Final Report

ROADMAP FOR THE SUSTAINABLE DEVELOPMENT OF SEAWEED AQUACULTURE IN CHILE

JUNE 2025



mayma
Humanidad Emprendedora

The Nature Conservancy
Chile

Disclaimer

The research included in this report was made possible through funding by the Walmart Foundation. The findings, conclusions and recommendations presented in this report are those of The Nature Conservancy Chile and Mayma alone, and do not necessarily reflect the opinions of the Walmart Foundation.

Foreword

A Message from Mr. Juan José Donoso, Country Director of The Nature Conservancy in Chile

At The Nature Conservancy, we firmly believe that nature conservation and human development must move forward hand in hand. In that spirit, we present this report, developed in collaboration with Mayma, which outlines a roadmap for the development of a sustainable and regenerative seaweed farming industry in Chile.

This document is the result of a collaborative process that brought together coastal communities, representatives from the public and private sectors, academia, civil society organizations, and national experts. Through interviews, workshops, and field visits, a shared vision was built that recognizes the vast potential of seaweed as a driver of economic, social, and environmental development.

Seaweed farming not only represents a sustainable productive alternative, but also an opportunity to regenerate marine ecosystems, diversify local economies, and empower women, youth, and Indigenous peoples who have historically been connected to this activity.

This roadmap is a testament to the commitment, creativity, and generosity of those who have shared their knowledge, experiences, and proposals to strengthen the foundations of a shared vision for an equitable, inclusive, and regenerative marine sustainability. We hope this report serves as a useful tool for decision-making, public policy design, and the coordination of joint efforts toward a more sustainable future for our coasts and communities.

Juan José Donoso
Chile Country Director
The Nature Conservancy – Chile



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01.INTRODUCTION

The Nature Conservancy (TNC)

The Nature Conservancy (TNC) is a global environmental organization dedicated to the conservation of the lands, oceans, and continental waters on which all life depends, working toward a future where both people and nature thrive.

Through a comprehensive, collaborative approach, TNC seeks to scale the impact of conservation and sustainability. This includes protecting critical terrestrial, freshwater, and marine ecosystems that support biodiversity and provide resilient livelihoods in the face of climate change. TNC also promotes food security through sustainable and equitable practices in fisheries, agriculture, and livestock, while advancing water security and climate adaptation through nature-based solutions.

One of TNC's global strategies is restorative aquaculture, which aims to advance seaweed farming as a means to deliver ecosystem services and benefits to local and Indigenous communities. Seaweed has the potential to become a key crop, helping to mitigate the impacts of pollution and climate change in marine environments.

However, scaling seaweed farming faces several challenges, including financial, infrastructure, and regulatory barriers. The collaboration between TNC Chile and Mayma was established to identify and address these gaps in small-scale seaweed aquaculture within the Chilean context, with the goal of improving livelihoods and building capacity among seaweed gatherers and farmers.





MAYMA IS ENTREPRENEURIAL HUMANITY

Mayma is an Argentine-born NGO that aims to accelerate the shift toward a conscious, inclusive, and regenerative economy by empowering entrepreneurs and SMEs with social and environmental impact in Latin America. Mayma has mentored more than 9,600 entrepreneurs and SMEs over the past 18 years in Argentina, Chile, Colombia, Mexico, and Uruguay, supported by a network of 400 mentors. To help address the food and climate challenges of Latin America, Mayma launched its work area called Regenerative Territories, with two of its programs, Bio and Azul, in 2019, supporting farmers in the transition to regenerative agriculture and aquaculture. As an organization, it also seeks to support the recognition of women's roles, their empowerment, and gender-inclusive management. Through its Mayma Azul program, it promotes the transition toward sustainable aquaculture models with a territorial and gender approach, supporting coastal communities and small-scale producers in building resilient livelihoods.

Why this report?

In partnership with The Nature Conservancy (TNC) Chile, Mayma led the methodological development, fieldwork, and territorial coordination of this study. The objective was to identify the structural barriers faced by seaweed communities, systematize local knowledge, and co-construct a roadmap and action plan with key stakeholders, aimed at scaling sustainable seaweed cultivation as a driver of triple impact: environmental, social, and economic.

