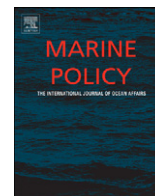




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The evolution of legal instruments and the sustainability of the Peruvian anchovy fishery

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ABSTRACT

Landings statistics of the Peruvian anchovy fishery show that the fishery went through a phase of explosive and uncontrolled growth from its establishment in the mid-fifties until its collapse in 1972. After the collapse, a second phase from 1973 to 1984 was characterized by unfavorable warm ocean conditions and low catches. A third phase, from 1984 to the present, with propitious ocean-environmental conditions and modern governance, can be further divided into a controlled growth period (1985–1994) and a sustainable landings' period (1995 to present). The most recent period of the third phase has enabled the fishery to maintain its catches and be labeled as one of the most sustainable fisheries worldwide. This article highlights the evolution of the legal system that provides for the current sustainable landings and governance of this fishery. Results show that General Fisheries Acts were enacted independently of failures to sustain anchovy landings. The three Peruvian Fisheries Acts were a reflection of broader national socio-political changes and were enacted mainly to define the role of the state and private investment and to delimit foreign involvement in the fishery industry. By contrast, the enactment of secondary legislation to control quotas and fishing seasons increased as the fishery moved towards stable landings. During this phase, enacted secondary legislation showed also a clear peak during strong positive sea surface anomalies driven by the El Niño Southern Oscillation (ENSO) 1997–1998, providing evidence of rapid adaptive management. The role of Fisheries Acts in defining access rights at the national level from a multilevel governance approach is discussed and further key elements that contributed to the transition towards sustainability are suggested.

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1. Introduction

Nearly one in four fisheries has collapsed during the period 1950–2000 with no apparent sign of improvement in this trend [1]. To confront these crises in fisheries and improve the management of fish stocks, twenty-first century approaches have recognized the importance of complex adaptive social-ecological system concepts [2–7]. However analysis of linked social and ecological processes has revealed shortcomings of sustainable resource management based on purely ecological and economic foundations [8]. During the last decade, a multi- and transdisciplinary perspective has been deemed necessary if fisheries are to become sustainable [9–13]. The role of fisheries governance, based on both legal and informal institutions, in the attainment of sustainable fisheries is one of the new research areas identified. An empirical approach to dealing with some of these issues, is to analyze legal instruments employed in successful cases of fisheries management that have evaded the conventional pattern of overfishing and non-recovery after a collapse [7,13–16].

One exceptional contemporary example of successful fisheries governance system is the Peruvian commercial anchovy fishery. This fishery represents almost 10% of worldwide marine fisheries landings [17] and 80% of all Peruvian landings [18]. It has been described as the largest mono-specific fishery that has ever existed on earth [19,20] and as the most intense and successful fishery worldwide [21]. Recently the fishery has allowed Peru to be placed first in a report ranking 53 marine countries by the sustainability of their fisheries [22].

Current annual anchovy catches by around 1200 purse seine vessels, usually operating within 60 miles from the coast, are around 7–8 million tonnes [23]. This fishery represents at least 7% of Peru's total foreign exchange earnings and employs some 18,000 fishermen [24]. About 140 factories process anchovy into fishmeal and fish oil for export to the international market. In 2008 fishmeal and fish oil exports reached 1.81 million tonnes, valued at US \$2.01 billion, of which fishmeal represented \$1.61 billion (FOB basis) and fish oil \$397 million [25].

Like most pelagic fisheries, since its establishment, the anchovy fishery has been highly vulnerable to drastic natural stock fluctuations, due to the sensitivity of these fish species to ocean-climate variability [26]. Historical anchovy landings show significant variation between years, mostly due to inter-annual climate variability,

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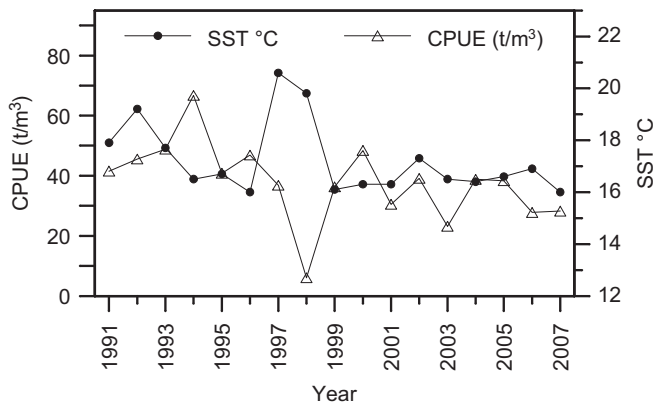


Fig. 1. Catch per unit effort of anchovies and average sea surface temperature (SST) in northern Peru for the period 1995 and 2007. Impacts of the ENSO 1997–1998 on the fisheries and the environment are shown. (Source: IMARPE).

of which the warm phase of ENSO or El Niño is the most critical component [27,28]. On top of inter-annual variation, inter-decadal ecosystem regime shifts, caused by lasting periods of warm or cold sea temperature anomalies have been also identified [29–31]. These anomalies are related to the approach or retreat of warm subtropical oceanic waters to the coast of Peru and Chile. Dramatic decreases in anchovy landings registered in 1972–1973, 1982–1983 and 1997–1998 have been attributed to the impacts of severe ENSO occurrences [27,28] (although the 1972–1973 decline was most likely caused by a combination of overfishing and ENSO conditions [32,33,37,55]); while, natural inter-decadal ecosystem regime shifts produce switches from anchovy dominated to sardine dominated configurations, reflected in the long-term historical landings trends of the fishery [28–30].

Thus a learning process has occurred, and anchovy fishery policies have developed from a highly fragmented, reactive decision making system, ignorant of resource management issues, during the first two decades of the fishery [35–37], to the current governance system that is able to cope with at least inter-annual variability [25,38] and ensure the ecological and economic sustainability of the fishery. This last governance system or resource regime has allowed annual anchovy landings during non-ENSO years, to stabilize between 23 and 48 t/m³ annual catch per unit effort (CPUE), expressed in tonnes of anchovy per total fleet holding capacity (Fig. 1); and between six and ten million tonnes of catches from 1995 to the present (Fig. 2a).

