Traditional and Local Knowledge in Chile: Review of Experiences and Insights for Management and Sustainability

Matías Guerrero-Gatica [1,2,*], **María Isabel Mujica** [1,3], **Matías Barceló** [2,3],
María Fernanda Vio-Garay [3], **Stefan Gelcich** [2,3] and **Juan J. Armesto** [1,3,4]

1   Institute of Ecology and Biodiversity (IEB), Casilla 653, Santiago 7800003, Chile; mimujica@uc.cl (M.I.M.);
     jarmesto@bio.puc.cl (J.J.A.)
2   Center of Applied Ecology and Sustainability (CAPES) Departamento de Ecología, Facultad de Ciencias
     Biológicas, P. Universidad Católica de Chile, Casilla 114-D, Santiago 8331150, Chile;
     barcelo.matias@gmail.com (M.B.); sgelcich@bio.puc.cl (S.G.)
3   Departamento de Ecología, Facultad de Ciencias Biológicas, P. Universidad Católica de Chile, Casilla 114-D,
     Santiago 8331150, Chile; fefa26@gmail.com
4   Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción 4070386, Chile
*   Correspondence: matias.guerrero.g@gmail.com or mguerrerog@ug.uchile.cl

Abstract: Scientific interest in traditional and local knowledge (TLK) has grown in recent decades, because of the potential of TLK for improving management and conservation practices. Here, we synthesize and evaluate TLK studies in Chile, discuss how this progress compares to the international scientific literature in the field, and contextualize our results according to the multiple evidence base approach. We found 77 publications on the subject, a steady increase since 1980, and a peak production in the 1990s and the 2010s decades. Publications most often provide basic information on species names and lists of resource uses in terrestrial rather than marine ecosystems. Papers had an emphasis on natural, rather than social sciences. Work was concentrated on the extreme northern and southern regions of Chile where more indigenous populations are found. Indigenous ethnic groups received greater attention than non-indigenous people. Future work in Chile must broaden its attention to local and urban communities and focus on how TLK can contribute to management and sustainability, rather than only acquiring the basic knowledge contained in local and traditional communities. To better comprehend TLK's contribution to policy measures, an interdisciplinary approach must be present to address these knowledge gaps.

Keywords: traditional knowledge; local knowledge; indigenous knowledge; ethnobiology; ethnobotany; ethnozoology; land management; Chile

1. Introduction

In recent decades, there has been an increasing interest in learning about how different forms of traditional or local knowledge (TLK) [1–5] could contribute to improve current practices for better management and conservation of ecosystems worldwide [6–11]. In a scenario where conventional approaches to management and conservation have been criticized [12,13], knowledge from other than Newtonian sciences (referring to Newtonian science as the science based on mechanistic, linear approaches; sensu Berkes, 1999 [1]), such as TLK, can provide fresh perspectives to help improving management and conservation, especially in rural and local contexts [14,15]. This approach is particularly relevant when the actions taken to conserve and manage ecosystems impact on a local scale, with its success that can be affected by the local communities. At the same time, using local

knowledge can provide a more detailed perspective of the ecosystem rather than using only scientific information [14,15].

Traditional ecological knowledge has been broadly defined as a "cumulative body of knowledge, practices, and beliefs about the relationship between humans and their environment, which changes over time through an adaptive process" [15]. TLK has been the focus of diverse disciplines including conservation biology or environmental anthropology [8]. Two major perspectives have prevailed in the literature: one focusing on the millennial knowledge accumulated by indigenous people, called traditional knowledge, but also imbricated with other concepts, such as indigenous knowledge, indigenous traditional knowledge, and indigenous environmental knowledge, among others [1]. The second perspective focuses on the knowledge held by local communities with a majority of non-indigenous people, termed local ecological knowledge. In this review of the literature, we refer to both perspectives as TLK.

This type of collective knowledge of nature rooted in social history can offer alternatives to enhance the compatibility of biodiversity and ecosystem conservation with productive uses of nature [16,17]. The contributions to locally acceptable conservation measures are also a benefit derived from local knowledge [18]. However, differences in epistemological approaches, context, motivation, and conceptual underpinnings have obstructed the integration of traditional forms of knowledge with formal scientific understanding [8,15]. A common language is necessary to ascertain how these two approaches can lead to knowledge accumulation [15]. This is particularly relevant in global scenarios where scientific knowledge is expanding, while TLK is rapidly dwindling [19].