This report not only represents a rigorous diagnosis of the current state of seaweed aquaculture in Chile, but also a concrete and shared proposal to promote a sustainable industry capable of protecting marine ecosystems, generating local economic opportunities, and highlighting the fundamental role of women and communities in coastal development with a focus on sustainability.

TEAM



ANA WEBB

DIRECTOR MAYMA AZUL

Biologist and Master's in aquaculture from the Universidad Católica del Norte (Chile), with more than 17 years of experience in sustainable aquaculture in Chile and Argentina. A consultant in environment and sustainability, she promotes the SDGs and supports triple-impact projects. She has worked for more than six years on community initiatives focused on water conservation and environmental education.



JUAN PABLO MALDONADO

PROJECT MANAGER MAYMA AZUL CHILE

Aquaculture Engineer and Diving Instructor with 19 years of experience in the Chilean salmon and mussel farming industry, in addition to collaborating with coastal communities. A leader with negotiation and team management skills, he focuses on a comprehensive vision that encompasses economic, social, and environmental aspects, aiming to innovate sustainably and generate value in the industries in which he participates.



MARIELLA MIRANDA

SPECIALIST IN RESEARCH AND DOCUMENTARY COLLECTION

A Master's degree holder in Social Responsibility Management and historian, she was born in Lima, Peru, to a family connected to underwater fishing. She worked on sustainable development projects in fisheries and aquaculture. She was a social specialist in an innovation program run by the Peruvian government and the World Bank, supporting entrepreneurial fishermen and aquaculture farmers. She currently works as a sustainable development consultant.



VERÓNICA MORENO

ASSISTANT DIRECTOR MAYMA AZUL

She holds a degree in Political Science and Public Administration from the National University of Cuyo, with a diploma in Management and Public Policy. She has over six years of experience in the public sector, working in the General San Martín City Council and in the City of Buenos Aires. She has participated in citizen service projects and collaborated as a research assistant with ELA, the University of San Martín, and UNICEF.



NATALIO GODOY

SCIENTIFIC LEADER IN OCEANOGRAPHY

He graduated as a marine biologist from the Universidad Católica del Norte, the same institution where he earned his master's degree in Marine Sciences. He also holds a master's degree in Biological Sciences and a PhD in Biological Sciences, with a focus on Ecology, from the Universidad Católica. He currently serves as the leader of the Oceans strategy for The Nature Conservancy in Chile and is actively involved in marine conservation and coastal marine resource management in the Humboldt ecosystem.



CRISTHIAN DANKO

EXPERT IN OCEAN SCIENCES

A marine biologist from Arturo Prat University, he has five years of experience in environmental consulting, aboard research cruises, scientific diving, coastal monitoring, and conservation project implementation. Since July 2024, he has joined The Nature Conservancy's Oceans Strategy team in Chile.

02.EXECUTIVE SUMMARY

This report analyzes the potential and challenges of seaweed farming in Chile, within the broader context of the national aquaculture sector's transition toward more sustainable and regenerative models. While Chile remains a global leader in aquaculture production, , the industry faces environmental and economic challenges due to its dependence on intensively exploited species such as salmon. In this context, the report focuses on seaweed farming as a regenerative alternative, with the potential to diversify production and strengthen coastal economies.

The research details that, although seaweed farming currently accounts for only 3% of national production, seaweed has enormous development potential and is a key alternative for developing restorative aquaculture models. Current production is largely based on an extractive model that limits added value and generates strong pressure on natural meadows, especially in regions where artisanal extraction is still dominant. Expanding seaweed cultivation represents a strategic opportunity for building a more sustainable and balanced industry that could capture carbon, mitigate environmental impacts on aquatic ecosystems, and enable the production of seaweed for diverse uses. . In addition, this transition could reduce pressure on natural habitats while creating new opportunities for coastal communities, including women and indigenous peoples, who have historically played an important role in the use of seaweed.

In terms of challenges, the report identifies structural barriers, such as high initial costs, insufficient infrastructure and the lack of specific promotion policies.

To overcome these barriers, it recommends strengthening the value chain and legislation to facilitate the transition toward sustainable aquaculture models. In addition, the report highlight the importance of effective integration of all actors involved in the value chain, highlighting the role of women who lead harvesting and farming activities, and who play a vital role in the economy of coastal areas. As well as women in an entrepreneur and scientist role.