This article explores the evolution of the legal system that provides the basis for the current sustainable landings and governance of the anchovy fishery. Based on analysis of historical legal material, fishery statistics and environmental data, the article aims to investigate both the role played by fisheries laws and possible factors influencing its development, and the contribution of other key elements that contributed to the transition towards sustainability. First, the section with Materials and methods and the current anchovy fishery management as a background information is described. The Results section presents the relation between law and fisheries landings development, and the structure and content of the principles of the three Peruvian Fisheries Acts are examined. The role of secondary legislation¹

¹ Secondary or delegated legislation refers to law made by an executive authority under powers given to them by primary legislation. For the Peruvian legal system, executive acts consist of five different administrative dispositions, including in order of precedence: Supreme Decrees, Supreme Resolutions, Ministerial Resolutions, Directorate Resolutions, and a fifth level containing several miscellaneous written regulations.

establishing quotas and temporal/spatial fishing restrictions is also considered in this section. Following Winter's analytical framework for fisheries laws originally named the "legal clinic for fisheries" [12, p. 319], the Peruvian acts are reviewed in the light of available literature on sustainable fisheries law. The Discussion section suggests key legal and non-legal institutional elements that contribute to sustainable fisheries landings from a multilevel governance perspective. This section also briefly discusses the use of Winter's analytical framework; and the tension between the need for a degree of legal certainty that simultaneously provides for adaptability and flexibility in governance of natural resources (see [39]). The article finishes with a section with Conclusions and a final remark.

2. Materials and methods

Legal material, from the establishment of the anchovy fishery until 2007, was collected and reviewed together with fishery statistics and environmental data from the Peruvian coast. Legal material included principal legislation prior to the enactment of the first General Fishery Act in 1971, the three General Fisheries Acts and their implementing regulations; and a historical database on the enactment of secondary legislation setting up quotas and limiting fishing effort through closed seasons, areas and prohibitions to fish during some days of the week. This database consisted of law enacted between 1965 and 2007. After 2007, the establishment of a system of individual vessel quotas for the anchovy fishery radically changed the regulation of management, and the situation after 2007 is not covered by this paper.

Oceanographic data consisted of sea surface temperature (SST) anomalies and occurrence of strong ENSOs, while fishery data included annual landings, fishing fleet and processing capacity of fishmeal factories. These data series covered the period between 1960 and 2007.

To explore the relation between the developments of legal instruments and the fishery transition towards sustainability, the enactment of fisheries acts was plotted against fishery landings and the occurrence of strong ENSO events. Further, numbers of enacted secondary legislation were plotted also against landings, ENSOs and SST anomalies. In both cases, oceanographic data (strong ENSO occurrences and SST anomalies) were used to clarify the environmental influence on the fishery and filter our visualization of possible legal impacts.

Structure and principles ("basic norms") from the three fisheries acts were compared and a semi-quantitative application of Winter's analytical framework [12] was performed. This framework consists of a list of 60 questions on topics to be covered by a national fishing law, which enables a diagnosis of the fitness of this law for the regulation and management of a sustainable fishery. To analyze the potential management failures of the Peruvian Fishery Acts, a ranking point system between three and zero was adapted to the framework. The ranking system assigned points to each answer of the list according to the following scale: three points: the content of the law covers this topic "clearly or in depth"; two points: the law covers this topic "basically"; one point: the law does not cover this topic at all; and zero point when the question was not applicable. Under this ranking system a law that ensures good practices of fisheries management should score between 120 and 180 points (two and three points times sixty questions, respectively).

2.1. Background setting—current management of the Peruvian anchovy fishery

Government management and control of fisheries in Peru is the responsibility of the Vice-Ministry of Fisheries in the Ministry

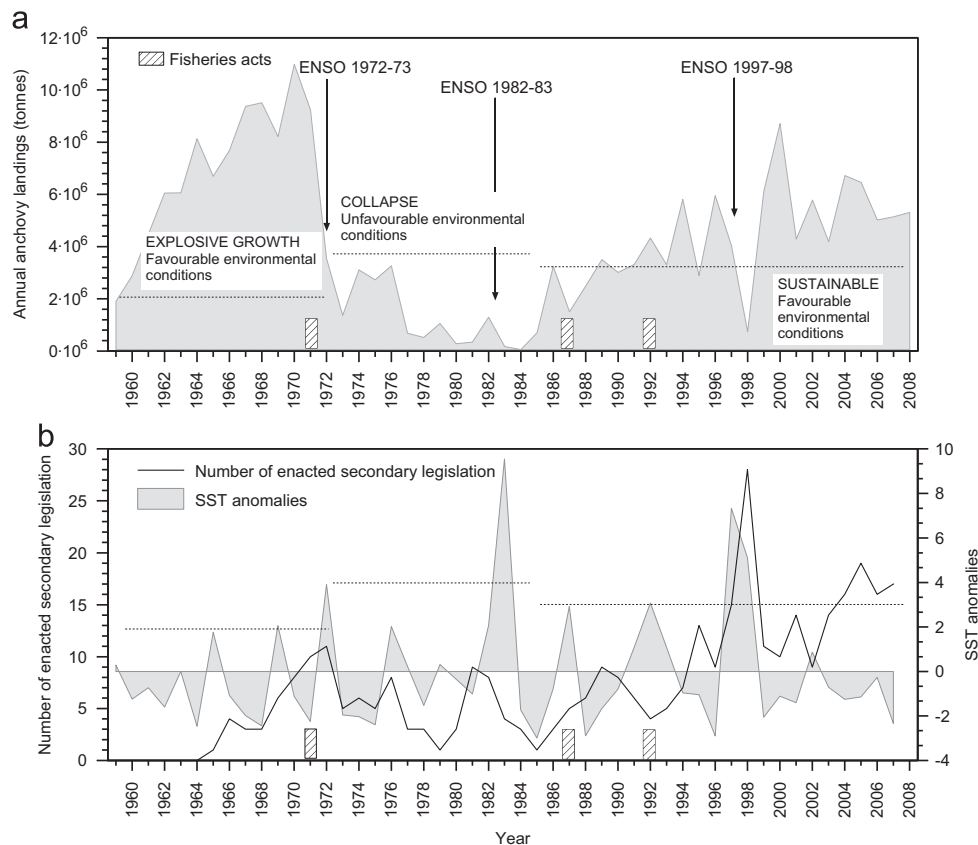


Fig. 2. (a) Historical annual anchovy landings, fisheries phases, strong ENSO events and enactment of General Peruvian Fisheries Acts and (b) number of enacted secondary legislation regulating anchovy quotas and close seasons, versus sea surface temperature anomalies in northern Peru between 1959 and 2007.

of Production (PRODUCE, by its Spanish acronym).² Within the Vice-Ministry of Fisheries, the General Directorates of Fishing Extraction and Processing, and Monitoring, Control and Surveillance share responsibility for anchovy fisheries management. Both offices are kept informed and advised by the Peruvian Marine Research Institute (IMARPE), whose institutional objective is to provide the scientific basis for the sustainable management of marine resources.

The Peruvian anchovy is a small, short-lived, fast growing pelagic fish widely distributed along the coast of South America. Off Peru, two population units are recognized: the north-central stock between parallels 3°S and 15°S; and the southern stock, from 15°S to the southern limit of the Peruvian maritime domain [40,55]. The north-central anchovy stock is by far the larger [23]. The government applies two different management schemes for the northern-central and the southern stock, the latter being exploited simultaneously by Peru and Chile.

