



Livelihood trajectories in the Chilean Patagonian region: an ethnographic approach to coastal and marine socioecological change

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Received: 6 February 2018 / Accepted: 28 July 2018
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Abstract

Livelihood trajectories are a conceptual device to synthesize the collection of successive strategies displayed by individuals and groups to ensure survival and wellbeing over time. Using this concept, we conduct an explorative analysis of how various episodes, interventions, and ecological change have influenced different livelihood strategies of small-scale fishermen in the southernmost region of the world, the Patagonian region of Magallanes, Chile. Through ethnographic research, we identified four trajectories along five distinct periods: (i) 1960–1972, from the year of the largest recorded earthquake in world history to the initial expansion of industrial fishing; (ii) 1973–1982, from the military coup and the beginning of neoliberal reforms; (iii) 1983–1990, marked by fishing export booms; (iv) 1991–2000, noted by return to democracy and enactment of the first Fishing and Aquaculture General Act; and (v) 2000 to present, characterized by coastal planning and changes to the aforementioned law. Along these periods, trajectories are marked by migration waves and the deployment of specific livelihood strategies, highly modulated by both global seafood markets and legal changes. The results show the potential of ethnographic approaches to the study of long-term interactions in marine and coastal socioecological systems by identifying underlying historical dynamics, specific pulses and pressures, and actors' responses to regional socioecological changes.

Keywords Southern Patagonia · Subantarctic region · Small-scale fisheries · Human communities · Coastal livelihoods · Socioecological change

Introduction

Any definition of sustainability relates to the society-nature interface and implies a need to understand the coupled interactions over time and space of human groups with other living beings and the surrounding life-support systems, relations that

here after we are going to conceive from a socioecological perspective. “Failure to recognize these connections can lead to unintended consequences and demonstrates the need for an interdisciplinary science that includes an expanded understanding of the coupled dynamics of socioecological interactions” (Elmqvist 2008: 71).

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In this article, we applied the concept of livelihood trajectories (henceforth LT) to the study of artisan fishing communities in the Region of Magallanes and Chilean Antarctica¹, to explore some of these key socioecological interactions and their changes over time. Trajectories are used as a means to conceptualize the ways in which “individual’s strategic behavior is embedded in both historical repertoire and in social differentiation” (de Haan and Zoomers 2005:43).

The coastal and marine ecosystems of the subantarctic region are considered of high importance for oceanographic research and climate change (Doney et al. 2012). They contribute to the temperature balance of marine currents and have a high primary productivity that sustains great biodiversity (Huovinen et al. 2016; González et al. 2016). In socioeconomic terms, the subantarctic fishing grounds are keys to international fisheries and food security, at both regional and global levels (Rozzi et al. 2005; González et al. 2016). In addition, its incomparable scenic beauty is increasing the flow of special interest tourism (Rozzi et al. 2005; Nahuelhual et al. 2017). Given this multilayered and interacting set of ecological and economic factors, the region faces old and new pressures that may threaten its sustainability.

The concept of livelihood arose in anthropology of the first half of the twentieth century to define economic relationships woven into social practices of non-Western cultures (Malinowski 1922; Evans-Pritchard 1992 [1940]) to, later, enter the domain of development studies (de Haan and Zoomers 2005). In the 1980s, the *livelihoods approach* focused on the study of poverty in the context of rural development planning (Kaag et al. 2004). From this perspective, poverty was observed as a problem of individual persons or families, masking the collective or social dimensions of their constituents (Wartena 2006). Due to such limitations, the concept of *livelihood strategy* gained visibility by studying the set of social relationships in which purposeful responses to obtain daily subsistence are produced (Perry and Sumaila 2007). Emphasis was placed on actors’ capacity to make decisions when facing situations of change (Long 2001). In the 1990s, the *Sustainable Livelihoods Approach* proposes interaction between five types of capital (natural, economic, human, physical, and social) necessary for sustainability

(Bebbington 1999). Thus, an evaluative and prescriptive dimension was introduced regarding the state of these capitals in a determined community (Van Dijk 2011).

In response to successive criticism of these approaches (Arce and Hebinck 2002; Kaag et al. 2004; Van Dijk 2011), terms such as livelihood pathway and LT arose, which incorporated historical aspects, patterns, and changes that are woven into human life history (De Haan and Zoomers 2005). In words of Bagchi et al. (1998), “livelihood trajectories” describe and explain individual or collective paths and patterns of livelihoods. Thus a LT approach allows the examination of strategic behaviors which are embedded in a historical repertoire, in social differentiation (de Haan and Zoomers 2005), and in perceptions of risk (Sallu et al. 2010). Mc Lean (2015) upholds that the LT focus does not only permit the understanding of long- and short-term strategies, but also incorporates nonhuman agents in the analysis (e.g., species or technologies). According to Murray (2002), a LT is a path through time, and refers to “the consequences of the changing ways in which individuals construct a livelihood over time” (Murray 2002 p.17). Thus, individual life histories become central in achieving a better understanding of LT, since it allows a deeper inquiry into the beliefs, needs, aspirations, and limitations of people’s lives (de Haan and Zoomers 2005). An important application of the LT approach is in exploring the shocks and stresses that may affect livelihoods, as well as in elucidating the characteristics of the overall livelihood strategy that contribute to increased resilience or vulnerability (Sallu et al. 2010).

We argue that an ethnographic approach to LT, including a historic and process-oriented account of socioecological changes, may contribute to the understanding of regional transformations. It offers a path to study socioecological changes in a long-term perspective, overcoming the limitations of traditional livelihood research. We propose to define LT as an identifiable bundle of strategies developed in response to environmental and sociotechnical changes that can be recognized from people’s life histories within a given region. In turn, livelihood strategies are individual or collective intentional actions born out of specific situations or processes of decision-making in which the ways to earn and sustain a living are at stake (De Haan 2012). They are composed of social relations and organizational practices, modes of inhabiting the space, technologies, and resources used (Mc Lean 2015).