As a response, the report proposes a sectoral roadmap and action plan for a sustainable seaweed farming industry in Chile. The aim is to establish a triple impact model (economic, social and environmental), promoting seaweed farming in a sustainable and collaborative manner, and fostering value-added products. The roadmap and action plan integrate international recommendations, such as the adoption of regenerative technologies, the importance of support and investment in R&D&I, circular economy approaches, equitable access to reSources, investment and the strengthening of local capacities. These are organized into four strategic pillars and 20 key actions to be implemented over a five-year period.

The objective is to position Chile as a global leader in sustainable and regenerative seaweed farming, contributing to the development of a blue economy, while advancing towards the Sustainable Development Goals (SDGs).



KEY CONCEPTS

Below are the key concepts that will help to better understand both the diagnosis and the proposed roadmap and action plan:

- **Sustainable aquaculture:** Sustainable aquaculture is based on the responsible use of natural reSources, respect for the environment, and the generation of social and economic benefits, including food security, decent employment and ecosystem protection.[1]

- **Restorative aquaculture:** Model of aquaculture that seeks to improve the health of aquatic ecosystems, while enabling sustainable food production. It is based on species and techniques that regenerate degraded habitats, improve water quality and promote local biodiversity.[2]

- **Ecosystem services:** Direct and indirect benefits that humans derive from ecosystems, such as food provision, climate regulation, water purification, coastal protection, and cultural support. They are key to human well-being and sustainable development and have the potential, when properly measured, to be traded.[3]

- **Blue carbon:** Blue carbon refers to the carbon sequestered by coastal and marine ecosystems - such as mangroves, salt marshes and seagrass beds - which store it in their biomass and soils for centuries.[4]

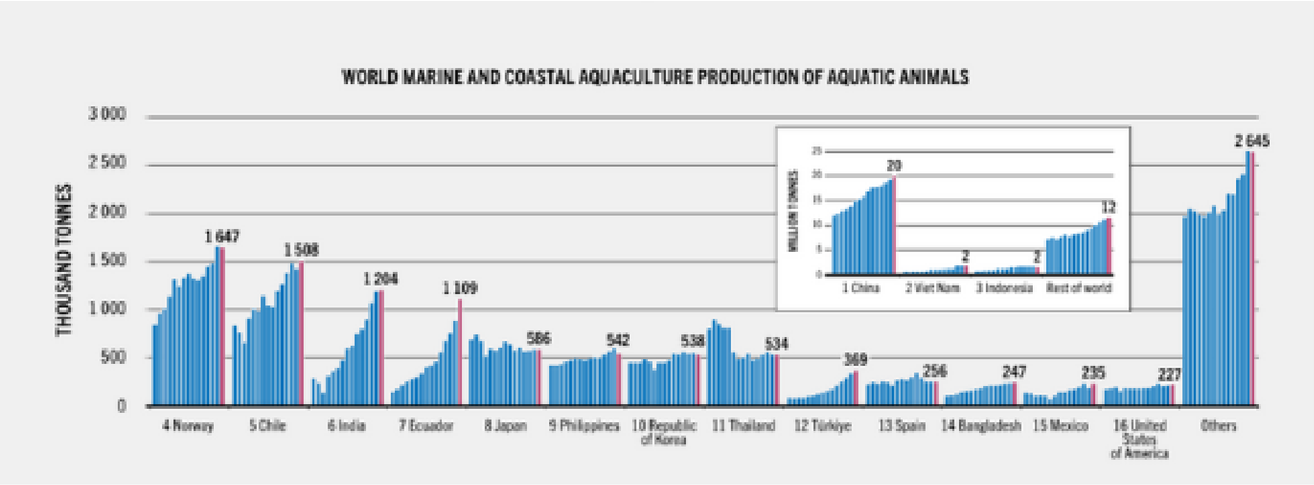
- **Blue Bonds:** Blue bonds are financial instruments that mobilize capital for projects that contribute to ocean sustainability. This includes initiatives related to sustainable fisheries, resilient marine infrastructure, pollution reduction, among others.[5]

