

Appendix 1

Capitals of the historical phases of Chiloé local (social-ecological) adaptive cycle. References are cited at the end of this appendix

Capitals of Phase r (1): (1826 – 1959)

Ecological Subsystem		
Natural capital	The western coast of the archipelago, and on the coasts of the inland sea, was filled with wetlands, peatlands, native forests, lakes, rivers, and reach marine ecosystems. Coastal marine ecosystems provided macroalgae, crustaceans, mollusks, and fishes. Those marine resources, mixed with potatoes, were the basic food for Chilotes. Other crops (wheat, oats, some legumes) and livestock were complementary.	Cárdenas and Villagrán (2005)
	Island forests were already suffering anthropogenic pressures due mostly to wood extraction (mostly larches) both for building and as firewood, vegetation fibers, and herbs for medical purposes. There also was the change from forests to prairies for agronomic purposes.	Muñoz Carreño (2016), San Carlos et al. (2018),
	Use of natural fertilizers, marine algae, for potatoes cultures. The use of birds guano started in 1940.	Cárdenas and Villagrán (2005), Andrade (2017)
	There were two varieties of potatoes, both susceptible to a fungus known as “tizón” (<i>Phytophthora infestans</i>), a disease that it is believed it arrived from Argentina, unnoticed until 1949. New colonists introduced new potatoes varieties more resistant to fungi during 1895 and by 1950 they replaced native potatoes.	Cárdenas and Villagrán (2005), Andrade (2017)
	Large bivalves’ extraction between 1930 and 1940.	Sfeir (2005)
Social Subsystem		
Bridge social capital	Chiloé becomes isolated from its former markets after its incorporation to Chile in 1826, due to a decrease in maritime transport and isolation from the rest of the country.	San Carlos et al. (2018)
	The Chilean state becomes the owner of 70% of the island, including areas that formerly belonged to indigenous communities.	Marino (1985)
	During 1950, the Chilean government imposed an emigration process off the island due to its alleged misery. The poverty moved Chilotes away from agriculture toward the harvest of coastal marine species.	Montenegro (2016)
Cultural capital and identity	Chilotes’ culture was built before this phase through the syncretism of indigenous peoples and Spaniard colonists	Cárdenas and Villagrán (2005)
	The isolation is an important factor that explains the maintenance of Chilote’s identity and culture. Two mythological entities, one of the forests (El Trauco) and one of the coasts (La Pincoya), were particularly important as resources regulators. Thus, “Chilotes extracted only what was necessary for their life”	Personal communication (Interviewee from Dalcahue)
Economic capital	Efficient rural self-subsistence economy. Productive activities oriented to self-consumption along with sales or exchanges to benefit the family and social activities.	Gajardo et al. (2017); Montenegro (2016); Daughters (2016)
	Emigration due to the lack of working opportunities due to excessive land division, general poverty, and low expectations from men.	Yáñez Aguilar (2011); Montenegro, (2016); Saldivar Arellano (2017)
Human capital	During 1850 many men migrate to work on sea wolf and/or forest exploitations abandoning agriculture and leaving women and elderlies in charge of them. This process reverts at the beginning of the XX century due to a decrease in forest exploitation with Chilotes returning to potatoes harvest until the middle of the century when fungi start creating problems.	Cárdenas and Villagrán (2005); Saavedra Gallo (2013)
	High family and community cohesion. Families share agricultural grounds. This custom is disturbed due to the land division generated by the Chilean government.	Marino (1985)

Union social capital	Community activities occur mostly on beaches and fishing pens, a Huilliche tradition that was maintained until the first half of the XX century.	Urbina (1996)
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Capitals of Phase Ω (1): (1960 – 1966)

