfish per year using net and hook and line gear. Another 58,000 participate in seaweed collecting and/or in the benthic shellfish dive-based fishery, which focuses on Loco extraction. The artisanal sector has grown consistently, although output from the Loco component boomed during the late 1970s and early 1980s, and then declined. In response, the Loco sector was the focus of an important management experiment in which Territorial Use Rights in Fisheries (TURFs) were formed to provide user groups with rights to manage and utilize shellfish and other sea floor resources found within fixed geographical areas.

TURFs are not yet common as a fisheries management tool, although they are likely to be important options in poorer countries for near shore fisheries. We thus examine Chile’s TURF system in some detail in this paper. We begin with a discussion of industrial fishing, as efforts to regulate this sector influenced evolving regulation in the artisanal sector as well.

1. Early History of Chilean Fisheries Management

A need to protect and regulate coastal fisheries led the Chilean government to assert sovereignty over extensive fishing areas and create strong regulatory institutions. During the 1950s and 1960s, responsibility for managing Chile’s fisheries rested with the Ministry of Agriculture (OECD 2009). The most important fisheries targeted the pelagic species including mackerel, sardines and anchovies. These species have highly variable distribution, ranging over wide areas. In the 1950s and 1960s, most coastal nations claimed and enforced fisheries jurisdiction out to 12 miles from shore (and sometimes only 3 miles). Chile, Peru, and Ecuador, however, took a bold step, in 1952, when they signed the *Declaración de Santiago*. Under the *Declaración*, each country adopted an exclusive economic zone (EEZ) that asserted fisheries jurisdiction out to 200 miles from shore. It also asserted the authority of each nation to control its own domestic fleets as well, and to regulate participation by fishermen from treaty-party nations.

³ Artisanal fishers must be registered with SERNAPESCA’s National Registry of Artisanal Fishermen (NRAF). Vessels must be smaller than 18 meters in length, have a maximum holding capacity of 80 cubic meters, and a gross rate tonnage limit of 50. In fact, most boats are relatively small. For example, of the 15,000 registered vessels in 2007, one-third of the vessels were less than 12 meters in length. Jerez (2003) estimates that the number of artisanal fishers and divers grew from about 3,000, in 1960, to 54,000 from 19 in 1999.

Following the signing of the *Declaración*, Chile, Peru and Ecuador immediately exerted sovereignty over the extended jurisdiction. Fishing vessels from Japan and the United States were seized in 1955, and a vessel owned by Greece was seized in 1956. Chile began monitoring domestic effort immediately afterwards under Decree 20 in 1956, requiring government approval for any new fishing activity and effectively introducing a licensing program. Decree 20 thus laid the groundwork for the *potential* control of effort.

In practice, government policy mainly sought to promote rather than control development of the pelagic reduction-based fisheries in the north, largely to buffer the employment losses then occurring due to a cyclical downturn in the copper sector. The Frei (1964-1970) and Allende (1970-1973) administrations implemented industrial fishery-promotion policies, which included lower tariffs for fishing-related capital imports, tax credits for vessel owners, and tax breaks for construction of domestic processing capacity. The government also aided the industry, in 1967, after a devastating El Niño threatened the Chilean pelagic industry with bankruptcy. The government assumed debt, consolidated operations under state ownership, and removed weak firms.⁴

1.1 Political Backdrop—the Pinochet Regime

In September, 1973, a military junta deposed President Allende and, in December, 1974, the junta appointed Augusto Pinochet as President. The new regime implemented a number of policies that affected the fisheries sector both directly and indirectly. Decree Law 600 (issued in 1974) allowed foreign investment in the fisheries sector, leading to the development of demersal hake, hoki, and conger eel fisheries in Chile's southern regions by Japanese, Korean and Spanish investors. The Pinochet administration argued that granting foreign access, with only modest recapture fees, would help develop these underutilized fisheries by attracting capital and new technology, and achieving access to foreign markets, thus benefitting the sparsely settled areas of southern Chile. An onshore industry was also developed by foreign investors to process demersal fish delivered by smaller artisanal vessels.

In 1978, the responsibility for fisheries management was transferred from the Ministry of Agriculture to the Ministry of Economy, elevating the political importance of the fishing sector (OECD 2009). Within the Ministry, three agencies oversee distinct aspects of the fisheries sector. These agencies are the Under Secretariat of Fisheries (SUBPESCA), the National Fisheries Service (SERNAPESCA), and the Institute of Fisheries Development (IFOP). SUBPESCA determines policies and regulations that

⁴ The northern industry was dominated by a single family, Angelini that controlled much of the harvesting and processing capacity.

seek to increase and sustain social and economic benefits from the sector. SERNAPESCA is charged with enforcement of fisheries regulations and recording fisheries statistics, and reports directly to the Minister of Economy. IFOP, which was created in 1964 under a joint agreement between Chile and agencies of the United Nations, conducts research and provides scientific advice to policymakers. IFOP receives some funding from SUBPESCA, but also competes for research funding from other public sources. These agencies have well trained technical staff, well-developed connections with other regulatory institutions internationally, and significant regulatory independence that transcends political administrations.

A hallmark of the Pinochet administration was the liberalization of Chile's economy, including opening it up to foreign competition and foreign investment and reducing government intervention in the domestic economy. This liberalization coincided with an unprecedented boom in global fish demand. These two factors had dramatic effect on Chile's fisheries sector. Revenues soared, efficiency increased and production expanded. During this period, Chilean fisheries still operated under open access (for those fishers who were authorized by the Chilean government) and the northern industrial pelagic industry expanded into the central Chilean zone in pursuit of pelagics that migrated down the coastline. The southern fishing industry boomed as Spanish investors built on-shore processing plants to receive deliveries from local small-scale fishermen, and as foreign and domestic investors built large-scale factory trawlers to scoop up large volumes of hake, hoki, and conger eel. Aggregate catch trended up sharply. In 1974, Chile's aggregate fisheries production was about one million tons and, by 1990, volume had grown to six million tons.

During the latter half of this boom period, Chile's fisheries began to show signs of overexploitation and Chile's government, like many others around the world, initiated greater effort to regulate the industry. Initially, these efforts were applied mainly through use of top-down, command-and-control regulatory instruments (e.g., minimum landings sizes, closed areas, closed seasons, catch quotas, and gear restrictions (SERNAPESCA, 1993; Peña-Torres, 1997 and Bernal *et al.*, 1999). These were the tools developed by fisheries scientists in the early 1950s to manage the important demersal species in the North Atlantic and they were well understood by scientists who recommended similar measures to maintain sustainable yields in Chile.

In 1983, the Under Secretariat of Fisheries imposed a Total Allowable Catch (TAC) on the important sardine fishery for the first time. However, plant owners and workers strongly protested, predicting the loss of many additional jobs in the midst of

what was already a severe recession.⁵ SUBPESCA was forced to relent, first raising and ultimately eliminating the quota, which led to catches that exceeded the recommended TAC. The sardine catch peaked in 1985 at 2.6 million tons and soon declined to 1.8 million tons, a result that many attributed to the failure to implement the policies recommended by fisheries scientists. However, SUBPESCA did close access to anchovy, sardine, and jack mackerel fisheries through Decree 436, thus ending the long period of fisheries growth under open access.

Despite these regulatory efforts to control fishing effort, high prices and high profits stemming from strong external markets motivated still higher fishing effort. Several fisheries were declared “fully exploited” and thereafter were subject to fleet freezes, but such conventional effort-control methods did not seem to work, as fishermen increased effort even when entry was closed under Decree 425 in 1985. High prices induced the purchase of larger, faster and more powerful vessels, which caused regulators to shorten seasons, which, in turn, motivated additional investments to increase capacity to catch more fish faster.

In hindsight, top-down, command-and-control measures were destined to fail. As fisheries economists have since come to understand, fishermen can increase effort in many dimensions. If regulators freeze the number of boats, owners will increase the capacity of individual boats when fish prices rise. If regulators use closed seasons to limit catch to target TACs, fishermen will build vessels designed to catch more fish in a shorter time, thus inviting further reductions in fishing seasons. This process of action and reaction is inevitable, given that insecure property rights to common pool resources create incentives to overinvest in their capture. By using measures that attempted to control effort rather than allocating rights to a fixed amount of resources, regulators were tackling the symptoms rather than the cause of the problem (Wilén 2006).

