Chapter 16
Cultural Limnology in Patagonia: Knowledge and Water Management in Mapuche Rural Communities

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1 Introduction

1.1 Cultural Limnology: An Overview of Local Freshwater Knowledge

Knowledge, practices, and values that different societies can establish with freshwaters are complex and differ according to culture and geography, as well as to different historical moments. Among urban societies, for example, waters are considered as part of the natural capital of each politically delimited space, which allows for human and animal life, as well as for economic and industrial development. In this sense, water bodies play the role of input for agricultural states growth, routes for fluvial transport of consumer goods, generators of hydroelectric energy, and even channels for waste release (Benez et al. 2010; Gartin et al. 2010). As long as their availability and access are politically determined, waters establish different opportunities for the growth of certain forms of progress, Western modernity, and wealth accumulation (Merlinsky et al. 2020).

Cultural limnology, as a scientific transdiscipline which approaches these issues, is interested in understanding the knowledge and practices associated with

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hydrological cycles and their biology, their relationship with festivities, also with annual productive calendars, with water management and governance, etc. (Trawick 2001; Gartin et al. 2010; Linton and Budds 2014; Usón et al. 2017). In recent years, these issues have begun to gain importance among scientific, technological, and governmental sectors, due to questions from different social and academic spheres to the prevailing logic of industrial and commercial use of water bodies (tourism, forestry industry, hydroelectric plants, mining), which many times exclude local populations from decision-making (Marino et al. 2009), and also due to failures in biological conservation, sanitation safety planning (OMS 2016), and water safety plan implementation (WHO 2005; Martínez et al. 2014; Morales et al. 2020).

In this sense, cultural limnology can document alternative scenarios to those of globalization, as examples of other ways of relating to water. Indeed, in rural and indigenous contexts around the world, alternative forms to relate with water are possible. Generally, these relationships are based on close, time-anchored contact of societies with their environment (Woodward et al. 2012; Guerra et al. 2019) and respond to complex, multidimensional and particular ways of seeing the world, in continuous adaptation to various socioeconomic change processes (Berkes and Turner 2006; Molares and Ladio 2014; Iniesta 2015).

The environmental perspectives of indigenous and rural societies are usually invisible in the whirlwinds of hegemonic scientific thought, or they are defined from Western frames and representations (Usón et al. 2017). As suggested by water anthropology, a field self-declared as relational, it is necessary to overcome the opposition between nature and culture in order to understand that social and ecological distinctions associated with water are nothing but semantic conventions (Ballestero 2019).

In this sense, it is necessary to admit that water is a critical component of landscapes and territories and that it is related to the way people identify themselves. Waters are at the basis of different residential arrangements and provide for diverse subsistence practices and modes of inhabiting the land. Such a basis implies recognizing some agency in this and other elements of the environment and, for some peoples, the possibility of engaging an intersubjective relationship with them (Rivera-Cusicanqui 2013; Di Giminiani 2018). In this broad sense, water is a fundamental part of local communities' biocultural memory (Caparelli et al. 2011; Skewes et al. 2011, 2012; Aigo et al. 2020).

Biocultural memory about waters manifests in particular symbols and practices, whose meanings are encoded in the material and nonmaterial culture, in language, iconographies, and myths, constituting part of their traditional limnological knowledge (Aigo and Ladio 2016). This knowledge is of community character, since it is transmitted from generation to generation through language and shared practices; it is also of spatial character because it adjusts to the inhabited landscape. Due to its dynamic nature, knowledge expands with the cognitive processing of hydrological events (e.g., droughts, storms, floods) and their effects on topography, flora, fauna, and local economies (Toledo and Barrera-Bassols 2008). Limnological knowledge, in this sense, implies the adoption of new criteria and sufficient evidence to respond to environmental events, frequently catastrophic, and even to state or private

corporations. Thus, it constitutes critical knowledge for the communities' biocultural resilience and resistance (Iniesta 2015).

From technical to ritual dimensions, behavioral norms contrive the relationship with waters, which, in turn, impacts the landscape. Water should be obtained from streams; wetlands are regarded as numinous places, and its consumption is regulated during spiritual and community ceremonies. Waters cannot be separated from human and nonhuman components of the environment. Its availability and use patterns give rise to diverse waterscapes, and even under environmental stress, its culturally informed management allows for the continuation of life (Skewes et al. 2012; Aigo et al. 2020). The definitions of water and waterscapes require a biocultural dimension, capable of containing its materiality, ecology, and history, where the complex life networks, places, and worldviews concur (Skewes et al. 2011; Ceballos et al. 2012). Though aligned with other points of view in the scientific multidisciplinary field of limnology (Edmondson 1994), cultural limnology perspective incorporates this symbolic and living character of waters, which governmental and conservation policies should take into account in indigenous and rural territories.