Ecological Subsystem		
Natural capital	<i>“The earthquake of May 22nd, 1960 lasted three minutes, it was 9.5 Mw. That is, it was a cataclysm. We lost everything here, we lost all coastal zones, the tsunami was very strong people said goodbye in between the three big waves. It was terrible, we saw gases coming from the earth, we could not eat fishes and seafood, all of them were contaminated. Chiloé then opened to the world, roads were opened, motorboats arrived, and it was the end of sailing boats. The positive issue was the existence of outside help, that, given the magnitude of the disaster, it was very important.”</i>	Personal communication (Interviewee from Dalcahue)
	After the earthquake, there was a closure of seafood fishing. Also, the falling of smut affected potatoes cultures until 1961, further reappearing during 1964. As a result, agricultures switch to culturing beet. During that period cattle were affected by diverse pathogens.	Urbina (1996)
	Ground-level subsidence with land flooding and the growth of wetlands made forest regeneration difficult.	Quintanilla (2004)
	Regional depletion of natural banks of “chorito” (<i>Mytilus edulis</i>) and “cholga” (<i>Aulacomya ater</i>). “Choro zapato” (<i>Choromytilus chorus</i>) was to the border of extinction and there was a collapse of natural banks of Chilean oysters (<i>Ostrea chilensis</i>) due to the null extraction up to 1961 and under 100 tones between 1962 and 1966.	Sfeir (2005)
	Replacement begins of traditional, chilote, fertilizers (based on marine algae and plant leaves) by the chemical super triple phosphate.	Cárdenas and Villagrán (2005)
Social Subsystem		
Bridge social capital	After the earthquake, the island’s human population gets temporally isolated, with few help networks and without immediate communication with the continent.	Manns (1972)
Cultural capital and identity	The construction of the Castro-Ancud route begins after the earthquake, making land transportation possible and negatively affecting the traditional maritime transport.	Mancilla and Mardones (2010)
Economic capital	Exports are profoundly affected due to the destruction of the train and docks. Employment starts depending on the generation of public structures, producing serious unemployment.	Urbina (1996)
	Seafood and macroalgae increase their value in Chile; the beginning of the current scenario of economic transformations.	Montenegro (2016)
	The earthquake generated the emigration of impoverished rural families from the island toward Argentina and Magallanes looking for better life conditions.	Saldívar Arellano (2017)
	The earthquake, and the following tsunami, buried the veins of gold making small scale gold-digging impossible	Gajardo et al. (2017)
	“The earthquake produced many changes. Here a customs benefit law is enacted (no taxes as an economic incentive), that persisted between 1960 and 1970. This “free port” allows the beginning of tourism, with outsiders starting to visit the island”.	Personal communication (Interviewee from Castro)
Union social capital	<i>“The earthquake generates a reorganization of Chiloé’s community. The country asks the catholic church to send a leader that may generate hope after the catastrophe. They sent an important priest, and everybody would go to Ancud to hear his prayers. This generated peace but people were still fighting for the food arriving from the continent. There also were connectivity changes, road building, and suddenly houses stop looking at the sea</i>	Personal communication (Interviewee from Dalcahue)

	<i>(Chiloé's tradition) and start looking at the road. Fishing pens also disappear due to the modification of the coastline".</i>	
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Capitals of Phase α : (1967 – 1973)

