

# The Maritime Cultural Landscape of Northern Patagonia

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**Abstract** This article is a contribution to the study of the indigenous navigation and its boats in the region of northern Patagonia. This article also aims to contribute to the understanding of indigenous navigation practices and technologies and their origins from prehistoric times to the mid-twentieth century. It presents and discusses the concept of Westerdahl's Maritime Cultural Landscape in relation to other landscape concepts. This model is applied to northern Patagonia in order to discuss if it is possible to speak of a true maritime culture in the region. For this purpose, archaeological, historical and ethnographic data are presented in an integrative and innovative methodology for the discipline. Finally, the Maritime Cultural Landscape model will allow the integration of aquatic and terrestrial landscapes as routes traveled by native inhabitants of northern Patagonia and southern Chile, and propose an important and diversified maritime, river and lake tradition.

**Resumen** Este artículo es una contribución al estudio de la navegación indígena y de sus embarcaciones para la región de la Patagonia Septentrional. También esperamos contribuir a la comprensión de las prácticas y tecnologías de navegación indígena y sus orígenes desde tiempos prehistóricos hasta mediados del siglo XX. En este artículo se presenta y discute el concepto de Paisaje Cultural Marítimo (*Maritime Cultural Landscape*) de Westerdahl en relación con otros conceptos de Paisaje. Junto con esto aplicaremos este modelo a la Patagonia Septentrional, para discutir si se puede hablar de una verdadera cultura marítima en la región. Para esto se presentan datos arqueológicos, históricos y etnográficos, en una metodología integrativa y de innovación para la disciplina. Finalmente, el modelo de Paisaje Cultural marítimo permitirá integrar los paisajes acuáticos y terrestres como rutas transitadas por los habitantes originarios de la Patagonia septentrional y del sur de Chile, y proponer una importante y diversificada tradición marítima, fluvial y lacustre.

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## Introduction

The concept of the Maritime Cultural Landscape of Westerdahl (1992) is an archaeological concept that combines land and sea. This term arises from the need for a scientific term for the unity of vestiges of a maritime culture on land as well as under water, and also includes what is known as a maritime culture (Westerdahl 1998). This concept can be applied to northern Patagonia, to explore whether it is possible to speak of a true maritime culture in the region. For this study, data from archaeological, historical and ethnographic sources will be presented in an integrative and innovative methodology for the discipline.

The cartographic analysis and the reconstruction of navigation routes, which are inserted in the regional circuits of transit, emphasizing the connections between the eastern and western Andean slopes is a central aspect that is expanded in this article. In the same way, it is possible to propose the most important areas in which such navigation would have developed, as well as the specifics, the heterogeneity of use, and experiences on aquatic environments.

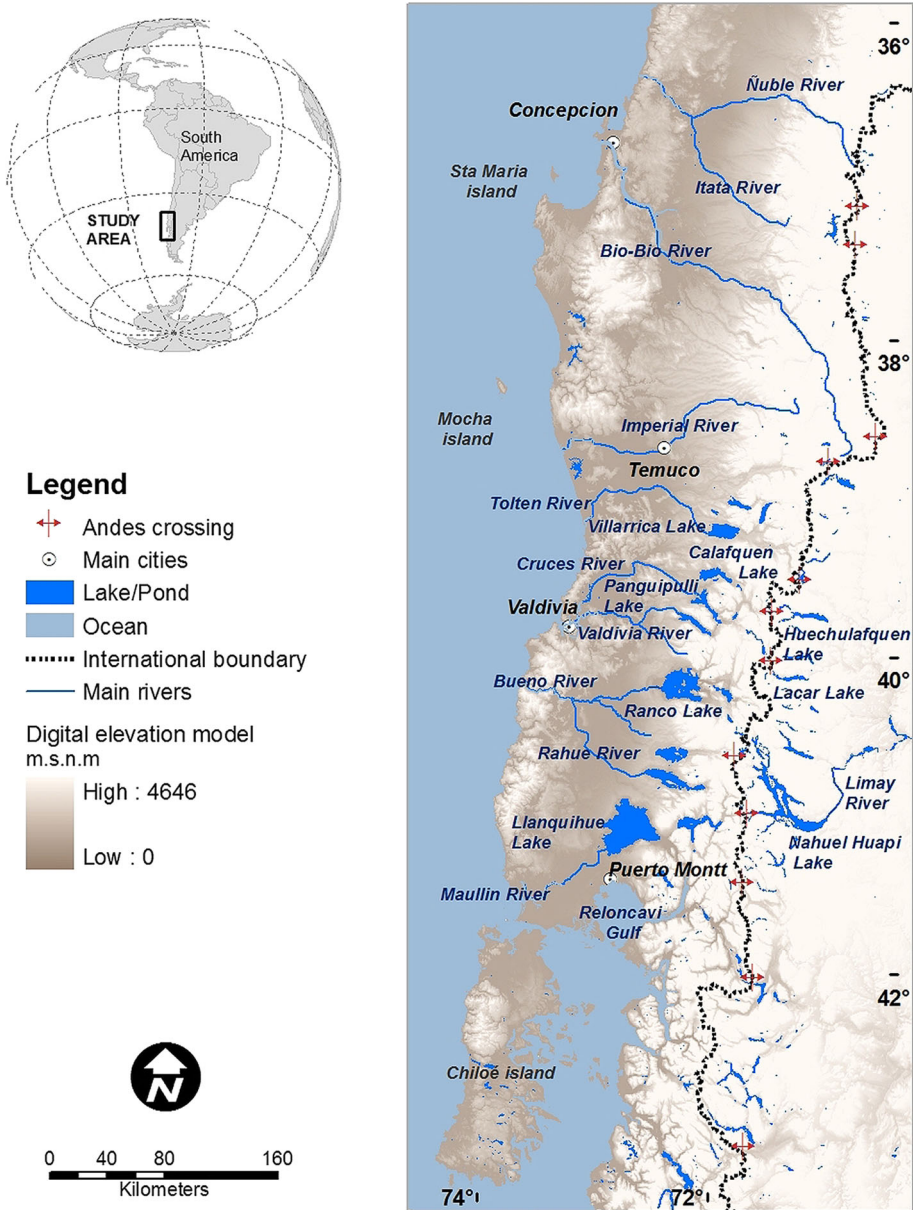
The analysis and the critique of this dataset allow for the reconstruction, in a preliminary way, of the history of navigation in this area, detailing its characteristics and particularities.

## Study Area

Northern Patagonia comprises the Chilean regions of Bío-Bío Araucanía, Los Ríos and Los Lagos, and the Argentine provinces of Neuquén and Río Negro; and has as its natural borders the Bio-Bio River to the north, the Seno de Reloncaví to the south, the Pacific Ocean to the west including the islands that extend beyond the continental shelf, and the Patagonian Andean lakes on the eastern slopes of the Andes (Fig. 1). This territory lies between 36°48' and 41°47' South latitude, and 73°40' and 70°57' West longitude. This area was inhabited by Mapuche–Huilliche small-scale agriculturalists and maritime hunter-gatherers (Yesner 1980) called Chonos when the Spanish conquistadors arrived, as well as groups of hunter-gatherers from the Andes, such as Pehuenches, Puelches and Poyas.

The geomorphology of this territory is divided into four longitudinal sections from east to west: the Cordillera de los Andes, the plains of the central valley, the Cordillera de la Costa, and the coast. The coast appears open to the sea, where only some bays and estuaries formed by the mouths of the great rivers offer shelter for navigation. Along with this, the coastal islands of Quiriquina, Santa María and Mocha, located in the northern part of the region, are ideal for navigation. The Cordillera de la Costa, which is oriented north-east/south-west in this area, is a low mountain range (maximum elevation of 1000 m). In some areas are extensive dune beaches, but often the mountains rise directly from the Pacific Ocean in the form of steep cliffs and wooded ranges, which are interrupted by the Chacao Channel, reappearing on the island of Chiloé (Lira and Legoupil 2014).

The central valley is crossed by large rivers draining from the Andes to the Pacific Ocean, forming a system of interconnected water bodies, and which in the past would have been more extensive than at present (Lira 2007, 2009, 2010). There are six main basins in



**Fig. 1** Northern Patagonia and its main water basins (map by A. Farias)

the region: Bio–Bio, Imperial, Tolten, Calle–Calle/Valdivia, Bueno and Maullin. These basins are formed by many tributary rivers, and more than 17 lakes and lagoons (see Fig. 1). In sum, the water bodies are a feature of the landscape and an element that influences the communities that inhabited this region. They represent navigation routes that connect with each other, facilitating transportation, communication and interaction between populations, along with access to different environments and resources.