Fishing of the northern stock is closed twice annually, during the austral summer and winter, in order to protect fish spawning peaks and recruitment periods respectively. Since 1983, one to four surveys to assess the abundance and spatial distribution of pelagic fish populations have been carried out each year by IMARPE [41]. The Total Allowable Catch (TAC) for both the north-central and southern anchovy stocks is estimated based on the results of these surveys. PRODUCE publishes TACs for each fishing season based on current biomass estimations and drawing on the results of biological and oceanographic monitoring carried

out by IMARPE personnel simultaneously at almost 100 landing sites. During 2009 for example, a TAC of 2 million tonnes was established for the second fishing season of the northern-central stock (Ministerial Resolution 446-2009-PRODUCE), based on IMARPE's biomass estimation of 6.7 million tonnes [42]. Landings for this season were 1.9 million tonnes [43]. Temporary closures of fishing areas, for a minimum of three days, are also imposed when the reported presence of juveniles (fish length less than 12 cm) exceeds 10% of total landings. Reports of catches and lengths come from real-time verification of landings carried out by IMARPE and dispatched daily to the Vice-Ministry. Based on these daily reports, once the TAC has been reached, the Ministry of Production orders the closure of the fishing season, banning not only anchovy fishing and landings but also fishmeal processing. In the case of the southern anchovy stock, although some efforts have been made in the past to coordinate its management in cooperation with Chilean authorities, usually no TAC is applied and the fishing season is open all year around.

Measures to control fishing effort by reducing or limiting the number of anchovy vessels have been enacted by secondary legislation since 1971, and in 1992 the most recent General Fishing Law stopped the issue of new licenses. Licenses for new fishing vessels are authorized only to replace broken-up units, taking care that total holding capacity remains the same.

On a daily basis during the fishing season, the Vice-Ministry of Fisheries publishes online the list of vessels with authorization to fish for anchovy, as well as the ones that are prohibited to do so. Fishmeal processing plants also need to be certified by the Ministry and are not allowed to receive catches from unauthorized vessels or from the artisanal fleet (vessels with less than 30 tonnes of holding capacity). Further regulations to manage the fisheries include a ban on the use of purse seines with mesh sizes

² In July 2002 the Peruvian congress decreed Law 27799 reorganizing the nation's administration system and merging the Industry and Fisheries Ministries in a single institution. This new institution is named Production Ministry or PRODUCE and the highest fisheries governing agency inside it is the Vice-Ministry of Fisheries.

Table 1
Summary of legal instruments to regulate the Peruvian anchovy fishery before enactment of the first General Fisheries Act.

Year	Legal instrument	Issue
1961	Law Nr. 13825	Apply 14% tax on fishmeal exports
1962	Decree Law 14195 Decree Law 14228	Regulating installment of fishmeal factories Fishmeal exports allowed only through cooperatives
1963	Supreme Decree 16 Supreme Decree 18 Supreme Decree 77	Setting up the National Fisheries Council Establishing exporting quotas and a new licenses' system for fishmeal processing plants Officially recognizing the Peruvian Fishmeal Consortium
1964	Law Nr. 15048 Supreme Decree 7	New tax system for fishmeal exports Establishment of Peruvian Marine Research Institute
1965	Supreme Decree 05-65	First anchovy closed season
1967	Law Nr. 16694	Law for Fisheries Promotion
1968	Law Nr. 17403	Setting import free taxes for fishmeal equipment
1969	Decree Law 180261	Establishment of Ministry of Fisheries
1970	Decree Law 18196 Decree Law 18253	Establishment of Fisheries Development Fund Establishment of State Company for commercialization of fishmeal and fish oil

smaller than half an inch (13 mm), and the obligation for all anchovy vessels to carry onboard sealed satellite positioning systems. Carrying out more than one fishing trip per vessel per day and fishing the northern anchovy stock within 5 miles of the coast are both prohibited.

Since 2004, monitoring and control of landings and of compliance with fishery regulations have been carried out by an independent Swiss company (SGS), which records landings 24 h a day at 134 unloading points. The costs of uploading and landing inspections are met by the fishing industry through a system of payments equivalent to 1.40 US dollars per metric tonne of landed anchovy. The ban on fishing within five miles of the coast is controlled by the General Monitoring, Control and Surveillance Directorate using a Satellite Monitoring System (*Sistema de Seguimiento Satelital* or SISESAT).

A management system of Individual Vessel Quotas (IVQ), locally referred to as Maximum Catch Limits per Vessel (MCLV), was established in July 2008 (Legislative Decree 1086) and is currently being implemented for both anchovy stocks. The fixed percentage of the overall allowable catch assigned to each vessel is established for each fishing season on the basis of the vessel's holding capacity and its average historical landings between 2004 and 2007. Vessel quotas are a percentage of the TAC recommended by IMARPE for each fishing season.

3. Results

3.1. Fisheries acts and fishing phases

Starting in the mid-fifties, the anchovy fishery in Peru went through a first phase of explosive and uncontrolled growth coupled with favorable ocean conditions, until its collapse in 1972 (Fig. 2a). By 1960, the annual catch reached 2 million tonnes of anchovies and since then three General Peruvian Fisheries Acts have been enacted in 1971 (Decree Law³ 18810), 1987 (Law 24790) and 1992 (Decree Law 25977). Regulations before the First Act were directed towards taxing profits and the assignment of competences to new fishing agencies. Table 1 summarizes the principal fisheries regulations enacted by the Peruvian government during the phase of explosive and uncontrolled growth (period 1959–1971).

³ Decree Laws are laws promulgated by the executive in *de facto* exercise of the legislative prerogative.

At the end of the first phase, a revolutionary military left-wing government took office establishing the Ministry of Fisheries and enacting the First General Fisheries Act. The principal motivation was the government's desire to exercise more direct control over important sectors of the economy, especially those in the hands of strong private groups or with substantial foreign capital investment [36].⁴

Following the anchovy collapse, a second phase between 1973 and 1984 was characterized by an environmental regime shift with unfavorable warm water conditions and low catches. No fisheries acts were enacted during this phase.

A third phase from 1984 to the present, characterized by propitious environmental conditions and modern management has enabled the anchovy fishery to maintain its catches and be sustainable. This third period can be further divided yet into a growth period (1985–1994) and a sustainable period (1995 to present). During the growth period the second and third General Fisheries Acts were enacted.

3.2. Structure and principles of fisheries acts

The first General Fishery Act was organized in 12 sections and 129 articles, while the second and third consisted of 10 and 12 sections and 112 and 90 articles, respectively. As shown in Table 2, all the three Fisheries Acts followed basically the same structure with some minor changes. The section on fishing communities and foreign capital guidelines was left out following the more liberal policies of the last acts. On the other hand, sections regarding aquaculture and fishing by foreign flag vessels had to be added according to the development of these fishing activities in Peru. Institutional coordination was included as a chapter in the second section of the First and Second Act, but was included as a section in the Third Act. Artisanal fishing was almost excluded in the First Act (Article 26 allowed only Peruvian fishers and vessels to have access to artisanal fisheries). This fishery was extensively regulated by the Second Act (Section 4, Chapter 6 of the act, plus 16 articles in the respective implementation regulation) and was devoted an entire section in the Third Act.