Ecological Subsystem		
Natural capital	There is indiscriminate cutting of native forests for the export of raw materials to Asia.	Sepúlveda and Geisse (1995)
	The export of chips from industrial waste pulp for cellulose begins. Also, the high demand for short fiber chips leads to the use of the best native wood for chips.	Hormazábal Henríquez (2006)
	Development of mussel farming on rafts with governmental funds (1967). Seed collection of "cholga" (<i>Aulacomya ater</i>) starts.	GESAM (2006)
	<i>"Up until 1970, you could still have natural banks of seafood. Chilotes would extract from nature only that necessary for its maintenance, not for sale. Fishing pens are one example of this."</i>	Personal communication (Interviewee from Dalcahue)
Social Subsystem		
Bridge social capital	The almost disappearance of mussel's banks after the earthquake motivated the Chilean state to start a research program to develop cultures. So, culture centers were established in several locations. At the end of the 70's decade, they are transferred to other institutions and universities and later to private enterprises.	Sfeir (2005)
	The Chilean state, in 1967, encourages the economic development, mostly of mussels farming.	"El gran auge de los choritos en Chiloé" (2007)
	The agriculture reform law (N° 16.640) enters into force in 1967. Its main goal is to modern social relations through land redistributions, generation of cooperatives and peasant's unions.	Altieri and Rojas (1999)
	Beginning of the introduction of Pacific salmon (Chile-Japan agreement, 1969).	Amtmann and Blanco (2001)
Cultural capital and identity	The local ancestral practice of the collective fishing pens is intrinsically attached to the local belief system and allows the maintenance of community access to marine spaces and extraction of species in low-scale capture.	Álvarez et al. (2008)
Economic capital	Diversification of economic activities and system's reorganization. Gold veins reappear in 1965, and dairy product's cooperatives (CHILOLAC) start in 1969.	Salières et al. (2005), Gajardo et al. (2017)
	Handicraft's market growth to sustain the beginning of tourism in the island.	Cárdenas and Villagrán (2005)
	There is a diversification of the economy matrix, influencing social and economic relationships in the archipelago.	Mansilla Torres (2006)
	The National Mining Company (ENAMI) encourages gold mining.	Gajardo et al. (2017)
Human capital	Poverty relates to poor soil's condition, erosion, illiteracy, lack of health systems and of state presence.	Grenier (1984)
Union social capital	New associativity: cooperatives and peasant unions.	Altieri and Rojas (1999)
	The aquaculture industry changes barter and reciprocity in monetary relationships. The idea of mutual obligation among neighbors decreases and traditional practices.	Salières et al. (2005), Daughters (2009)

Capitals of Phase r (2): (1974 – 1995)

Ecological Subsystem		
Natural capital	<i>In 1974 salmon production begins with eggs imported from USA. In 1979 a Japanese-Chilean enterprise starts culturing pacific salmon in the region. Later in 1984 the Pacific oyster is introduced in Chiloé coastal zone for culturing.</i>	Claude et al. (2000), Aros and Marchant (2018)
	In 1980, free access to resources, guided by the neoliberal model, generates overexploitation, with negative social, economic, and ecological impacts. It also changed traditional fishing practices.	Gajardo and Ther (2011)
	In 1981, the salmon aquaculture industry gets affected by Pacific salmon syndrome. In 1998 there is massive fish mortality due to the bloom of the microalgae <i>Heterosigma akashiwo</i> and in 1989 a bacterial disease kills many fishes. Later, in 1993, a parasite isopod appears in Chiloé salmons.	Fryer et al. (1990), Carvajal and González (1990), Sievers et al. (1996)
	Increase in the harvest of coastal marine algal prairies during the '80s.	Sfeir (2005)
	The National Fisheries and Aquaculture law is enforced in 1989, modified in 1991 and 1997. In 1994 appears the national policy on the use of coastal zones.	Marín and Gelcich (2012), Álvarez et al. (2008)
	The salmon industry in Chile uses antibiotics, fungicides and algicides and encourages the fisheries of <i>Merluccius australis</i> (southern hake).	López and Buschmann (1991); GESAM (2006), Coq-Huelva et al. (2018)
	Four million salmons escape from their cages between 1994 and 1996, and later are used as artisan fisheries resource.	Soto et al. (2001)
	Mussel farming was a secondary activity during the '80s, but it grows in the '90s when it is considered one of the most important Chilean productive revolutions.	"El gran auge de los choritos en Chiloé" (2007)
	The industrial economy starts using native forest wood both for building purposes, firewood, and splinters. During the '80s forest exploitation for splinters is intensified mostly from native forests.	Cárdenas and Villagrán (2005), Hormazábal Henríquez (2006)
	There is a diversification in land use with governmental support, but without regulation. Forestry plantations increase 48.7% between 1989/90 and 1997/98.	Amtmann and Blanco (2001)
Social Subsystem		
Bridge social capital	In 1976 the Undersecretariat for Fisheries is created and in 1978 the National Fisheries Service. Also, in 1976 Chile Foundation (Fundación Chile) starts its operation based on state and international participation. Later the foundation starts salmon farming operations in Chiloé through linked enterprises.	Claude et al. (2000), Fløysand and Román (2008)
	Salmon farming ends the free access to the coastal border. The law then grants rights for the use of marine resources that become tradable rights.	Ramírez et al. (2009)
	An association of salmon producers (SALMONCHILE) is created in 1985 and a similar one for mussel farmers (AMICHILE) is created in 1991. Both with the idea of supporting export processes.	Barton and Fløysand (2010)
	In 1974 a splinter production society is generated in Chiloé, to cut 125 thousand hectares of native forest. The response is the creation of a foundation (FUNDECHI) that starts reporting the consequences of the splinter project. As a result, Chiloé National Park is created in 1983 and in 1995 the park is returned to the Huilliche people.	Barros (1980), Oltremari and Guerrero (2003), Alcalde Silva (2014)