Livelihood trajectories constitute a pillar in the comprehension of socioecological changes of the Patagonian region, as they allow us (i) to understand transformations in strategies for making a living over time in response to regional environmental changes, (ii) to identify the capacity for action and decision-making of people in adverse environmental or social situations, (iii) to observe multiple relational strategies within certain regions that are changing during the course of people’s

¹ An important feature of the Chilean case is that the word region acquired constitutional status in 1974 when the last reform for the decentralization of the country set the term “region” as the largest subnational politico-administrative unit. Thus, Magallanes is one of the 15 regions composing the Chilean nation, part of the ecological system known as subantarctic region, and a fraction of the socially constructed region known as Patagonia (see Fig. 1). Patagonia is a large cross-bordered area associated to the southernmost territories of Argentina and Chile that through colonial times and up to the late twentieth century has exhibited vague boundaries and changing names. In the Chilean case, there is a further geographic division between the Northern Patagonia, integrated by the Region of Aysén and the Province of Palena, and the Southern Patagonia which is the Region of Magallanes. This distinction is not official and does not have administrative consequences but is culturally acknowledged by their inhabitants (Blanco 2009).

lives (Long 2001; Kaag et al. 2004), and (iv) to identify how lifeways and practices are not only affected but can affect regional ecological systems.

Among the four groups of native people of Southern Patagonia, two, Selknam, and Aónikenk were terrestrial nomadic groups that become extinct due to the brutality of the colonial process (Harambour 2015). The other two, Kawésqar and Yámana, were nomadic canoeing tribes whose livelihoods were based on benthic fishing and sea mammal hunting. Sadly, they were decimated during colonial times and the remaining families forced to become sedentary, first by the Anglican missions in the late nineteenth century, and later by the Chilean Navy in the first half of the twentieth century (Serrano and Marticorena 2014). We, however, limit this inquiry to the last five decades which is the temporal scope of information obtained from fishermen's life histories. Three questions lead the research: who are the artisanal fishermen of the Magellan Region and how they have become part of complex regional socioecological systems? Which strategies characterize fishermen LT over time? and, which have been the main natural and anthropogenic drivers shaping these strategies and trajectories in the last 50 years? By answering these questions, we aim at deepening our understanding of long-term human dynamics in complex marine ecosystems and their effects in regional processes of socioecological change.

The case study offers an ideal setting for the exploration of LT for three reasons: (i) the rich, but rugged, environmental conditions of the Southern Patagonian region have historically brought people to its seascape searching for opportunities to make a living, which translate into a variety of life histories and livelihoods comprising diverse strategies; (ii) Chile has gone through profound transformations in the last five decades, transiting from a state-led import substitution model in the 1960s to the most neoliberal economy of South America since the mid-1970s, all which has deeply impacted ecosystems and livelihoods; and (iii) as a result of such reforms, the country is highly dependent on foreign markets, which also affects marine resources and coastal livelihoods, and poses important challenges to marine and fisheries governance.

Methodological approach

Study area

This research was carried out in the Region of Magallanes (48° 37' and 56° 30' S) (Fig. 1). This region is comprised of extensive territory, with a coastline of gulfs, canals, estuaries, and fjords. Fisheries are found around archipelagos, given their navigable canals. Exploration since the nineteenth century through the Gulf of Penas revealed the important abundance of benthic resources in the southern archipelagos (Martinic 2004).

The population of the region is 165,593 residents (National Institute of Statistics 2017, INE in Spanish). The Fishing and Aquaculture General Act No. 18.892 (henceforth FAGA) defines artisan fishermen as individuals whom, in a personal, direct and habitual manner work as artisan fishermen and distinguishes the categories of artisanal shipowner, shellfish diver, seaweed gatherers, and artisan fisher as such. A fisherman may be ascribed to one or more occupational category. An artisanal vessel is understood to be of no more than 18 m long and having 80 cubic meters of storage, operated by an artisan shipowner, identified, and registered as such in the corresponding National Records.

In 2016, 5969 artisan fishermen were formally registered in the National Artisan Fisheries Record, representing 6.03% of the national total (98,798). Of the latter, 521 were female, and 5438 were male; 5281 were registered as seaweed gatherers, 1002 as divers, and 4506 as fishermen.