TLK can be investigated from two dimensions. One of these dimensions is related to environments held by traditional and local communities. Research on this type of knowledge is predominantly descriptive, focusing on traditional classification systems and common names of plants and animals [20]. Quantitative methods became integrated more recently, allowing for assessments based on different indices [21–23]. Such analyses allowed us to link TLK with scientific variables, such as child health or sustainable resource management [24,25], favoring their integration [26–28].

A second dimension of TLK concerns its application to the management of nature. Research in this area has highlighted alternative management systems based on traditional practices that could be more environmentally friendly than current forms of management [29,30]. Thus, TLK could provide alternatives to modern theory-based approaches to nature conservation and management [1], which have often been ineffective [31–33].

Considering the recent growth of TLK studies in the literature, and its potential to promote management and biodiversity conservation in modern society, we conducted a systematic review of the progress of TLK studies in Chile in the past 100 years. We carried out the review, analyzing the studies' shortcomings and potential growth areas within the context of merging TLK with formal scientific understanding. Chile represents an interesting case study since it is considered as one of the recognized global biodiversity hotspots [34]. Additionally, due to its diversity of ecosystems and different cultures that inhabit them, it is an interesting case in which to assess the relations and dynamics between people and nature. Our overall goal was to systematically survey the scientific literature related to traditional and local knowledge produced in Chile with the following questions in mind: (i) What are the main ecosystems where studies have concentrated? (ii) What are the main disciplines that have addressed the questions regarding TLK? (iii) What are the main ethnic groups studied (i.e., indigenous versus non-indigenous local groups) and how have the studies' trends evolved over time? (iv) What are the major gaps in the current understanding of TLK in Chile and Latin America? We finally discuss how to incorporate TLK into management and sustainability policies from the multiple evidence base approach [35]. In addition, we provide guidelines to improve future research on TLK in the region and elsewhere, by placing the analysis in a comparative context within Latin America.

2. Materials and Methods

2.1. Literature Review

The literature review [36–38] considered only articles found in the Web of Science ISI Web of knowledge and the Scopus database from between 1945 and 2019. We searched scientific literature on traditional knowledge about the biota or the regional environment held by local communities, independently of the explicit mention of the terms "traditional knowledge" or "local knowledge", due to their recent emergence. We used the following keywords in the search: ''ethnobiology'', "ethnoecology", "ethnobotany", "ethnozoology", "ethnopharmacology", "ethnomycology", "ethnoveterinary", "ethnomedicine", "traditional ecological knowledge", or "local ecological knowledge", along with "Chile". We identified a total of 35 publications from the databases since 1945, from which we applied three filters. In the first place, we identified publications that investigated the relationship between humans and nature, the biological classification system used, or the ways of managing ecosystem or practices acquired through a cumulative, empirical body of knowledge, traditions, and beliefs. The second filter targeted publications conducted in Chile. Finally, the third filter identified publications based on fieldwork (surveys, focus groups, interviews, among others), excluding work that acquired information from other sources. To improve our review, we reviewed the references of publications selected, adding both papers published in indexed and non-indexed journals while applying the same filters described above. Also, we contacted national experts, Carolina Villagran and Victoria Castro, to ask for recommendations about relevant literature of local and traditional knowledge in Chile.

2.2. Criteria of Classification

Once a publication complied with the criteria explained above, the publication content was analyzed, each paper was classified by knowledge dimension (basic knowledge and/or management knowledge), main ecosystem studied (terrestrial and/or marine), the authors' main fields of work (natural science or social science), and the human group subject of study (indigenous and/or non-indigenous origin). We classified the literature according to different criteria explained in Table S1. It is worth noting that in the categories of dimension of knowledge, ecosystem studied, and focal ethnic group, one publication can address both dimensions of knowledge, both ecosystems, or both focal ethnic groups. Additionally, if one publication was not available, we obtained the maximum information from the abstract.