1.2 Historical and Geographical Context of Mapuche Limnological Knowledge

Mapuche are the largest indigenous people in the Southern Cone. Throughout *Wallmapu* (Mapuche ancestral territory), between the Atlantic and Pacific oceans, the Andes mountain range has been, since ancient times, land of refuge and circulation space for different communities located both to the East, that is, *Puelmapu*, and to the West, that is, *Gulumapu* (today Argentina and Chile, respectively). In these vast landscapes, postglacial remnants, the snowy regime, rains, and the contribution of water from the temperate forests nourish the main river basins on which these entire ecosystems and its human and nonhuman components depend (see Chap. 9).

In the nineteenth century, capitalist cattle, agricultural, and timber industries, promoted by the Argentine and Chilean States and sustained by military occupations, the misnamed "Conquest of the desert" in Argentina and the "Pacification of the Araucanía" in Chile, took over the best and most fertile valleys and farmlands, forcing Mapuche communities to move to rugged mountains and drier lands, drastically reducing its territory (Zabala 2000; Briones and Del Río 2002). Today, Mapuche people live in rural communities, or many of them have migrated to the cities looking for jobs and educational opportunities. Mapuche people have a strong identity and keep most of their traditions and language alive. However, the Chilean and Argentine States of the twenty-first century have not yet resolved their relationship with Mapuche society, which continues to be one of the most impoverished and marginalized social groups in both countries (Bengoa 2012).

The long-standing relationship between Mapuche and waters has sedimented a deep biocultural memory recreated in the new scenery the communities confront. This memory allows them to discern the behavioral aspects of the elements, which are imperceptible for western observers. The flight of a bird, the breeze, or an escaping fox are signals that, when deciphered, allow the community to anticipate events or to orient their behavior according to patterns ingrained in their living practices (Guevara 1913). As suggested by Bengoa (2003) and Carabias et al. (2010), the history of Mapuche is closely connected to rivers and water streams. They intensively used the courses of water to create navigation systems, allowing exchanges and social bonding in the vast *Wallmapu* territory. The abundance of trees allowed the construction of *wampos* (canoes) used as a primary means of transportation. Such was the importance of navigation that in the Andean lakes where the invasion took over the land in the early XX century, it was prohibited by Chilean authorities and substituted by boats and ships managed by private companies (Skewes 2019).

Language, practices, and cosmology reflect the importance of water in Mapuche ways of life. Cultural spiritual beings such as *Shumpall*, *Abuelito Huentellao*, *Manquian*, and others maintain their presence either as embodied life forces in the rocks on the coast or as immanent spirits in the lakes. The word *lafquen* indistinctively applied to the ocean or the great lakes has a mystical meaning. Likewise, the Milky Way corresponds to the *wenuleufu*, the river of the sky, where the original ancestors of the contemporary Mapuche live. Water sacredness and its deep meanings translate into the reverential treatment water must receive. Waters are living entities within a continuum of relationships sustained as far as reciprocity and mutual respect between them and humans exist, a meaning that invites us to transcend the utilitarian notion (Di Giminiani 2018).

In the context of environmental disasters due to overexploitation of goods provided by nature, the biological conception of nature refuges demands a new approach of a biocultural nature (Barthel et al. 2013). In Patagonia, the sub-Antarctic forests and the riverine groves that make up the green spots of the steppe are inextricably linked to Mapuche communities. As such, these biocultural refuges protect the waters, while people keep alive their claim for the lands that have been taken away from them in the name of development. The communities' accommodation to waterscapes in a context of devastation and uncertainty is a critical point from which to study waters in its multiple facets and expressions.

In this chapter, we deal with some aspects of the Patagonian cultural limnology, analyzing the Mapuche experience in different rural enclaves (Fig. 16.1) where waterscapes, as part of Mapuche universe, incarnate the spatial accommodation of aesthetic, symbolic, and economic practices that characterize these people (Skewes et al. 2012; Skewes and Guerra 2016; Ibarra and Riquelme 2019, Aigo et al. 2020). The case studies are in Argentina—Costa del Lepá (42° 41′ S–70° 45′ W), Gualjaina (42° 43′ S–70° 32′ W) (Sub-Andean steppe, Chubut province), and Raquithue and Lafquenche (39° 56' S–71° 03' W) (Sub-Antarctic forest, Neuquén province)—and in Chile: Maihue (40° 15' S–72° 01' W) and Rupumeika (40° 18' S–71° 58' W) (Sub-Antarctic forest, Los Ríos Region) (Fig. 16.1). A qualitative approach which included interviews, observation, participatory workshops, and hikes with the