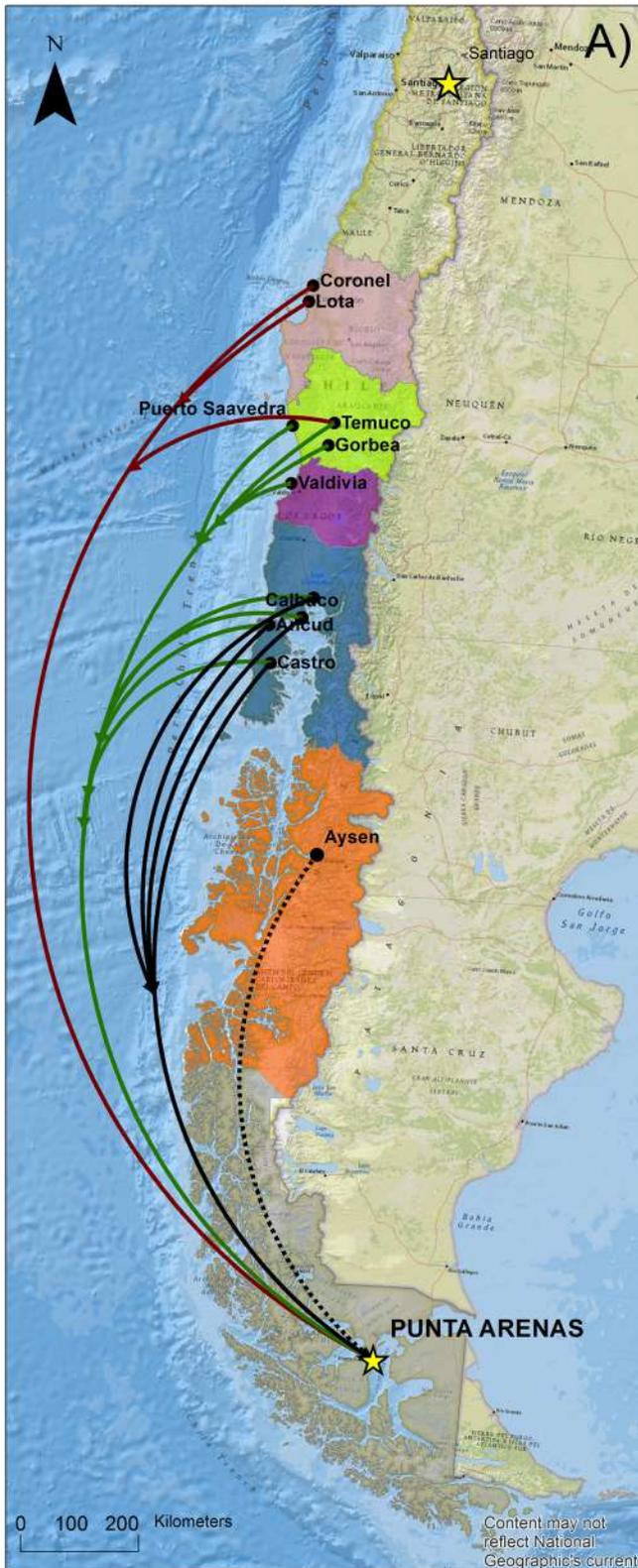
This region supplies the global market with products such as Chilean king crab (*Lithodes santolla*), Chilean snow crab (*Paralomis granulosa*), sea urchin (*Loxechinus albus*), red marine algae or "luga roja" (*Gigartina skottsbergii*), southern hake (*Merluccius australis*), and razor clam (*Ensis macha*). Among the farmed fish species produced in the region are Atlantic salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*).

Regarding total contribution to national figures, 76% of Chilean king crab (4234 tons), 99.9% of Chilean snow crab (3612 tons), 38% of Chilean sea urchin (10,970 tons), 40% of red marine algae (8886 tons), 33% of razor clam (787 tons), and 0.65% of southern hake (44 tons) were shipped from the region during 2016.

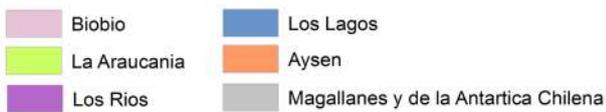
The study is centered in the Punta Arenas municipal area, located on the northern shore of the Magellan Strait, at 53° 10' S and 70° 54' W, where the regional capital bears the same name (Fig. 1), and where most of the population is located (133,282 residents, amounting to 80% of the region's total population). Geography in this area is characterized by vast plains that have been used since colonial times for sheep and cattle grazing (Martinic 2008). From the beginning of its modern habitation in the late nineteenth century, the region has been a focal point for national migration, especially from the Island of Chiloé (42° 40' 36" S–73° 59' 36" W). Chiloé's migrants comprise an ethnically mixed population. They are descendants of the Huilliche people, settled in the archipelago since pre-Hispanic times, canoe peoples, and Chilean descendants of Spaniards who early occupied the Island from the seventeenth century (Díaz 2010). The area of Punta Arenas contributes 68% of the region's artisan fishermen, with 3657 registered vessels (INE 2015).

Ethnography and extended case study

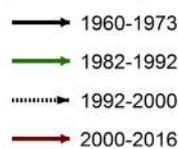
The research was undertaken through an ethnographic extended case study (Burawoy 1998). The extended case method



Central and southern regions of Chile



Trajectories- Time period



Datum: WGS 84
19 S

Fig. 1 Study area in the Magellan and Chilean Antarctic Region, and fishermen migrations per livelihood trajectories. **a** Central and southern regions of Chile, livelihood trajectories, and time periods. **b** Republic of Chile within South American continent. **c** Fishing coves under study within the Region of Magallanes and Chilean Antarctica

traces the events in which the same group of actors are followed over a mid- to long-term research period and around the same research sites. In this approach, there is a strong emphasis on the processual dimension of social life qualifying relationships between components—empirically and conceptually defined—based on logical and not statistical inference (Mitchell 2006). Ethnography was used for its rich descriptive capacity in the qualitative assemblage of the case (O'Reilly 2012). Through this approach, we aimed to gain a more profound understanding of the underlying processes that motivate social action and practices, focused primarily on fishermen's knowledge and their life histories. The unit of analysis is fishermen's livelihood strategies, which, as stated above, are made of individual or collective actions and practices related to decision-making processes. In turn, these strategies emerge in narratives, which woven through time become identifiable LT. We understand LT as a methodological and analytical construct (de Haan and Zoomers 2005), by which certain periodization emerging from interlinked life histories becomes a meaningful organizing timeframe to both the interviewees and the researchers. Another important feature of conversational techniques used to retrieve life histories is that they bring to the forefront interactions between humans and more-than-humans that otherwise become analytically separated (Mc Lean 2015).

Fieldwork was conducted in two phases. In phase one, an intensive four-month period from December 2015 to March 2016, and successive field visits by two of the authors from April 2016 to September 2017. In this phase, fishermen were contacted at the following fishing coves: Barranco Amarillo, Agua Fresca, Huairavo, Bahía Mansa, and Los Ciervos River. Later we broadened the sample of interviewees through snowball sampling.

Life histories were based on 44 in-depth interviews and several informal conversations with fishermen. In the fishing coves, we also conducted direct observation. Lastly, the research team participated in multiple daily activities of four key informants, using direct observation and open conversations.

In the second phase, fishermen's interviews were contrasted and complemented with 12 interviews with key informants from the following public institutions: Department of Maritime Works (DOP in Spanish), Housing and Urbanism Service (SERVIU in Spanish), National Service of Fisheries (SERNAPESCA in Spanish), and the Fishing Development Institute (IFOP in Spanish). As secondary sources, we review the following: statistical reports from

INE, historical records and documents from various national and regional authors, local newspapers, and public archives. In this manner, it was possible to triangulate information, situating life histories in a larger web of sources.