3. Results

3.1. Publication Trends

We found a total of 77 articles (35 from databases, 29 from experts, and 13 from references) about TLK in Chile, published between 1917 and 2019 (Table S2). For the period 1917 to 1950 we recorded only four articles according to the classification criteria (Figure 1). The total number of TLK publications increased over the second half of the 20th century, mainly in the 1980s (eight publications) and in the 1990s (18 publications). The number of publications in the following decade has remained similar (19 publications). Nevertheless, the number of publications increased again in the decade of 2010 to 2019, with 25 new studies addressing TLK.
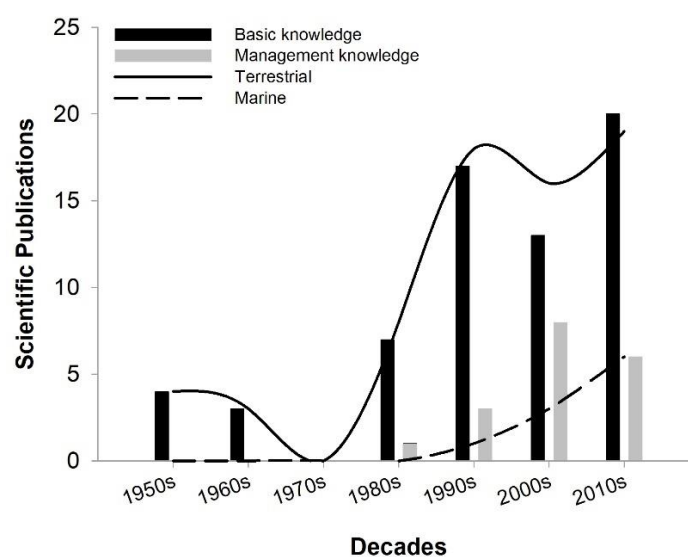
Figure 1. Number of scientific publications (natural and social sciences) discussing traditional and local knowledge (TLK) per decade in Chile, from the 1950s or earlier, to 2019. Bars represent the dimension of knowledge studied (black bars: basic knowledge; gray bars: management knowledge), and lines represent the ecosystems where studies were conducted (solid line: terrestrial ecosystems; dashed line: marine ecosystems).

There were 50 publications in indexed journals (65% of the total), and the average Impact Factor of journals was 1.74. Since 2010, all the articles have been published in indexed journals (19 publications), despite a lower percentage in previous decades, with two studies published in indexed journals in the 1960s, no publications indexed in the 1970s, three publications in the 1980s, 11 publications in the 1990s and 15 publications from 2000 to 2010. Twenty-seven articles were published in national journals, representing 35% of the articles in our database.

Most studies reviewed here were classified in the basic knowledge dimension (83%, 64 articles; Figure 1). These focused mainly on the ability of local people to identify and name wildlife species using local classification systems, as well as on the ethnic origin of names and various medicinal uses of plants. A smaller number of studies (23%, 18 publications) were classified in the management dimension. These focused on the application of traditional knowledge to the management of nature and resources by local communities.

In terms of the ecosystems studied, terrestrial ecosystems were the focus of most publications on TLK (88%, 68 publications), with inquiries mainly within the basic knowledge dimension. Studies of marine ecosystems (13%, 10 publications; Figure 1), in turn, focused mainly on the management dimension. Only one publication studied both terrestrial and marine ecosystems, although this did not consider the relation between both ecosystems, researching them independently. Studies of terrestrial ecosystems peaked in the 2010 decade (19 publications). On the other hand, TLK studies of marine ecosystems only appeared in the 1990s (one publication) growing in number to three publications between 2000 and 2010, and six publications between 2010 and 2016.

Concerning the taxa studied, most TLK studies in Chile referred to knowledge about plants (55 publications), followed by knowledge about animals (seven publications; Figure 2). We recognize a lack of specific species or group of species studied in the publications. Some other publications studied the knowledge about landscapes (six publications), shellfish and crustaceans (five publications), and birds (five publications). Finally, two publications solely studied the knowledge about algae.
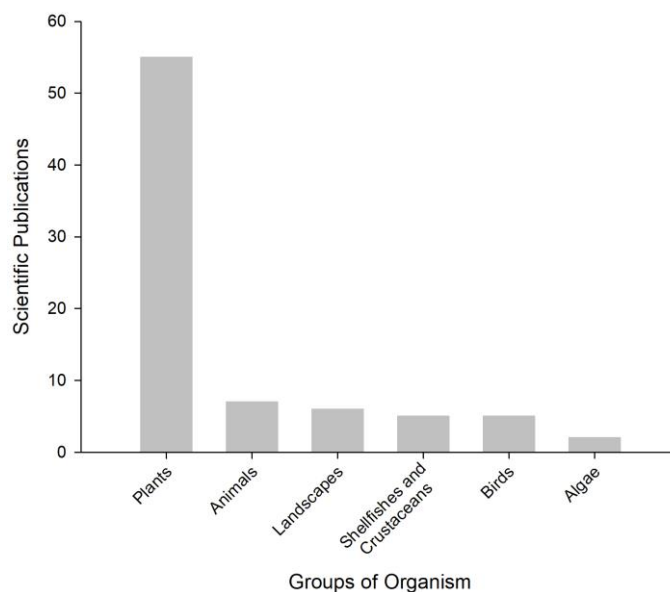
Figure 2. Main groups of organisms considered in TLK studies in Chile.