Towards the heart of Reloncaví gulf and the island of Chiloé (42°–44° S latitude), the easily accessible and cultivable land of the Chilean coast ends. Beyond that are the archipelagos that only the navigating populations of Patagonia can access. This part of northern Patagonia, at the intersection between the narrow rectilinear strip of the north-west coast and the southern archipelagos, is a key sector for man's adaptation to the sea (Lira and Legoupil 2014). The whole region was modeled by the Pleistocene glaciers, whose last advance is dated between 28,000 and 12,500 BC (Denton et al. 1999). From Puerto Montt to the Gulf of Penas, the central valley was occupied by a large glacier that caused its depression and flooding by the sea. The coast resulting from this process is very uneven, consisting of a number of channels, fjords and gulfs that make up what has been called the "inland sea", protected from the open sea by archipelagos. Rivers fed by lakes drain into large estuaries in the Gulf of Reloncaví. The island of Chiloé was linked to the mainland throughout the Pleistocene, and only became separated in the postglacial period due to rising sea levels (Lira and Legoupil 2014).

The presence of different types of temperate forests is another characteristic of the environment of northern Patagonia. Forests provide a great variety of resources that were known and used by the inhabitants of the region not only as food resources, but also for the construction of houses, tools and boats.

### Cultural Landscapes and the Maritime Cultural Landscape

To understand what is happening on the coast of northern Patagonia, one must have a global perspective of the territory of this region, from the Andes mountain range to the sea. Waterways (lakes, rivers and the sea) should be considered together with terrestrial routes, in an integrated vision. Evidence of the exchange of materials, objects and products (obsidian, sea shells, pottery, metal objects, and corn) between the coast and the mountain range is observed in different archaeological sites of the region. The original inhabitants of this region didn't have pack animals before the introduction of the horse by European settlers. The only way to transport any cargo was by pedestrian means or using boats and navigation. Thus, the interior routes of rivers and lakes, as means of transport and displacement, integrate and alternate with local road systems, and together constitute a maritime cultural landscape of its own (Lira and Legoupil 2014).

The notion of 'Cultural Landscape' is useful to characterize the relationship suggested by Bengoa (2007) of a riverine indigenous society in which the sea, rivers and lakes have meaning for them. The connection system of fluvio-lacustrine water bodies would have facilitated the communication and interaction movements of the ancient inhabitants, who established navigation routes that interconnected and allowed rapid access to different areas. The large basins that shape the landscape from the Bio-Bio River to the south, to the islands of the Chiloé archipelago, as well as the coast, would have been the central stage in which the life of the Mapuche–Huilliche and Chono populations would have developed. Traditional boats would have played an important role in society, by way of settling and moving in this territory (Bengoa 2007) (Fig. 2). Along with this, the interaction and knowledge of vegetation allows the configuration and use of this Cultural Landscape.

This approach allows us to think and understand the landscape of this region in a new dimension, in which forests, the aquatic landscapes and finally volcanoes were and still are full of meanings. The close relationship that the indigenous communities had and still maintain with these elements of the environment allowed them to experience nature as a culture (Castro 2002) in a dialectical and meaningful relationship. For local inhabitants volcanoes represent the place of connection with the ancestors, the lakes and rivers are full



**Fig. 2** Mapuche dugout in the shore of Lake Ranco. Photograph by Rodolfo Knittel, 1934. Collection from the Universidad Austral de Chile

of mythical beings that live under water, and that allow navigation and safe passage through them. They are also filled with mythical water animals, which sometimes come to the earth to mingle with the other animals.

Along with this the concept of ‘Maritime Cultural Landscape’, coined by Westerdahl (1992), is very useful to integrate the aquatic and terrestrial landscapes, especially in the form of routes followed by the inhabitants of northern Patagonia, combining navigation routes and pedestrian paths.

Further inland, rivers and lakes, as transport routes, as well as the local road network, must be taken into account in order to properly understand the maritime cultural landscape. In fact, estuaries are privileged areas where inland waterways find the coastal landscape, constituting transit points where a riverine cultural area meets other cultural developments (Westerdahl 1992). As Herrera (2008) explains, inland waterways are not only considered as passages for the transport of goods, but as places where contact between coastal and inland communities is exercised. In this way the concept of maritime cultural landscape tries to integrate inland waterways, rivers and lakes.

Another useful and appropriate concept in our case is that of ‘Seascape’, to refer to maritime and coastal landscapes. This concept (Cooney 2003) aims to be even more inclusive and broad. Although it is presented as a synthesis between maritime and landscape archeology (Van de Noort 2003), similar to what Westerdahl’s concept of maritime cultural landscape aspires, it aims to demonstrate how human beings related to the sea. In this way the concept of seascape aspires to go further, focusing on how the sea was perceived from the land (Van de Noort 2003), but also how the land was perceived from the sea. This also includes recent periods, cosmology and cosmovision, beliefs and rituals, notable points of the landscape, whether material or immaterial, geographical knowledge that allows navigation, and all aspects that involve a maritime culture.

The concepts of maritime landscape and seascapes are important theoretical tools that try to translate complex realities at different scales. It is the integrative character of these which is most attractive. However, both the concept of maritime cultural landscape and seascape appear as somewhat restricted when referring to inland waters, or fluvio-lacustrine interconnection networks. Both concepts emphasize the maritime character, to the detriment of the interior aquatic environments. In this way it seems appropriate to propose a new, more inclusive concept: the ‘Aquatic Cultural Landscape’.

### Archaeological Background of the Region

Archaeological investigations in this part of northern Patagonia have been guided from the outset by the desire to understand the Mapuche past (Adán et al. 2010) and to address the problems of the origins of these populations. From the middle of the twentieth century, historical-cultural constructions were imposed, among them the chronological framework elaborated by O. Menghin in 1962. These ideas began to be influenced by ecological-cultural perspectives in the 1970s, incorporating themes such as ecological adaptation, the study of subsistence economy, settlement patterns and technology (Adán et al. 2010; Dillehay 1990). This influence is still present, highlighting the need for an ecological approach to understanding the prehispanic history of the Mapuche region (Adán et al. 2010; Dillehay 1990), in addition to a biogeographic characterization based on vegetation distribution and ethnographic research (Adán et al. 2010; Aldunate 1989). From the chronologies that have been proposed for this region (Dillehay 1990; Nuñez 1983; Aldunate 1989; Quiroz and Sánchez 2004) and the most recent data provided by García (2005) and Adán et al. (2004, 2010) a new chronological summary has been constructed for the region (Table 1). However, we must bear in mind that this synthesis has the specific purpose of serving the research we are developing, and setting a chronological framework for navigation in the region, so it should not be seen as a finished and definitive chronology.

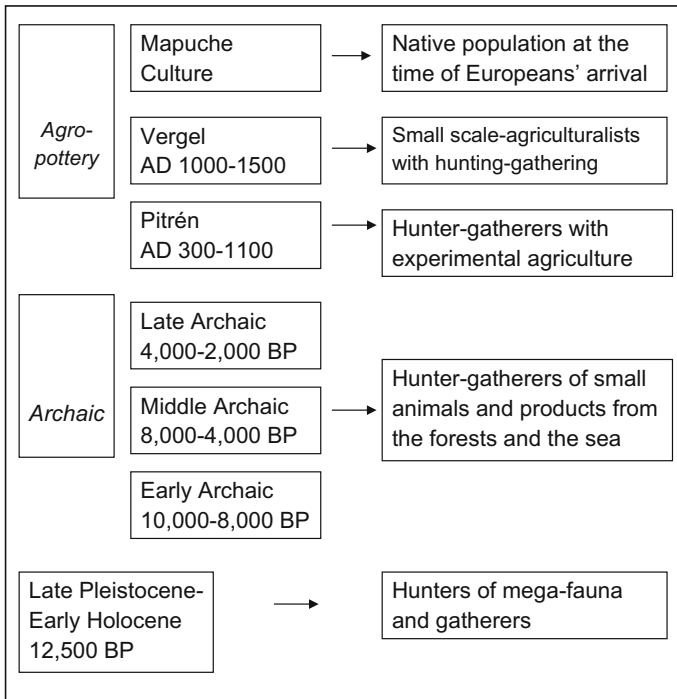
#### *Tradition of Temperate Forests and Wood Technology*

Several authors have identified an original cultural development in northern Patagonia, based on the exploitation of forest resources, wood working and navigation, which would have extend up until the present day: the ‘Tradition of Temperate Forests’. Ethnographic and ethnohistoric studies have documented the significant relationship between the Mapuche–Huilliche populations and their environment, recording a highly specialized knowledge of forest resources (Aldunate 1989, 1996; Villagrán 1991, 1998; Aldunate and Villagrán 1992; Rappaport and Ladio 1999).