From the collected research material, we reconstructed a historical period of 50 years dating back to 1960. Within each LT, we identified livelihood strategies prioritizing information in the following dimensions of analysis: (i) fishing arts and technologies, (ii) modes of work organization, (iii) fisheries resources, and (iv) markets.

Results

Pulses and pressures shaping livelihood strategies and trajectories

Life histories reveal that livelihood strategies have been influenced by particular political, economic, and environmental pulses and pressures that can be organized in five distinctive periods identified from the interviewees (Table 1). We understand pulses and pressures as two different types of triggers of socioecological change that might occur at global, national, regional, or local level. A pulse refers to a single or a set of interrelated events occurring during a short time, whereas pressures are sustained activities that create identifiable effects in the long-term. The proposed periods are to be understood as an organizing timeframe emerging from clustering certain recurrences appearing in fishermen's narratives vis-à-vis the revision of secondary sources. The linearity of chronological information is nevertheless challenged by the four LT identified in the next section, which are based on social arrangements that were perceived as open-ended and full of uncertainties while they occurred.

1960–1973: emergence of national fishing industry

This period is marked by the largest earthquake in Chilean and world history (1960), which, along with the subsequent tsunami, devastated coastal areas and settlements. Simultaneously, economic policies were initiated, aimed to exploit exclusive maritime zones. An example of this is Decree with Force of Law (DFL) N° 266 (1960) which grants franchises to fishing organizations (societies or cooperatives) and DFL N° 524 (1964) that regulates the creation of fishing industries by maintaining franchises (Orrego 1972). Under an open access regime, unregulated artisan fishing spreads to the south, which led the regional government to promote the Program for Demographic Development and Rural Center Equipment (1964–1970), which sought to consolidate the presence and territorial sovereignty of fishermen and South American fur seal hunters migrating from southern Chiloé (Martinic 2004; Matus 2008). The migratory flows from

Table 1 Periods that represent changes in the pulses and pressures on the region under study. Spatial reach is defined as global, national (Chile), and local (Magallanes and Chilean Antarctic Region)

Periods	Pulses	Pressures
1960–1973	1960 earthquake in Valdivia (south-central Chile) (national) National policy to promote the fishing industry (national)	Industrial anchovies (<i>Engraulis ringens</i>) resource extraction crisis (national) Appearance of El Niño-Southern Oscillation (ENSO) 1965–1966 (global)
1973–1982	Military coup (national)	Overexploitation crisis of anchovies, sardines (<i>Strangomera bentincki</i>), and horse mackerel (<i>Trachurus trachurus</i>) due to bottom trawling (1973–1980) (national) ENSO 1973–1975 (national) Border conflict between Chile and Argentina for Cape Horn islands (national)
1990–2000	Return to democracy (national)	Enactment of General Law of Fishing and Aquaculture (FAGA) (national)
2000–2016	Changes in FAGA (national)	Supreme Court Decree No. 660 legalizes the use of artisan fishermen Fishing coves (national) Territorial ordering and the zoning of the coastal areas (local)

Chiloé—temporary or permanent—have been constant since colonial times (Weber 1903; Urbina 1988), and can be understood as a culturally rooted practice that, under certain circumstances, such as the potato blight (*Phytophthora infestans*) in the 1950s, tends to intensify (Urbina 1988).

The Magellan fishing sector becomes increasingly important for the economy due to its ports and the industrialization of seafood products, favored by the expansion of fishing zones in Patagonian and Fuegian archipelagos (e.g., Port Eden, Port Natales, and Port Williams). As a result, between 1964 and 1970, vessels multiplied and industrial production tripled (Martinic 2008).

1973–1982: neoliberal structural reforms and national fisheries crisis

This period was marked by the military coup, which provoked political shock, along with serious economic problems throughout Chile. Overexploitation of anchovies (*Engraulis ringens*) (Zuleta 1990), along with the El Niño-Southern Oscillation (ENSO), led to a more intense crisis in the fishing sector (Camus and Hajek 1998).

During the dictatorship (1973–1990), profound structural adjustments were articulated to consolidate a market economy based almost exclusively on the export of raw materials (e.g., copper, cellulose, and fish). In addition, a successive wave of privatizations began. In this period, the foundations for a model that will condition the subsequent stages are laid. These transformations promoted a strong internal migration of people towards the south. Between 1977 and 1982, a 29.9% immigration rate was observed for the region (González and Rodríguez 2004).

1982–1990: the fishing export boom

In 1980, Chile became the world's leading producer of fishmeal from species such as the sardine and jack mackerel and the fifth leading producer from catches of diverse species. This intensified during the 1980s, leading to a growth rate of almost 8% annually (Zuleta 1990). Between 1982 and 1983, the ENSO phenomenon reappeared, generating vulnerability among fishery resources (Camus and Hajek 1998).

The open access regime was maintained until the 1990s, specifically until 1991 with the enactment of the FAGA, and the regional fishing effort increased gradually (SERNAPESCA 1988). This period marks the opening of the country to the international market, expressed by the export of species such as the Chilean sea urchin and the Chilean king crab as the main catch by artisan fishers in Magellan Region. North America and Japan were the main buyers during this period.

1990–2000: the first attempts to govern open access to marine resources

With the return to democracy in 1990, the FAGA was promulgated in 1991, marking the most important milestone in terms of management and exploitation of fishery resources, which until then, had been open access. Among its general guidelines, the FAGA integrates criteria for rational and sustainable marine resource management. Rather than protecting marine species, it seeks to “create conditions of exploitation that can be controlled by authority” (Camus and Hajek 1998). The FAGA stipulates the implementation of two measures: (i) exclusive fishing rights for artisan fishers within 5 miles of the coast and (ii) the Benthic Resources Management and Exploitation Areas (AMERBs in Spanish). A management

area is defined as “a geographically delineated coastal zone, exclusively supplied by SERNAPESCA to a legally constituted artisan fishermen organization, for the purpose of controlled exploitation of benthic resources present in the area through a management plan” (SERNAPESCA 2005). Along these lines, the catch system was regionalized, the Artisanal Fishing Register was created, and the Artisan Catch System was established, restricting the interregional fishermen mobility.