1. (FAO, 2025)
2. (The Nature Conservancy, 2021)
3. (Millennium Ecosystem Assessment, 2005)
4. (World Bank, 2020)
5. (World Bank, 2024)



03.INTRODUCTION TO THE SITUATION OF THE EXTRACTION AND CULTIVATION OF SEAWEED IN CHILE

Chile is a country known worldwide for its fishing and aquaculture potential. **At the aquaculture level, Chile ranks 5th in the world production of aquatic animals from marine and coastal aquaculture, reaching 1,508 thousand MT of production during the year 2022.**[6]



Graph N° 1: World production of aquatic animals from marine and coastal aquaculture.
Source: (FAO, 2024 pp20).

This places Chile in a key position in the world ranking of suppliers of hydrobiological products, a position it has held for several decades. However, the demand for food of hydrobiological origin continues to increase, but the supply of wild capture species is stagnating. Therefore, the need for these to come from aquaculture is much more urgent.[7] This is because aquaculture with sustainable practices helps to reduce fishing effort and secure quantities of reSources, without putting greater pressure on the natural biomass of different species.

Chile has a series of aquaculture products, among them mollusks, for which Chile is in 2nd place worldwide, behind China. As well as in relation to salmon, where they occupy the 2nd place after Norway.[8]

In relation to salmon farming, a species that characterizes the country, to date it is estimated that there are more than 1300 salmon farming concessions in Chile. However, in spite of the millions of pesos generated from exports of this species, salmon farming has been the target of criticism for some years due to negative environmental impacts linked to this aquaculture, which include concerns about the sustainability of the industry in view of the possibility that not all producers correct their practices.[9]

Given this scenario, the growth of aquaculture under a sustainable approach is key to ensure that this production minimizes negative environmental impacts. However, there are some cases in which aquaculture has already generated negative impacts on ecosystems and therefore it is necessary to evaluate alternative crops that are not only sustainable, but can also be managed with a regenerative approach that allows improving the situation of various aquatic spaces, while adding to development processes with an inclusive approach in coastal communities.[10] The aquaculture we should be aiming for is one that is executed under a sustainable and triple impact model, in which progress is made considering economic, social and environmental sustainability.

One of the reSources with potential to achieve this type of process is seaweed. The cultivation of seaweed in Chile can be recorded in Sources from the 1960s, focused mainly on the agar-producing species, Agarophyton chilensis (known as pelillo). According to Camus and Usandizaga, by the 1970s, some natural meadows of this seaweed were already showing a reduction in their productivity due to overexploitation, leading to the start of the cultivation of this red seaweed in the early 1980s.[11]

Although the history of seaweed cultivation in Chile, in terms of recorded data, may be about 60 years old, fishing practices and the use of seaweed have been recorded since pre-Hispanic times, evidencing the ancestral links that the Chilean people have had with this reSource, from consumption to use as an agricultural input.[12]

6. (FAO, 2024)
7. (Camus & Usandizaga, 2023)
8. (FAO, 2024)
9. (Camus & Usandizaga, 2023)
10. (The Nature Conservancy, 2021)
11. (Camus & Usandizaga, 2023)
12. (CeBiB Chile, 2016)



Although the history of seaweed cultivation in Chile, in terms of recorded data, may be about 60 years old, fishing practices and the use of seaweed have been recorded since pre-Hispanic times, evidencing the ancestral links that the Chilean people have had with this reSource, from consumption to use as an agricultural input.

Mayma team's own travel record in Chile, August 2024

SEAWEED PRODUCTION IN CHILE

According to FAO reports, Chile ranks 11th in seaweed aquaculture production worldwide, reaching 13 thousand MT during the year 2022. This places it below the Asian powers in seaweed cultivation, but leading the production of this reSource in American countries.