The populations of this region would have adapted, interacted and known very precisely their environment and resources, and would have had a markedly traditional and highly specialized way of life on forest resources (Adán et al. 2010; Adán et al. 2004; Velásquez and Adán 2004). They are characterized by an expeditious and multifunctional lithic technology, a subsistence based on hunting small mammals, the harvesting of freshwater mollusks and forest products, and brief but repeated settlement sites over time, in a strategy of high mobility that was possibly seasonal.

These populations would have developed a “wood technology” (Dillehay 1990, Ocampo and Rivas 2004). From the knowledge they had of their ecosystem and wood resources, such as its strength, flexibility and hardness, it is not surprising that the oldest

**Table 1** Simplified chronology of northern Patagonia



records of this technology have been found in the archaeological site of Monte Verde (12,500 BP) (Dillehay 1989).

The development and construction of wooden boats (dugout canoes and sewn plank canoes) would be a concrete manifestation of this specialized wood-working technology that would have developed amongst the populations that occupied this region (Lira 2007, 2009, 2010; Carabias et al. 2010).

### *A Coastal and Maritime Society in Northern Patagonia*

The ideas proposed by Bengoa (2007) in relation to the prehispanic Mapuche society as an eminently river-oriented society must also be taken into account, in contrast to a traditional view of Mapuche society as eminently terrestrial, focused on livestock raising and small-scale agriculture. They settled on the banks of the rivers and lakes, and they mobilized, communicated and traded throughout them using canoes. In this way, the boats would have played a central role in their society (Fig. 3).

On the other hand, the population of the archipelago of Chiloé and its environs, known as Chono, was an eminently maritime culture. They were known as *canoeros*, a society who exploited maritime resources and spent most of their life on their canoes. These two cultures, the Mapuche and Chono, met in the archipelago of Chiloé, producing a cultural synthesis that has not yet been studied in depth.



**Fig. 3** Mapuche dugout by the photographer Valck, 1870

## Results

### Transportation Zones and Transportation Points. Navigation Environments in Northern Patagonia

For Westerdahl (2000) the transport zones can be defined as traditional areas of transport. This would be an aspect of the maritime cultural landscape, as well as the landscape of transport and communication. In this way, large-scale transport, on land as in water, would be concentrated in specific areas or corridors.

Indigenous navigation was carried out with different objectives, characterized by different ways in which marine activities were carried out. Along with this idea, it is important to note that navigation was carried out with a pre-set destination, which means that there was a known place to which one wanted to arrive, and therefore the boat took a pre-determined course. These two elements, both the function and the destination to fulfill this objective, are in close relation with the environment in which navigation is developed.

We can distinguish a large number of aquatic environments in which the navigation of indigenous tradition was carried out in northern Patagonia, but which can be set into three large groups. Each one presents different challenges and navigation opportunities that we will try to characterize briefly.

#### *Maritime Navigation*

Navigation in the marine environment is influenced by a series of permanent factors that can hinder or favor the transit of a boat. Waves, currents, winds, and tides are all elements that must be taken into account at the moment of beginning a voyage. The resources



offered by the marine environment, much more abundant than those offered by lakes and rivers, are in themselves one of the main motivations for navigation.

However, not all maritime environments are the same. It is not the same to sail on the open sea without reference points on the horizon, and to carry out coastal navigation (cabotage) always having the coast in sight. Nor is it the same to sail in the so-called “inner seas”: systems of canals created by archipelagos, which give protection. This is the main difference between coastal navigation, and marine or offshore navigation, where orientation is no longer realized by notable landmarks, but by other reference systems such as the stars, the sun, waves, etc. (Irwin 2013). This allows long-distance navigation over several days, away from land and without sight of other landmarks on the horizon. But in the same way, a final destination is known.

Along most of northern Patagonia, there would have been mainly coastal navigation, always keeping in view the mainland. However, this could have been done for long distances, both in northerly and southerly directions. Along with this, would be voyaging to the adjacent islands already mentioned, Quiriquina, Santa Maria and Mocha, of which the first two are very close to the mainland (11 km for Quiriquina and 14.4 km for Santa Maria) and Mocha, somewhat further away (34 km) although in sight of the mainland at all times.

Further south, towards 42°/44° South latitude and reaching the heart of Reloncaví gulf, Chacao channel and Chiloé archipelago, there are also particular characteristics. Here begins the zone of the channels and fjords, which offer greater protection to the boats than the waters of open sea. Navigation would be facilitated by the protection of the archipelagos, as well as by the proximity of the islands and mainland that at all times are in sight. However, the difficulty is imposed by the amplitude and force of the tides, that at their maximum, can produce currents that greatly impede navigation in the opposite direction.

In this same area is the estuary of Reloncaví, an arm of the sea that penetrates inland and presents mixed navigation conditions, both maritime and fluvio-lacustrine, presenting itself as a privileged area for the transit of boats as well as concentration of resources. Something similar is what occurs in other large estuaries of the study area, such as the mouth of the Maullín River and the mouth of the Valdivia River, where we also find these mixed conditions in which marine and fluvio-lacustrine elements are mixed, constituting as unique ecotonal zones. On a smaller scale we can observe similar characteristics at the mouth of the different rivers that drain into the Pacific Ocean.

### *Lake Navigation*

Navigation in lakes seems at first glance as something relatively simple. However, a number of particular elements need to be taken into account when studying navigation in this environment. Firstly, the density of freshwater is much less than seawater, so the different materials with which the boats are manufactured have less buoyancy in this medium compared to those in the marine environment. On the other hand, the winds are less constant than those in the maritime environment, and are more unpredictable and changing. These winds are able to produce strong waves that, in a few minutes, can increase so violently that they prevent any navigation.

Along with this it is necessary to take into account the morphology of the lake shores. The lakes' glacial origins and the proximity of the mountain range to most of these has created steep cliffs that hinder access to one side of them, while the opposite shore is soft beaches and mounds, deposits of glacial moraines, that facilitate access. The rivers that drain into these lakes have formed extensive beaches, which are even easier to access. On

the other hand, the forest vegetation, which often reaches up to the lake shore, in many cases prevents access to its banks or to the interior. This vegetation, known as the Valdivian rainforest, is very dense in the majority of cases and it is difficult to transit; this explains the predilection of the use of lakes as a means of communication and transportation. Along with this, one can propose some particular characteristics of certain lacustrine environments that would favor or stimulate the use of boats, such as the existence of islands, as well as the elongated or elliptical forms of some of them. This last aspect means that the access to opposite shores in a transversal direction will be much more convenient by crossing the lake in boats rather than travelling around it by land. This situation contrasts with what happens in lakes of circular form, where navigation doesn't represent a great advantage in terms of distance in relation to the access by land. Additionally, lakes constitute a special landmark in the landscape that grant extraordinary visual range, favouring communication and navigation. Lake navigation is presented as an articulator of the different riverside spaces, being part of basins formed by a series of lakes and rivers connected between them.

### *River Navigation*

River navigation has been described as navigation directly inscribed in a terrestrial landscape, with a series of physical limitations related to the nature of the rivers like waterways and the displacement that can be realized in them: lateral limits, linked to the distance from the banks; vertical limits, produced by a reduced water depth; longitudinal constraints, which determine downward and forward axial navigation. In this way, river navigation is by definition discontinuous, since it is interrupted consecutively by several obstacles that impede the transit of boats through a river, and that require particular maneuvers that can stop navigation for shorter and greater amounts of time (Rieth 1998).

River navigation can be done in two senses: a longitudinal sense taking advantage of the course of the river, and that uses the river as a facilitator of communication to access other spaces that are found along its course; a transversal sense to cross the river to access the opposite shore.

River navigation has two central aspects that influence boats. The first is the flow (Rieth 1998) that never stops; in the rivers of the western slope of the Andes Mountains, it is in a westerly direction that drains into the Pacific Ocean, while the rivers of the eastern slope are mostly eastbound, draining into the Atlantic Ocean. The flow of the rivers never stops, although the magnitude is not the same along its route, nor at different times of the year. This will depend on both the flow rate and the regime and morphology of the river, as well as the inclination it takes. In northern Patagonia, the regime of most of the great rivers is pluvial. This means that their flow increase in winter with the rains and decrease in summer, with the decrease of precipitation. In this way there are rivers in which it is not possible to navigate depending on the season, either because the flow is very stagnate, or on the other hand, it is too strong, making it dangerous to navigate in it. In large rivers the wind can cause surface currents, while at their mouths ocean tides cause currents, sometimes stronger than those of the river. The current can be used as a means of propulsion that leads a boat in its favor along the river, making navigation much easier in the direction in which it runs. On the contrary, to go up the river requires more effort, although there are techniques and tools that make it possible to overcome the difficulties. For this, “*choques*” (hooks) and “*horquetas*” (forks) of luma (*Amomyrtus luma*), wood of great hardness and resistance, were used. To grab the branches of trees in the case of “*choques*”, a wooden

pole with a hook at its end was used, while sterns of boats were pushed with “forks”, poles whose end terminated in two points (Lira et al. 2015; Señoret 1878: 198).