Since the 1990s, a significant portion of fishery resources entered full exploitation, which determined a system of quotas and closures for each resource. For demersal resources, such as the southern hake, a global catch quota was generated and distributed according to specific criteria. Benthic resources were expected to operate under management areas. But in the particular case of the region, designated management areas have not been implemented, with only one existing operative in Parry Bay, registered in 1998 (SUBPESCA 2015). Thus, in Magallanes, boats, depending on the resource they were collecting, moved along the coast of the entire region, specifically through channels, straits, and fjords, making regulation extremely difficult.

Return to democracy triggered the organization of artisan fishermen in trade unions. By the end of the year 2000, 3000 fishermen were registered in the region, supplying more than 30 processing plants (Martinic 2006), mostly concentrated in Punta Arenas. Since the 1990s, immigration of southern hake fishermen groups from the Aysén Region had increased catches of this species in Magallanes (E. M. January 2016).

2000–2017: moving towards coastal and marine spatial planning

This period is marked by incipient administrative decentralization, granting greater impetus to regional governments. The first actions of regional space planning were initiated through two fundamental instruments in 2011: the territorial ordering and the zoning of the coastal area. The official artisan fishing ports were created through coastal zoning.

The Directorate of Port Works aimed at modernizing fishing coves in the country through the Artisanal Fishery Port Infrastructure Program granting maritime concessions to legal organizations of artisan fishermen which regularized the effective occupation of beach and coastal borders (MOP 2005). In Punta Arenas, road and port works were inaugurated. This led to the displacement of artisanal fishing families who had occupied the coastal area since the 1970s and had represented the physical place where social networks of immigrant fishermen were constituted.

The current Barranco Amarillo artisan fisherman wharf in Punta Arenas (see Fig. 1) was inaugurated in 2005 and is managed by four unions as a private corporation under

concession. This wharf provides artisanal fishermen an appropriate and highly technological space for unloading or stranding tasks. Authorized landings of all resources caught in the region, mainly Chilean king crab, snow crab, sea urchin, razor clam, red marine algae, and southern scallop (*Chlamys vitrea*), are carried out on the wharf, but not their commercialization. The port is used by boat owners who can pay for its use and are not engaged with private carriers or middlemen.

The FAGA was modified in this period, implementing the Artisanal Catch System for southern hake through Law 19.923 in 2003, which generated quotas for the industrial and artisanal sector and subdivides the global quota for the “macro southern austral region” (Los Lagos, Aysen, Magellan, and Antarctic Regions), due to common conflicts between artisanal fishermen and the state.

Actors livelihood strategies and trajectories

Interviewees migrated from other regions of the country in four waves of migration (Fig. 1), which assists the classification of LT. We assume that there is no single trajectory, but types of trajectories marked by individual/familiar experiences that share time and space recurrences and processes. LT in this sense are understood as heuristic devices to account for similar patterns of livelihood strategies and experiences of a group of fishers and, consequently, to obtain first-hand knowledge over major regional socioecological transformations though an extended period of time.

Trajectories type 1 (T1)

The first trajectories (Table 2) begin with the migration of fishermen from Chiloé, Calbuco, and Puerto Montt (Region of Los Lagos) in the 1960s (see locations in Fig. 1). Although we mark a temporary milestone defined by the pulse generated by the 1960 earthquake, it can be argued that this first trajectory represents certain continuity with the historical migratory pattern between Chiloé and Patagonia.

This first wave was composed of diving crews working on Magellan mussel (*Aulacomya atra*) fishing for the national canned food industry, in response to overexploitation of shellfish in the traditional sectors of Chiloé and Calbuco (Region of Los Lagos) (Martinic 2004). The following testimony describes this beginning: “As many as ten divers came from Calbuco to here (Punta Arenas) ... We were on a sailboat, towed by a man with a small tug boat, he would tow some of us and we would go to work fishing scallops in the Bross inlet. We would make a small homestead built with veneer and sticks and it would even have a small stove inside, and we would get up early, have some coffee and go to work” (L.B., March 10 2016).

This seminomadic form of work on the southern coast of Chile is associated with the lifestyles of fur seal and otter

Table 2 Livelihood strategies per type of trajectory, period, and dimension of change

Type of trajectory	Dimension of change	1960–1973	1973–1982	1982–1992	1992–2000	2000–2016
T1	Technology	Small boat oars/diving	Small boat/diving	Small boat/motor board/diving suit	Fishing boat/diving suit	Fishing boat/diving suit
	Organization	Group work	Production network	Group work	Production network	Union
	Fisheries resources	Shellfish	Sea urchin, Chilean king crab	Shellfish, Chilean king crab	Sea urchin, Chilean king crab	Red marine algae, sea urchin, and Chilean king crab
	Market	Local and national	National and global	National and global	Global	Global
T2	Technology			Small boat/diving suit	Fishing boat/diving suit	Fishing boat/diving suit
	Organization			Group work	Production network	Union
	Fisheries resources			Sea urchin, Chilean king crab	Sea urchin, Chilean king crab	Red marine algae, sea urchin, and Chilean king crab
T3	Market			National and global	Global	Global
	Technology				Fishing boat	Fishing boat
	Organization				Group work	Union
	Fisheries resources				Southern hake	Southern hake
T4	Market				Global	Global
	Technology					Fishing boat
	Organization					Group work
	Fisheries resources					Razor clam
	Market					Global

hunters, such as the Kaweskar people. One informant recalls: “The Kaweskar travelled together, the whole family, kids, grandparents, etc. I met the Márquez family, who were Kawéskar here [Chabunco River, and old fishing cove] they hunted otters and fur seals” (L.B. 2016).