Mayma team's own travel record in Chile, August 2024

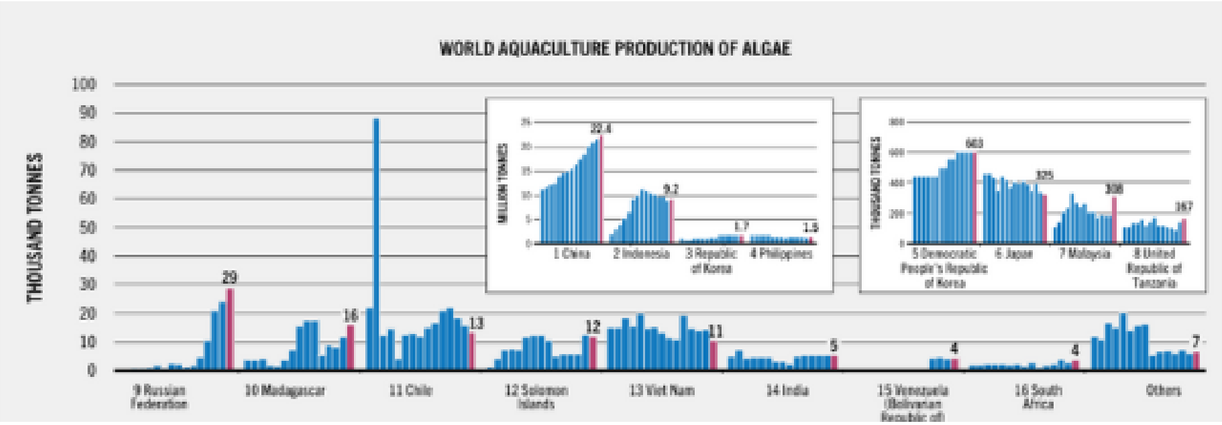


Figure N° 2: World aquaculture production of seaweed

Source: (FAO, 2024 pp 21).

Based on SERNAPESCA data, seaweed is the 3rd hydrobiological reSource with the highest number of formally registered production centers, reaching 1,101 registered centers by 2023.

REGION	ALGAE	CRUSTACEANS	MICROALGAE	MOLLUSKS	OTHERS	FISH
XV	0	5	0	0	0	7
I	4	0	4	15	2	5
II	6	0	0	13	2	4
III	38	0	0	42	2	5
IV	25	6	2	63	35	15
V	5	3	0	7	4	14
RM	0	1	0	0	0	25
VI	0	1	0	1	1	4
VII	2	0	0	3	0	8
XVI	0	0	0	0	0	10
VIII	12	0	1	12	4	35
IX	3	0	0	64	0	97
XIV	9	1	0	23	0	47
X	738	4	0	1 261	13	658
XI	233	0	0	5	0	740
XII	26	1	0	25	0	140
GRAND TOTAL	1101	22	7	1 534	63	1 814

Graph No. 3: Number of centers registered in the National Aquaculture Register, by species group.

Source: (SERNAPESCA, 2024 pp2 " There are centers that have authorized more than one group of species, therefore, they are counted in each of them").

However, the use of algae in Chile, as previously mentioned, does not come solely from cultivation.

However, as previously mentioned, seaweed landings in Chile do not only come from cultivation. Currently, the most common practice in the country is the extraction of seaweed from the natural environment, using both direct extraction practices and the collection of stranded seaweed. Likewise, although there are natural meadows in intermediate extraction stages, there are meadows with overexploitation problems in various areas of the country, due to the use of more intensive extraction methods, which generate deterioration in the ecosystems and social conflicts.[13]

Associated with seaweed extraction, according to SERNAPESCA, 22,601 women and 51,994 men are formally registered as seaweed fishers[14] in Chile. By 2023, the region with the highest number of registered seaweed fishers is Los Lagos (X).

In comparison to other extractive practices, algueros are in 2nd place, behind fishers of other reSources and above the number of shipowners and divers.

13.(Laboratory for the Modeling of Complex Ecological Systems (LAMSEC), 2020).