The other aspect that influences inland navigation is related to morphology, and includes the depth, and shallows or rocks that may present along a river’s course that can obstruct navigation. Although the boats of indigenous tradition have, as one of their central characteristics, a low draft and generally flat bottom, there are areas they cannot access like waterfalls and zones of rocks. This means that river navigation in a longitudinal sense, is in some cases interrupted, and vessels must be transported by land around these to avoid those stretches (portages), or by transshipping to other boats that are beyond these obstacles.

### **The Means of Transport. The Types of Indigenous Vessels in Northern Patagonia**

For Westerthal (2000), means of transport, in this case vessels, are a component of the theory of transport zones. They are intimately adapted to the natural geography (characteristics of the coast, bays, currents and prevailing winds) and the load to be carried. We can complete this idea by saying that boats are specially adapted or designed according to their function, whether for cargo or passenger transport, resource exploitation, war, communication, among others.

In northern Patagonia, three types of boats of indigenous tradition have been identified: rafts, dugout canoes and sewn plank boats called *dalcas*. Unfortunately, the archaeological remains are very scarce: so far only 23 dugouts and fragments of three *dalcas* have been registered, as well as one ethnographic *dalca* (the *dalca* of Goteborg) (Tables 2, 3). This is mainly due to problems of material preservation, along with a lack of research in this area.

In order to characterize these, typologies previously developed by other authors for such vessels in other parts of the world will be applied: McGrail (1985, 2001), Lothrop (1932) for the south-central dugouts of Chile or the typology developed by Arnold (1995) from the logboats of Central Europe.

#### *Rafts*

Rafts are characterized by the buoyancy properties of each of the individual elements that comprise it, with their specific density being less than 1, and which together allow the vessel to float on the water (McGrail 1985, 2001). In simple words, the raft is able to float because the materials it is made of are lighter than water. But this is not enough to make a raft; it must have enough buoyancy to carry passengers and cargo. For Rieth (1998), in agreement with McGrail, rafts have natural buoyancy assured by one or many elements that have a lower density than water. These are based on a colligative structure, the union of different elements that float naturally and/or hollow containers. Rafts can be considered as a simplified form of boat.

Rafts can be manufactured from different materials, provided that the general principles of buoyancy already mentioned are respected. For this reason there are rafts manufactured in leather, vegetable fibers, wood and in general any element that can float.

The rafts used in northern Patagonia would have been constructed mainly from vegetal fibers or logs of wood, according to historical documentation. Although we do not have detailed descriptions of them, we can say that for the most part, they would have been relatively simple, medium or small in size, and simple to make in a short time. Unfortunately we do not have archaeological remains to support this idea. However, historical sources inform us of the use of rafts, mainly to cross rivers. The largest and most important

**Table 2** Dugouts analysed in this study

Dugout	Length (m)	Width (m)	Origin	Wood taxa
Lanalhue 1	4.85*	0.77*	Lake Lanalhue	<i>Laurelia sempervirens</i> (R. & P.), Tul, laurel
Lleu–Lleu 1	5.93*	0.71*	Lake Lleu–Lleu	<i>Laurelia sempervirens</i> (R. & P.), Tul, laurel
La Flor 1	5.96	0.85	La Flor lagoon, Lake Colico	<i>Laurelia sempervirens</i> (R. & P.), Tul, laurel
Trancura 1	5.72	0.85	Trancura River, Llafenco area	<i>Nothofagus alpina</i> (P. & E.), Oerst, rauli
Maullín 1	7.34*	1	Maullín River, Changue area	<i>Eucyphia cordifolia</i> , Cav, ulmo
Calafquén 1 (Carabias et al. 2007)	6.45	0.95	Site “ <i>Dos canoas</i> ”, Pucura, Lake Calafquen	<i>Laurelia sempervirens</i> (R. & P.), Tul, laurel
Calafquén 2 (Carabias et al. 2007)	5.84	0.66	Site “ <i>Dos canoas</i> ”, Lake Calafquen	<i>Laurelia sempervirens</i> (R. & P.), Tul, laurel
Illahuapi 1	8.03	1.02	Lake Ranco	<i>Laurel Laurelia sempervirens</i> (R. & P.), Tul
Hueninca 1	5.8	0.7	Hueninca River, Lake Pullinque	<i>Laurel Laurelia sempervirens</i> (R. & P.), Tul
Hueninca 2	3.32	0.64	Hueninca River, Lake Pullinque	<i>Laurel Laurelia sempervirens</i> (R. & P.), Tul
Hueninca 3	4.77	0.85	Hueninca River, Lake Pullinque	<i>Laurel Laurelia sempervirens</i> (R. & P.), Tul
Maule 1	4.28	0.57	Maule	<i>Coigüe Nothofagus dombeyi</i> (Mirbel), Oerst
Contaco 1	3.67	0.53	Contaco River, Osorno	<i>Coigüe Nothofagus dombeyi</i> (Mirbel), Oerst
Nahuel Huapi 1 (Braikovich 2004)	4.65	0.78	Lake Nahuel Huapi, Playa Bonita	<i>Coigüe Nothofagus dombeyi</i> (Mirbel), Oerst
Nahuel Huapi 3 (Braikovich 2004)	2.95	0.70	Lake Nahuel Huapi, Lago Moreno inferior	<i>Cipres Austrocedrus chilensis</i>
Nahuel Huapi 5 (Braikovich 2004)	6.48	1	Lake Nahuel Huapi, la Angostura isla Menéndez	<i>Coigüe Nothofagus dombeyi</i> (Mirbel), Oerst
Nahuel Huapi 6 (Braikovich 2004)	4.60	0.53	Lake Nahuel Huapi, Puerto Huemul	
Nahuel Huapi 8 (Braikovich 2004)	3.67		Lake Nahuel Huapi, Brazo Campanario	
Nahuel Huapi 9 (Braikovich 2004)	4.77	0.40	Lake Nahuel Huapi, isla Victoria	
Nahuel Huapi 10 (Braikovich 2004)	1–2		Lake Nahuel Huapi, Puerto Venado	
Nahuel Huapi 11 (Braikovich 2004)	4.45	0.85	Lake Nahuel Huapi, Villa Angostura	<i>Coigüe Nothofagus dombeyi</i> (Mirbel), Oerst?

**Table 2** continued

Dugout	Length (m)	Width (m)	Origin	Wood taxa
Nahuel Huapi 12 (Braikovich 2004)	3.42	0.61	Lake Nahuel Huapi, valle Encantado	

\* Indicates incomplete dugouts. The references correspond to dugouts studied in previous research

**Table 3** *Dalcas* (plank boat) remains analysed in this study

<i>Dalca</i>	Description	Origin	Wood taxa
Chapo 1	3 planks	Lake Chapo	Ulmo <i>Eucraphya cordifolia</i> , Cav
Achao 1	2 pieces of planks	Achao, Chiloé Island	Coigüe <i>Nothofagus dombeyi</i> (Mirbel), Oerst
MNHN 1	1 plank	Curaco de Velez, Chiloé Island	Coigüe <i>Nothofagus dombeyi</i> (Mirbel), Oerst
Goteborg 1	complete ethnographic <i>dalca</i>	Southern Patagonia	Coigüe <i>Nothofagus dombeyi</i> (Mirbel), Oerst

were those made with *maguay* fiber (*Puya berteroniana*), used to cross over to the Quiriquina, Santa María and Mocha islands, and capable of transporting up to 30 people and even cattle (Rosales 1877: 173).

### Dugouts

Dugouts, *wampos* or *bongos* as they were called in Mapudungun, the Mapuche language, are the best documented and studied vessels in northern Patagonia (Table 2). The chroniclers and priests of the colonial period give the best descriptions, with Father Diego de Rosales providing the most details (Rosales 1877, Vol I: 174).

Dugouts are characterized as a shell carved from a tree trunk by means of a subtractive technique (reduction). To this shell secondary elements can be added, morphologically and functionally diverse. These elements would in any case be minor, and would not change in any way the very principle of the dugout structure (Rieth 1998).

For Arnold (1995), dugouts are characterized as small boats of which at least 90% of the submerged section of the hull consists of a single piece of wood. In this way it is possible to incorporate in this classification dugouts to which are added other pieces like planks.