The Kaweskar inhabited the channels and fjords of the Southern Patagonian region. They were nomadic canoe people, who spent long periods hunting and gathering seafood. The whole family would mobilize and they would settle for short periods using hides and branches to build tents (Empeaire 1963).

Between 1970 and 1980, fishing was still abundant along the coast of the Magellan Strait. “The guys were fishing 4 or 5 hours away, filled their boat and returned in the afternoon or even two days later” (F. C. January 2016). Marketing was informal; fishing had no restrictions and artisan fishermen had their own schedule, depending on the best time to extract each species. In addition, there were two types of fishermen, those working shellfish and crustaceans, who responded to fisheries and the national market, and those who worked with small row boats and fishing nets on the beach. These fishermen supplied the local market (M. E. August 2016).

By the end of 1970s, aqualung diving was replaced by diving suits, which became an important technical innovation for fishing benthic resources, and consequently expanding shellfish trade. In turn, king crab fishing for the international market (SUBPESCA 2014) gradually intensified through the use of traps.

Trajectories type 2 (T2)

The second trajectories began with a migration wave in the 1980s by young rural men and salaried workers from Puerto Montt, Chiloé, and Valdivia, searching for better living conditions (Table 2). “In that time [1980s] salaries in Chile were very low, miserable even. Where I’m from (Puerto Montt) people said, ‘do you want to earn money? Go to Punta Arenas’” (F.C. January 2016). Another testimony states: “and so I left the farm life (Gorbea, Araucanía Region), because it was not profitable” (E. M. January 2016).

Family networks helped them to get settled and become a fisherman, as corroborated by the following testimony: “I lived in Corral (Valdivia, Los Ríos Region). I came when I was 22 years old (1983). I came through a relative, an uncle. He worked here in the king crab fisheries, which were starting.

We didn't have the equipment that they have now, and the Magellan's waters are more sheltered than the open sea" (L. E. January 2016).

At first, these fishermen worked for processed food industries, which supplied the national market or sold directly. "In '86, we worked with sea urchin, the sea urchin fever had not begun and there were no restrictions. We sold (sea urchins) to some men from Santiago [Chile's capital] who owned a restaurant. A gentleman shared his fishing boat with me [informal work contract, based on trust between the parties and the equitable distribution of profits]. I looked for people to work, I went out and from there I paid the people, the expenses and we split what was left. Afterwards, we went on king crab fishing expeditions, around 1989" (J.L. January 2016).

"That year, 1986 ... we fished for sea urchins with 15, 18, maybe 22 small boats or so. The boats had a sailor and a diver ... these people (middlemen) had three large boats. The boats were dedicated to extracting the product and the larger boats brought the product to Punta Arenas. Usually, the boats were out for two months. It wasn't so long (time) because seasons are longer in king crab areas, the first few years I was there, there was no such thing as off seasons" (L. E. January 5 2016).

In the early 1990s, international seafood markets opened (SUBPESCA 2009, as cited in Hernández 2016). Consequently, the number of vessels and internal immigration grew at an accelerated pace. In 1992, there was an export boom of sea urchins to these markets, which allowed many artisan fishermen to purchase boats.

"With the sea urchin boom, we started to earn good money, in '93, '94. In '96 I had my first boat, it was 8.3 meters with a 40hp motor ... In '99 I bought another one with the same characteristics. In 2000 I made them into longboats, enlarged them, and put a cabin in them; one was 9.3 meters, and the other 10.7 meters. Over time I was able to buy two shipping boats" (A. P. January 2016).

"Wherever you went, there were sea urchins, you did not have to go far to get them, right here even [Magellan strait]. Now it takes 20, 30 hours of searching and it is even more risky. Before, one could work the canals because they were not exploited yet" (L. E. January 2016).

At present, only the international market is supplied with king crab and sea urchin, which are increasingly scarce and maintain a high price in the market. "The first king crab buyers were from the United States. Then came buyers from France who began to manage canning. But it was the United States that bought the large volumes of crab ... but then it was no longer set at a good price ... now lastly, South Korea appeared, buying whole king crabs, and things got better because they are paying \$5000, \$6000 per kilo [approximately US \$10/k]" (F.C. January 2016).

In time, it became evident how fishing efforts had to increase to maintain the same catch. "When I arrived (1977), a ship owner who had 100 traps [king crab traps] was rich; the

one who had 50 was middle class and the ones who had 20 were poor. But those 20 traps produced the same amount that a boat with 600-800 traps produces today" (F. C. January 2016).

Currently, as in the past, fishermen maintain the strategy of fishing multiple resources throughout the year. Thus, fishing for sea urchins and red marine algae "luga" is a strategy to sustain their livelihoods during the off seasons between December and June: "I fish for king crabs in the crab season, I fish for sea urchins until March, and then I stop for a while" (L.E. January 2016).

Trajectories type 3 (T3)

These trajectories are composed of strategies used by artisan fishermen who came from the Aysén Region in the 1990s where southern hake fishing was particularly relevant. These hake fishermen had originally migrated to Aysén from Puerto Montt and Valdivia, during the hake boom in the 1980s. For these fishermen, migrating to Punta Arenas becomes an option during a period of temporary decline in southern hake fisheries in Aysén and Los Lagos.

"Before the 1980s, no hake were caught in any of the three regions (Los Lagos, Aysén, or Magellan). Exploitation began in the year 1982 onwards. We are the hake fishermen here [Union of Ship-owners and Demersal Crew]. The majority of Magellan fishermen did not fish hake" (E.M. January 2016). A group of fishermen arrived in Puerto Natales and Punta Arenas with "espineles" (baited hooks used for long line demersal artisan fishing) and small boats, different from those used in the region for hake fishing. "These crews caught hake and handed them over to codified artisan fishermen in the Region [fishing code given by the State authority to artisan fisherman to legally catch certain quota of resources]" (E.M. September 1 2016). "The boats stayed in the sea, in fishing zones. They came here once a year in December, and by January 10th or 15th we were already going out to sea again" (E. M. January 2016).