Basic norms or principles of the three Fisheries Acts are presented in Table 3. According to the three laws, marine resources from the coastline and within 200 nautical miles of the coast are the property of the Peruvian state. This jurisdiction was

⁴ By 1971, the fishing industry was responsible for 35% of the total foreign currency revenue of Peru and only four fishing companies were annually producing more than 100,000 tonnes of fishmeal, from which two were foreign capital enterprises [45].

Table 2

Comparison of structure between the three General Peruvian Fisheries Acts from 1971, 1987 and 1992.

First Fishery Act	Second Fishery Act	Third Fishery Act
1. Basic norms	1. Basic norms	1. Basic rules
2. The fishing sector	2. The fishing sector	2. Fisheries management
3. The fishing process	3. Aquaculture	3. Fisheries practices
4. Fishing rights	4. Fishing practices	4. Artisanal fishing
5. Fishing incentives system	5. Fishing rights and the fishing communities	5. Aquaculture
6. Foreign capital guidelines	6. Procedures	6. Concessions, authorizations, permits and fishing licenses
7. Fishing communities	7. Infringement and sanctions	7. Fishing by foreign flag vessels
8. Authorizations, permits, licenses and concessions	8. Contracts and fishing records	8. Fishing general records
9. Bans and sanctions	9. Fishing incentives system	9. Fishing incentives system
10. Contracts fishing and records	10. Special, complementary, transitory provisions	10. Institutional coordination
11. Final provisions		11. Bans, infringements and sanctions
		12. Transitory and final provisions

Table 3

Comparison of principles or “basic norms” between the three General Peruvian Fisheries Acts.

Basic norm	Fishery Act (year)	Statement
Marine resources ownership	1971	State domain—from the coastline and within 200 miles.
	1987	State property—from the coastline and within 200 miles.
	1992	Nation assets—from the coastline and within 200 miles.
National fisheries tasks	1971	Integral use of marine resources as a public good and for the interest of society.
	1987	Rational exploitation of marine resources and aquaculture; to address mainly direct human consumption fisheries.
	1992	Source of food and employment ensuring responsible use of marine resources.
State role	1971	To manage marine resources promoting, supervising and controlling fishing activities.
	1987	To assess, protect, plan and manage marine resources considering social welfare.
	1992	To regulate integral management and rational exploitation of marine resources.
Use rights	1971	The state promotes maximum national involvement deciding limits and procedures for foreign participation.
	1987	The state promotes the involvement of any corporate or company organization concordant with the democratic principles of the national constitution. It encourages the contribution of national investment to the industry, while foreign investment remains subject to pertinent Peruvian legislation.
	1992	The state promotes ample involvement and encourages foreign investment in the fisheries sector subject to pertinent Peruvian legislation.
Economic units	1971	Any person working for a fishing company providing capital or labor represents one single economic unit. The state promotes their involvement in the company's property, management and profits.
	1987	Article omitted.
	1992	Article omitted.
Marine resources exploitation	1971	Involves research, withdrawal, processing and marketing phases.
	1987	Involves research, withdrawal, processing, marketing and services phases. It is carried out after obtaining a granted license from the Fisheries Ministry.
	1992	It is recognized to be a permanent but an irregular occupation given the random nature of marine resources.
Fisheries Ministry role	1971	To regulate, guide, and control marine resources exploitation to ensure species conservation, economic efficiency and maximize social welfare.
	1987	To be responsible for the management of marine resources and guide fishing policies.
	1992	To decide according to available scientific and socio-economic information on the management, quotas, fishing bans, fishing gears and further management tools to ensure protection and rational exploitation of marine resources.

underpinned by the “Declaration of the 200 nautical mile Maritime Zone”, jointly proclaimed and signed by Chile, Peru and Ecuador at the First Conference on the Exploitation and Conservation of the Maritime Resources of the South Pacific in August 1952.

It is worth noting here also that the term “rational exploitation” is a synonym for “sustainable use” and was widely used in Peru before the latter term gained worldwide currency after the Rio Declaration in 1992. This term is still often used commonly to avoid what are regarded as unsuitable Spanish translations of the word “sustainable” (“*sostenible*” or “*sustentable*”). Thus rational exploitation was understood by the authors of the First Act to

mean exploiting natural resources in a way that ensures it can be maintained in the future. The contrary term “irrational exploitation” is frequently used to describe the unsustainable harvest of Peruvian guano (seabird's excrement used as a fertilizer) during the 19th century. The overexploitation of guano led to the establishment in 1909 of the national Guano Administration Company with the aim of managing and restoring guano production. This represents one of the first and most effective examples of sustainable exploitation of a natural resource undertaken by a government [50] and has had a profound influence on subsequent natural resource legislation, including the three fisheries acts.

With the exception of a basic norm related to use or access rights, minor differences are shown between most of the principles stated by the three acts. Access rights were a reflection of broader national socio-political changes and were intended to regulate the role of the state and private investment and to delimit foreign involvement in the fishery industry. The first Peruvian Fisheries Act was enacted in March 1971 under a dictatorial military government. This regime (1968–1975) was characterized by left-leaning policies and was driven by a desire for radical structural economic, political and social change to give justice to the poor of Peru. It nationalized entire industries, expropriating companies to consolidate them into single industry-wide government-run entities. The aim was to increase government control over economic activities by enforcing the monopolistic status of these entities and preventing any private and foreign activity in those sectors. This government brought to an end a long Peruvian tradition of limited government involvement in economic and social development and at the same time altered the relative political influence of those participating in policymaking [36]. The 1971 General Fishery Act was a reflection of the socio-political changes introduced during this period. The Act promotes maximum national involvement in the fishery sector, setting limits on foreign participation. The law aims to “obtain the optimal development of the Peruvian fisheries compatible to the rational exploitation of marine resources”. The first Fisheries Act has the following specific objectives:

- a. Optimal use of marine resources.
- b. High productivity.
- c. Improved nutritional status of the Peruvian population.
- d. Fair distribution of economic income obtained from the exploitation of marine resources between the state, labor and capital.

Among the purposes of the Fisheries Ministry, the fishing industry reorganization to permit fair participation by workers in the management of the industry's organization and the distribution of profits, the reduction of salary differentials among workers in the industry, in accordance with the then government's revolutionary policies, and the promotion of a “peruanization” of the fishing industry were established.

For the pelagic fishery, the main changes introduced by this law were in Article 37, which decrees that fishmeal marketing is carried out exclusively by the state; Articles 64 and 70, which establish the so-called “fishing communities” to represent the employees in any fishing company, with the right to receive 20% of the net income of each company; and finally in a transitory regulation requiring anchovy fishing companies to reduce their foreign capital to at least 51% of their total capital.