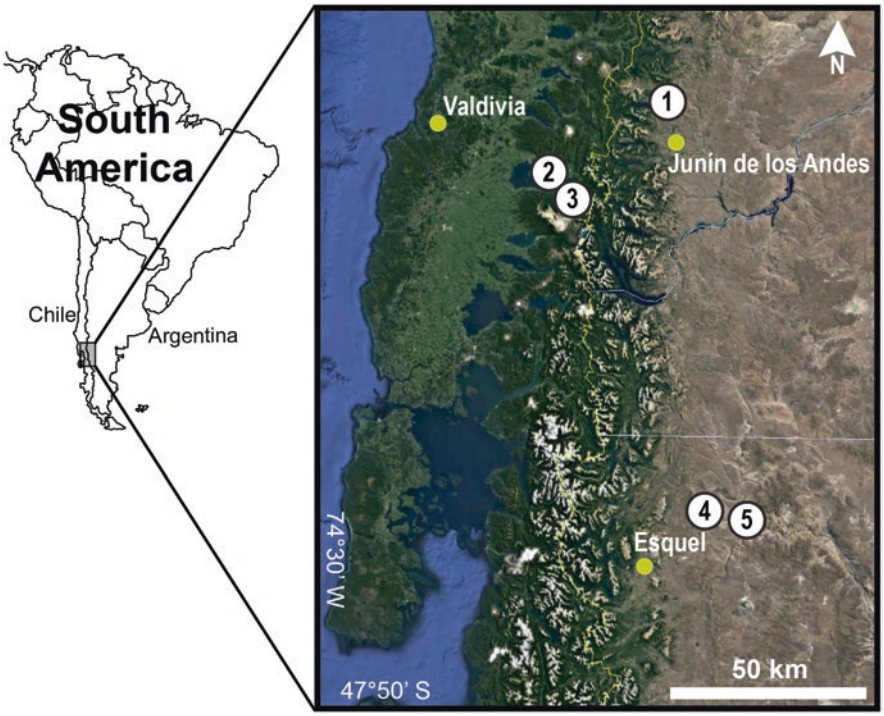

Fig. 16.1 Map of study area. 1: Raquithue and Lafquenche, Chimehuin, Neuquén Argentina; 2: Maihue, Los Ríos Chile; 3: Rupumeika, Los Ríos Chile; 4: Costa del Lepá, Chubut Argentina; 5: Gualjaina, Chubut Argentina

residents was the primary tool of this research work, while observing ethical guidelines, including consent forms with the collaborators in these communities (International Society of Ethnobiology 2006; United Nations 2012; Albuquerque et al. 2014).

2 The Becoming of Waters: Some Experiences in Mapuche Communities of Patagonia

2.1 Drinking Waters in Patagonian Arid Zones

From Eastern Andes cordillera basins to Patagonian arid steppes, water flowing superficially, together with springs, *mallines* (glacial wetland, see Chap. 10), and other groundwater forms, make up complex networks which sustain the settlement of Mapuche communities in the territory. Surface waters, often scarce in summer and cloudy or muddy during fall floods, are mainly used to cultivate food and

forage; groundwater, which emerges discontinuously in land surface, is mainly considered as drinking water. This is so in Costa del Lepá and Gualjaina communities (Chubut river basin) (Fig. 16.1), where, as in the great majority of communities in the region, there is no main water supply provided by the State administration.

Groundwater preference and the relationships built with them when used as drinking water come from organoleptic, thermal, and ecological criteria, which constitute a guide for perception and quality testing processes, as well as from the deep symbolic meaning of springs as powerful entities having *ngen* (strength in *mapuzungun*). These criteria, as mnemonic and heuristic tools, allow to remember, associate, and transmit essential information during the teaching-learning processes on this kind of water, as well as on the need to protect and value springs as a key biocultural heritage for survival. In this sense, for Costa del Lepá and Gualjaina communities, water emerging in springs is "sweeter" and "fresher" than others, and it "runs"—unlike stagnant water—"leaving bacteria on both sides" guaranteeing its purity and the development of many *lawenes* (medicinal plants) such as *Mentha* spp. (menta, poleo), *Equisetum bogotense* (limpia plata), *Apium prostratum* (apio de campo), among others, of great cultural importance (Molares and Ladio 2014). Besides, their ancients (ancestors) used to drink water from springs, with which medicine is prepared, and also the one with which "mate" is made (yerba mate, typical infusion of *Ilex paraguariensis*) so that "a little foam is formed"; that is why it is considered the healthiest water. Inversely, tap or bottled water tastes like chlorine, and it is drunk only when there is no other option (away from the house or after occasional flooding), or under health agents' indication (official medical system).