1.2 The Chilean Fisheries and Aquaculture Law (CFAL)

By the mid-1980s, Chile was facing a number of fisheries management crises brought on, in an important sense, by the success of Chile’s economic transformation. Landings volumes had grown to unsustainable levels in a number of fisheries and there were numerous management failures, disputes over access rights, and conflicts between sectors. As a result, SUBPESCA began working on a reform of Chile’s fisheries law to better address these issues and fine-tune the institutions responsible for management. The result was Law 18.892, the Chilean Fisheries and Aquaculture Law (CFAL), which

⁵ GNP fell 14% in 1982-83 due to macroeconomic and international trade disequilibria, and unemployment was high.

was initially enacted in December 1989, though not implemented until September 1991, after significant modification.

While CFAL placed emphasis on the industrial fisheries, it contained important innovations that affected both industrial and artisanal fisheries. Fisheries were to be categorized as “fully exploited”, “under development”, or “under recovery”, and different management tools were approved for different categories. Fisheries designated *under recovery* are subject to total fishing bans for at least 3 years. Fisheries designated *fully exploited* are subject to both TACs and limited access. Access permits are permanent and transferable, and pyramiding is prohibited. Vessel owners must pay annual fees that depend upon GRT. Fisheries designated as being *under recovery* or *under development* can be managed with Individual Transferable Quotas (ITQs), subject to decree by SUBPESCA. ITQs, if applied, are allocated for a 10-year initial period by public auction, after which 10 percent of the quota is withdrawn annually for public auction. To date, two fisheries *under recovery* (red and yellow prawn demersal) and two *under development* (Chilean sea bass and orange roughy) have been managed under ITQs. Fisheries that are *fully exploited* may also be managed under ITQs, again at the discretion of SUBPESCA. For *fully exploited* fisheries, initially only 50 percent of the quota can be allocated by auction, with the remainder allocated according to historical use. Thereafter, 5 percent of the quota may be withheld annually and auctioned. To date, no fisheries under the *fully exploited* category have utilized ITQs.

CFAL contained three other innovations pertaining especially to the nearshore artisanal fisheries. First, it resolved conflict between the small-scale and the industrial fleets by assigning an exclusive fishing area within 5 nautical miles from the shore to the small-scale artisanal sector. Second, it regionalized the nearshore fishery into eleven zones, thus eliminating the fisher mobility that characterized the 1980s boom. Small-scale fishermen were required to register with a national registry that established and limited their rights to particular coastal zones. Finally, CFAL provided two options to manage access rights to nearshore fisheries, namely Individual (Nontransferable) Fishing Quotas (IFQs), and Territorial User Rights in Fisheries (TURFs).

2. Nearshore Artisanal Fisheries

Artisanal fishermen with small boats harvest a variety of finfish species with fishing gear and a variety of seaweed and mollusk species with dive gear, while others gather benthic species simply by hand gathering in shallow areas. Most artisanal fishers are based in

coves, called *caletas* in Chile, of which there are hundreds along the Chilean coast.⁶ Fishing communities are located close to many of these coves, particularly in the central and northern parts of Chile. The Chilean nearshore dive system supports a shellfish fishery of over 60 species, with an aggregate shellfish catch of 300 thousand tons and a value of 300 million U.S. dollars per year (2009). The most valuable shellfish species (roughly 90 percent of the value of output) is the so-called “Chilean abalone” or *Loco*, a predatory snail harvested by divers who pry it from rocky substrate. While some *Loco* are consumed domestically, most are exported to Taiwan, Japan and China. Other important mollusks are sea urchin and limpets, both also mainly exported to Taiwan and Japan. Chile is also the world’s largest producer of seaweed, accounting for 40 percent of the global production of seaweed and other aquatic plants.

2.1 *History of Management*

Management of the mollusk fishery has focused on the *Loco* fishery. The fishery has evolved through five phases. The first phase took place prior to the mid-1970s, when Chile’s shellfish fisheries were open access. Demand for shellfish was limited almost wholly to the local market. Annual landings of *Loco* averaged about 5,000 tons, below maximum sustainable yield.

During the second phase, in the late 1970s and early 1980s, the still open access *Loco* fishery experienced a sharp rise in foreign demand following Chile’s economic liberalization and improved opportunities for trade. The *Loco* was introduced in Japan in 1976, and Asian demand increased rapidly. The resulting high prices for *Locos* led to a sharp, uncontrolled increase in harvest, which peaked at 25,000 tons in 1980. Diving for *Loco* employs simple technology, with very low entry cost, and there are many potential fishers. When unemployment and *Loco* prices were high, many individuals could engage in *Loco* harvesting on an occasional basis to earn a bit of extra money. A large number of *Loco* divers became mobile, often working for businessmen who financed their work and transported their boats along the coast in search of new opportunities. These mobile divers sparked disputes with resident fishermen, particularly in the south (Castilla and Gelcich 2008; Gelcich et al. 2010). Under the growing fishing exploitation, *Loco* landings then experienced a rapid decline, falling in 1986 almost down to pre-boom levels. Stocks probably also declined, but information on stocks in this period is limited (Bustamante and Castilla 1987; Castilla *et al.* 1998).

⁶ *Caletas* are officially designated strips of land above the high-tide that provide specific rights to users, including access to the sea and rights to land a boat, remove catch and erect certain buildings. The *Servicio Nacional de Pesca* (SERNAPESCA 2005) identifies 558 artisanal *caletas* along the Chilean coast, of which 453 are considered permanent *caletas* (343 rural and 110 urban) and 105 temporary *caletas*. In Chile, both coves and the fishing communities located around them are synonymously referred to as *caletas*.

As noted, by the mid-1980s, the national institutions charged with managing fisheries had been relocated and transformed, and managers and scientists had initiated efforts to reign in the explosive growth in the large-scale industrial offshore fisheries. Chile's small-scale artisanal sector drew less initial attention and continued to be subject to open access, although the government attempted to control harvest by implementing closed seasons and minimum sizes, with little effect. However, as Loco landings continued to decline, with significant economic effect on artisanal fishing communities, regulators took note, deemed the Loco fishery overexploited and implemented a ban on Loco harvesting in August, 1989.

Closing the entire Loco fishery began phase 3, which lasted until December 1992. The closure caused considerable hardship on many fishers and their communities (Aviles and Jerez 1999), although the ban was not fully effective, as the government lacked the means to enforce the ban and numerous fishers continued to harvest clandestinely. The development of extensive illegal fishing and illegal marketing of the Locos marginalized many other fishers, who were unable or unwilling to participate in these activities.

Phase 4 began when the ban on Loco harvesting ended in December, 1992, and was replaced by the implementation of Individual (Nontransferable) Fishing Quotas (IFQs). TACs were established for all eleven nearshore regions and parsed out among IFQ holders, who were required to record landings of Loco against their individual catch coupons. Processing quotas were also allocated among authorized processing plants (Bernal et al. 1999; Castilla and Defeo 2001; Leiva and Castilla 2002). Again, however, the new control efforts failed. It was difficult to assign and allocate quotas to the large number of individual fishers and government authorities lacked the ability to monitor harvests and enforce IFQ landings. Nonetheless, although SUBPESCA quickly recognized the inadequacy of this system, it remained in effect for some years until an alternative, the implementation of TURFs, could be prepared.

The fifth and most recent phase of nearshore small-scale benthic fisheries management began in late 1996 with enactment of the TURF system. The first 45 TURFs were assigned in 1997 and additional TURFs were assigned in subsequent years. By 2006, nearly 650 TURFs had been approved for development, of which more than 300 had implemented formal management plans with coordinated harvesting and another 300 were in earlier stages of development (SUBPESCA 2006). Initially, as most benthic fishing areas remained outside the TURFs, harvesting was permitted in non-TURF areas. However, beginning in 2000, Loco harvesting was banned in non-TURF areas. While this policy encouraged fishers to accept TURFs, as fishers could not afford to forego fishing for their most valuable species, the established TURFs could not accommodate all

fishers. Many of those who remained without TURFs, by choice or by necessity, continued to fish in non-TURF areas and sell their catch through clandestine channels. The interaction between fishing in TURF and non-TURF (illegal and quasi-open access) areas is complicated and is an important aspect of the new management phase which we discuss subsequently.