Two years after this Act, the government passed Decree Law 19999 setting up the State Company for Fish Meal and Oil Production known as *PESCA PERU*, which was given exclusively responsible for the fishery and processing of anchovy in Peru. In line with this law, the entire anchovy industry was expropriated by Decree Law 20000. One thousand two hundred and fifty-six fishing vessels and 105 anchovy processing plants passed to the administration of *PESCA PERU*. The new state company was now also responsible for around 27,000 workers including vessel crews and employees of processing plants [36]. Government bonds were given to ship and factory owners in exchange for their property. At the same time the fishery collapsed and landings in 1973 were less than 1.5 million tonnes, compared to 10 million tonnes in 1971 [35,36] (Fig. 2a). The assets of the industry at the time of collapse were estimated at 120 million US dollars, compared to debts of 227.5 million US dollars [45].

The second Peruvian Fisheries Act was enacted in 1987 by the second democratically elected government following 12 years of

military dictatorship. This left-wing government was controlled by a populist social democratic political party with President Alan Garcia as the head of the country. Article 3 of this Act stresses the promotion and control by the state of the rational exploitation of marine resources considering social welfare (Table 3). Nationalized anchovy vessels had been returned to the private sector in 1976 by Decree Law 21558; and the rights of the fishermen to participate in company ownership, management and profits according to the First Act (the “fishing communities”) had been also repealed in the late 1978 (Decree Law 22329). Both laws had been enacted to make private capital investment in the industry more attractive [51] and the need to ensure that national social and democratic principles guided the fishery policy had to be emphasized. President Alain Garcia's administration (1985–1990), recognizing that these state-private sector conflicts were gradually undermining fisheries management, emphasized the importance of cooperation in formulating sectoral development priorities [37].

Considering use rights, again here, close to the start of the document, Article 4 declares that the state exploits marine resources, promoting the involvement of any individual, corporate entity or company, encourages the contribution of national investment to the industry, while foreign investment remains subject to pertinent Peruvian legislation (Table 3). However, the specific objectives of this new law remain literally the same as in First Act. New purposes of the Fisheries Ministry related to the anchovy fisheries included: (a) to carry out scientific and technological research to address the best species exploitation rate and environmental potential and (b) to integrate different fishing activities within all the companies involved. Government attempts to express its concerns for the development of the fisheries sector for human consumption, besides the establishment of policies for the anchovy industry, were exposed in further purposes of the Ministry of Fisheries, as: (a) to regulate withdrawal, industrialization, diversification and production and yield enhancement of fish products for human consumption, (b) to develop and promote aquaculture and artisanal fisheries, and (c) to supervise and control fish supply for internal markets limiting exportation and advertise regularly nutritional advantages of fish to enhance its consumption. A novel purpose related to the supervision and control of entrance and use of marine resources in natural reserves was also introduced.

The third General Fisheries Act was enacted in 1992 by a right-wing democratically elected government. Here, Article 3 underlines the promotion by the state of foreign investment in the fisheries sector under the regulations established by Peruvian legislation. The law adopts a neo-liberal perspective and emphasizes the application of free-market policies. It aims to regulate the fishing sector to promote its sustainable development as a source of food, employment and income; guarantee responsible use of marine resources, optimizing economic profits in harmony with environmental protection and biodiversity conservation.

No special functions are defined for the Ministry of Fisheries; however, the basic norms insert an article to protect the environment from pollution, and a second one to regulate foreign flag vessels operations.

3.3. Secondary legislation and fishing phases

During the first phase of uncontrollable growth of the fishery, the first legal regulation to set up a closed season was declared in 1965. According to Supreme Decree 05-65 the fishery was closed for the month of August 1965 and fishing was banned during weekends. In January 1966, a three-month winter closed season was declared, lasting from mid-May to mid-August (Supreme Decree 05-66-PE), and the first TAC of seven million tonnes for

one year was established. Additionally, the landing of catches with more than 50% of juvenile anchovy by-catch was prohibited. In 1967, a closed season was declared from July to September.

Two reasons have been identified for the acceptance and enforcement of the closed season ban by the industry at this point. First, the closed season was planned for southern winter months, when anchovy shoals were more dispersed and difficult to fish [46] and weather and sea conditions were also adverse. Second, the fishermen and plant processing owners could make use of this closed season to repair and maintain their vessels, fishing gears, equipment and facilities [36]. Scientists from IMARPE also welcomed this regulation enthusiastically, since research on anchovy reproduction had already identified a major spawning peak during winter months [47,48]. On the other hand, quota limits were not complied with and anchovy landings at the end of the sixties greatly exceeded the annual limits of 8 and 9 million tonnes that were recommended by IMARPE [21,46,49]. Annual number of enacted secondary legislation regulating quotas and close seasons increased from one in 1965 to a maximum of 10 in 1972 simultaneously to the ENSO 1972–1973 (Fig. 2b).

During the collapse phase of the fishery, succeeding the establishment of the Ministry of Fisheries and the enactment of the first Fisheries Act, specific regulations for the management of the anchovy fishery for closed seasons and quota limits were all established by means of Ministerial Resolutions. This procedure was grounded legally on a Supreme decree enacted in 1977 (Supreme Decree 03-77-PE). During this collapse period of low catches (1973–1984), the number of enacted secondary legislation fluctuated between five and ten with a very slight increment during the moderate ENSO of 1976, but no relation with positive SST anomalies during the strong 1982–1983 ENSO event.

An increasing trend in the number of secondary legislation can be observed between 1994 and 2007, which coincides with the sustainable landings phase of the fishery. In this phase, the exceptional peak of 28 enacted secondary legislation establishing quotas and/or fishing areas during the most recent strong ENSO event in 1997–1998 was recorded (Fig. 2b).

3.4. The analytical framework towards a sustainable fisheries' law

The results of applying Winter's framework are presented in Table 4. Almost no differences were observed between the First and the Second Act, while the Third Act improved coverage of topics like management and its guidelines and tools, surveillance and enforcement (due in part to new available technologies), and control of fisheries. According to these results, only the third Fisheries Act (121 points) scored just enough to guarantee good management practices for this fishery.

4. Discussion

Anecdotal evidence suggests that it was the passing a new law that set off the development of the anchovy fishery. Law 12283, passed in April 1955, extended the application of Law 10753, which reduced the export tax applied to mineral and agricultural companies, to fishery exports [44]. It was probably this law that triggered the expansion of the anchovy fishery. However it was probably also favored by other concurrent factors, including the replacement of cotton fishing nets by nylon ones in 1956, the availability of low cost second-hand vessels and fishmeal processing plants following the collapse of the Californian sardine fishery, and an increasing fishmeal demand from the USA and European countries [35,45].