Our results about the interdisciplinary character of the studies showed that most publications (64% of publications) were co-authored by a disciplinary team (Figure 3A). On the other hand, 37% of the studies (27 publications) were co-authored by scientists from various disciplines, generally teams that included both social and natural scientists (Figure 3A). Four publications did not have information about the disciplines of the authors. In terms of disciplines of origin, 66% of studies (50 publications) on TLK in Chile were lead-authored by natural scientists (Figure 3B). One publication did not give information on the discipline of origin.
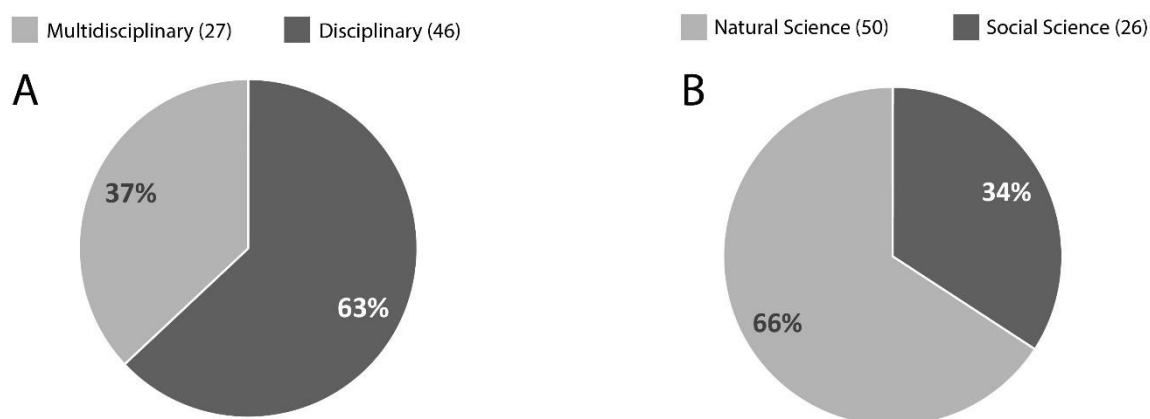
Figure 3. (**A**) Publication numbers according to the discipline of the first author; (**B**) publication numbers based on multidisciplinary or disciplinary groups of authors. Numbers in brackets represent the number of publications.

3.2. Relation between Indigenous Communities and TLK Studies

The geographic distribution of Chilean TLK studies showed a concentration of work in the northernmost and southernmost regions of the country (Figure 4). In contrast, there were fewer studies in central Chile, where there is a greater concentration of human population and urban areas. There is a high proportion of TLK studies in the forested Araucanian Region (40° S), with 22 publications over the 50-year period, followed by the Andean highlands of the Antofagasta Region (20° S) with 16 publications. No studies were reported for the extensive region of Aysén (45° S) in Patagonia. Only

two studies were conducted in the semiarid Coquimbo Region (29° S) and in the central region of Valparaíso (33° S).
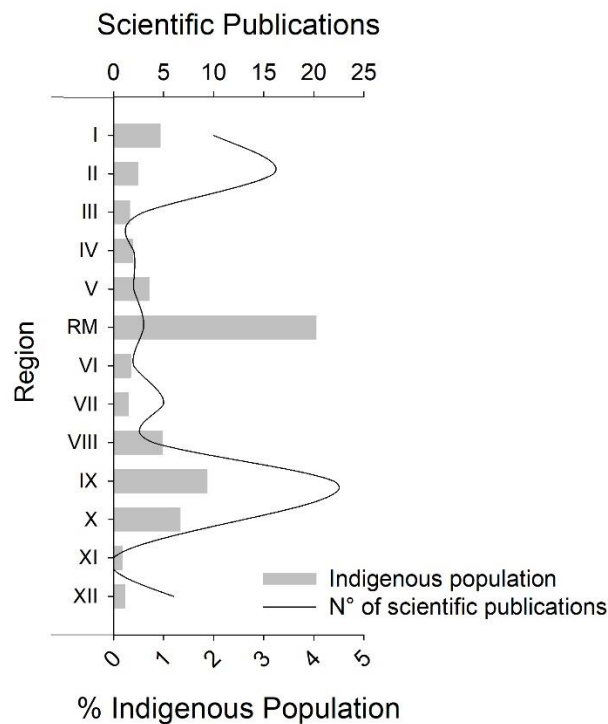
Figure 4. Distribution of publications in the administrative regions of Chile and the percentage of indigenous population living in those regions. Most people in Chile live in Santiago (RM) but indigenous people are mostly found in the IX Region (Araucanian) and in the X region (Los Lagos).