2.2 Scientific, Administrative and Political Preconditions for TURFs

Chile's TURF system builds on historically important harvester communities that have dominated the coastal system. Records suggest there are 453 permanent fishing communities located in small coves or *caletas* (SERNAPESCA 2005) spread along Chile's coast. These communities now contain about 86,000 registered small-scale fishermen, including roughly 38,000 dedicated to fin fish, 34,000 dedicated to seaweed collection and 14,000 divers dedicated to shellfish extraction. Most fishermen are members of one or more local fishermen's organizations, varying somewhat by name and type: *sindicatos, asociaciones gremiales and cooperativas*, depending on the period and political context in which they were formed, but all serving to coordinate fishing efforts and achieve more effective political lobbying. These organizations are grouped in regional federations and two national confederations (Orensanz et al. 2005). The fisher organizations played two important roles in the emergence of TURFs. First, several well organized communities engaged in experimental research with Chilean academics and government scientists throughout the 1980s. The results provided ecological knowledge showing that fisher management of benthic resources was likely to be feasible, and this knowledge motivated fishers and fisheries experts to press for creation of the TURFs. Second, fisher organizations were effective politically in lobbying the democratically elected Aylwin government to replace the failing IFQ system with TURFs. They then became a vehicle for identifying the class of potential participants who were granted access rights under the new TURF regime, and finally became a natural unit for motivating locally-oriented leadership under the new system.

Chile's TURF system thus emerged through the interplay of several factors. Most importantly, CFAL established the legal framework that permitted the creation of TURFs. As an institutional concept, TURFs were intended to provide user groups with quasi-permanent usufruct rights over marine resources within a defined physical space, thereby providing an incentive to protect, develop and harvest resources in an efficient manner. Chilean fisheries experts were aware of the concept and their long-term successful use in Japan, where TURFs had emerged through a lengthy historical process. Although TURFs had not been applied in Chile, there were a number of local preconditions (Gonzalez et. al. 2006). Chilean fishers in a number of *caletas* had been sufficiently organized to experiment with certain fishing controls in the late 1970s and

had worked with a Chilean university biologist, Juan Carlos Castilla, on experimental fishing closures from 1981 to 1988. Other biologists had also experimented with the effects of human exclusion on the intertidal areas, e.g., Moreno (1984, 1986). These efforts provided important information about the basic ecology of the coastal marine environment and the impact of controls on sustainable yields.

By the late 1980s, government fisheries experts in IFOP, university researchers and a number of organized fishery communities were aware that TURFs were a potentially useful fisheries management tool. As a result, in 1987, the state began a five-year research/demonstration project, granting exclusive harvest rights to benthic resources in grounds adjacent to a few well-organized *caletas* to further analyze the feasibility of TURFs. Results showed that when Loco harvesting was curtailed, its population recovered within 3 to 5 years (Gelcich et al. 2010). Locos emigrating from inaccessible harvest refuges quickly re-colonized even fishing areas that had been heavily overharvested. Thus, government fisheries experts, university research, and artisanal fisher organizations all began to push for the introduction of TURFs as a means of controlling fishing.⁷

The passage of CFAL involved significant political maneuvering, however, which directly influenced fisheries management. As previously noted, CFAL was developed during the Pinochet Administration and was passed in December 1989, only days before that administration ended. However, the new democratically elected government was concerned about some aspects of the new law and immediately suspended CFAL's implementation. Discussion and enactment of a modified CFAL continued until 1992. Essentially all of the debate regarding CFAL's modifications was focused on the off-shore industrial fisheries, which were the most important economically. The reform anticipated the use of ITQs, which was intended to solve the effort control problem. A struggle ensued between firms located in the north of Chile, which wanted increased access to fish in the sea off central Chile, and the industrial firms already operating in the central area, who resisted access from northern firms. The Aylwin Administration also anticipated a constitutional challenge as to whether it had the power to impose ITQs. This issue had arisen during the Pinochet Administration, and the new administration did not want to pass a law that, if challenged and rejected, might significantly reduce its ability to regulate in numerous areas. Further, if ITQs were to be implemented, there was

⁷ President Aylwin visited the coastal region in 1991, where artisanal fishermen were complaining about the closure of nearshore Loco fisheries. His meeting with regional authorities was interrupted by a leader of the regional federation of artisanal fishers. Aylwin listened to the leader's complaints and his evidence that local fishing communities were having success managing individual *caletas*, and instructed the Undersecretary of Fisheries to consider the evidence that new management tools based on local organizations might allow sustained production. This helped end the fishing ban, which occurred in 1992 (Orensanz and Parma, 2010).

much discussion about how to define historical use and its weight in determining the allocation of ITQs.

In contrast to the debate regarding implementation of CFAL for the industrial fisheries, there was little disagreement among fisheries experts, fishers or in Congress regarding how the new law would affect the nearshore fisheries. By 1992, fishing authorities were under great pressure from fisheries organizations to end the ban on Loco harvesting. The modified law contained options for the imposition of ITQs or the establishment of TURFs. There was growing interest in TURFs, but their implementation seemed to require much larger systemic change, which was politically uncertain and administratively difficult (San Martin et al. 2010; Orensanz et. al, 2005). In contrast, it was relatively easy to achieve general agreement that ITQs, or rather Individual (non-transferable) Fishing Quotas (IFQs), should be adopted, largely because they were being used for the industrial fisheries. As one SUBPESCA official told us– it seemed natural to use IFQs for the nearshore fisheries too.

The assignment of IFQs was intended to limit the total catch by limiting the total amount caught by each fisherman. The process assumed that it would be possible to identify all fishers and divers, assign each a quota, and ensure that quotas were enforced. In practice, this proved impossible. The difficulties encountered illustrate the difficulty of implementing a uniform control policy when information about the number of fishers is lacking and enforcement capacity is inadequate. For example, SUBPESCA initially contemplated assigning some IFQs based on historical use and auctioning off the rest. However, there were no records to clearly indicate historical use and there was no registry of boats or divers that had been involved in benthic fishing. A registry of individual fishers was established in 1991, but the number of individuals registered probably exceeded the number of active fishers, since those registering may have anticipated a benefit.

SUBPESCA also planned to assign TACs on a regional basis and then distribute those TACs through individual quotas to fishers. Processing quotas were also allocated among authorized processing plants (Bernal et al. 1999; Castilla and Defeo 2001; Leiva and Castilla, 2002). However, regional TACs were based on assessments that proved to be inaccurate, according to another SUBPESCA official, causing fishers in some regions to receive more quota than fishers in other regions. Moreover, as artisanal fisheries had historically been largely divided between fishers (finfish) and divers (shellfish), regulators intended to preferentially assign individual quotas for shellfish to divers, who primarily harvested shellfish. Instead, because records were imperfect and because the process was subject to local influence, many shellfish IFQs were obtained by fishers, including some who were previously inactive. As dissatisfaction with the allocations

mounted, fishers and divers pressed for and achieved an expansion in the number of quota recipients, which almost doubled from the original allocation to nearly 11,000 in 1993. A black market in tickets also emerged and these tickets were often used to launder illegal catches. Regardless of whether IFQs were assigned to the “right” individuals in the “right” amount, government authorities were unable to monitor harvests and enforce IFQ landings. As a result, the assignment of IFQs suffered from problems similar to those of previous control systems. Too many fishers wanted to fish and the government was unable to control the harvest.

SUBPESCA soon recognized the inadequacy of the IFQ system, decided that IFQs could not succeed and began to prepare to implement TURFs. IFQ’s remained in effect, however, until TURFS began to be established in 1996.

2.3 *Implementation of TURFs*

Chile’s TURF system assigned to organized groups of fishermen temporary (four years but renewable) access and management rights to the marine resources within individual coastal fishing areas. These rights were known as Management and Exploitation Areas of Benthic Resources. The TURF system intended that the assignment of quasi-property rights to groups of fishers would lead them to exploit the fishing resource efficiently, and that the profits (rents) so realized would motivate those fishers to protect that resource from others. Nonetheless, the government maintained significant control.

SUBPESCA incorporated a number of design options based on findings from other successful rights allocations around the world. For example, preference was given to applications from groups that traditionally had exploited local fishing areas. Fisher organizations supported this feature. Some interest groups wanted TURFs assigned as property rather than as a usufruct right, but SUBPESCA rejected this proposal, wanting to ensure that fishing areas remained national, not private resources. SUBPESCA also did not want TURF recipients to be able to sell the rights to others. Thus, no mechanism exists by which individual members can sell their rights to another member, e.g., and retire. To keep groups from claiming excess space, a rental fee was levied on area rather than on resource richness, as economic theory probably would have suggested. To encourage group cohesiveness, applicants were required to invest in baseline studies and pay for the upfront costs of applying for the TURF. Finally, to provide a backstop against profligate waste of the resource, SUBPESCA required annual review and approval of harvesting plans to ensure that they were within recommended biological guidelines. The guidelines focused on exploitation rates and on minimal harvest sizes to preserve spawning stocks.