4.1. Legal instruments and the transition to sustainable landings

The transition towards sustainable landings in the case of the Peruvian anchovy fishery has been a result of co-evolutionary processes of alternating slow and rapid change occurring at different scales. According to Loorbach [52], this is the way transitions occur, leading from one relatively stable state to another. Legal instruments to manage the fisheries have been part of this change process and have contributed to the sustainable state in which the fishery is currently placed. When considering also secondary legislation, this case study coincides with formal institutions of long-lasting resource use systems where operational rules had been devised and modified over time according to a set of higher level rules; these higher-level rules might themselves be modified slowly over time [53].

Peruvian fishing law evolution has followed socio-political and economic policies transformation in the country. With the partial exception of the third Fisheries Act and the establishment of management systems for different marine resources and fisheries, the structure, basic principles and contents (according to Winter's framework, see 3.4) showed no significant differences to explain a transition towards sustainable fisheries based merely on new regulations. Fisheries acts have apparently had little direct influence on the way the anchovy fishery has been managed on the operational level. The acts were a manifestation of broader national socio-political changes and expressed general attitudes towards the exploitation of natural resources that mirrored the political ideologies of the governments of the day. The three General Peruvian Fisheries Acts were not changed or adapted in response to crises in the fishing sector or their economic and social consequences. In fact the anchovy fishery collapsed shortly after the enactment of the first General Fisheries Act in 1971 (Fig. 2a). No relation is observed between the enactment of fisheries acts and the occurrence of extreme ENSO events of 1971–1972, 1982–1983 and 1997–1998, which dramatically impacted anchovy's fishmeal production and marketing [27,28]. When new management measures were introduced, for example the adoption of Geographical Positioning Systems (GPSs) to control compliance of restricted fishing areas in 2001, or the introduction in 2007 of new procedures for inter-sectoral collaboration in response to a request by the newly established Ministry of the Environment, this was achieved by amending the implementing regulations, while in each case the act itself remained in force.

This apparently minor influence of fisheries acts on the sustainability of the fishery is explained by the fact their principal role was to define rules of access to the resource at a sectoral and national level. Fisheries acts were used to outline the role of the state and private investment and to delimit foreign involvement in the fishery industry. In the case of common pool property resources like fisheries, the definition of clear access boundaries has been described as the first design principle for robust institutions in adapting complex social-ecological systems [53]. Boundary rules relate to who can enter the area, harvest and manage the resource, and potentially exclude others from doing so. Although typically enforced by external officials, such rules impact on the presumption that a participant has about the likely levels of trustworthiness and cooperation of the others involved [53]. The vast current literature on the benefits of implementation of Individual Transferable Quotas and community fishing rights at local (household) levels is a reflection of the importance accorded to this thesis by the international scientific community. However, there has been very little work done to clarify access rights needed at different and higher levels of governance. This example relating to the impact of laws on the anchovy fishery provides new insights into this key element of fisheries governance.

Table 4
Winter's analytical framework applied to the three General Peruvian Fisheries Acts.

Checklists of potential management failures	1971	1987	1992
Is the law taken seriously?	0	0	0
Are binding rules of international fisheries law transposed and applicable in the country? ^a	0	0	2
Does the constitution contain rules relevant for fisheries?	2	2	2
What is the formal quality of the relevant laws?			
Is there a specific law on fisheries?	3	3	3
Is the legal language precise and in line with general legal doctrine?	3	3	3
Does the law cover all elements of fisheries management?			
Principles	2	2	3
Instruments of promotion	3	3	3
Instruments of management	1	1	3
Structures and competences of institutions	3	3	3
Delegation of powers for specified issues	2	2	2
Definitions of infringements and sanctions	2	2	3
Access to courts for affected parties and NGOs	1	1	1
Subtotal fisheries management	14	14	17
Was the law properly promulgated and disseminated?	3	3	3
Is the law's relationship (hierarchy, <i>lex specialis</i>) with other laws unambiguous?	2	2	2
Is the law compatible with constitutional requirements?	1	3	3
Is the law compatible with principles of international law? [*]	0	0	2
What is the formal quality and content of any sub-legal norm?			
Are they based on and consistent with higher ranking law?	2	3	3
Are they compatible with other sub-legal norms?	3	3	3
Are they appropriated promulgated and disseminated?	3	3	3
Do they impose sanctions for infringement?	2	2	3
Subtotal sub-legal norms	10	11	12
What material standards guide the application of fisheries management instruments?			
Are fish resources defined as a common good?	2	2	2
Is sustainable use of fish resources defined?	2	2	2
Are ecosystems effects to be considered?	1	2	3
Is the precautionary principle to be applied?	0	0	2
Do measures have to be based on best available scientific knowledge?	2	3	3
Subtotal guides for fisheries management	7	9	12
How are responsible institutions shaped?			
Is allocation of competences to legislate and administer between the levels of government clearly defined?	3	3	3
Is the environment ministry involved in decision making on fisheries management? ^b	0	0	0
Does the law provide for participation of fishermen's associations and environmental NGOs?	3	1	1
Have self-regulatory structures been established?	1	1	1
Is transparency of decision making ensured?	1	1	1
Subtotal institutions	8	6	6
Is distribution justice ensured?			
Are inshore areas reserved for artisanal fishing?	1	1	3
Is fishing in the EEZ nationalized?	3	3	3
Are quota for individual effort and catch allocated according to fair criteria?	1	1	1
What informational resources are provided on?			
Is there research on stocks and ecosystems?	3	3	3
Monitoring of catch in the EEZ?	2	2	3
Monitoring of fishing capacity?	1	1	1
Data banks?	2	2	3
Access to stakeholders and the public to fisheries related information?	1	1	2
What promotional measures are taken?			
In the case of under-capacity: are promotion policies in line with sustainable catch limits?	2	2	2
In the case of overcapacity: are promotion policies re-orienting towards reducing capacity?	1	1	1
What management tools are applied?			
Catch limitation	2	2	2
Effort limitation	2	2	2
Technical measures: prohibition of destructive methods, selectivity of nets, reduction of by-catch, etc.	2	2	2
Marine protected areas: pollution prevention, nature protection, recovery and species management zones	1	2	2
Time and area limitation protecting spawning and nursery	3	3	3
Organization: bottom-up in the coastal zone, participatory top-down in EEZ and high seas	2	2	2
Subtotal management tools	12	13	13
How effective are surveillance and enforcement mechanisms?			
Does surveillance cover strategic topics (catch, by-catch, landings, transshipments, foreign catch)?	2	2	3
Do fishermen, buyers and port authorities have recording duties? Are they reliable, and cost-effective?	1	1	1
What safeguards are in place against corruption?	1	1	1
How qualified is the inspection personnel?	1	1	3
Are technical equipment is available?	1	1	3
Are legal remedies available for affected parties?	1	1	1
Are legal remedies available for public interest groups?	1	1	1

Table 4 (continued)

Checklists of potential management failures	1971	1987	1992
Subtotal enforcement	8	8	13
Is there flag state control over fisheries in the high seas and foreign EEZs?	0	0	0
Participation in regional fisheries commissions	0	0	0
Licensing of vessels	3	3	3
Catch limitations	0	0	0
Control of landings	0	0	0
Vessel monitoring systems	0	0	0
Subtotal fisheries in the high seas	3	3	3
Is there port state control of landings from vessels flying foreign flags and fishing in high seas and foreign EEZs?	1	2	3
Total score	94	99	121

^a Only applicable for the Third Fishery Act from 1992.