According to the classification of McGrail (1985, 2001) dugouts used in this zone would correspond to the C1 class, of hulls constructed by means of reduction techniques only.

Dugouts have a wide distribution throughout the world, which is due to their versatility, being used for navigation both in the ocean and in rivers, lakes, estuaries and marshes. They were used on all continents and oceans.

The manufacture and use of dugouts in northern Patagonia is well documented, from the arrival of the Spaniards by the chroniclers and priests of the time up to some decades ago by ethnographers. They corresponded in historical times with the Mapuche–Huilliche culture between Bio–Bio and Chiloé island. They were used both in the many lakes and rivers that cross the territory of the Cordillera to the sea, as well as in coastal navigation.

Continuity has been proposed for the use of this type of boat in northern Patagonia until the first half of the twentieth century (Carabias et al. 2007). By the arrival of the conquistadors, navigation in these canoes was quite developed and extended from the inhabitants south of Bío-Bío to the Reloncaví gulf, as documented by the first chroniclers (Bengoa 2007), which could suggest a tradition that would have consolidated over time, long before the arrival of the first Europeans. In the mid-twentieth century this tradition of navigation in *wampos* would have continued in certain isolated areas where it would have had very strong roots, especially in some mountain lakes (Panguipulli, Calafquén, Ranco) and lakes on the coast (Lanahue, Lleu-Lleu and Budi).

As with rafts, Europeans also used dugouts very intensively to navigate in northern Patagonia. These were modified boats, based on their own knowledge and nautical experiences, which resulted in the incorporation of some constructive elements of European origin that were not previously known in the area. Among these elements of European influence are the rudder, the sternpost, the keel and the frames. The use of the sail is a discussion that has not been settled.

Currently, dugouts are no longer used in northern Patagonia, with the exception of some tourist projects promoting “Mapuche canoes”. A few are preserved in some museums in southern Chile. However, they still persist in the memory of the oldest inhabitants of this region (Godoy 2005, Bustamente et al. 2005).

### *Sewn Plank Canoes or Dalcas*

The word *dalca* comes from Mapudungun, the Mapuche language, and refers to a boat suitable for ferrying. The Spanish conquerors called them *piraguas*, a Caribbean word that had become familiar among the conquistadors and chroniclers of America, and also *gondolas* (Cárdenas et al. 1991), although *dalcas* present notable differences to these boats.

A *dalca* (Table 3, Fig. 4) is composed of three or five planks, sewn together by seams of fibre and caulked with a special water-proof bitumen. At the point of arrival of the Spaniards it would have been in use by the natives of Chiloe and its environs. Already in historical times and like the dugout canoes, it would have been used in southern Patagonia, displacing the bark canoe among the *Kaweshkar*, their traditional boat.

The *dalca* is classified as a plank boat or sewn plank canoe. According to McGrail’s classification, these vessels would be in the C7 class: a watertight or watertight shell, built from its hull first, where reduction, transformation and construction techniques have been used.

This vessel has been compared to the plank canoe of the Chumash Indians of the Pacific coast of the Santa Barbara Canal in North America, known as *tomol* (Latham 1930; Kroeber 1945; Lothrop 1932). However, there would be notable differences between these two types of craft. While the *tomol* would have been built with several small planks, the *dalca* would use only large planks.

The *dalca* was a very efficient boat for navigating the channels and inland seas of Chiloé. They were easy to disassemble from their seams and, thus, easily transported by land through portage paths called “*pasos de indios*”, which saved time and energy through the intricate geography of the area. For these reasons it survived until historical times. It was also used by the Spaniards who settled in this area, who introduced modifications, some of which were adopted by the indigenous populations.

The Jesuits that settled in the area beginning in 1609 used the *dalca* as the only means of transportation in their evangelizing missions (Medina 1984). The indigenous populations were used mainly as *bogadores* or rowers in the missionary journeys through the



**Fig. 4** *Dalca* kept in Etnografiska Museum of Stockholm, brought to Sweden by Skottsberg in 1906

archipelagos (Cárdenas et al. 1991). This is why the Jesuit priests are a main source in the characterization of these vessels, both their manufacture and their use, and navigation in general for this area. Many of these missions had shipyards where indigenous peoples constructed these canoes, making them privileged witnesses of these processes.

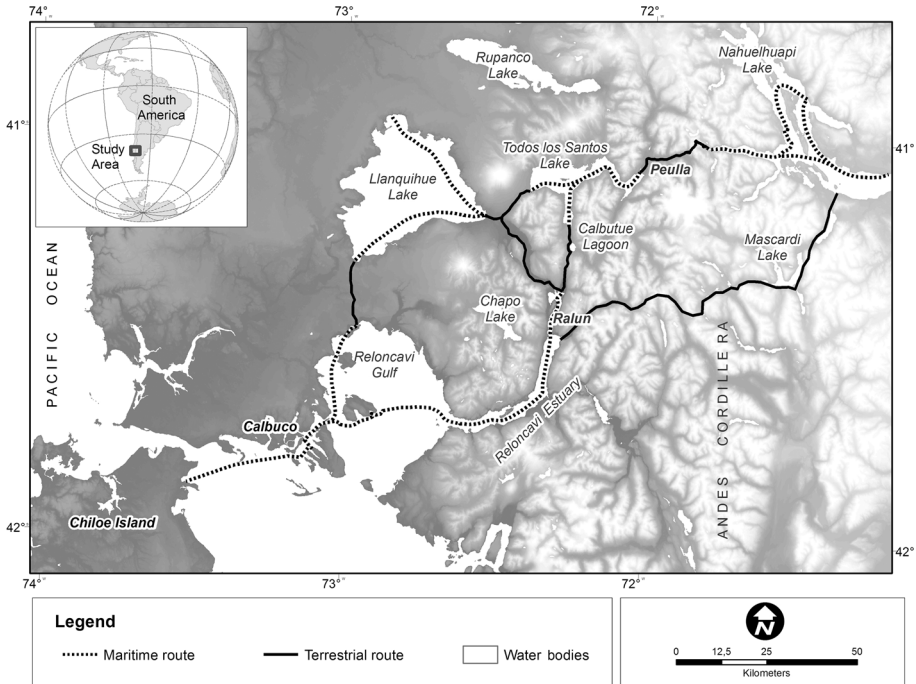
### **Maritime and Inland Enclaves or Niches**

For Westerdahl, enclaves or niches would be areas of possible permanent settlements, where a majority of their inhabitants (up to 80%) engage in maritime activities and where maritime experience and traditions have passed down from generation to generation. Fishing is a primary activity, and other maritime activities emerge from it (Westerdahl 2000).

These ideas are very important at a regional level, but difficult to apply in the inland waters of northern Patagonia. In this region only a few enclaves or niches would fit Westerdahl's definition, particularly in coastal environments such as Chiloe island and archipelago, and its surroundings such as the Reloncaví gulf, Reloncaví estuary and the Maullín River estuary. The Valdivia estuary would qualify as a niche or enclave in the strict sense of the term. However, it is possible to think of these in a wider sense, to include routes of internal waters that have a tradition of navigation. These are the upper reaches of the Valdivia basin with its rivers and lakes, Lake Ranco from which flows the Bueno River, and the area between the Reloncaví estuary and Lake Nahuel Huapi. We can also mention in this category the coastal lakes of Lanalhue, Lleu–Lleu and Budi. These could be characterized as riparian enclaves (Westerdahl 2000), areas of inland waterway routes where traditional navigation has been practiced since ancient times, and where the indigenous population has a strong and close link with water and waterways. At this stage of the research and with the data available, we can only outline the axis of circulation and exchange in these areas, the routes.

### *Circulation and Exchange Axes: Routes*

The focus of this section is on two axes of circulation and exchange between the eastern Andean slope and the Pacific Ocean: firstly between Chiloe island following the estuary of Reloncaví up to Lake Nahuel Huapi; secondly the Valdivia estuary and its river basin, following a route through different lakes and rivers up to Lake Lacar on the eastern slope of the Andes. These are the best recorded routes.