To be able to apply for a TURF, fishing associations had to be officially registered and had to successfully develop an organization plan and pay the required application fees before they could receive a TURF (Cancino 2007; Orensanz, et al., 2005). The organization plan had to include a baseline analysis of the fishing resource, which was to allow monitoring of productivity changes over time, and a harvest/management plan for all species to be harvested. Moreover, once established, the managing association had to develop an annual harvest plan consistent with government biological guidelines for resource sustainability.

The initial organization plan and a mandatory annual stock assessment had to be carried out by government-approved technical consultants, but paid for by TURF members.⁸ Aided by such reports, the government determined a TAC for each TURF. The government maintained additional control by regulating minimum catch sizes and the potential for closure, if deemed appropriate, as the government was unsure how well the new TURFs would function. The association also paid an annual rental fee based on the physical area of the seabed awarded the TURF, which was intended to defray the costs of program oversight.⁹ TURFs were allowed to generate their own internal management schemes within these constraints.

The universe of TURFs is now fairly stable. As of 2011, SUBPESCA had identified 769 coastal areas as being apt for TURFs assignment, covering roughly 250,000 ha (2013). Of these areas, 520 had been assigned. Applications for another 364 were in some stage of processing – more than one application can be submitted for the same site. However, of the 520 TURFs assigned, only 323 were classified as working well, while 197 appeared not to be functioning or functioning only partially. The number of TURFs working well and in process has remained roughly constant in recent years. A number of TURFs have not followed through to complete their applications, while a number of approved TURFs operated for a time and then ceased to operate. The well-functioning TURFs controlled roughly 48,000 ha, or roughly 20% of the total area in which benthic production is identified to occur, but appear to account for 70% to 80% of the total value of benthic production.

Most initial TURFs were created in central Chile around long-standing fishing areas utilized by local fisherman organizations. The scale of these TURFs was thus

⁸ The role of consultants is somewhat controversial. The use of consultants was introduced to provide independent technical assessments. However, some feel consultants have too much power, while others feel consultants only rubber stamp the desires of TURF associations, which can replace consultants if they do not.

⁹ Most TURFs have ceased to pay the annual fee in recent years and no sanctions have been imposed on those that do not.

determined by historical practices, and applications for larger-than-needed TURFs were discouraged by the imposition of the annual rental fee. More recently established TURFs have been created in remote southern areas that were previously subject to mobile open access fleets of harvesters. Established TURFs are heterogeneous in many aspects, including size, organization, catch, and profitability. Some areas have not progressed much beyond an unregulated race to fish among participants whereas others have adopted intricate and imaginative rules of use, innovated new productive activities, coordinated harvest with processing firms and some have integrated some operations with other TURFs (Cancino 2007).

2.4 Internal management and distribution of proceeds

The internal management practices of the various TURFs vary widely as to the types of self-enforced rules intended to rationalize fishing effort and to share fishing proceeds. In most TURFs, there are more members than actual divers. Members are often paid for work performed. Divers are usually paid at a higher rate than non-divers, which is consistent with a concept of payment for higher skills, effort and risk, while owners of boats and specialized equipment are paid for the contribution of those inputs. Although practices vary across TURFs, there is a generalized effort to establish incentives that appropriately reward productive inputs. In addition, all members usually receive a share from the surplus after Loco is marketed. That is, TURFs pay for factor inputs and then divide the profits (rents) (Cancino 2007).

Cancino identified two general types of effort allocation procedures, each with ramifications for incentives and for distribution. One method simply apportions the total TURF-specific TAC among production “units”, typically consisting of a diver, 2 crew, vessel and gear. Some TURFs using this scheme distribute proceeds to their members via a pooling system while others pay each unit according to the quality of the product harvested. The other method leaves the TURF’s TAC unallocated but distributes proceeds to members via a pooling system. This method is often also combined with a rotating effort assignment plan that equalizes work burden and distributes effort more uniformly over the TURF space. In others cases, piece-rate schemes are used to incentivize divers with different skill levels and to promote effort by discouraging shirking. Under most allocation methods, a fee is taken off the top of TURF sales to pay for the baseline studies, the annual biological assessments, the TURF fee, and for other organizational activities, which may include marketing, effort administration, and policing the TURF’s boundaries. Non-diver members assist in landing and marketing activities and in policing the borders and they usually are paid for these activities, either directly or implicitly. In many cases, borders are policed 24 hours per day, and hence,

although fishing effort has been reduced, the total level of effort may not have changed much (Cancino et al. 2006).

A number of TURFs employ fines or otherwise sanction members for failure to comply with the organization's operational guidelines. Fines are implemented for failing to carry out border policing duties, attend meetings, or helping with administrative functions like landing, distributing and marketing output. More serious sanctions, including suspension and expulsion, are applied to members caught illegally harvesting within TURF borders. Some TURFs have implemented detailed *ex ante* procedures and protocols for avoiding and resolving internal conflicts whereas others have adopted *ex post* voting and consensus-based mechanisms.

2.5 Results of TURF Implementation

Have TURFs met basic conservation goals? Functioning TURFs seem to have achieved basic conservation goals. This result is more or less the intent of the process by which annual stock assessments are conducted, management plans filed, and feedback provided by federal scientists on harvesting plans. While federal authorities comment on harvest plans developed by TURFs, via their consultancy studies, each TURF ultimately makes its own decisions about the number and minimum size of Locos harvested, subject to the government's minimum size constraints. Biologists generally believe that Loco exploitation rates in the range of 20 to 35 percent of exploitable biomass are sustainable. During the early 1998-2005 period, a significant number of TURFs requested TAC targets less than 20 percent of the exploitable biomass. Moreover, the actual harvests of most TURFs were below the requested TAC targets.¹⁰ Cancino (2007) reports survey results for TURFs he examined that reveal that during the 1997-2005 period, actual exploitation rates were often below requested rates,¹¹ many TURFs requested conservative exploitation rates at the lower end of the 20 to 35 percent range recommended by biologists, and very few TURFs overexploited their stocks. This conservative pattern of operation during the early years reflects that most TURFs that had been overexploited during the pre-CFAL phase undertook conscious rebuilding efforts that often took several years. In addition, real prices for Locos declined during the early formative period and some TURFs seem to have decided to reduce extraction in hope of selling output at higher prices in the future. In summary, there is solid evidence that TURFs have generally managed resources in a manner consistent with long term sustainability. Moreover, fishers appear increasingly willing to participate in marine

¹⁰ In terms of average size of Loco harvested, biological recommendations are for minimum sizes of 10 cm; actual average sizes were closer to 11.4 cm. during the early period (Cancino, 2007).

¹¹ See also Jerez (2003)

conservation and creation of the TURFs seems to be a factor in attitudinal change (Gelcich, et al. 2009).

Nonetheless, the evidence shows that aggregate (legal) Loco landings from TURF areas have not recovered to levels achieved over the whole nearshore system prior to the mid-1970s boom. The official data show annual landings of 3,000 tons to 6,000 tons in the pre-1975 period, rising sharply to about 25,000 tons, then declining, going to zero during the period of closure, and then roughly stabilizing after TURFs were introduced in the late 1990s, but at a level of 2,000 to 5,000 tons.

Three factors may explain why official Loco landings have failed to surpass landings from the pre-1975 period. First, harvesting within existing TURFs may be too conservative; i.e., TURFs are taking less of the stock than can be taken sustainably. This could occur because fishers are innately conservative, or are fearful of a regulatory response if they are perceived to harvest too much (although we know of no solid evidence to support this view). Second, the extraordinarily high landings achieved during the boom years were probably the result of harvesting an “old growth” resource. We would not expect a system that has drawn down the older and larger parts of the original biomass to be able to sustain harvest levels typical of the drawdown period. Third, the pre-boom period involved a coastal matrix of exploited and unexploited areas, the latter of which were likely replenishing the harvested areas. To the extent that the coast is now more uniformly harvested, or even overharvested in non-TURF areas, there could be less dispersal and replenishment of existing TURF areas. This is consistent with the evidence that harvested areas are, at least initially, fairly rapidly reseeded and recolonized by locos in adjacent areas but not reached by fishers. Finally, legal fishing may be a much smaller proportion of total landings today so that the official data are not representative of actual fishery productivity. We will return to this theme subsequently to discuss the issues of fishing in areas outside the TURFs (background areas) and poaching within the TURFs, but first we discuss other aspects of TURF operation that shed additional light on the incentives created by TURFs and on members’ responses.