^b Peru did not have a Ministry of the Environment until 2008.

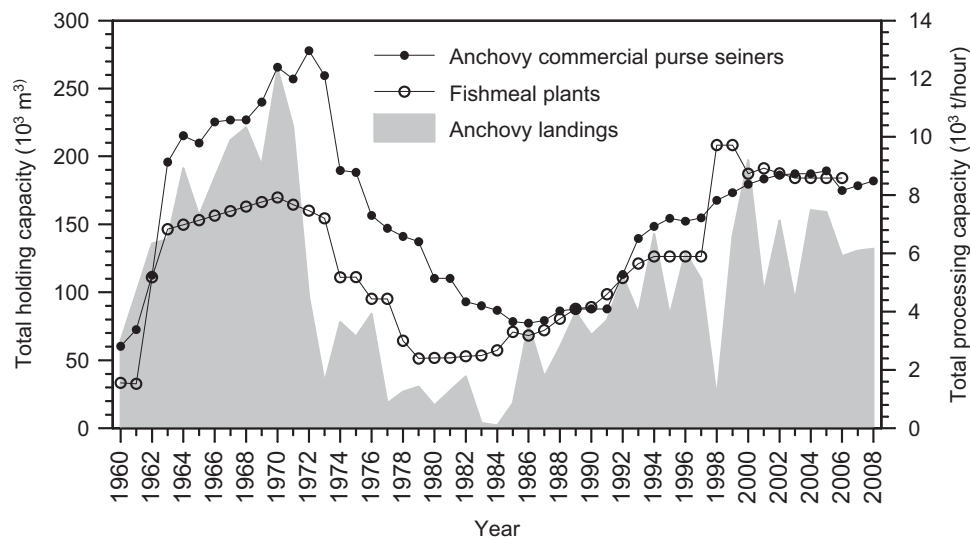


Fig. 3. Historical total holding capacity of the Peruvian anchovy commercial purse seiners, and processing capacity of fishmeal plants between 1960 and 2008. (Source: IMARPE).

Evidence suggests that both restriction of access and maintenance of biological productivity are necessary conditions to achieve sustainability [16]. The reason why the anchovy fishery did not enter a sustainable phase after the first Fishery Act can be explained with respect to these conditions and suggests two possible non-exclusive propositions, which are discussed below.

First, although the acts defined access limits at national levels, Peruvian restrictions to limit access at local (fishing companies), operational levels have been generally poorly implemented. Thus, within the broad boundaries to participation defined by law, vessels entering the fishery have operated under a *de facto* open-access regime [56]. As shown in Fig. 3, there is a strong relation between the historical evolution of total holding capacity of the anchovy fleet and fluctuations in landings, implying failures to limit the activity of vessels authorized to take part in the fishery. Overcapacity of the anchovy fleet and processing capacity has been a consistent feature of this fishery [20,45,49,54,55] and this condition did not change when the fishery entered the sustainable phase in 1994. Due to new neo-liberal policies and the recovery of pelagic stocks between 1990 and 1995, the private sector found optimal conditions to invest in vessels and plant modernization and construction. As a result, the anchovy fleet capacity experienced a fast expansion [56]. The General Fisheries Act of 1992 required vessel construction for anchovies to be balanced by decommissioning older boats. Many firms were authorized to build vessels for the sardine and jack-mackerel fisheries but means

were finally found to access the anchovy fisheries as well [56]. Furthermore, in 1998, the government passed Law 26920 which authorized owners of wooden boats larger than 30 m³ to join the anchovy fleet. Around 600 wooden artisanal vessels were legally incorporated into the anchovy fishing fleet adding 35,000 tonnes to the total holding capacity.

However, there is no broad evidence that open access regimes are largely incompatible with sustainable management of fisheries [14]. Maintenance of biological productivity depends more on the management agencies' choice of harvest levels and their ability to enforce these limits; thus defining property and access rights will not automatically lead to full efficiency in fishing; for that to happen the path of TACs over time must also be optimal [13]. That seems to be the case of the Peruvian fishery, where TAC allocation has improved since the implementation of seasonal acoustical cruises to estimate pelagic fish biomass in 1983 [41]. After attainment of the cumulative TAC, the manner in which recent secondary legislation not only ban further fishing activities but simultaneously also fishmeal processing is also important. The clearly identifiable smell of burning fish, detectable even some miles away from the factories, makes it impossible for illegal fishmeal reduction to go unnoticed, and supports compliance of processing bans. The prompt recovery of the anchovy fishery after the last ENSO of 1997–1998 could also be an indicator of healthy maintenance of biological productivity during the sustainable landings period. As reported by Gulland [57] and

later confirmed by Caviedes and Fik [33], only when ENSO events are associated with extremely high fishing levels, do significant barriers exist to a recovery in anchovy landings. Gulland's claims are based on the little discernible impact of the two ENSOs of 1957 and 1965; after which the anchovy fishery recovered a few months of their onset. Caviedes's conclusions are based on a model comparison between ENSO impacts on Peruvian and Chilean fisheries. In both cases, the negative impacts of ENSO events on the biomass of anchovies are not disputed; the studies focus on the time-span required for its recovery to pre-ENSO levels and subsequent resurgence of the fishery.

Second, contrary to the enactment of fisheries acts, secondary legislation in the form of ministerial resolutions has noticeably increased in number during the sustainable landings phase of the fishery. The higher number of regulations related to quotas and closed periods or areas during the ENSO 1997–1998 is a reflection of the adaptive approach to management adopted during this phase. During the 1972–1973 ENSO, a similar pattern could be observed to a minor extent, however, the lack of strong scientific evidence at that time [57] coupled with policy decisions that feared social discontent and unemployment and an important source of foreign capital for the country [33],⁵ prevented the success of such regulations to avoid the collapse of the fishery. During the sustainable phase, not only were policy and practice modified in accordance with new ecological knowledge as required by adaptive management practices [58], but updates in the allowable catch by IMARPE were made in a timely fashion consistent with the biology of the species [15] (anchovy is a short-lived fish species with a short life span of around three years and age at first maturity at one year [47]).