	Artisan fisheries is regulated through the General Fisheries and Aquaculture law (1991) near the end of this phase.	Arenas et al. (2001), Coq-Huelva et al. (2018)
Cultural capital and identity	The government modifies the fisheries and aquaculture law in 1991. The main change is the limitation for artisan fishermen to work only in its region, stopping the traditional custom of Chilotes fishing in other regions.	Marín and Gelcich (2012)
	<i>“The introduction of a new political and economic system, neoliberal, generates a series of changes, where materialism is everything and the spiritual side is weak. Here in Chiloé, there is a destruction of natural and cultural patrimony. (...)In this model the only thing important is money, my neighbor is not important nor my cooperation history”.</i>	Personal communication (Interviewee from Dalcahue)
	Fishing pens ends in the 1980’s decade.	Álvarez Abel (2016)
Economic capital	In 1984 there are nine enterprises producing salmon, initiated mostly with Chilean capitals. They increase employment in Chiloé, but it is precarious and with high personal risks (e.g. injuries).	Montero (2004), Salgado Reyes (2005), Aguayo and Barriga (2016)
	The Los Lagos Region from 1985 until the end of this phase change from being a forestry-agriculture region to an aquaculture zone. Agriculture, hunting, and fishing labor force decreased by 9.8%, while manufacture decreased by 18.1%.	Antmann and Blanco (2001)
	High increase in salmon exports (250% in 1987) reaching 30 countries around the world. In 1994 Chile becomes the second world salmon producer.	Montero (2004), Bravo Sánchez (2004), Fløysand and Román (2008), Ceballos et al. (2018)
	In the year 1980, the selling of rural residential properties starts to be used for tourism.	Cereceda and Dahse (1980)
Human capital	In the ‘80s salmon aquaculture industries install big hatcheries, generating a demand for labor generating the proletarianization of the Chiloé’s peasants.	Mansilla Torres (2006)
	The emigration of Chilotes to Patagonia decreases, due to the new employment opportunities. This generates a decrease in the labor force of rural communities.	Barton and Román (2016), Daughters (2016)
	Immigrants from other zones of Chile start appearing in Chiloé. There is also an increase in education.	Zanlungo et al. (2015)
Union social capital	<i>“A financial system for farmers starts, along with the arrival of enterprises. Individualism is born! Chilotes have to work in the enterprises, with bad salaries and abuses. Self-maintenance is no longer possible, everything is more expensive.”</i>	Personal communication (Interviewee from Dalcahue)
	<i>“There is a decrease in the trust after the military coup, decreasing traditional cooperative activities. There is also a decrease in self-maintenance capabilities. Young people go to work for industries.”</i>	Personal communication (Interviewee from Dalcahue)

Capitals of Phase K: (1996 – 2006)