Unlike rivers, streams, or big water springs that are for community use, small springs are often of exclusive family use. Each family accesses water using buckets, jugs, or sometimes hoses, rarely pumps; they clean it from algae and keep dogs, farm animals, and trespassers away, thus avoiding to disturb the spring, who bubbles angrily and even punishes by drying up or emerging somewhere else. When springs dry up, drinking water runs out.

In recent years, increasing droughts caused many places to dry up in the region; according to some elderly people, this phenomenon was the result of transgressing certain respect and reciprocity customary rules toward *ngenko* (water protecting force, guardian of the water), thus disrupting the sacred order of springs (Morales et al. 2020). The communities internally discuss this problem with the premise that it is necessary to strengthen the practices of gratitude and reciprocity to improve the situation. Organization around the *nguillatun* will be key, as will also be described in Sect. 2.3. In the meantime, the adaptive response of the people is the continuous exploration of the territory in search of new small water springs, a practice that has been developed in the region for generations, though more intensively nowadays. Recognizing this intermittency in behavior and changing availability of springs has placed them in an outstanding place regarding territory preservation, even though there are some other ways to have access to groundwater, such as wells (Fig. 16.2) and drilling.

However, it is important to point out that local preference for groundwater sources is in tension with its microbiological aptitude according to laboratory

Fig. 16.2 Costa del Lepá's woman drawing drinking water from a well near her house. (Source: Photograph by Daniela Morales)

parameters which indicate that water is not apt for human consumption in more than a half of the springs (e.g., high values of *Escherichia coli*, *Pseudomonas aeruginosa*, and coliform bacteria, as recommended by the World Health Organization and the Argentine Food Code). This is even more significant for rivers and streams, since water is not suitable for drinking in any of them, mainly due to the presence of livestock and their defecation and the household waste (plastics, cans, etc.) and/or due to the proximity of latrines and human feces (Morales et al. 2020).

Despite having received information from local health workers, recommendations to boil water, supply of chlorine tablets or other disinfectant products, inhabitants of these communities do not consider the use of these treatments a positive step. For people, it is not always possible to boil water as firewood is a scarce resource, while the use of chlorine is not preferred because it is considered bad for the stomach. In general, local people do not really believe that consumption of untreated water can have negative effects on their health, and so they do not follow the recommendations.

It is possible that the gap between local perspectives and State interventions is due to a lack of understanding between both points of view. That is, the perception of water quality is not necessarily the same between cultural perspectives, which are not "related to imaginary ways of seeing the world, but to the real worlds that are being seen" (*sensu* Viveiros de Castro 2004). In this context, making progress with the idea of health interculturality might help to understand these complex cultural relationships and collaborate so that the different approaches can interact in an atmosphere of equality and mutual respect. As shown in this case study,

interdisciplinary approaches were useful to identify disagreements in the perception of water quality measured by microbiological and local parameters; this could be a starting point toward better communication between communities and the official care system.

2.2 *Waters for Agriculture: A Design Based on Accommodation to Water Network*

Subsistence economy in the Patagonian steppe is mainly based on sheep and goat raising and, to a lesser extent, on family horticulture. This practice allows for the supply of vegetables, fruits, medicinal and ornamental plants, firewood, and ceremonial elements. In recent years, selling these products has allowed to diversify monetary income and contributed to a diet which includes healthy food free from agrochemicals (Ladio et al. 2013). This is remarkable if we consider the distance which separates these rural communities from commercial centers and the limiting edapho-climatic characteristics they cope with: rainfall never over 150 mm a year, intense winds, and the predominance of poor soils (Davel et al. 2015), which turn horticulture into a great challenge. In addition to this, we must consider precarious conditions of basic services and poor State support, as it has been already mentioned.

This is the context shared by Costa del Lepá and Gualjaina communities (Fig. 16.3), wherein the management of horticultural systems depends on local knowledge which guides water and soil use practices and preservation. Part of this management comprises working within the horticultural sector (greenhouses, orchards, and farms), selecting the plant varieties most resistant to water scarcity, and preserving soil moisture (e.g., mulching). Likewise, it is necessary to organize the environment by installing forest curtains, which reduce wind effect and provide shade, and to locate the domestic horticultural infrastructure in the most humid areas within the family farm, which implies following the surface water networks and, sometimes, the springs largest streamflows (Morales et al. 2020).