Factory ships were an option for artisan fishermen during the 1990s. "In 1998, there began to be a lack of hake in Magallanes. The quota ran out quickly and no one knew who had extracted it. The globally registered quantity of fishing quotas was taken from the austral macro zone; registered artisan fishermen, in addition to the industrial fishermen. In '85, 70,000 tons of hake were caught, in '92 that amount had already dropped to 50,000 tons. Then it was declared to be in maximum exploitation, because the biomass fell to 25,000 tons and from then on a yearly quota was set" (E.M. March 2 2016).

"Around '96, '97, I was part of a Spanish fishing company called Andes. At that time there were many Spanish companies here in Magallanes. It was the time of the hake and cod fever, that's when I really got to know the Atlantic Ocean. Ships that came here working for many different companies.

There was Mar Azul, the CONCAR, Pesca Chile, the South Iberian, and they paid much better” (J. E. January 5 2016).

Currently, this resource is commercialized mainly in the Spanish market and its exploitation is carried out by both industrial and artisan fishing, causing permanent tension between both sectors.

“Trade began to fail because there was a crisis in Spain in 2011, Spain was the only buyer who consumed hake, and they paid the best prices” (E.M. March 2 2016); this caused us to turn in quotas from the artisan fleet to the industrial. “The law amendment 19.923 allowed up to 50% of quota transferring from artisan fishermen to industrial actors, for up to two years. But the Longueira Law (name of the Minister that in 2012 had amended the original FAGA) authorized selling 100% of the fishing quota to industrialists” (E.M. September 1 2016).

This implied that artisan activity regarding hake ended for those who had to transfer their quota, with the consequence of many ceasing the activity, at least temporarily. “When the hake quota was finished and there was no diving work [sea urchin diving], I grabbed my bag and went to unload trucks ... I never stopped working” (E.M. March 2016).

These groups of demersal fishermen from the Aysén Region started a work organization in Magallanes. They incorporated and adapted relatively quickly to changes imposed by the global quota system, in part by selling their quotas to industrialists and joining other forms of fishery production.

Trajectories type 4 (T4)

This type is characterized by the migration of artisan fishermen from the Bio Bio Region in 2005, and afterwards from the Araucanía Region. These fishermen worked in the extraction of razor clams and knew the fishing technique before migrating. Given the opportunity of the Chinese market, the Magellan industry recruited fishermen from these regions to work their extraction after prospecting existing banks in the Magellan Strait. The first intensive fishing season began in 2005 (1709.6 tons), but there was an overexploitation of the resource, forcing an official closure of fishermen licenses for 2006.

In spite of this, artisan fishermen continued fishing from other banks along the Magellan Strait (FIP 2008), which they carried out with small boats and divers.

Shellfish in the banks of the strait have been affected recently by a harmful algae bloom known as red tide (El Pingüino August 2015). Currently, it is the only species that is not in danger of overexploitation.

Discussion

LT of fishermen in the Patagonian region have in common an initial migration that is a mutually shaped response, by both their agency and a series of natural, political, and

socioeconomic events. Once relocated, these fishermen will deploy a series of strategies characterized by different (i) fishing arts and technologies, (ii) modes of work organization, (iii) targeted fishing species, and (iv) market conditions. The strategies that make up these trajectories become viable options for each artisan fisherman, only to the extent that they are able to combine skills in a flexible way. Therefore, these LT should not be understood as excluding life activities, but as accommodating, sometimes rational, and sometimes contingent strategies, with the purpose of maintaining livelihoods linked to the seascape.

Mobility and migration

The trajectories reveal the importance of mobility and migration in response to natural (e.g., earthquake), political (e.g., military coup), economic (e.g., market liberalization and prices), and socioecological (e.g., agricultural unemployment due to a crop disease) pulses and pressures, occurring at different spatial and temporal scales.

However, this mobility is also a response of fishermen’s own cultural repertoires as shown in T1 and T2. People from Chiloé or “Chilotes” are an expression of a diasporic culture (as coined by Clifford 1997), where discourses and practices in the process or appropriation of new spaces tend to reproduce those of their place of origin. The Patagonian regions of Aysen and Magallanes are part of Chiloé, as a “cultural area” (Herskovits 1948), in contrast to the technocratic logic of administrative regions under which the country was organized since the 1970s and transposed later to small-scale fishing activities by the FAGA. The migrating culture of Chilote people contrasts with southern hake or razor clam fishing dynamics (T3 and T4), where fishermen seem to have primarily an economic instrumental logic, showing less concern for reproducing a territorial identity linked to the place to which they belong by birth.

Diversified versus specialized trajectories

Strategies and trajectories reveal patterns of diversification or specialization, which responds to the preferences and knowledge of fishermen, as well as to complex interactions between markets, regulations, and contingency. The narratives support both diversification (T1 and T2) and specialization (T3 and T4) strategies. Specialized strategies concentrate on one area (e.g., T4, Magellan Strait), on one species (T3, southern hake; T4, razor clam), or a single fishing method (T4 and T3; small boats).

Specialized technology can facilitate intensive fishing of species of high economic value (T1 and T2 post 1990s; larger vessels for king crab fishing). Larger, more autonomous vessels with innovative technology are usually assumed to fall within the specialized strategy; however, vessel size and level

of technology are not the only factors which need to be accounted for (Salas and Gaertner 2004).

Diversification has tended to decrease due to the FAGA, which has limited the variety of possible species to capture through the Artisan Fishing Register (e.g., T3 and T4). On the other hand, successive market booms of high value species such as the southern hake, king crab, and sea urchin have given shape to the FAGA model, promoting specialization in response to the needs of the global market. In addition, trade of other species (conger, luga, and clam) has been consolidated in national and regional markets.