Ecological Subsystem		
Natural capital	During 1997 salmon production grows eight times, and regional fishmeal becomes the largest in the country. However, there is an increase in salmon diseases, infecting a local species.	Claude et al. (2000)
	There is an inverse relationship between salmon aquaculture and the population of sea wolf, (<i>Otaria flavescens</i>). One of the causes would be intentional catches to avoid sea wolf's attacks on salmon cages.	Buschmann et al. (2002)
	There is an increase in the frequency and spatial coverage of harmful algal blooms, reaching Chiloé in 2002.	Molinet et al. (2003)
	There is an increase (by a factor of 7.5) in sardine and anchovy catches in the period 1999-2009.	Coq-Huelva et al. (2018)
	The National Forestry Corporation (CONAF) approves subsidies to forest in fragile soils ("ñadis").	Gatica (2012)
	During the period 1998-2013, there is a loss of native forest of 10268 hectares, while forestry increases from 623 to 5443 hectares.	Frêne et al. (2014)
	<i>Pinus spp.</i> and <i>Eucalyptus spp.</i> are a potentially accelerated decrease in water reserves due to young forestry plantations.	Oyarzún and Huber (1999)
In 1998 the export of mosses (<i>Sphagnum spp.</i>) and peat starts, making this an important source of income during the next decade, influencing regional hydric balance.	Díaz et al. (2005), Zegers et al. (2006)	
Social Subsystem		
Bridge social capital	The National policy on aquaculture is approved during 2003.	Bermúdez (2010)
	The government authorizes Chilotes to fish in the Aysén Region.	Marín and Gelcich (2012)
	The government creates a buffer zone between Chiloé National Park and human settlements.	Oltremari and Guerrero (2003)
	Hacia el final de esta fase, en 2004 ocurre el anuncio público de intensificar los planes para construir un puente que conectaría Chiloé por tierra mediante un megaproyecto de puente y posteriormente se propone el plan Chiloé del MOP.	Delamaza et al. (2012)
Cultural capital and identity	In 2003 the Ministry of culture (Government of Chile) was created, an important milestone, since Chiloé becomes a powerful pole of tourist attraction. This from the exploitation and construction of a performative and stereotypical image of a natural, magical and mythological place, anchored in a rurality that in many respects seems to be pre-modern, and which, judging by the increasing tourist flow, would be meeting the needs of exoticism of a visitor of urban origin who seeks difference and cultural and natural 'authenticity'.	Mansilla Torres (2006), Ulloa and Del Valle (2014)
	In 2000, UNESCO designated several historic churches in Chiloé (built entirely of wood from native forests) as World Heritage Sites. These unique churches were built in the late 1700s and during the 1800s.	Ortiz et al. (2014)
Economic capital	The Ministry of Agriculture since the beginning of this phase (1996) accentuates international exports. Chile joins Southern Common Market (MERCOSUR). However, regional industries start showing economic crises.	Torres (2000), Antmann and Blanco (2001)
	During 1997 the US Chamber of Commerce accuses Chilean producers of dumping, occurring in parallel to the Asian crisis affecting salmon prices. However, despite this, there is no noticeable effect on the industry, but rather its consolidation with the start of the process of company acquisitions and mergers, together with an aggressive	Antmann and Blanco (2001), Barton and Fløysand (2010)

	transnational expansion in the industry in 1999. The agricultural census (1997) shows that family forest exploitation is only 1% of total forestry production.	
	In the first years of the 2000-decade salmon farming starts emigrating from Chiloé.	Estay and Chávez (2015)
	People increase their purchasing power as a result of the development of the salmon industry.	Barrett et al. (2002)
	Salmon farming modifies the traditional potatoes market, resulting in a relocation of this activity outside Chiloé.	Cárdenas and Villagrán (2005)
Human capital	The automation of processes in the salmon industry at the end of the '90s generates a 40% decrease in employment.	Claude et al. (2000)
Union social capital	Near the end of the 2000-decade NGOs encourage the creation of labor unions (TERRAM, Ecoocéanos, among others.), reaching 50% of all island workers.	Ramírez et al. (2010), Oseland et al. (2012)
	In 2002, the salmon sector signed the Clean Production Agreement of the National Council for Clean Production, dependent on the Ministry of economy (Government of Chile), and in 2003, a "Code of Good Practice" was developed by SALMONCHILE.	Muñoz (2006)

Capitals of Phase Ω (2): (2007 – 2016)