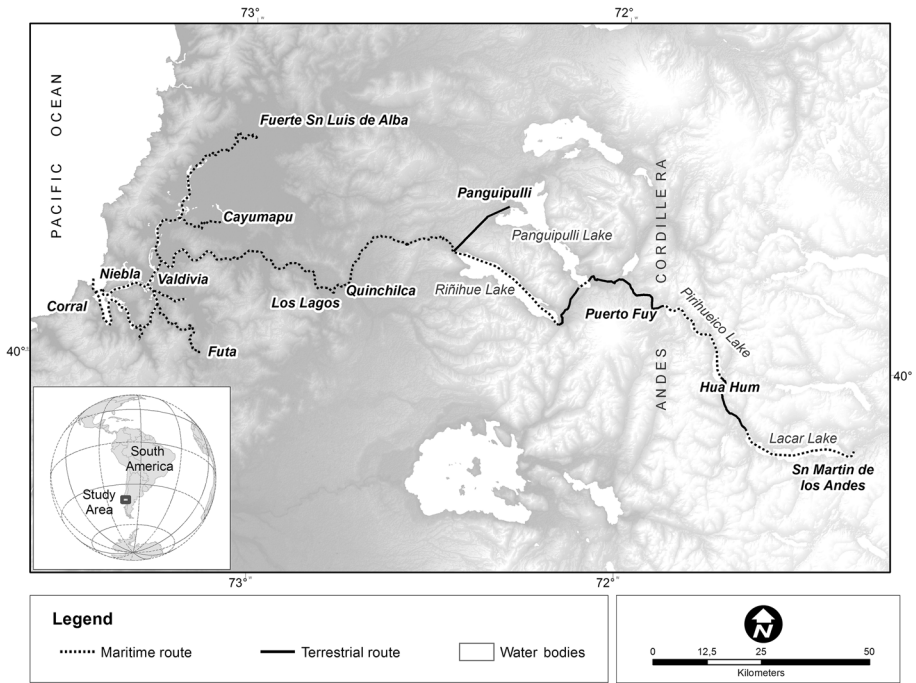
**Fig. 5** Chiloé–Nahuel Huapi routes (map by A. Farias)

We must take into account the different scales of analysis that can be applied. The studied routes are part of regional circuits, but they also can have a local character, joining places near or contiguous. At the same time they are composed of aquatic and terrestrial paths, in which this study has emphasized the first. The study of the aquatic routes, however, presents an additional difficulty to the study of the terrestrial routes. The transit routes, through which a vessel is mobilized, are invisible ways in an ever changing aquatic environment, not physically demarcated by man, but structured in a particular logic. In this way it is impossible to reconstruct physically an aquatic path in its exact trajectory, as only the start and end points are known, and some places or milestones that indicate its trajectory.

*Chiloé–Nahuel Huapi route:* One of the most important routes, due to the numerous references and historic documents that record it, is between the archipelago and island of Chiloé and Nahuel Huapi Lake, in the Andean mountain range (Fig. 5). This route would have been used since prehispanic times by indigenous peoples (Braikovich 2004, 2006; Bellelli et al. 2008), with *dalcas* and dugout canoes.

Historical records show that the route to Nahuel Huapi from Chiloé was first used by the Spanish expedition of Captain Juan Fernandez in 1620 (Urbina 2008). They left Calbuco with 46 men in *dalcas*. According to Urbina (2008), the story of the trip (Fig. 5) does not show great difficulties in finding the lake, which would indicate that it is a route known by indigenous peoples. Later this route was followed by Jesuit missionaries, who founded a mission at Lake Nahuel Huapi in 1670, which was in use intermittently until 1717. With the destruction of the mission by the indigenous population around the lake, the route was





**Fig. 6** Navigation routes in the Valdivia basin (map by A. Farias)

lost to the colonizers until the end of the eighteenth century, when the Franciscan missionary Francisco Menéndez was commissioned to rediscover the lake and the route that led to it from Chiloé. Menéndez made three trips to Nahuel Huapi following this route between 1791 and 1793 (see Fig. 5). All these expeditions were carried out with the service of indigenous peoples of Chiloé, who guided the Europeans by their traditional routes, using their *dalcas*. The difficulties of this route were numerous, which made its duration between nine and ten days.

*Valdivia Basin:* The other system of routes characterized here in detail unites the basin of Valdivia (Fig. 6). Unfortunately we do not have files that document trips that have followed it completely as a single route from the ocean to the Andes or in the opposite direction. In its place, historical records show, since the first exploration of this territory, a continuous use of this fluvio-lacustrine system on the part of the original populations in their traditional vessels, and of the European conquerors and colonizers who adopted them.

The Valdivia basin covers an area of 9902 km<sup>2</sup> (Niemeyer and Cereceda 1984, Subiabre and Rojas 1994). It originates in Lake Lacar, in present-day Argentina. It drains in a westerly direction towards the Pacific Ocean, descending through the Andes and traversing eight successive lakes and rivers. The access to the coast and the Valdivia estuary, through the Bay of Corral, allows for contact between the populations of the interior and those of the coast (see Fig. 6).

Solari et al. (2011) recreate a series of routes that would have followed the indigenous populations in their canoes, especially in the interior course of the basin. It is important to note that the boats used in these routes would have mainly been dugout canoes (although

they would also have used rafts on some occasions, especially to cross the rivers). Unlike the *dalcas* used in the route of Chiloé–Nahuel Huapi, the dugouts canoes were not possible to disassemble and transport over portages, to overcome the different obstacles of navigation. Probably there was a system of boats maintained in different points that could be used as necessary, making it possible to combine aquatic and terrestrial routes. In places where there were no ready-to-use boats, it was possible to request a canoe through smoke signals to other communities. Along with this, there is ethnographic evidence of the existence of specialists in navigation, which ensured the operation of the system.

## Discussion

The radio-carbon dating analysis (Table 4) of wooden vessels in northern Patagonia allows for a proposal of a preliminary chronology for navigation in the region. However, these dates are still insufficient to establish a solid and definitive chronology. In spite of this, we can propose some conclusions with the data available. First of all, there are no early dates for these boats. The oldest vessel in this area is the Chapo 1 *dalca* (Lira 2006), dating to immediately prior to the arrival of Europeans to the region. This is not to say that boats were not used before these dates, or that the previous populations did not navigate along the coast, on rivers and lakes. On the contrary, indirect archaeological evidence, composed

**Table 4** Radio-carbon dates of dugouts and *dalca* sampled in northern Patagonia

Boat	Lab No	Datation B.P.
Lieu-Lieu 1 (Lira 2007)	Beta 220273	140 ± 50
La Flor 1 (Lira 2007)	Beta 220272	270 ± 50
Calafquén 1 (Carabias et al. 2007)	Beta 205208	130 ± 70
Calafquén 2 (Carabias et al. 2007)	Beta 205209	330 ± 80
Mauullín 1	Beta 220271	280 ± 40
Mauullín 1	SacA 30432	345 ± 30 AMS
Mauullín 1	SacA 30433	320 ± 30
Ranco 1	SacA 30441	195 ± 30 AMS
Ranco 1	SacA 30442	190 ± 30 AMS
Contaco 1	SacA 30443	200 ± 30 AMS
Contaco 1	SacA 30444	185 ± 30 AMS
Villarrica 1	SacA 30676	485 ± 30 AMS
Villarrica 1	SacA 30677	380 ± 30 AMS
Trancura 1	SacA 30977	200 ± 30 AMS
Trancura 1	SacA 30978	130 ± 30 AMS
Budi 2	SacA 30427	Modern
Budi 2	SacA 30428	Modern
<i>Dalca</i> MNHN	SacA 30980	225 ± 30 AMS
<i>Dalca</i> MNHN	SacA 30981	200 ± 30 AMS
<i>Dalca</i> Achao 1	Beta-277775	160 ± 40 AMS
<i>Dalca</i> Chapo 1	Beta 207295	460 ± 70
<i>Dalca</i> Chapo 1	SacA 30430	375 ± 30 AMS
<i>Dalca</i> Chapo 1	SacA 30431	400 ± 30 AMS

**Table 5** Dates from insular occupations as indirect evidence of navigation

Site	Distance from the coast (km)	Conventional datation B.P.	References
Mocha Island	34	3.280 ± 60	Vasquez (1997: 235)
Santa María Island	14.4	1850 ± 40	Massone et al. (2012)
Victoria Island (Lake Nahuel Huapi)	4.2	1980 ± 60	Braikovich (2004), Hadjuk (1991)
Chiloé Island	1.8–4.6	5030 ± 120 (Puente Quilo 1) 5940 ± 80 (Yaldad 2)	Ocampo and Rivas (2004) Legoupil (2005)

of the earliest coastal and lacustrine island settlements (Table 5), shows a tradition of navigation very old and strongly rooted in the communities of this region, back to the middle Archaic period in the case of the oldest occupations of the island of Chiloé (5940 ± 80 BP) (Legoupil 2005), (5030 ± 120 BP) (Ocampo and Rivas 2004) and the late Archaic period in the case of Mocha Island sites (3280 ± 60 BP) (Vasquez 1997). We hope that in the future we will find boats of indigenous tradition from earlier periods.