TURFs generate incentives to enhance and alter habitat production that might not emerge under decentralized IFQs. For example, many TURFs have adopted stock enhancement strategies, with some of these simply extending and refining strategies fisher organizations implemented even before the TURF program was implemented. In order to proceed with stock enhancement, a TURF is required to hire a consultant to prepare a technical report specifying the objectives of the project, the methods to be used, and the expected effects on the TURF’s ecosystem and biological indicators. This report must be approved by SUBPESCA before fishermen are allowed to implement the project. For example, some TURFs have transplanted Loco within the TURF area to places with

better food supplies. Some TURFs practice “ecosystem management” by controlling commercially valuable species that are food supply for more valuable species in the TURF ecosystem. Loco prey on sea squirts and barnacles (Stotz et al. 2003), and some groups have refrained from exploiting these species or even attempted to increase their stocks through repopulation programs. However, TURFs have also relocated Loco from areas outside their TURF (background areas and/or other TURFs), for development and sale under their approved TAC. Such relocation is illegal and has aroused discontent and, in some cases, violent conflict between “open access fishers” and “TURF fishers”. Some open access fishers assert ownership over background areas, even if fishing there is technically banned. Government control over background areas is minimal, which allow fishing to continue and conflicts to occur.

Some TURFs have developed mariculture facilities within their TURFs, for example, by gathering, culturing and growing out red sea urchin seed. Once the cultured seed reach a certain size, they are placed in small mesh cages, fed fresh kelp and adjusted to maintain optimum density in the enclosures. Sea urchins juveniles are released in the natural habitat once they reach about 20 millimeters, when they are better able to feed themselves and avoid natural predators. Other TURFs are working to develop shore-based Loco culturing facilities, which depend upon seaweed extraction for feed. Fattened adult Loco are sent directly to the lucrative Japanese and North American markets.

A few TURFs have started companion industries that take advantage of the fact that the TURF is granted rights to an area rather than to just a collection of species (Cancino 2007). For example, a TURF near a relatively wealthy town has developed its own fisherman’s market that includes lobster tanks with live fish and shellfish for portside visitors. The same TURF established three diving courses with different degrees of difficulty for Chilean dive tourists within the TURF limits. Fishermen also developed subsurface charts to allow self-guided tours through the diving trials, as well as diving-related services such as diving lessons, guided underwater tours and rent of diving equipment. Such marketing innovations would not emerge from an ITQ-based regulatory system that grants rights only to harvest individual *species*. Instead, these innovations have emerged as a result of incentives that TURFs provide to make best use of a marine ecosystem *space*.

Most TURFs organize their fishing seasons to maximize revenues (Cancino 2007). This involves coordinating and contracting with buyers to deliver the entire year’s harvest on a particular delivery date after a short period of intense harvesting. As a result, fishing for Loco has evolved from one where many fishermen were fishing at low levels of success over long seasons, to one in which harvesting is concentrated in time to minimize effort and maximize price (Jerez 2003). This result differs significantly from that brought about in most other reformed fisheries, where short and intense derby fishing

has been followed by protracted and slower seasons after rationalization. In the Loco fishery in Chile, the adoption of short seasons is a consequence of the sedentary nature of the resource, which grows throughout the year and can be harvested at will, combined with the existence of numerous small production units spread along the coast which individually are too small to profitably supply the market continuously. Thus, buyers and TURF operators have negotiated agreements by which the entire season's production can be delivered sequentially by various individual TURFs in a coordinated manner. The system-wide total is distributed more or less uniformly over the marketing period, similar to what we observe in highly integrated agriculture.

The TURF system has also allowed fishermen to better organize their TURF harvest timing in order to maximize price. Most TURFs coordinate harvest in order to deliver pre-arranged quantities and sizes at particular dates. Some buyers in turn coordinate deliveries by many TURFs and smooth out the supply delivered over the whole coast.¹² This has allowed some fishermen to use TURF fisheries to supplement their income from other sources rather than committing long periods of time to fishing. Fishermen groups are also cooperating and coordinating across TURFs by pooling multiple TAC harvests to gain leverage over buyers, or by forming their own export firms.

These agreements benefit the fishermen insofar as the TURF provides increased income with less fishing effort during the fishing period. However, while fishing effort is reduced by TURFs, significantly larger labor effort is required to monitor the TURF's borders and protect the Loco from theft. Indeed, the concentration of fishing effort to achieve coordinated, timely sales has led to growing stocks of Locos that create particularly attractive targets for poachers. Because TURFs are located in relatively shallow waters where Locos can be exploited using simple technology, they are vulnerable to theft. Ironically, while TURFS achieve their economic benefit by providing the incentive to protect, manage and harvest resources efficiently, their success depends precisely on the security of the usufruct right. Although Chile has strong property rights and a reasonably well-functioning police and judicial systems, theft from TURFs is a considerable risk. Thus, TURFs must monitor and protect their stocks throughout the year. The risk of theft seems to have been one factor in the demise of a number of TURFs. In addition, one of the major benefits of TURFs is avoidance of the rent dissipation that occurs under open access, both from higher production and reduced effort. The more successful TURFs are in generating rent, the more likely is the need for increased effort to protect TURFs, which reduces the economic gain that would otherwise occur.

¹² Though many positive practices have emerged, some TURF regions have limited access to markets.

Many TURFs have not been able to launch or sustain themselves, once initiated. Of the roughly 700 TURFs whose applications were initiated prior to 2005, about 400 had been approved by that time and the rest were in approval limbo, awaiting more action by applicants. Further, of the 400 approved, 200 had initiated operations and then abandoned them, so that only about 200 TURFs were in operation. In addition, numerous fisher organizations that initially sought TURFs did not complete their applications. The failure to constitute these TURFs was sometimes due to conflicts among fisher organizations that are contesting the areas.¹³ However, it seems equally likely that many areas have not supported TURFs because they are insufficiently attractive economically, having low resource productivity (low rents) or being difficult to protect. This is true for areas for which TURFs were never established, as well as for areas where TURFs approved and implemented and then ceased to function (Sobenes and Chavez 2007).

The size of TURF membership may also be a factor in determining TURF viability. TURFs vary greatly in area, productivity and number of members, and larger membership, other things equal, implies less income per member. Exploitation of Locos generally yields TURF members a significant income, but it is usually only sufficient to supplement other income. For example, a successful TURF might yield its average member one to several thousand US dollars equivalent per year. Chile's current per capita income is about \$15,000. Thus, having a TURF is economically attractive, but unless the TURF yields a high income per member, members must dedicate most of their labor to other activities, e.g., fishing for other species, farming, or other non-fishing activities. Moreover, if annual TURF earnings are too small, it is understandable that members will cease to be interested, particularly given the labor needed to monitor and protect the TURF.

Official numbers are said to considerably overstate the number of fishers actually involved in the loco fishery on a daily basis. As economic growth has proceeded, numerous fishers have entered other occupations. However, because TURF members have rights to a share of TURF profits, fishers who have ceased to fish on a regular basis have an incentive to remain a TURF member and participate in TURF profits. Since having a larger number of relatively inactive members dilutes the profits and the interest of those who remain active, it would be economically preferable if a mechanism existed by which inactive members could sell their shares and exit the TURF. However, TURF members have a usufruct right to a relatively short-lived permit and it would be difficult to structure an agreement that would allow active members to purchase rights from inactive members. SUBPESCA has worried as well that such a mechanism could lead to

¹³ In at least one case, a severe conflict among fishers was resolved by agreement to forego a TURF and allow all fishers in the area access to the traditional grounds.

private quasi-ownership of a TURF, which while perhaps economically efficient, would conflict with current images of the TURF as a cooperative or community organization.

3. Political Economy Backdrop to Chile's Nearshore Artisanal Fisheries Reform

One might be tempted, after superficial review, to conclude that Chile's unusual choice to adopt TURFs in the nearshore fisheries was a result of the "Chicago Boys" neoliberal influence during the Pinochet Administration. After all, TURFs create property rights and decentralize important decisions to users, often with only vestigial oversight by the government. However, although the creation of TURFs was influenced by the market-based revolution in Chile, the causes of their establishment is considerably more nuanced.