In these domesticated sites of the landscape (Casas et al. 2016), people make their own design for irrigation, based on water intakes, canals, and flood plains. Water is captured from rivers or streams with water intakes made with stones, sandbags, animal hides, tree trunks, and other materials and diverted through lateral canals toward cultivation areas. Opening and closing canal circuits are decided through agreements between neighbors, considering social codes based on the efficient use of water, equitable distribution, and reciprocity among human and nonhuman beings (dogs, cows, fish, birds, sheep).

However, the scenario of water scarcity resulting from variations of the hydrogeological cycle and water reduced supply at the headwaters due to climate change (Garreaud 2018) that causes crop and pasture loss and animal mortality in the region (Roveta 2008) and has forced people to search for new management practices in order to satisfy their basic needs, such as the incorporation of innovations promoted

Fig. 16.3 Horticulture in Costa de Lepá, Chubut Argentina. (Source: Photograph by Soledad Molares)

by State organisms (drip systems, groundwater pumping, and water reservoirs which allow to keep up to 20.000 liters). But, in general, these measures have been planned and executed in a top-down way, without considering the symbolic precepts of water, that is, not disturbing the springs, or the community or family practices of

traditional management. These technologies are not available for all inhabitants, either because they are not selected as beneficiaries, or because the proposals are misunderstood and then rejected, or due to the lack of external inputs or own resources to complete the installations (e.g., bulldozers). These causes are poorly understood by the State's promoting organizations, while the innovations proposed, due to their lack of consensus, often deepen social inequalities and break community ties (Aigo et al. 2020).

2.3 Waters in the Transition from the Sacred to the Political Dimensions

Mapuche worldviews and practices understand water is related to human behaviors, framed by *azmapu* (norms that regulate human relations with nature), who explains bonanza or scarcity periods (Melin et al. 2016). One of the most prominent ritual expressions of conciliatory inspiration between human behavior and the world is the *nguillatun*. In this celebration, through animal sacrifice, the ritual community restores the cosmological order that daily life alters. The Rupumeika *nguillatun*, in the eastern border of the Maihue Lake in Chile (Fig. 16.1), exemplifies, with particular precision, the practice that sacralizes the relationship with water. In that place, the Rupumeika Alto, Rupumeika Bajo, and Maihue communities come together for the celebration (Moulian 2012; Guerra et al. 2019).

During the ceremony, the ritual norms restrict water use and consumption. The congregation in the sacred place must abstain from using water beyond their bodily needs. The ritual practitioners invite their guests to carry buckets of water from the lake, situated 200 meters away from the *rehue* or sacred site, indicating them to be careful while pulling or carrying water: no spilling must occur. Any undesirable event, including spilling or shaking off water, is a dark omen, and any bad behavior during the ceremony carries undesirable consequences for the ritual and daily life. Intense and dry heat or heavy rain are unequivocal signs of the *azmapu* transgression during the *nguillatun*.

The ritual practice is oriented toward *Puelmapu*, the East, where life, sun, and water come from. Prayers and sacrifices invoke *ngechen*, people's custodian spirit, to have a regular season with no heavy rains or drought so they have no problem harvesting their crops. The *trutruka*—a five-meter long wind instrument made of caña colihue, an autochthonous bamboo (*Chusquea culeou*)—is the only object that, along the four-day ceremony, receives water as a means for protection but also because it is the ritual voice, which connects with *ngechen*, indicating the different phases of the ritual.

Climate change becomes noticeable in the celebration of the *nguillatun*. Absence of rain in the mountain results in the ritual's lack of firewood: rivers, in the past, used to carry fallen trees after the alluviums which followed the storms. Historically, the *nguillatun* benefited from the accumulated wood in the lake. Today's absence of wood forces the acquisition and felling of trees from forest renewals, which increase

the community's dependence on money. Simultaneously, water scarcity threatens the social networks in Costa del Lepá and Gualjaina (Sect. 2.2) and increases costs for the performance of ceremonies in Rupumeika. However, the ritual community, united around the celebration of the *nguillatun*, starts playing new roles for the local organization's benefit. Indeed, the religious leaders of the *nguillatun* headed a social mobilization against capitalist projects.

Beyond the social dynamics related to climate change, the expansion of capitalism represents a great risk for Mapuche communities. Mountain waters are object of the voracious capital either for energy production or for tourism or real estate ventures. The emergence of powerful interests provokes inevitable tensions among residents to whom the outside business offers money or other benefits in exchange for their acquiescence.