Regarding the origins of focal ethnic group studied, 70% of studies (54 publications) compiled knowledge gathered by human communities of indigenous origin, compared to non-indigenous communities (20 publications; 26%). The research trend to downplay the knowledge from non-indigenous people is changing, with a decade of 2010–2019 showing more publications of non-indigenous communities (16 papers) compared to indigenous ones (nine publications; Figure 5).
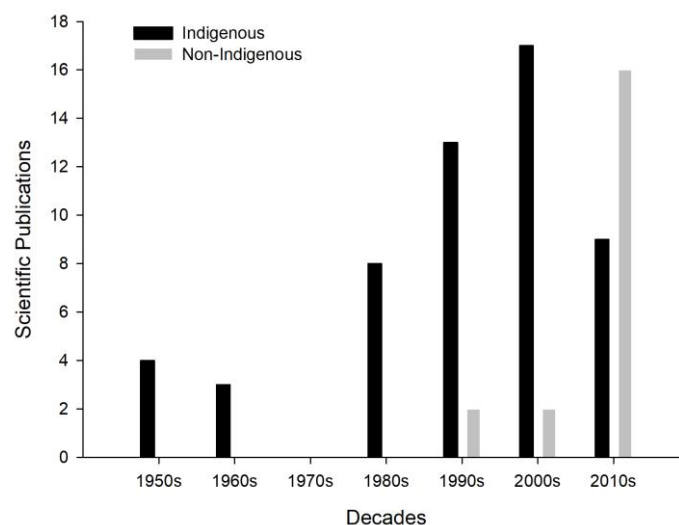
Figure 5. Research trend over decades about publications, depending on the origin of the communities inquired into, that is, indigenous or non-indigenous communities.

4. Discussion

4.1. Publication Trends

Our results demonstrate a steady increase in the number of publications on TLK since the first publication added to our review was published in 1917. The increase in the number of publications in the 2010–2019 decade follows a global scale trend reported by Brook and McLachlan until 2004 [39]. The diversification of research groups interested in issues related to TLK may explain the increase, a scenario not well-developed in past decades. This is partly because the research about ethnobiology and TLK were developed by specific researchers interested in the topic (e.g., see the number of publications done by Villagrán et al. in the 1990s and beginning of 2000s in Table S2).

In the recent decades there has been a greater demand and peer pressure for publications in indexed journals, driven by national funding agencies, which may explain this increase. We expect a further increase in these indexed publications. Nevertheless, several publications found in our review evidence the importance of publications in non-indexed journals. For example, most publications until the end of 1980s were published in non-indexed journals. We believe that funding agencies should pay more attention to TLK studies published in non-indexed journals, as they can build an important knowledge base on issues that in many cases are contextually specific. These locally relevant publications are difficult to publish in international and indexed journals. Nevertheless, in many cases they represent the basis for initiating knowledge coproduction initiatives which are based on TLK [40].

The dimension of knowledge more developed by the studies related to TLK was the basic dimension. While the development of basic knowledge is essential to then researching more complex aspects of knowledge, such as coupled human and nature dynamics, there must be more development in the management dimension, which would be in agreement with the growing international recognition of the relevance of TLK to improve management practices [1,2,41]. The knowledge acquired to manage and use local resources can be an opportunity to integrate TLK into policy measures and then recognize the importance of the body of knowledge maintained by local and traditional communities. We hope that future studies will address different forms of TLK, and their practical applications related to the adaptive capacity of local communities (e.g., [42]). Studies about basic knowledge dimension of TLK will continue to be important and will help prevent future TLK degradation and loss.

Concerning the prevalence of terrestrial ecosystems in the publications reviewed, the trend might be explained by the dominance of articles focused on terrestrial plants, which is related to the greater development of ethnobotany compared to ethnozoology or other sub-disciplines in Chile since the first study was reported in 1917. Historically in Chile, TLK studies have been dominated by research on the medicinal or edible plants used by indigenous peoples [43–45]. A study conducted by Gundermann [46] roughly thirty years ago represents the first publication in ethnozoology, which reports the use of territory for animal husbandry by indigenous people. The high plant diversity and endemism in the Chilean biodiversity hotspot (ca. 50% of the total vascular plants [47,48]) might be one reason for the stronger development of ethnobotany compared to other sub-disciplines. Our results resemble the development of ethnobiology elsewhere, in which ethnobotany is developed first and tends to be more common than ethnozoology ([41], pp. 16–17). Another important factor is, again, the prevalence of particular research groups that were interested in the issue. Terrestrial ecosystem research in Chile derives essentially from the work done by one research group, which focused on forests and desert ecosystems, and published multiple papers on ethnobotany during the 1990s (a team led by C. Villagrán, see Table S1).