In the 1980s, fisheries experts in Chile's regulatory and research agencies were aware of ITQs and favored their introduction in the industrial fisheries as the best way to protect and regulate Chile's offshore fisheries. However, given the political and administrative difficulties of imposing ITQs, the government might not have moved successfully in this direction in the absence of the strong neoliberal influence among its economic policy makers, particularly given the strong opposition of an important fishing interest. The authoritarian nature of the government at that time may have provided the government with unusual power to make such a decision, though it is clear that the government was sensitive to the opposition from important industrial fisheries firms. Regardless, the government decided to implement ITQs in the offshore fisheries and this decision indirectly affected the nearshore fisheries as well. However, the move to use TURFs, another market-based instrument, in the nearshore industry, was mainly an outcome of pressures from fishers' organizations, researchers, and national fisheries authorities, who were desperate to find a solution to overfishing in the nearshore benthic fishery after the IFQ system had failed, rather than to the influence of neoliberal economists. The move to TURFS was partly based on an improved understanding of coastal marine ecology that suggested the TURFs might work, partly on a push by fishers organizations for an instrument that they perceived would benefit them, and partly on the political transition from an authoritarian to a democratic government wherein all parties found something that they liked in the TURFs, while also creating space for greater than usual influence from fisheries authorities during the period of implementation.

3.1 Northern Chilean Industrial Interests and CFAL

To understand the nature of the evolution of Chile's fisheries management reform over the past 60 years, it is important to acknowledge the players who have been the important industrial-based interests in Northern Chile. The most important player in Chile during the post-liberalization reforms and throughout the design and enactment of CFAL was the Angelini group. The Angelini group was a powerful player well positioned to craft and influence the drafting of the CFAL that was in process as early as

1986. The Pinochet government had divested itself of numerous state-run entities, among which were fish processing plants and harvesting operations that had been seized during the late 1960s bankruptcy of the industrial sector. The Angelini group arose out of the subsequent re-privatization of the plants nationalized during Allende. The Angelini group dominated the northern Chilean industrial pelagic fishery in both harvesting and processing, accounting for at least half and up to two-thirds of total harvest, with sales in 1992 exceeding 2 billion U.S. dollars and 20 percent of Chile's exports (Peña-Torres 1997).

As the 1980s came to a close, there was significant conflict brewing between the fisheries administrators of the Pinochet regime and the powerful northern Chile industrial interests. The fisheries bureaucracy had attracted very competent scientists who were well versed in the management innovations being discussed (and implemented) around the world, including TACs, limited access programs, and ITQs (World Bank 2006). These scientists and policy makers in SUBPESCA, SUPERNESCA and IFOP were working to develop a new fisheries law for Chile that would embody all that was known at that time about fisheries management. The core of that law called for limiting entry and freezing capacity growth in overexploited fisheries, implementing TACs as a basis for within-season control, and developing ITQs to avoid capital stuffing and the wasteful race to fish.

Simultaneously, and in lock step, the Angelini group and other northern interests were busy lobbying to block many of the intended policy changes. As fisheries regulators began to work on the new law in the mid-1980s, the northern pelagic fisheries were exhibiting classic signs of overexploitation, unsurprisingly given the previous decade of open access effort growth under booming markets and high prices. But the Angelini group and other aligned northern industrial interests repeatedly thwarted even the most basic conservation-oriented policies, namely TACs. This left fisheries managers only with closed seasons, gear regulations, and limited entry to regulate harvest. These conventional command and control measures did not moderate effort and, as a result, the stocks of the important northern pelagics were in significant decline by the late 1980s.

Northern industry representatives made multiple arguments why their stocks should be left virtually unregulated. They first argued that it was impossible to predict abundance of highly variable pelagics like sardines and anchovies and hence the use of TACs would be unworkable. They also argued that the industry was an important employment source that would be adversely affected with TACs or any interventionist regulation. Northern interests also argued against both limited entry and ITQs on the grounds that restricting entry was unconstitutional.

At the same time, industrial interests in the central part of Chile and the southern region lobbied in favor of ITQs and limited entry to protect their less well developed fishing areas against incursion by northern interests. Many of these firms had been attracted into developing the southern and central area fisheries by the Pinochet Administration's open door policy, together with liberalized access to capital and investment tax breaks. From their perspective, they needed protection against the northern fleets that had overexploited their stocks and were looking to move into different regions. Throughout this period, fierce competition led to sharp decline in the number of firms operating in each segment of the coast, e.g., north, central and south, and growing industrial concentration, which increased the economic and political influence of the remaining firms.

The conflict between incumbents and regulators came to a head with the passage of CFAL, a law that was originally passed in 1989, but whose implementation was delayed until 1991. CFAL was viewed by many as substantially compromised by the need to placate powerful northern Chilean industrial fishing interests. The challenge that northern interests mounted to the constitutionality of restricting access, and to charging for access, was partially upheld by a Constitutional Tribunal, which nevertheless left unresolved the fundamental question of the constitutionality of limited access and the ability of the state to sell marine property rights. The modified CFAL also made concessions to gain buy-in by the northern interests.

As discussed earlier, the core of the modified CFAL upheld the principle that SUBPESCA could limit access for "well-founded" reasons. Fisheries were categorized as fully exploited, under recovery, or under development. The fully exploited fisheries (mainly the northern Chilean industrial pelagic fisheries) were left to be managed by (transitory---one year, renewable) entry limitations as well as conventional closed seasons and TACs, with an option to implement ITQs. Fisheries under recovery (overexploited) were closed for rebuilding for a minimum of three years, after which they could be re-opened with either access permits or ITQs. And fisheries under development could be managed with short-term access permits, after which they would transition to either limited access permits or ITQs. CFAL also called for TACs and other core biological instruments of control, provided guidance for penalizing fishing regulations violations, and transferred legal jurisdiction to civil rather than local police courts.

3.2 *TURF Support among Fishers*

As previously described, powerful artisanal fisher organizations in central and northern Chile encouraged TURF creation. Their leaders saw opportunities to use TURFs to better manage fishing resources, in addition to using TURFs to capture rents by

achieving control over fishing areas and thereby excluding others (Aviles and Jerez, 1999). It appears that there was only moderate formal political opposition within the central and northern benthic areas to the creation of TURFs, despite the lengthy evolution of their establishment. But many fishers believed the TURFS were unnecessary or only a minor threat and preferred not to participate in them when they were first proposed. Other fishers did not like the idea of TURFs, as they were accustomed to fishing wherever they wanted, whenever they wanted; nonetheless they did not constitute significant organized resistance.

Fishers in the south were less supportive of TURFs, even though the south has a large number of artisanal fishermen harvesting Loco.¹⁴ However, fishermen in the south were not then well organized, nor culturally associated among themselves. In part, this was because they are primarily seasonal fishermen, working in agriculture and livestock during the rest of the year. When fishing, they also divide their effort between diving for shellfish and fishing for finfish, which is different from those artisanal fishermen (divers) in the central and northern regions that traditionally harvested shellfish all year long. Southern fishing areas are generally more distant from populated areas and fishers are accustomed to ranging widely and less accustomed to fish a “neighborhood” area. Though fishers in the south generally were less interested in and/or more antagonistic toward the idea of TURFs, they also were a weaker political force because of their lack of organization and their distance from the seat of government. Once TURFs began to be established in the south, fishers who were excluded from the TURFs became more actively and vocally opposed than has been witnessed in the center and north.¹⁵

In summary, although fishers have been divided in terms of support for the introduction of TURFs, the organized fishers of the central and northern regions, who had also worked closely with academic and fisheries’ authorities’ scientists for more than a decade, had much greater influence than those fishers in regions that were not organized and who, in the south, were also less involved in the TURF design process.

¹⁴ The major production zones in the country are in the 3rd and 4th regions, the 10th region and the 8th region. The 11th Region is not well suited for TURFs as the fishing areas are distant from the populated areas, making it very costly to protect the fishing areas.

¹⁵ In Ancud Bay (Region X), for example, hundreds of fishers revolted against the introduction of TURFs, illustrating the difficulties inherent to the partition of fishing territories when a large number of fishers have historically harvested the same grounds. The conflict was mediated by the Catholic dioceses, and was accompanied by the creation of a local independent confederation (‘Confederation of Fishers for Equity’). In the end, an agreement was reached to return some of the designated tracts and to stop allocating new TURFs within the bay.