Wood, despite being a biodegradable organic material, is sufficiently resistant to deterioration under certain natural conditions. Archaeological sites that possess conditions of high humidity, or are submerged or semi-immersed, peatlands—in general water saturation conditions—allow wood preservation under significant conditions. Likewise, wood that has been exposed to fire and charred, or those associated with metal allow for proper conservation. However, the analysis of this type of cultural material is still insufficient in Chile, since in the majority of the cases adequate methodologies have not been applied for its study and preservation (Lira et al. 2012). From the results obtained from the different analysis of wood identification, it is possible to suggest that the people who built these boats had a certain degree of specialization in the use of wood resources, since species with special characteristics were selected for boat building. Wood selection would have focused on species easy to carve and to work, with a medium mechanical resistance and that does not present greater complexities in its drying, as the laurel (*Laurelia sempervirens*, Looser), *ulmo* (*Eucryphia cordifolia*, Cav) and *raulí* (*Nothofagus alpina* (P. & E.), Oerst). In addition to this, the symbolic meaning that the original communities of this region have attributed to these trees may be another factor in their selection, as in the case of laurel used in Mapuche ceremonies (Hall and Witte 1998). The characteristics of natural durability, that is, resistance to attack by fungi and insects, which may seem an important priority, would pass into the background because of the predilection for the properties already mentioned.

Together with these factors, the local populations probably considered the availability of the various species in different areas, the weight of the trunk and its transportation to the site of construction, often through inaccessible terrain. The tree was selected for the characteristics reached in its mature state that could fulfill the requirements for a boat (Lira et al. 2012).

Another important aspect in relation to manufacturing techniques is the use of fire as a reduction technique. Most of the vessels mentioned above have traces of exposure to fire, either extensively or partially. This requires in-depth knowledge, control and management of fire, a central element in communities that have interacted significantly with the forest. Some of the boats that were exposed to fire were manufactured using metal tools, so it was

not necessary to burn the trunk to reduce it (Lira 2007, 2010), but this procedure would have helped improve the resistance of the wood to the attack of fungi and insects, resulting in a longer working life of the boat (Arnold 1995). Another hypothesis suggests that the fire would have been used to increase the mechanical strength of the wood.

## A Navigation Culture

The different environments in which navigation took place in northern Patagonia (coast, rivers, and lakes) present different challenges and opportunities. As Rieth (1998) points out, one should not oppose or compare river navigation with maritime navigation to characterize them. Each is inscribed with a very different logic. All require a thorough knowledge of both the environment and the boat. This knowledge, acquired, memorized, enriched and transmitted, essentially through practice, is very important in constantly changing navigation environments, as presented. To determine the strength of the current, to locate a counter-current when approaching a meander, to evaluate the direction of the navigational channel, to estimate the ever-changing depth of rivers and coastal zones are part of this knowledge. In other words, there would be specific strategies for each type of navigation, with rules not to be confused with each other (Rieth 1998).

In this way, this knowledge is inscribed within a culture of navigation, or within many aquatic cultures that specialize to a greater or lesser extent in these environments. This leads to the development of a specialized way of life - a way of life that requires a deep knowledge of the environment, of the tools and of the materials for the construction of boats.

The concept of 'Maritime Cultural Landscape' (Westerdahl 1992, 2000), discussed above, is appropriate for application to northern Patagonia. However, it is somewhat restrictive and limited. Its definition by Westerdahl, in the context of maritime research, has meant a prioritization by marine and coastal phenomena, leaving the inner waterways, rivers and lakes somewhat sidelined. In other words, inland waters are always seen from the coast, the connections and transit points where the means of transport change, and in the estuaries where the maritime culture meets river culture (Westerdahl 1992). There is a lack of a different perspective where the waterways can be seen for themselves, or at least at an egalitarian level and complementary to the maritime context. Inland waterway routes should not be considered as simple passages for the transport of goods, but rather the contact spaces between coastal and inland societies (Herrera 2008).

The perspective of navigation cultures (Rieth 1998) or aquatic cultures help to complete the ideas proposed by Westerdahl (1992, 2000).

The maritime cultural landscapes of northern Patagonia, as characterized and exposed in this article, allow us to propose to very ancient and diversified maritime, river and lake tradition in this region.

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## References

- Adán L, García C, Mera R (2010) La tradición arqueológica de bosques templados y su estudio en la región lacustre cordillerana de las regiones IX y XIV (centro-sur de Chile). In: Actas del XVII Congreso Nacional de Arqueología Chilena, Tome 2, pp 1461–1471, Valdivia, Ediciones Kultrún
- Adán L, Mera R, Becerra M, Godoy M (2004) Ocupación Arcaica en territorios boscosos y lacustres de la región precordillerana andina del centro-sur de Chile: El sitio Marifilo 1 de la localidad de Pucura. In: Actas XV Congreso de Arqueología Chilena, Revista Chungara, vol 36, no 2, pp 1121–1136, Arica
- Aldunate C (1989) Estadio alfarero en el sur de Chile. In: Hidalgo J, Schiappacasse V, Niemeyer H, Aldunate C, Solimano I (eds) Culturas de Chile. Prehistoria. Editorial Andrés Bello, Santiago, pp 329–348
- Aldunate C (1996) Mapuche: gente de la tierra. In: Hidalgo J, Schiappacasse V, Niemeyer H, Aldunate C, Mege P (eds) Culturas de Chile. Etnografía. Editorial Andrés Bello, Santiago, pp 111–134
- Aldunate C, Villagrán C (1992) Recolectores de los Bosques Templados del Cono Sur Americano. In: Aldunate C, Villagrán C (eds) Botánica Indígena de Chile de Ernesto Wilhelm de Moesbach. Editorial Andrés Bello, Santiago, pp 23–38
- Arnold B (1995) Pirogues Monoxyles d'Europe Centrale: construction, typologie, evolution, vol 1. Musée cantonal d'archéologie, Neuchatel (Archéologie neuchateloise, 20)
- Bellelli C, Scheinsohn V, Podestá M (2008) Arqueología de pasos cordilleranos: un caso de estudio en Patagonia norte durante el holoceno tardío. Boletín del Museo Chileno de arte Precolombino 13(2):37–55
- Bengoa J (2007) Historia de los Antiguos Mapuches del Sur. Desde antes de la llegada de los españoles hasta las paces de Quilín. Editorial Catalonia, Santiago
- Braicovich R (2006) Las Canoas Monoxilas del lago Nahuel Huapi. In: Furnari P, Britze F (eds) Arqueología Histórica en América Latina Temas y Diluciones recientes. Ediciones Suárez, Mar del Plata, pp 49–70
- Braikovich R (2004) Las canoas del Parque Nacional Nahuel Huapi. Unpublished thesis presentada en la escuela de antropología de la Facultad de Humanidades y Artes de la Universidad Nacional de Rosario para optar al grado de Licenciado en Antropología, director Lic. Adán Hayduk, Rosario, Argentina
- Bustamante A, de la Maza F, Gonzalez G, Luna L, Silva G, Veintie T (2005) La Comunidad Mapuche de Putue cuenta su Historia. Equipo de trabajo de la Pontificia Universidad Católica de Chile, Comité de Desarrollo Agrícola de Putue Comunidad Indígena Pedro Ancalef, Putue, Villarrica
- Carabias D, Chapanoff M, Adán L (2007) Evidencias de navegación en ambientes lacustres precordilleranos andinos: evaluación arqueológica subacuática del sitio “Dos canoas del lago Calafquén”. In: Morello F, Martinic M, Prieto A, Bahamonde G (eds) Levantando piedras, desenterrando huesos... y develando arcanos, VI Jornadas de Arqueología de Patagonia. Punta Arenas, Chile, pp 503–514
- Carabias D, Lira N, Adán L (2010) Reflexiones en torno al uso de embarcaciones monóxilas en ambientes boscosos lacustres precordilleranos andinos, zona centro-sur de Chile. Magallania 38(1):87–108
- Cárdenas R, Montiel D, Grace C (1991) Los Chono y los Veliche de Chiloé. Ediciones Olimpho, Santiago
- Castro V (2002) Ayquina y Toconce: Paisajes Culturales del Norte Árido de Chile. In: Mujica E (ed) Paisajes culturales en los Andes: memoria narrativa, casos de estudio, conclusiones y recomendaciones de la reunión de expertos, Arequipa y Chivay, Perú, Mayo de 1998. UNESCO Office Lima, pp 209–222
- Cooney G (2003) Seeing land from the sea. World Archaeol 35(3):323–328
- Denton GH, Heusser CJ, Lowell TV, Moreno PI, Andersen BG, Heusser LE, Schluchter C, Marchant DR (1999) Interhemispheric linkage of paleoclimate during the last glaciation. Geogr Ann 81A(2):107–153
- Dillehay T (1989) Monte Verde: a late pleistocene settlement in Chile. Paleoenvironment and site context. Smithsonian Institution Press, Washington, D.C
- Dillehay T (1990) Araucanía. Presente y Pasado. Editorial Andrés Bello, Santiago
- García C (2005) Estrategias de movilidad de cazadores recolectores durante el período Arcaico en la región del Calafquén, sur de Chile. Memoria para optar al título de arqueólogo. Facultad de Ciencias Sociales, Universidad de Chile, Santiago
- Godoy M (2005) Informe Etnográfico Proyecto FONDECYT N 10402326 año 1. Cuenca del Río Valdivia, Sector Cordillera, comuna de Panguipulli. Script in possession of the author
- Hadjuk A (1991) Sitio arqueológico de contacto hispano-indígena Llao-Llao. Comunicaciones científicas del Museo de la Patagonia Francisco Pascasio Moreno 2:1–24
- Hall M, Witte J (1998) Maderas del Sur de Chile: árboles, aplicaciones y procesos. Editorial Universitaria, Santiago de Chile
- Herrera J (2008) *The reflexive navigator: theorie and directions in maritime archaeology*. Thesis for the degree of doctor of Philosophy, University of Southampton