The isolation of Rupumeika Alto and Rupumeika Bajo communities was intensified by a landowner who impeded their access to the city by restricting them from passing through his property (PiensaChile.com 2021). Until late in the 1980s, Maihue remained ill-suited in terms of roads and means of transport. Most of their traffic was toward Argentina on horseback, a shorter trip than moving to southern Chilean cities. Navigation was the only means to connect peoples from Maihue and Rupumeika and to meet in times of the *nguillatun*. A municipal, poorly maintained motorboat named Santita (Little Saint) provided the service until 2005 when it sank, where 17 people died in the accident (Fig. 16.4). Land ownership, lack of infrastructure, and poorly maintained means of transportation are part of the policies that imprisoned these communities in what used to be the *meika* (medicine woman) route: trails and riverbanks where she used to gather medicinal plants.

The entire scene changed dramatically with the expansion of hydroelectric projects and tourism. The announcement by SN Power Hydroelectric Co. of a project in Maqueo Port, in Maihue Lake in 2007, created a new context for the ritual community which, until then, had the sole purpose of protecting the relationship between the community and water (Environmental Justice Atlas 2019). The community members took a leading position in a mobilization that forced the company to

Fig. 16.4 La Santita boat disembarking practitioners who attend the "nguillatun". (Source: Photograph by Debbie Guerra (ca. 1999))

abandon its project. The translation of the biocultural memory into political practice and territorial control would continue from then onward, until access was limited to tourists in March 2020, to prevent Covid-19 propagation.

From cultural limnology and forestry perspectives, by protecting their lands and planting native species, Rupumeika and Maihue communities expand the vegetation in territories that, in their absence, would be occupied by invading vacation properties characterized by high degrees of water consumption and pollution (Hidalgo and Zunino 2017). Likewise, from a territorial point of view and due to collective action headed by the ritual community, Mapuche people increase their space of autonomy. In this sense, through their ritual relations and political practices, Mapuche communities tend to recover part of the territories they lost during the Spanish conquest and that they lose to Chilean capitalist expansion. Sustainability and water protection depend on processes that integrate political, sacred, and hydric dimensions.

2.4 Waters in the Emergence of Memories and Rights Vindication

In Chimehuin River (Limay river sub-basin) (Fig. 16.1), since 2000, the necessary evolution of environmental co-management between National Parks Administration and Mapuche Raquithue and Lafquenche communities represents a key fact to achieve more symmetrical relationships between stakeholders, with the aim of preserving biodiversity. Currently, Huechulafquen-Paimun and Epulafquen Lakes, located at the head of the Chimehuin river, make up a dynamic socioecological system where different situations emerge around the management of water spaces and wherein Mapuche communities constantly try to express their local knowledge (Fig. 16.5). In these situations, they respond through community organizational processes, ensuring the reproduction and/or legitimation of their local knowledge. This is a complex cultural framework where territorial relationships take place in a political sphere wherein different interests are disputed, on the one hand the protection of the waters and on the other the production of tourist services based on their consumptive and nonconsumptive use.

This great lake system, along the famous Chimehuin River, has become a well-known tourist destination over time. These landscapes host all kinds of water bodies (e.g., streams, rivers, lakes, natural springs, *mallines*) (Chaps. 9 and 10), with abundant rain and snow during winter. Both the rich diversity of water bodies and sub-Antarctic forest constitute multiple habitats for a wide variety of human and nonhuman inhabitants. In these territories, the forms of water use have changed over time, largely as a result of the appearance of foreign cultural elements to Mapuche communities and the consequent changes in their traditional ways of life. Traditionally the waters of the territory have been used by local people for human and animal consumption, for personal hygiene, and for irrigation of family gardens. Currently waters are also used for touristic activities.

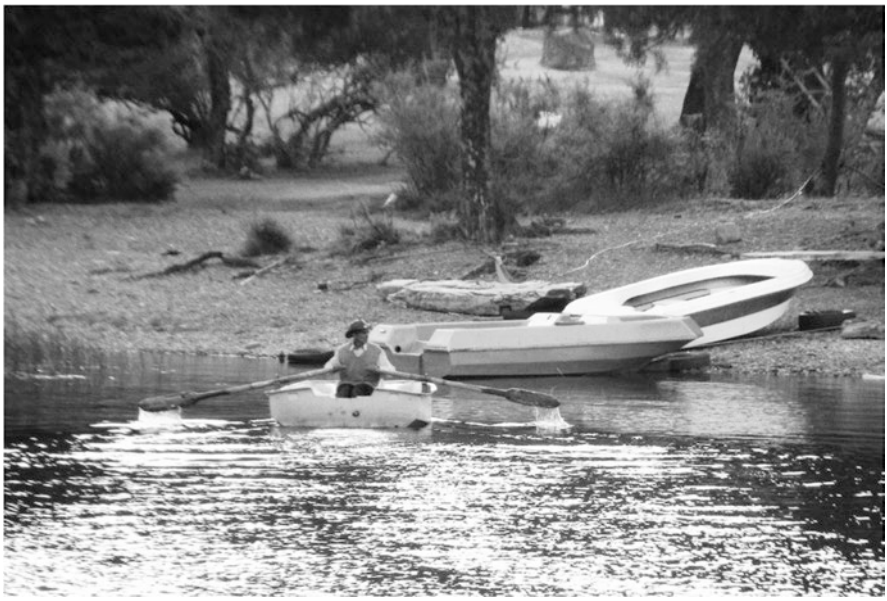

Fig. 16.5 Mapuche residents crossing by boat at the crossing of the Huechulafquen and Paimun lakes. (Source: Photograph by Juana Aigo)