Even though Chile includes 4000 km of coastline, we did not find a strong development of marine TLK studies. The small, recent rise of studies about marine TLK reflects an increasing global awareness of the value of TLK for the management of marine ecosystems [49]. The analysis reveals only sporadic interest by research groups in issues related to TLK as well as an absence of long-term research efforts on marine TLK (Table S1). TLK is a long-term social-ecological process [1,49,50]; therefore, we expect that future research will transcend short-term analyses. There is a need to overcome the research bias

on terrestrial ecosystems because of the relevance of marine ecosystems for the livelihoods of many people that depend on coastal ecosystems [42,51].

Interestingly, when we assessed the taxa that studies researched, we did not find a specific target group. The traditional and local knowledge may represent an approximation, which is difficult to reduce to the units used by ecological sciences. When the researchers want to understand TLK, the holistic approach pushes the analyses through broader units than a specific species or group of species. This is noticed in different ways of views of indigenous communities from Chile, where concepts such as Ñuke Mapu (nature in Mapuche cosmology but beyond soil, forests, or mountains), Pachamama (a religious deity from Aymara representing nature), or other holistic understandings of ecosystems described in other countries ([1] p. 190), go beyond working with one specific and delineated taxa.

In researching issues regarding TLK, there is broad recognition that it represents a multidisciplinary or even interdisciplinary task [1,50]. Studying TLK from a single disciplinary perspective, mainly the natural science perspective, limits the impact of research, particularly in cases where different approaches and methodologies must be used to understand the knowledge–practice–belief complex [1]. For example, 83% of studies analyzed basic knowledge, that is, complex systems of classification and language by different human communities, which is not the area of expertise of natural scientists. Disentangling the way such different forms of knowledge are maintained or transmitted must require future interdisciplinary research.

4.2. Relation between Indigenous Communities and TLK Studies

In our review, we found a concentration of studies in two regions of the country: Antofagasta and the Araucanía Region. The interest of researchers in studying indigenous communities may explain the regional distribution of published TLK research. Indigenous people that still occupy their original homeland and remain less influenced by modern society were a primary focus of Chilean TLK studies. In contrast, there is a lack of research addressing the local knowledge maintained by indigenous and non-indigenous people that now inhabit large urban settlements and anthropic landscapes in rural or urban central Chile, such as indigenous people in the regional capitals (e.g., the city of Santiago or Valparaíso), or rural communities in the Metropolitan region (an exception is the work by Barraza et al. 2014 [52]).

While our results showed an important amount of publication that focused on indigenous communities, there has been growth in publications studying non-indigenous communities in the last decade. The tendency can be explained first by the large number of publications diversifying the human communities researched. Additionally, there is a growing recognition of the body of knowledge by communities with diverse cultural backgrounds, such as people from rural communities, local farmers, fishers, among others [39]. There is a potential for researching non-indigenous knowledge, particularly in urban or rural settings for studying TLK. Knowledge dynamics, such as the loss or maintenance of traditional knowledge in urban contexts, remains understudied [52–54], and information from such studies can serve as important tools for improving motivation for conservation. For example, the highly endemic, Mediterranean-climate ecosystems of central Chile [34,55] also harbor the largest human population, and are the center of the farming and forestry industry in Chile [56]. Recovering some of the ancestral knowledge of ecosystems and traditional management practices in central Chile remains difficult due to the loss of local knowledge and the extinction of experiences in dealing with diverse ecosystems (i.e., [57]).

4.3. Regional Comparisons

Our study complements a broader regional research by Albuquerque et al. (2013) [58], who reviewed studies from 17 countries in Latin America with a primary focus on ethnobiology. There are differences between ethnobiology and TLK. Ethnobiology is a discipline that studies the "knowledge and concepts developed by any society about the plant and animal world, encompassing both the way in which a social group classifies plants and animals, and how they use them" ([59], p. 15). TLK is a kind

of knowledge that addresses peoples' understanding of ecological processes and their relationships with the environment [1,15]. Despite these particularities, ethnobiology and TLK are closely related, which allows us to use the conclusions of Albuquerque et al., as a benchmark to compare the progress of TLK studies in Chile as well as regionally.