14. According to SUBPESCA's glossary, the term "alguero" is understood to mean "the artisanal fisherman who harvests and harvests seaweed, with or without the use of an artisanal vessel". (SUBPESCA)

REGION	ALGAERO		SHIPOWNER		DIVER		FISHERMAN		Total		GRAND TOTAL
	WOMEN	MAN	WOMEN	MAN	WOMEN	MAN	WOMEN	MAN	WOMEN	MAN	
XV	28	322	14	196	0	74	88	1 618	107	1 744	1 851
I	171	817	12	275	0	220	275	1 262	422	1 792	2 214
II	227	1 675	20	457	1	443	255	1 736	442	2 871	3 313
III	500	1 976	18	457	4	387	389	2 260	837	3 528	4 365
IV	426	2 834	20	1 101	4	909	311	3 852	665	5 183	5 848
V	304	2 332	35	844	5	270	242	4 682	487	5 410	5 897
VI	202	545	3	57	0	37	26	375	220	749	969
VII	261	995	17	379	1	115	463	2 284	613	2 540	3 153
XVI	58	140	5	29	0	20	50	125	103	213	316
VIII	4 127	7 819	205	2 555	0	1 547	3 052	13 955	5 798	16 259	22 057
IX	401	859	11	164	1	29	174	753	484	1 148	1 632
XIV	861	1 867	37	550	5	540	263	2 223	1 018	2 997	4 015
X	13 481	21 889	94	2 745	29	4 815	1 202	9 728	13 556	23 000	36 556
XI	827	2 646	30	421	8	539	442	1 919	862	2 856	3 718
XII	727	5 278	59	672	2	1 002	296	4 116	824	6 289	7 113
Total	22 601	51 994	580	10 902	60	10 947	7 528	50 888	26 438	76 579	103 017

Graph N° 4: Number of registered fishermen by catego rías and region, 2023.

Source: (SERNAPESCA, 2024 pp2.)

Infographic Nº 1: Composition of the sector by macro zone (RPA)

Regarding the composition by macro-zone, the largest number of seaweed farmers are located in the southern macro-zone and the one with the smallest presence is the northern macro-zone.

NORTH

Arica y Parinacota, Tarapacá, Antogafasta, Atacama, Coquimbo

17,583

Persons registered in the RPA 2023
15,898(2021) - 16,660 (2022)

	2,473 Registered in the RPA 2023 1.963 (2021) - 2.185 (2022	15,110 Enrolled in the RPA 2023 13.935 (2021) - 14.475 (2022)
COLLECTORS	**1.352** 1.279 (2021)- 1.346 (2022)	**7.620** 6.045 (2020) - 7.620 (2021)
SHIPBUILDERS	**85** 76 (2021)-79 (2022)	**2.490** 2.416 (2020) - 2.451 (2021)
DIVER	**9** 8 (2021) - 8 (2022)	**2.032** 2.055 (2021) - 2.046 (2022)
FISHERMEN	**1.318** 851 (2021)- 1.025 (2022)	**10.727** 9.470 (2021) - 10.011 (2022)

CENTER

Valparaiso, O´Higgins, Maule, Ñuble, Araucanía, Biobío

34,015

Persons enrolled in the PR 2022
31.120 (2021) - 32.860 (2022

	7.704 Enrolled in the RPA 2023 7.121 (2021) - 7.373 (2022)	26.311 Inscritas en el RPA 2023 19.301 (2021) - 24.999 (2022)
COLLECTORS	**5.353** 5.168 (2021)- 5.199 (2022)	**12.715** 12.774 (2020) - 12.698 (2021)
SHIPBUILDERS	**276** 253 (2021)- 270 (2022)	**4.025** 3.992 (2020) - 4.024 (2021)
DIVER	**7** 7 (2021) - 7 (2022)	**2.044** 1.926 (2021) - 1.910 (2022)
FISHERMEN	**4.008** 3.500 (2021)- 3.763 (2022)	**22.167** 20.894 (2021) - 21.423 (2022)