- Irwin G (2013) Les voyages maritimes et le peuplement de l'océan Pacifique à la Préhistoire. In: Guiot H (ed) *Vivre la Mer, expressions océaniques de l'insularité*. Presses Universitaires de Rennes, Rennes, pp 15–34
- Knittel R (1934) Mapuche dugout on the shore of lake Ranco. Photography by Rodolfo Knittel. Collection from the Universidad Austral de Chile
- Kroeber A (1945) *Antropología general*. Editorial Fondo de Cultura Económica, México
- Latcham R (1930) La dalca de Chiloé y los canales patagónicos. *Boletín del Museo Nacional de Historia Natural, Chile* 13:63–72
- Legoupil D (2005) Recolectores de moluscos tempranos en el sureste de la isla de Chiloé: una primera mirada. *Magallania* 33(1):51–61
- Lira N (2006) Registro, análisis y puesta en valor de tres fragmentos de dalca del lago Chapo, X región. Informe de práctica profesional realizada en el marco del proyecto FONDECYT 1020616. Script in possession of the author
- Lira N (2007) Canoas monóxilas en el centro sur de Chile: Navegando sobre los árboles. Memoria para optar al título de Arqueólogo, profesora guía Victoria Castro, Universidad de Chile, Santiago
- Lira N (2009) Embarcations de tradition indigène dans la Patagonie du nord: connexions, contacts et routes entre le versant oriental et occidental des Andes. *Mémoire de Master 2 Préhistoire-Ethnologie-Anthropologie, Université de Paris 1 Panthéon-Sorbonne, Paris*
- Lira N (2010) Canoas Monóxilas en el Centro-sur de Chile: Navegando sobre los árboles. *Actas del XVII Congreso Nacional de Arqueología Chilena* 2:1473–1485
- Lira N (2016) Antiguos navegantes en los mares de Chiloé. In: Aldunate C (ed) *Chiloé*. Ediciones del Museo Chileno de Arte Precolombino de Santiago, Santiago, pp 88–119
- Lira N, Legoupil YD (2014) Navegantes del sur y las regiones australes. In: Aldunate C (ed) *Mar de Chile*. Ediciones del Museo Chileno de Arte Precolombino de Santiago, Santiago, pp 102–143
- Lira N, Diaz-vas JE, Muñoz S (2012) Dugouts from the Center-South of Chile: conservation and cellular structure analysis of the wood. *Magallania* 40(1):307–318
- Lira N, Figueroa V, Braicovich YR (2015) Informe sobre los restos de dalca del museo etnográfico de Achaó, Chiloé. *Magallania* 43(1):309–320
- Lothrop S (1932) Aboriginal navigation off the west coast of South America. *J R Anthropol Inst G B Irel* 62:229–256
- Massone M, Gaytán E, Sánchez M, Contreras L, Silva C, Jácome C (2012) El sitio arqueológico SM-39, un espacio de uso funerario de especial significación en la isla Santa María, entre los siglos I y XIV DC. *Informes Fondo de Apoyo a la Investigación Patrimonial de la DIBAM* 14:47–81
- McGrail S (1985) Towards a classification of water transport. *World Archaeol* 16(3):289–303
- McGrail S (2001) *Boats of the world: from the stone age to medieval times*. Oxford University Press, Oxford
- Medina A (1984) Embarcaciones chilenas precolombinas: La Dalca de Chiloé. *Revista Chilena de Antropología* 4:121–138
- Menghin O (1962) *Estudios de Prehistoria Araucana*. *Studia Praehistorica II*, Centro argentino de estudios prehistóricos, Buenos Aires
- Niemeyer H, Cereceda P (1984) *Hidrografía*. Colección Geografía de Chile, vol VIII. Santiago, Instituto Geográfico Militar
- Núñez L (1983) *Paleoindio y Arcaico en Chile: Diversidad, Secuencia y Proceso*. Serie Monografías 3. Ediciones Cuicuilco, México
- Ocampo C, Rivas P (2004) Poblamiento temprano de los extremos geográficos de los canales patagónicos: Chiloé e Isla Navarino. *Actas del XV Congreso de Arqueología Chilena Revista Chungara* 36 (T1):317–331
- Quiroz D, Sanchez M (2004) Poblamientos iniciales en la costa septentrional de la Araucanía (6500–2000AP). *Actas del XV Congreso de Arqueología Chilena. Revista Chungara* 36(1):289–302
- Rapaport E, Ladio A (1999) Los bosques andino-patagónicos como fuentes de alimento. *Bosque* 20(2):55–64
- Rieth E (1998) *Des Bateaux et des Fleuves, Archéologie de la batellerie du Néolithique aux Temps modernes en France*. Editions Erance, Paris
- Rosales D (1877–78 [1678]) *Historia General del Reino de Chile, Flandes Indiano*, vol I. Valparaíso: Imprenta de El Mercurio
- Señoret M (1878) Exploración del río Rahue y del lago Rupanco. In *Anuario Hidrográfico de la Marina de Chile, Tomo VIII*. pp 187
- Solari ME, Cueto C, Hernández F, Rojas JF, Camus P (2011) Procesos territoriales y bosques en la cuenca del río Valdivia (siglos XVI y XIX). *Revista de Geografía Norte Grande* 49:45–62
- Subiabre A, Rojas C (1994) *Geografía Física de la Región de los Lagos*. Ediciones Universidad Austral de Chile, Valdivia

- Urbina X (2008) La frustrada misión estratégica de Nahuel Huapi, un punto en la inmensidad de la Patagonia. *Magallania (Chile)* 36(1):5–30
- Van de Noort R (2003) An ancient Seascape: the social context of seafaring in the early bronze age. *World Archaeol* 35(3):404–415
- Vásquez M (1997) El Arcaico en la Isla Mocha. In: Quiroz D, Sánchez YM (eds) *La isla de las palabras rotas*. Biblioteca Nacional de Chile, Centro de Investigación Barros Arana
- Velásquez H, Adán L (2004) Marifilo 1: evidencias arqueofaunísticas para entender las relaciones Hombre y Bosques Templados en los sistemas lacustres cordilleranos del centro-sur de Chile. In: *Contra Viento y Marea, Arqueología de Patagonia, V Jornadas de Arqueología de la Patagonia*, vol 832, pp 507–519
- Villagrán C (1991) Historia de los bosques templados del sur de Chile durante el Tardiglacial y Postglacial. *Revista Chilena de Historia Natural* 64:447–460
- Villagrán C (1998) Etnobotánica indígena de los bosques de Chile: sistema de clasificación de un recurso de uso múltiple. *Revista Chilena de Historia Natural* 71:245–268
- Westerdahl C (1992) The maritime cultural landscape. *Int J Naut Archaeol* 21(1):5–14
- Westerdahl, C. (2000). From land to sea, from sea to land. On transport zones, borders and human space. In J. Litwin (Ed.), *Down the river to the sea, Proceedings of the Eighteen International Symposium on Boat and Ship Archaeology*. Gdansk: Polish Maritime Museum
- Westerdahl C (1998) The maritime cultural landscape on the concept of the traditional zones of transport geography. Institute of archaeology and ethnology, University of Copenhagen, Copenhagen
- Yesner R (1980) Maritime hunter-gatherers: ecology and prehistory. *Curr Anthropol* 21(6):727–750