In the context of efforts to attain the sustainability of the anchovy fishery, a major challenge has been to develop the ability to respond to rapidly changing conditions and uncertainty both in the natural environment and in socio-economic and political systems. Moreover, although the impacts of ENSO are now relatively well understood, the frequency and intensity of its occurrence remain a source of uncertainty for fishermen and managers [28,34,35]. Even less well understood are the impacts of natural driven inter-decadal regime shifts which were first reported by scientists only after 50 years of commercial fishing [29–31]. Thus for the Peruvian fishery, the adoption of adaptive and rapid management in accordance with ecological conditions should also be considered as a key element to the transition towards sustainability.

4.2. Multilevel fisheries governance

Multilevel governance has been described as a “system of continuous negotiation among nested governments at several territorial tiers—supranational, national, regional and local” [59]. It is practised not only in Europe, from where it originates, but also in the current management of resources in distant developing countries. This case study, showing the role of the Peruvian state defining national policies towards use of natural resources, reinforces the theory that power of central governments under multilevel governance systems has not been eviscerated and remains the primary governance level [60]. According to Pierre and Peters [61, p. 68], “the new [multilevel] governance ... does not mean the end or decline of the state but its transformation and adaptation to the society it is currently embedded in”. Nevertheless, under the multilevel governance approach, economic-fishery policies in Peru have evolved, both ceding power to supranational institutions and adopting new policy instruments that involve partnerships with the private sector [62]. Supranational institutions like the Food and Agricultural Organization of the United Nations

(FAO) have played a role in influencing the most recent Peruvian Fishery Act, for instance by putting pressure on the government to adopt fishery management plans and environmental protection measures (see Table 4). These themes were included in the law but to enact a new fisheries' act was taken by the Peruvian state alone. Not even the Rome Declaration on the implementation of the Code of Conduct for Responsible Fisheries adopted by Peru in 1999 had a straightforward effect on fisheries legislation.

Regarding other institutional arrangements beyond the state like networks, informal norms or agreements between actors, there is no doubt of their key role in fisheries governance in Peru; however, these kinds of arrays take place under existing legal and structural frameworks that remain in place. As shown in this study, the function of the state and its political administrative system should not be neglected in the study of multilevel governance of sustainable fisheries.

4.3. Winter's analytical framework for fisheries law

Although the knowledge of the role of laws to support fisheries sustainability is limited or has been restricted to analyze non-compliance, Winter [12] identifies good laws in fisheries as the ones that create legal certainty, integrate higher rank human rights and resource protection obligations, clarify objectives, set out rights and duties of fishers, determine governmental competences, limit administrative discretion, provide enforcement tools and allow for judicial review of administrative measures. Some of these features are covered by the current Peruvian Fisheries Act, as reflected in the score obtained, but some potential management failures remain a threat under the current legislation. The top-down management of the fishery, no legal remedies for affected parties, general public and NGOs, and no safeguards in place against corruption, are worth mentioning here. It is understandable, however that the availability of new technologies like satellite positioning systems, and even text messages and the internet has improved enforcement of surveillance and control. This fact explains the major score obtained by the third Fisheries Act and has certainly contributed to ensure appropriate fisheries management practices during the sustainable landings phase of the fishery.

Regarding the potential use of this innovative semi-quantitative tool, some difficulties appeared when comparing laws over such a long period of time. Many terms, principles, fishing practices and technologies were not available at the time the first Peruvian act was enacted, causing some problems for interpretation of results. Only the first question: is the law taken seriously; appears unfeasible to answer without a specific research to address this topic. Considering this question, already in the First Act some sections of the law were definitely taken seriously. The implementation of the “fishing communities” and the limitations towards foreign participation in the fishing industry are some examples, while the increment of the nutritional index of the Peruvian population or the requirement for which each fisherman should be registered and in possession of a boarding permit was not really compelled.

Winter's framework is nevertheless a worthy and promising first attempt to quantify the potential of a fisheries' law; and further development of the methodology should be encouraged. The tool could be used for instance for semi-quantitative comparisons of national fisheries laws between countries.

4.4. Legal certainty and adaptability

Laws are the governmental instruments that provide frameworks for many of the interactions between the members of our society, and legal relations are fundamental to creating order in societies, not least in the form of economic relations [63]. Complex social–ecological fisheries systems are shaped by laws

⁵ By 1971 the anchovy industry was responsible for 35% of all Peruvian foreign currency supplies [45].

of nature and simultaneously by human-made laws. According to Ebbesson [39] legal certainty is an important virtue of law; and does not as such necessarily prevent adequate flexibility in administrative decision-making concerning health, the environment or the use of natural resources. In the case of the anchovy fishery, the law not only does not contest flexible adaptive management but supports the settings in which this adaptability takes place. The name given to the Fisheries Acts, as “General Acts”, mirrors the intention to enact fisheries principles leaving operational management issues to secondary legislation or non-legal norms. Finally, legal human-made certainty added to environmental uncertainty appears to reduce the total system uncertainty and promote sustainable transitions.

5. Conclusions

Although specific lessons for fisheries management do not come in black and white and in fisheries management we should never claim successes, only achievements [7], the future of fisheries sustainability will depend on our ability to understand the key elements of these achievements and apply them well [14]. This study provides some insights in key elements of achievements of the Peruvian anchovy fishery, and does not purport to fully explain the complex dynamics that have steered the anchovy fishery towards sustainable landings in recent years. However, legal instruments in this case have been certainly part of the broad range of activities that fisheries management has consisted of, many of which are often overlooked by outsiders [16]. Fisheries acts in Peru define access rights to the fishery and regulate the fisheries sector within national, economic and political dimensions. To achieve sustainable landings goes beyond the tasks of these acts and should be addressed by sub national governance levels. The base-level governance to manage landings is left to secondary legislation that evolves according to different tools like institutional and organizational functioning, agencies legitimacy, science, technologies and innovations, or even experience and learning capacities. This secondary legislation and further institutions should operate linked to environmental and ecological settings and be adaptive to guarantee stable landings. Following this analysis fisheries laws in Peru cannot guarantee sustainable landings on its own. After defining access rights and political strategies, what Gerd Winter does define as “a sustainable fisheries law” works as an umbrella to allow secondary legislation and other norms to evolve towards sustainability. Further research is necessary to reveal if specific secondary legislation and informal institutions, once established to undertake sustainable landings, are robust to national, political or economic adjustments.

It seems also important to mention here that similar studies that have provided material for the discussions above are all taken from fisheries research with detailed data from developed countries like the US northeast Atlantic, Australian and New Zealand fisheries [64]. However, current worldwide fishery statistics show that nine of the top twelve top fishing countries are developing countries [17] and these countries have contributed to more than two-thirds of total fish production during the last decade [65]. Under these conditions it appears imperative to direct more efforts towards case studies in developing countries, where not only artisanal but also important commercial fisheries take place. South Africa, Mexico, Indonesia, Chile are just some examples to be mentioned.

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