In the Albuquerque et al. study, Chile was ranked ninth regarding the production of studies in ethnobiology, including TLK. As in our study, the authors report an increase in this type of research from 1990 to 2010 in all Latin America. We found little evidence of international collaboration in Chilean studies. Our review reveals that most Chilean studies address the basic knowledge dimension, which is also true for Latin America [58]. Information on such studies derive from social or ecological knowledge generated locally, which partially explains the rarity of international collaboration. Furthermore, Chile's indigenous populations are geographically isolated from neighboring countries by mountainous environments, which divide biological and ethnic communities to the east and west of the Andes.

Albuquerque et al. reported that Honduras had the highest percentage of collaborations (50%), but only produced two studies in the period analyzed (1963–2012). On the other hand, 11 studies from Brazil (3.8%) derived from international collaboration, out of 289 studies produced. It is imperative to foster international collaboration, considering that many indigenous communities are not restricted to one country (e.g., Aymaras, in Chile, Bolivia, and Peru). It is also necessary to compare knowledge-generation processes across regions with similar socioeconomic and cultural settings.

When working with local and traditional communities through a participatory approach, conservation can sustain biodiversity, embrace stewardship, [60] and achieve locally-contextual measures [61]. In this way, opposition toward conservation goals can be reduced and the collaborative approach can create synergies for local ecosystem management.

If we examined the potential journals for publishing TLK studies in Latin America, only three journals are dedicated to ethnobiology and TLK. These are *Ethnobiology and Conservation* (Brazil), *Revista Etnoecológica* (México), and *Etnobiología* (México). None of the articles reviewed by us were published in these journals. Regional journals can act as platforms, improving the integration of research that has a strong collaboration component, thus stimulating the construction of novel theoretical frameworks [21]. Publishing articles in these journals can increase their visibility among potential partners.

4.4. Lessons from TLK to Improve Management and Sustainability

We expect that future studies of TLK in Chile and Latin America will elaborate and test hypotheses about the management dimension. This should include the factors that determine the maintenance and loss of TLK in a given community context, such as knowledge transmission (e.g., [62]), sustainability outcomes of traditional practices (e.g., [61,63]), and how TLK influences populations' livelihoods and adaptive capacity (e.g., [64,65]). New policies which create new venues for TLK in natural resource management, such as the one on coastal spaces for indigenous communities in Chile, open new avenues to embrace this type of research. Research on TLK applications and construction should provide opportunities to also expand conservation programs beyond national or private protected parks. In fact, by 2020, the Convention on Biological Diversity in its Aichi Biodiversity Targets mandate integration of traditional knowledge relevant to sustainable use of biodiversity into national legislation with participation of indigenous and local communities.

Management dimensions should be integrated into future TLK studies of terrestrial ecosystems, and studies of marine ecosystems must incorporate basic and management dimensions, which can inform conservation. Although there is broad knowledge of local classification systems and uses of vascular plants across regions, many other organisms such as shellfish, insects, algae, birds, and mammals remain to be studied. Policy application regarding on TLK must diversify the taxonomic groups [42,66,67] as well as considering the holistic view of nature from different cultures [1,8], which is sometimes difficult to understand from the ecological sciences perspective. The challenge that arises when both types of knowledge; that is, the scientific, western knowledge, along with the TLK, must work together to create management and conservation measures.

In terms of the interdisciplinary character of the studies, we call for attention to stimulate the collaboration and interdisciplinary character of the studies. The different issues that cross together in a topic such as TLK require working with people from both the natural and social sciences. Such collaboration will enhance understanding of the social-ecological and socio-cultural interfaces within TLK. Furthermore, contributions of TLK studies that examine local ecosystem management must strengthen the feedback of TLK into policy-making processes.

4.5. Multiple Evidence Base Approach for Integrating TLK into Sustainability Policies

To address information gaps and better understand synergies between different knowledge systems (i.e., traditional, local, scientific knowledge), a recent approach was proposed to enhance the understanding of governance in biodiversity and ecosystem services. The multiple evidence base (MEB; [35]) approach allows the complementarity of knowledge systems as equally valid in generating evidence for changes in the environment. Additionally, it recognizes that each knowledge system has its processes of validation, thus avoiding assigning the role of validator to one dominant knowledge system.