3.3 Congressional Action

Eventual agreement on the TURF legislation was probably favored by the transition from one administration to another, which seemingly increased the attractiveness of the intellectual idea, while reducing the scope for political maneuvering. The political alliance composing the democratically elected Aylwin Administration (*Concertacion*) that assumed power in 1990 did not control the Senate in Congress because the Constitution allowed the out-going Pinochet Administration to appoint a number of non-elected senators that gave the opposition (*Alianza*) a majority of that house. Accordingly, any major legislation had to obtain support from both “right” and “left”. Fortunately for the legislation, the *Alianza* favored policies like TURFs that were property-rights based and economically efficient, at least in theory. Similarly, the *Concertacion* favored policies that would benefit the poor, particularly organized groups of the poor, and saw the TURFs in this light. Indeed, the new alliance was not opposed to microeconomic liberalization, i.e., greater reliance on the market, but it was eager to amend laws to provide social benefits to assist the poorer elements of society that it felt had been left behind by the previous administration’s policies. Thus, the new administration was attracted by the community-empowering aspect of TURFs that would provide usufruct rights to poor fishers, and the TURFs were expected to benefit many fisher organizations that were likely to be important constituents. Fishers opposed to establishment of the TURFs were less organized, less effectively connected to the new Congress and thus poorly placed to challenge the new regulatory structure.

Given the ongoing crisis in the benthic fisheries, following the failure of both closures and the use of IFQs, the attraction of TURFs to each of the two main political groupings, the support of organized fishers from the coast and the north, and the lack of effective opposition from fishers opposed to TURFS, the moment was propitious. At this time, Chile’s reliance on its technocracy was also important. According to some, at a time when few in Congress had a strong view, the voice of experts within the Ministry of Economics, e.g., within SUBPESCA and IFOP, was very powerful. These factors all coincided in a manner that resulted in Chile deciding to implement TURFs in the nearshore benthic fisheries.

3.4 Additional Assessment of the Chilean TURF Experience

As discussed earlier, establishment of the Chilean TURF system has generated significant achievements, including important steps toward conservation of Loco stocks and a higher level of sustainable harvest. Operating TURFs appear to be managing their resources in a way broadly consistent with expectations. TURF members are generally supportive of TURFs and are increasingly motivated to conserve benthic resources.

These conclusions are important and provide support for the consideration of TURFs in other situations. Other lessons can also be learned from the experience.

In retrospect and not unexpectedly, there were drawbacks and unforeseen consequences to the allocation process. It was difficult for government staff to sift and sort through applications to determine which groups actually had legitimate precedence in a particular area. The best sites, i.e., the most productive and/or most accessible and easy to monitor, were reportedly snapped up quickly, including some cases where traditional local users were not organized quickly enough to get their applications through the process. Not all fishers thought TURFs would succeed. Many fishers were skeptical about the value of closing access, thought the TURFs would fail (as had closures and the IFQs), and hoped that they could continue to operate under open access. These people were quickly squeezed out of the process, foregoing the chance to be part of a recipient group. The process also closed out many Loco fishermen that were not members of local organizations, who had moved up and down the coast in trucks, stopping to harvest, and moving on during the open access period. However, others of the mobile fishers applied for sites in the neighborhood of communities that had fished there, creating insider/outsider conflicts that were not conducive to long term stewardship.¹⁶ The southern area presented its own special problems. Most nearshore grounds were isolated, local populations were sparse and widely separated, and the grounds were not frequently harvested. Finally, and most importantly, the process resulted in some fishers gaining rights to TURFs while others were excluded. The number of those excluded was large. Those excluded moved into other occupations, illegal fishing on the now closed fishing grounds outside the TURFs, or poaching from the TURFs.

The relatively limited number of functioning TURFs implies that the transactions costs of forming, operating and sustaining a TURF may exceed the value of making the effort in many areas where loco is present. The main causes seem to include low resource productivity of the assigned area, difficulty of protecting from theft, and the substantial costs required to organize and maintain a group that can manage a TURF, e.g., act as a unit, divide responsibilities, resolve shirking problems, and resolve disputes over distribution and other issues. Cancino's research (2007) also points to the importance of leadership in achieving successful group management of a TURF.

Biologists repeatedly focus on scale, emphasizing that a TURF should be as large as the typical range of the species in question. But the Chilean TURF experience

¹⁶ A past SUBPESCA official recounted that he had spent considerable time adjudicating between/among groups, e.g., one that claimed a long history of fishing in one region, but that had not originally sought a site, versus another group that had lived more distant from the site, but had claimed and obtained it as a TURF. In some cases, the renewable aspect of the usufruct rights has provided some opportunity for SUBPESCA to incorporate excluded groups in the TURF framework.

suggests socio-economic scale may be equally or more important, as potential productivity per member must be sufficient to attract and hold members. An area may be biologically productive per unit of marine space, but if there are too many claimants, it may not be worth the opportunity cost of organizing to accumulate the rents. A key measure of potential success is thus per capita resource productivity. Cancino's work demonstrates that revenue per TURF member is related to fishable biomass per member.

It appears that TURFs are in many cases failing to realize the full potential rents. Granting rights to a unit of space rather than the species within it seems to provide incentives to manage the system in a manner that would not occur with, for example, multiple ITQ systems. Some of the outcomes of place-based incentives were discussed above, including managing inter-species competition, allocating effort to utilize spatial productivity differences more effectively, using space for activities other than fishing, etc. Granting rights to the use of resources in a unit of marine space opens up the possibility to manage a complex of resources in a way that eliminates residual externalities that might exist with species- rather than space-based forms of property rights. But such effort requires coordination and collective action by the group, and the transactions costs and management requirements have thus far exceeded most groups' abilities to take advantage of the potential gains.¹⁷ Moreover, although each TURF contains a number of marketable species, rarely have species other than Locos, sea urchins, limpets and seaweed been important enough economically to warrant additional internal coordination and control.

Somewhat ironically, a SUBPESCA official indicated that while the TURFs give usufruct holders the rights to all seafloor resources, other fishers have the right to exploit fish within the vertical depth of the water. TURF recipients often want to exclude fin fishers from their area – but this is contrary to the original distribution of resources between fishers and divers.¹⁸

3.5 *Effects on Fishing Effort and Employment*

TURFs are unlikely to be a solution for all fishers, because, as with IFQs, the creation of a TURF is intended to lead to a rationalization of fishing effort. If TURFs lead to a reduction in fishing effort, employment of Loco fishers within the TURF will decline unless TURFs require much additional labor to protect from theft and/or can

¹⁷ Although TURFs are required to hire technical consultants to help them develop their exploitation plans, these consultants do not seem to be playing the role of systematically improving management or suggesting entrepreneurial activities. Several fisheries authorities expressed a belief to us that the technical consultants should be government employees.

¹⁸ Some TURFs are planning to initiate aquaculture projects. In these cases, fishing authorities are prepared to allow TURFs to control "water space" not just resources on the sea, but it is not clear to what extent control of water space will be permitted.

successfully intensify other types of benthic resource exploitation, which thus far has been rather small in Chile. Thus, while conservation of the Loco fishery was intended to assist fishing communities, it has potential to increase overall fishing income, but create greater income inequality, as the incomes of some fishers increase while those who are excluded from the TURF decrease (Gelcich et al. 2009).

3.6 *Illegal Harvesting*

Our interviews reveal that many fishers and government officials believe poaching from TURFs is a serious problem, though only one aspect of illegal Loco harvesting. Illegal harvests are of three types: 1) fishing in areas outside TURFs, which is considered the largest source, 2) theft from within TURFs by outsiders, and 3) undeclared fishing within TURFs (theft within by a TURF member). Illegally harvested Loco are sold on the local market, processed (illegally) for export from Chile, and also exported to Peru, mainly for export as Peruvian Loco (Gonzalez et al. 2006). Based on fragmentary data from different sources and in different years, Gonzalez et al. (2006) estimate that illegal Loco harvesting in Chile accounts for at least 50 percent of the total Chilean catch and, more probably, 60 percent.¹⁹ Chileans are well aware that illegal fishing and contraband fishing is large and are debating measures to reduce it. Theft of Loco is only a misdemeanor, even if the value of the theft is large. As a result, poachers that are caught are not significantly sanctioned. There is discussion of making poaching a felony, but such a measure is politically sensitive, particularly as it would require increased police and judicial effort and could have significant effect on individual fishers and on fishing communities.