Ecological Subsystem		
Natural capital	The beginning of this phase (2007) is marked by the ISA virus crisis, making salmons unmarketable.	Bustos (2015)
	Increase in harmful algal blooms.	Sandoval et al. (2018)
	During 2013 Chile becomes the second world producer of mussels, exporting 240 thousand tones, and obtaining 99% from natural produced larvae. So, natural mussel banks show low recruitment.	Avendaño et al. (2011), FAO (2015); Molinet et al. (2017)
	During February 2016 a massive algal bloom of <i>Pseudochoatonella verruculosa</i> , produced a large salmon mortality in the region. Later that year a harmful algal bloom develops, leaving Chiloé archipelago as a disaster zone.	Buschmann et al. (2016)
	There is a controversy between forestry subsidies (USD 1.9 millions) and subsidies to manage and conserve the native forests (USD 84 thousand). So, <i>Eucalyptus spp.</i> forests start replacing natural forests.	Frêne et al. (2014)
	Authors describe this period as experiencing fast changes in the use of land and sea, extraction of algae and mosses (<i>Sphagnum spp.</i>), generation of industrial wind parks and unprecedented environmental changes such as harmful algal blooms and droughts.	Elwell et al. (2018)
	During 2007 concern starts over peatland exploitation, which is generating increasing summer water crises. Furthermore, wind parks have generated the destruction of peatlands.	SERNAGEOMIN (2008), Mondaca (2017)
Social Subsystem		
Bridge social capital	Salmon farming is an economic development concentrated on few enterprises, with weak connections with the local economy, generating dependency among local citizens. The role of the Chilean state is described as permissive, abandoning the community.	Cabello et al. (2018)
	In 2008 the law on coastal marine spaces for native people (ECMPO) enters into force, given the problems between exploitation areas and indigenous communities.	Saavedra Gallo (2013)
	During the 2016 harmful algal bloom, the Chilean government provides financial compensations, which are interpreted as the “typical” governmental response.	Thomas (2018)
Cultural capital and identity	Since the first ISA virus crisis, regional economic paradigms change, diversifying the economy toward non-extractive activities such as tourism.	Barton and Fløysand (2010)
	FAO declares Chiloé as Globally Important System of the world agricultural patrimony (GIAHS).	"Agricultores de Chiloé llaman a resguardar el patrimonio agrícola local" (2015)
	Patrimonial tourism is proposed as a way to maintain the socioeconomic characteristics of communities in need of support.	Sánchez et al. (2016)
	During 2009, Chiloé occupies the third place of tourism destinies worldwide (<i>Lonely Planet</i>).	Ulloa and Del Valle (2014)
	Scientists propose that tourists have a negative perception of aquaculture.	Outeiro et al. (2018)

	During 2012, the patrimonial school of crafts is founded.	"Al rescate del patrimonio cultural intangible. La escuela patrimonial de artesanías y oficios de lingue, Chiloé" (2020)
Economic capital	During 2007, the ISA virus crisis generates a salmon production crisis with socioeconomic consequences.	Gillet and Olate (2010)
	In June 2008, 64 million USD are lost reducing 1000 employments. Banks state that they will reconsider the requirements to loan money to salmon farmers.	Bustos (2015), Katz et al (2011)
	The traditional community work is transformed into individual wage work. After enterprises closed, in 2007, people migrated from rural to urban areas increasing unemployment and/or accepting precarious jobs.	Lazo and Carvajal (2018)
	In 2007 the milk products enterprise CHILOLAC enters into bankruptcy.	"Declaran quiebra de Chilolac. Banca privada y trabajadores son los principales acreedores de la lechera" (2007)
	In 2012, some authors propose that Chilote's dependency of the aquaculture sector has reduced their adaptation capacity.	Barton et al. (2012)
Human capital	The ISA virus crisis had a profound effect on human capital. People returned to their original regions due to unemployment, generating a perception of instability and distrust.	Zanlungo et al. (2015)
Union social capital	During 2008, The New York Times TM published an article criticizing the practices conducting to the ISA virus crisis. At this point, the crisis turned global.	Barton and Fløysand (2010)
	In 2013, two people die in Quellón, due to the precarious health conditions of the island. Social protests end after negotiations with the central government and local authorities.	Arriagada (2016)
	During 2015, artisan fishermen were deeply affected by salmon farming, also feeling that the Chilean state did not guarantee their activities. This condition generated Chilote's May during 2016.	Barton and Román (2016), Valdebenito Allendes (2018)
	The closure of fishing and aquaculture areas during May 2016, due to red tide events generates the social-environmental crisis " <i>Mayo Chilote</i> ". The government ends this crisis by offering monetary subsidies to fishermen.	Cabello et al. (2018)

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