In their daily lives, people understand that nature, of which they are part of, is alive. Hence, in the face of waters' multiple manifestations, there are signs and signals that guide human behavior. Lakes, streams, rivers, springs, and wetlands are protected by different *ngenko*, so an intersubjective and dialogical emotional bond is created: the person *che* owes respect to water *ko* and to its different *ngenko* (Aigo et al. 2020). As with drinking waters of Costa del Lepá and Gualjaina and sacred waters of Rupumeika, *ngenko* will respond to people according to the way they are treated. People from Raquithue and Lafquenche constantly observe waters' behavior, for example, if the lake wakes up calm or angry, and also its physical and chemical appearance: with what color, smell, taste, and temperature it wakes up.

People from Chimehuin basin have a wide ecological knowledge of these environments, of their different human and nonhuman inhabitants, and of the changes produced in them. The *inai lonko* (Mapuche authority), a woman from Raquithue community, affirms her concern about the increase in heat sensation in summer and about the change of waters' temperatures, which used to be cold in the past and are presently warm. In the same way, people of Raquithue community record in their memory recent changes in waters as a consequence of the latest seismic movements and volcanic eruptions in the area (see Chap. 3). According to the Mapuche word, after the *pillan* (volcano, main water supplier of these environments) has trembled and breathed, the lakes have expressed their anger through sudden movements and forceful changes in water color.

On the other hand, when community members talk about aspects related to land use planning within the basin, local knowledge about Mapuche water geography emerges. The local toponymy based on *mapuzungun* names is revealed through the narratives of the people behind the colonial history of this region. From an intra-community process of decolonization, when people of these communities talk about the hills and the waters, they mention the names imposed on the official maps and those indigenous names that they know well and do not forget. A Mapuche person mentions the true name of one of the hills *futa ufko*, which refers to a waterfall that lives on that hill, different from the name "Cerro de los Ángeles" imposed by the *winka* (foreigners). Likewise, people expose their knowledge to tourists about other water inhabitants, such as native and introduced fish, whom they refer to by their generic name *challwa*.

Mapuche limnological knowledge around the Huechulafquen-Paimun-Epulafquen lake system reflects the intimacy of the bonds of reciprocity, respect, and care between people and waters, as well as the strong social control that exists through customary rules of use and calls for attention or sanctions for those who violate them. Mapuche communities, through orality, keep alive the collective memory of the basin. In particular, the *epew* (stories) constitute one of the traditional forms of transmission of the *kimün* or Mapuche knowledge, from the elderly people to new generations within these communities. In this way, knowledge is translated within the basin into ethical and practical guidelines for decisions regarding use and management of the different water spaces and is enriched from new lived experiences with nature. These experiences are frequently manifested through the observation of changes or signs in nature which are later retransmitted orally in contexts of conversations or *nütram* within communities.

The current co-management within Chimehuin basin is complex and poses daily challenges that require strong roundtables with the participation of Mapuche and non-Mapuche people, private tourism service providers, and members of National Parks Administration, in order to consider different points of view and make decisions about what to do and how in each area of the territory. In this context, each year, through internal assemblies, the communities review, rethink, and agree about behaviors toward the environment, and in dialogue with National Parks' members, they determine tourists' uses in the different water spaces. At present, the most attractive recreational activities enabled for tourism are associated with water; this presents the intense challenge of reaching agreements between parties.

Waterscapes within the Chimehuin basin are undeniably dynamic ecosystems in constant tension. Currently, Raquithué and Lafquenche communities propose management actions considering the Mapuche point of view; people raise the idea of "letting certain environments rest," as opposed to their concession to subject them to tourism exploitation. Among the actions, use and protection of spaces such as thermal springs (hot waters) fundamental for people's health due to the unique therapeutic properties of its waters and medicinal plants are discussed.