Incorporating the above-mentioned approach has important challenges. One of them is to recognize the diverse epistemologies of different knowledge systems. To overcome this barrier, it is necessary to incorporate participatory approaches and, at the same time, validate the diversity of knowledge systems as a solid evidence into policy and management processes. Unfortunately, in Chile these issues still remain understudied. Moreover, little effort has been made toward incorporating evidence emanated from local or traditional societies into management and conservation measures. Therefore, how they adapt to changing local and global drivers is unknown.

There is great potential to work from novel approaches to trigger synergies between TLK and scientific knowledge into policy-making processes. For example, Reid et al. [68] document the utility of traditional knowledge in supporting information for participatory planning processes to adapt to climate change. Gill et al. [69] also document a case study in Canada where the local indigenous people participated in the monitoring process to respond to climate change and other human impacts. This brings TLK and scientific knowledge and methodologies a step forward towards integration, but integration into local and national legislations is also needed.

The integration of TLK into policy and management decision processes is of importance in Latin America, where indigenous groups and many local communities still rely largely on local ecosystems from the land and ocean for their subsistence. TLK could be an important stronghold for their livelihoods as well as the survival of their culture. For example, in the Bolivian Amazon, the value of ethnobotanical knowledge by the Tsimane' society is illustrated by the fact that mothers with higher levels of knowledge have healthier children [25]. In the case of artisanal fisheries in Latin America and the Caribbean, there have been recent calls to include TLK in strategies to achieve ecosystem management, thereby improving the livelihoods of coastal and small-scale fishers [70,71]. In Chile, as researchers explore TLK, it is becoming evident that indigenous practices and traditions of local communities reflect deeply rooted understandings of the relationships between people and nature [51,61]. Unfortunately, this kind of knowledge has been often underutilized and is rarely considered by local or regional governments [42]. The shift in focus towards management and increasing number of TLK examples should build the necessary leverage to initiate discussions about the relevance of TLK for managing and constructing policy.

5. Conclusions

In this review, we demonstrate that TLK research has grown steadily during the second half of the 20th century in Chile. TLK studies have predominantly addressed the basic knowledge dimension and focused primarily on terrestrial ecosystems, largely neglecting marine coastal areas and the relation between marine and terrestrial ecosystems. Additional efforts should be directed to study the management dimension of TLK in both terrestrial and marine ecosystems, especially

considering collaborations between social and natural scientists based on a common framework. The interdisciplinary character urgently needed in subsequent studies will enable to advance into our understanding about the way such different forms of knowledge are maintained (or are disappearing), and offer important insights into ecological processes and locally based ways in which to sustain cultures and biodiversity, and reduce local knowledge loss.

Research groups or institutions that are capable of supporting TLK studies for prolonged periods in a given region are scarce. Long-term research is necessary to document social-ecological processes and knowledge evolution. At the same time, studies should test hypotheses about the processes that generate and sustain TLK in different environmental and cultural settings, regardless of their ancestral origins. Such studies will offer important insights into ecological processes and locally based ways to sustain cultures and biodiversity and the mechanism of knowledge loss. Furthermore, such studies will support conservation and management measures with the aim to integrate both scientific along with traditional and local knowledge. In such a task, the approach analyzed through the application of the multiple evidence base approach can serve as a working path with the aim of integrating different knowledge systems.

Holistic understanding of TLK could improve new tools to conserve and manage biodiversity, by integrating social and natural sciences, basic and applied knowledge, and by incorporating anthropological and social information into the explanation of social-ecological practices. Our analysis of the progress of TLK in Chile and Latin American provides an example of how to assess the status of TLK in other countries, sharing socio-economic and cultural backgrounds. We encourage the application of the multiple evidence base approach for evaluating the progress of TLK and critically assessing its relation to current or future management policies and practices.

Our review also remarks on the necessity to assess the knowledge that has emerged from TLK to then implement systematic research to fill the gaps, particularly in the decision-taking and policy arena. Thus, our review can serve as a milestone to replicate other assessments in other Latin American and global regions, which can meet similar ecological, political, and cultural configurations.

Supplementary Materials: The following are available online at http://www.mdpi.com/2071-1050/12/5/1767/s1, Table S1: Criteria used to classify the types of studies about traditional and local knowledge; Table S2: Detailed description of publications analyzed in the review.

Author Contributions: M.G.-G. and M.I.M. conceived the study. M.G.-G., M.I.M., M.F.V.-G. and M.B. participated in the design, in the enrichment of the manuscript, in data collection, data analysis, and helped to draft the manuscript. S.G. and J.J.A. participated in the design and in the analysis and revision of the manuscript. All authors have read and agreed to the published version of the manuscript.

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