Illegal fishing grew markedly during the 1989-92 Loco fishery closure (Gonzalez et al. 2006), with much of the catch exported clandestinely to Peru. This activity was covered regularly in the Chilean and Peruvian press, and was revealed directly by the sharp rise in Peruvian Loco exports,²⁰ which quickly exceeded by several times the small volume of Loco produced in Peruvian waters. Smuggling routes were established and perfected during the closure period, but appear to have remained active for more than two decades despite efforts by Chilean and Peruvian authorities to stop smuggling (Gonzalez et al. 2006).²¹ Most clandestine exports today seem to result from Locos harvested in areas outside TURFs and poached from TURFs by non-members. Both phenomena appear to be unintended consequences of the process used to create the TURFs and subsequent related decisions regarding the overall management of the Loco fishery.

¹⁹ See also UCN (2002) and González et al. (2004).

²⁰ See FAO statistics. Also see citations in Gonzalez et al. (2006).

²¹ For example, confiscations reached 3 million Locos in 1990.

These are among CFAL's unanticipated, but important secondary economic and social effects. Illegal catch is also sold for domestic consumption in substantial amount.

Much of the analysis of Loco fishery performance is based on amalgamation of fragmentary and dispersed data. Using a detailed review of diving surveys, Gonzalez et al. (2006) conclude that Loco abundance increased approximately five times between 1998 and 2000 within established TURFs, and remained stable thereafter. They estimate that TURFs, although constituting a small proportion of the total Loco fishing area,²² now account for 70 to 80 percent of total Loco productivity (by weight) and conclude that the catch from TURFs increased from 2000 to 2003, including the catch per unit effort. They also conclude that while abundance in background areas is only about one-fifth that in TURFs, the illegal catch from background areas is no less than 50 percent of total catch (in number of animals, not weight), but composed mainly of locos of sublegal size.

No evidence allows us to derive precisely how illegal harvesting is distributed between illegal harvest from non-TURF areas and poaching from TURFs. However, it seems that TURFs must be losing a significant share of their production to poaching. Moreover, total landings in recent years must significantly exceed the roughly 2,000 tons to 5,000 tons shown in official figures. For example, if total illegal landings in recent years are, say, 30 percent of the total harvest, the total harvest would be probably be somewhat higher, not lower, than in the early 1970s, a result consistent with the now improved management, at least within areas where TURFs exist.

Why is illegal fishing so high today? First, TURFs were not expected to incorporate all benthic fishers. Fishers were allowed to request a TURF and hundreds of applications were received, but even had all of these applications been approved and become operational, many fishers would not have been included in a TURF. Accordingly, these fishers either had to harvest Locos in areas outside the TURFs, fish for something other than shellfish, or change profession. It appears that many chose to fish outside TURFs and some to poach from TURFs. The process during which fisher groups organized to request a TURF, prepared their application, which was then evaluated and approved, was lengthy and, indeed, continues today. Initially, fisheries authorities allowed continued Loco harvesting under the original IFQ system in areas that had not yet been assigned. Access to these areas provided opportunities for fishers who were not included in TURFs, doubtlessly contributing to an expectation that they could continue to function as before. Some argue that fishing in background areas is a

²² According to Montecinos (2000), from a total of 4,533,442 ha of TURFs made available by the Chilean government, the small-scale fishers' organizations had requested 66,920 ha, from which only 32,768 ha were within effectively functioning TURFs.

legitimate practice because in the old days they were free to fish wherever they wished (Gelcich et al. 2005).

In 2000, after the TURF system had been initiated, the government formally concluded that the IFQs were a failure and banned harvesting locos in non-TURF areas. The government has no ability to enforce this ban, however, because of the extensive coastline, and illegal fishing continues in many non-TURF (background) areas, which effectively operate under open access. The illegal fishing has increased conflict and eroded trust among participants in the TURF system as the catch is largely forced into clandestine channels, including exports to Peru. Moreover, it appears that the existence of the (large) clandestine channels has also created a ready market for Locos poached from TURFs.

Poaching appears to be conducted both by fishers who have few other opportunities to fish and resent being excluded from fishing areas that were once open to them, by members of TURFs, and by more sophisticated, organized poachers. It appears many TURF members dive for Locos in non-TURF areas much of the year and TURF members also poach from their own TURFs and from neighboring TURFs. In some cases, the poachers are well known, but as sanctions are small relative to the gains, poaching continues.²³ Interviews suggest that some Loco thieves employ scuba diving equipment with lights for undetected night poaching, GPS devices that allow pursued poachers to drop sacks of Locos in shallow water for subsequent recovery, and even helicopters. Poaching in TURFs has been the source of severe conflict among fishers in some areas, with pitched battles, and it seems likely that this will get worse, rather than better, as development occurs, unless the poachers can be subdued.

Fishermen can monitor their boundaries, but they cannot legally enforce rights to their TURF. They must count on an effective police and judicial system to enforce their property rights. Currently, enforcement is low (Gelcich et al. 2009). The theft of Locos, even if very large in monetary value, e.g., \$50,000, is a misdemeanor in Chile. The government was unwilling initially to request severe sanctions for illegal fishing, including poachers, largely because it understood that many fishers would continue fishing in the areas outside TURFs. It was impossible to adequately patrol Chile's extensive coastline and it knew some fishers excluded from TURFs had few options. However, the low level of sanctions has contributed to the rise of poaching. Indeed, given that police know that the penalty for poaching is so limited, they have less incentive to pursue poachers. As a result, violence between TURF members and poachers is becoming an important issue. In addition, the contraband market contributes to the growth of broader criminal activity, which some suggest is now linked to drug

²³ The cost of being expelled from a TURF may be less than the benefit from poaching.

trafficking. Plans have been discussed for several years to alter the law to make poaching a felony. However, given the prevalence of illegal fishing in background areas, as well as poaching, designing an appropriate law will not be easy, and implementation will confront serious socio-economic as well as judicial challenges.

4. Where to From Here?

Chile's experience suggests that the creation of TURFS is likely to benefit some workers and harm others, while improving resource allocation within TURFS, but worsening allocation outside the TURFS. These issues should be considered when designing TURF programs. Fishing effort is generally too high within an open access regime. TURF organizations can be expected to rationalize and thus reduce fishing effort within a TURF, regardless of the number of individuals assigned membership. TURF membership allows all to share in TURF rents as production is optimized, but larger fisher organizations are likely to lead to an increase in the number of non-participatory members, complicating organization and possibly diluting incentives. If, in the formation of TURFS, some fishers are excluded – in anticipation of the desired reduction in fishing effort – government should assist excluded fishers in transition to other employment. Similarly, if not all fishing areas are conducive to formation of TURFS, e.g., because their productivity is insufficient to motivate appropriate monitoring to protect the resource base, TURFS will not serve as a management tool for some portion of the resource base. Prohibiting fishing in the non-TURF areas has significant disadvantages as it implies that those areas cannot be exploited, that a larger number of fishers cannot be employed, and/or, if the government lacks control measures to police prohibition (which is often a reason for the establishment of TURFS), they will continue to fish and catch will be sold clandestinely.

In Chile, the creation of the TURF system appears to have improved resource management in areas in which TURFS have been established. However, a significant part of the Loco fishery appears unsuitable for TURFS. An alternative control mechanism is needed for the non-TURF area, but as no such mechanism is obvious, allowing open access fishing in these areas may be better than prohibiting fishing. However, resource degradation is likely in the non-TURF areas if other forms of control are not found, and, if the sale of Loco from non-TURF areas is legal, the incentive for theft from TURFS could increase. Coordinating management in TURF and non-TURF areas is difficult, as was recognized by an international panel in 1999 (Parma et al. 2001). Legalizing the open-access nature of the background areas and thus allowing capture to be legally marketed may be attractive, while simultaneously working with fisher communities to achieve improved control. It will be a challenge to design a dual option that preserves and reinforces the economic attractiveness of TURFs, reduces fishing

pressure in non-TURF areas, and is also socially and politically acceptable. A recent revision of Chile's CFAL introduces a Fisheries Management Plan that is intended to permit the negotiation of agreements that may move in this direction. These plans can be implemented at different scales in an attempt to achieve this goal. Involvement of fishers, communities and broader socio economic units in the policy dialogue is needed to identify workable options that further improve marine ecosystem stewardship and achieve broader economic benefit (Gelcich et al. 2010). Many fishers greater input from fishers could improve TURF effectiveness (Gelcich et al. 2009).

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