From the Mapuche point of view, the communities defend the concept of "letting rest," which implies allowing the *ngenko* to return to their places of origin and rest undisturbed. Through internal consensus, communities oppose new concessions

and exploitation by private agents of the thermal springs "*Lawenko* Hot Springs" located around the lakes. In the same way, they claim to reduce the usage of the waters and the consequent impact on them by questioning other concessions that involve sailing with large vessels such as catamarans. In a context of constant tension between Western and Mapuche views, the parties involved in water co-management face the challenge of recognizing and articulating different types of knowledge to arrive at consensual decisions on water care (Aigo et al. 2020).

3 Conclusion

The role of water in its material and nonmaterial components of Mapuche memory underscores the importance of understanding and incorporating the cultural dimension in Patagonian limnology. While the diverse situations explored in this chapter highlight the role of water in the making of the Mapuche world, they also suggest that water stands in an intersubjective relation with people. This dialectical relationship explains the emergence of diverse waterscapes in Patagonia (Di Giminiani 2018; Aigo et al. 2020), that is, conceiving water as an agent, Mapuche worldview allows a locally centered view of the waterscape: each site is unique and emerges from the relation that the community establishes with that agent in that place. Hence, in Patagonia, waterscapes vary from region to region.

The testimonies gathered here give evidence about the importance of these waterscapes for water supplying for consumption, food, medicinal plants, and firewood and as habitat providers for terrestrial and aquatic fauna, too. Also riverbanks are the most important and preferred residential and productive areas for horticulture and animal breeding, wherein humidity creates the required microclimate for survival. However, utilitarian access to water occurs in a context of multiple meanings, all of which account for humans' duties and responsibilities concerning waterscapes.

Mapuche communities base their relationship with the hydric world on mutual respect, and they understand that water's behavior reflects human behavior (Aigo and Ladio 2016). Ritual regulations, spiritual beings, and transcendental dimensions speak about a peculiar engagement between humans and waters. Communities translate the biocultural memory through its daily practices in waterscapes' transformations; thus, collective identity incarnates in the environment, molding their self-perception and relationship with it (Skewes et al. 2011, 2012). In this sense, the social practices observed by the Mapuche under the *azmapu* aim at gaining autonomy and biocultural conservation simultaneously (Skewes et al. 2012; Ibarra and Riquelme 2019; Morales et al. 2020).

Faced with a changing world, Mapuche communities confront challenging dilemmas. Either in adopting new technologies or in their political mobilization against external investors, they find themselves confronting undesirable consequences of such transformations. In Costa de Lepá and Gualjaina, the needed investments produce, as a result, a process of growing social disparities, while in Maihue

and Rupumeika, if mobilized, the corporations try to gain loyalties by giving away some resources. Differentiation and division are threats pending on the communities. However, communities find a way to avoid this contradiction, by organizing themselves and strengthening their identity and territorial control. This is the case of Raquithue and Lafquenche, wherein the emergence of water memories makes it possible to strengthen community decisions in the political arena of co-management with the State and private corporations, legitimizing ancestral rights over water (Aigo et al. 2020).

Facing various socioenvironmental difficulties, Mapuche limnological knowledge appears diverse and flexible, without losing its identity features. As urbanization and environmental change expand, the need to embrace the biocultural dimension in water management is growing. It is increasingly recognized that the inclusion of a diversity of worldviews on the relationships between people and the environment is necessary toward a more sustainable and fair world (see Chap. 18). However, establishing bridges for dialogue between knowledge systems seems not an easy task. Conceptual differences and lack of disposition to listen to one another are part of the barriers that need to be overcome.

In this line, it is important to recognize that limnology and Mapuche traditional knowledge are parallel ways of understanding the waterscape: the former deals with biological, chemical, and physical features of lakes and other freshwater bodies, and the latter speaks about the life of water. Yet, the physicality of freshwater eludes the community's attention, and its spirituality is equally elusive to the scientists' eyes. Cultural limnology is a crossroad enlightening both the community and the scientists' comprehension of the sociobiological processes concerning the waterscape. The early dismissal of either of these views has undesirable consequences. People's attitude toward water, for example, secures its careful use and subsequent good quality. In a period of hydric crisis, the generalization of such an attitude is a challenge for society.

In the construction of a new space for this dialogic encounter, it will be necessary to find ways to exchange ideas and language understandable to all. In other words, decolonized forms of research that put the multiple epistemologies on an equal footing (Delgado and Escóbar 2006). In this new discourse, the condition will be the full recognition of biocultural diversity and therefore the organic integration of methods and categories from different environmental perspectives (Oelschlaeger and Rozzi 1998; Ibarra and Pizarro 2016; Estévez et al. 2010). The transdisciplinary approach of cultural limnology can help not only to understand the dynamics between culture and waters but also to discuss other ways of dealing with contemporary socioenvironmental problems and promote an atmosphere of equality and mutual respect between ways of seeing waterscapes.

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