High-priced fish markets have generated high incomes for fishermen, some of whom buy motorboats and/or become middlemen. Thus, a process of internal stratification is produced with at least four links: the fisherman himself, the middlemen, the purchasing power (processing plant), and the exporter. The state mediates these relations through regulations that are unilaterally directed towards artisan fishermen, ignoring power relations and the role of other actors in fisheries sustainability.

Cooperation relations

Although fishing is usually perceived as a competitive rather than cooperative activity (Salas and Gaertner 2004), in our case evidence suggests that over time a cooperative form of work has prevailed in all trajectories. This solidarity can be an expression of the migration experience as seafarers and the early form of work organizations through *cuadrillas* (group work in all trajectories) by which fishermen travel long distances tied to larger vessels under very hard weather and sailing conditions, camping in the middle of Patagonian channels (particularly T1 and T2). Cooperation is required given the characteristics of the region's coast and the fishing itself, where crews fish for extended periods of up to 5 months (T1 and T2).

The return to democracy in 1990 and the enactment of the FAGA mark a new form of organization: Fishing Unions, meant to be the sociopolitical representation of workers, and however, remarkably articulated by law to markets. By means of the FAGA, fishermen as an organization or group have been fragmented according to the main fishing practice: benthic, demersal, or pelagic and bound to a specific region. In practical terms, this means they will aid each other when necessary in the fishing zone, but for the most, they are a social force divided by market interests.

The role of markets and state agents

Evidence supports the idea that “markets have created fisheries” (Meltzoff 2013). Most fisheries in Magallanes are high-priced export fisheries, specifically Chilean king crab, snow crab, sea urchin, southern scallop, and southern hake. Nevertheless, the ethnographic testimonies suggest a complementary idea: markets not only create fisheries, they also

contribute to creation of fishing cultures, and, despite they are conditioned by market rationality, a process of territorial rooting and identity formation takes place simultaneously.

The idea that fishers respond to economic stimuli is controversial, with some authors clearly in favor and others in disagreement (Salas and Gaertner 2004). For the case at hand, the role of markets cannot be overlooked. Prices are indeed a strong variable within the system, scarcely counterbalanced by any regulation or local practice. Whereas these markets grant economic prosperity to fishers, they can also promote undesirable practices. A recent study (Hernández 2016) identified three types of illegal, unreported, and unregulated fishing practices in the case of king crab in the Magallanes region: (i) the use of an excessive number of traps per boat (there is no limit established by the regulations in this regard), (ii) trapping with nets that have been banned since 1980. It is estimated that in November 2016, at the end of the season, only 35% of total catches were trapped with traps, and (iii) violations regarding entry of new vessels to the fishery. It is estimated that approximately 50% of the fleet operates outside the artisan fishing register. The author exposes the responsibility of processing plants and exporters, which promote high prices in critical periods, such as the end of the extraction season when trap efficiency decreases, providing nets and traps for fishermen to encourage the increase of production, thus gaining exclusivity of purchases. King crab landings have increased from 500 tons in 1974 to 1965 tons in 2016 (SERNAPESCA 2016).

The role of distant markets, changes in consumer patterns, and the social construction of quality are key aspects in the globalization of seafood (Mansfield 2003; Phillips 2006), but its effect on the supply chain of specific marine products requires further elucidation.

This is aggravated due to the fact that in tough times (reduced prices or fish stock declines), state agents make conscious exceptions not to enforce certain regulations (such as in the southern scallop ban) as a kind of social security measure, as long as fishermen do not provoke social unrest (Meltzoff 2013). This is not surprising as the FAGA has created a market-oriented view on fishing activities, where each fisherman or organization is a company, without accounting for important elements of the activity such as cultural identity, lifeways, safety, occupational health, and last but not the least: a sustainable ecosystem.

Conclusion

The LT described in this work aspire to be an ethnographic contribution to the understanding of long-term processes of regional socioecological change. In the same light as de Haan and Zoomers (2005), life histories have become the key narrative component of LT, proving the analytical capacity of this heuristic device to relate individual agency with historical

patterns. Despite the multiple drivers of change identified, the case study provides significant evidence of the increasing pressures derived from distant market agents to seemingly peripheral marine ecosystems, as well as the sociotechnical recomposition of actors, species, and artifacts they trigger. These evolving regional geographies of socioecological change become crucial in understanding not only the effects of global processes and the reconfiguration of power relationships but the vibrant array of creative responses for the persistence of coastal and marine livelihoods.

Artisanal fishermen have been shown to deploy varied strategies in response to these changes. In this research, we have identified four trajectories organized through five major periods. They are not static historical milestones, with a clear-cut beginning and end, but are periodically updated in their four dimensions (technology, organization, resources, and markets) and, presumably, in emergent ones.

In the present time, fishermen continue to migrate or move from Chiloé, Calbuco, or Aysén, as they have done whenever circumstances permit. Likewise, young people, of rural or working class origins, continue to migrate, because they see in artisanal fishing of king crab, sea urchin, or the southern hake, a possibility to improve their incomes. With the current fishing regulations, new fisheries for export will probably emerge and the sustainability of current ones will be at stake.

In the case of artisan fishing, it is essential to address research that combines small- and large-scale interactions between marine and coastal socioecological systems as a historical dynamic process, mediated by various human and nonhuman actors. This is what traditional livelihood approaches do not take into account: as long as human livelihood prevails, effects to ecological systems are usually overlooked.

In spite of the great adaptive capacity and resilience, the sustainability of fishers' livelihoods lays in their mobility to access mobile resources and changing fishing grounds. That is to say, its activity may be sustainable on a wider (trans-regional) spatial scale rather than limited to regional or local marine ecosystems. On the other hand, growing capitalization, expressed in larger and better vessels, with increasing safety, control, and fishing technology can only be economically viable with catches close to industrial levels, which opens a further debate on when the size and scale of fishing activities do not match what has been historically regarded as artisanal fishermen.

Funding information This work has been funded by the Centro de Investigación Dinámica de Ecosistemas Marinos de Altas Latitudes, IDEAL (FONDAP 15150003).

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