SOUTH

Los Ríos, Los Lagos, Aysén y Magallanes

51.395

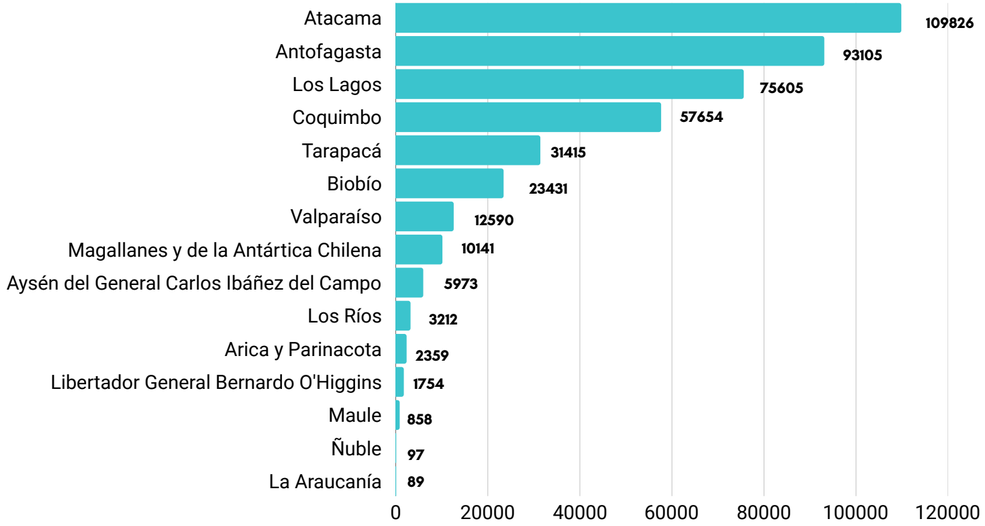
Persons enrolled in the PR 2023
49.146 (2021) - 50.037 (2022

	16.258 Enrolled in the RPA 2023 15.143 (2021) - 15.623(2022)	35.350 Enrolled in the RPA 2023 34.003 (2021) - 34.414 (2022)
COLLECTORS	**15.895** 14.841 (2021)-15.294 (2022)	**31.676** 30.845 (2020) -31.138(2021)
SHIPBUILDERS	**220** 206 (2021)-211(2022)	**4.392** 4.328 (2020) - 4.351 (2021)
DIVER	**44** 45 (2021) - 43 (2022)	**6.894** 2.055 (2021) - 2.046 (2022)
FISHERMEN	**2.206** **1.989** (2021)- 2.083 (2022)	**17.989** **17.197** (2021) - 17.522(2022)

Source: (SERNAPESCA, 2023 pp 10)

On the other hand, with respect to artisanal seaweed landings during 2024, a total of 428,119 tons was reached, with the main landing region being the Atacama with 109,836 tons.

Figure Nº 5: Artisanal landings of seaweed by region, year 2024.

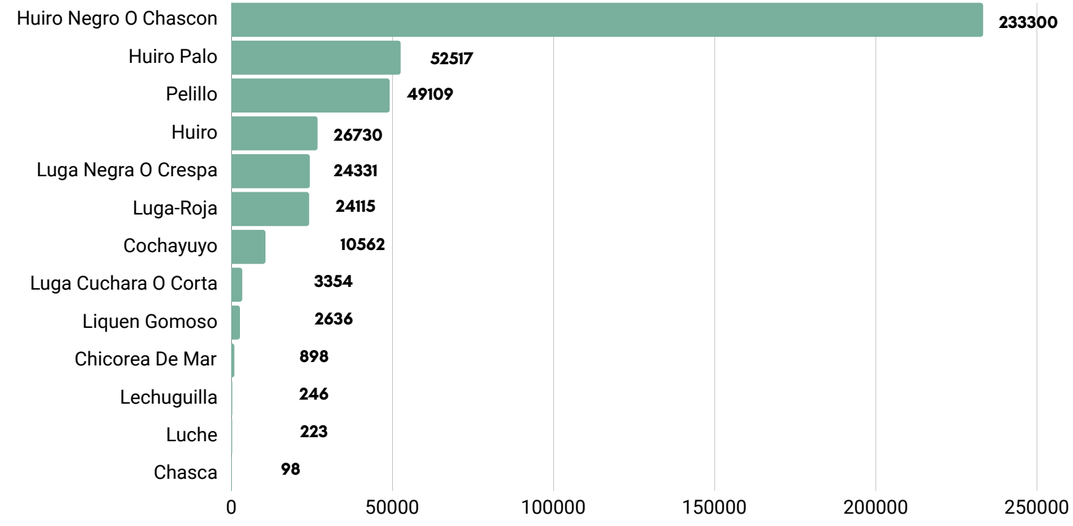


Own elaboration (Source: (SERNAPESCA, 2024)



DOf the total artisanal landings registered during the year 2024, the seaweed with the highest figure is the black seaweed or chascón, with a figure of 233,300 tons, followed by the huiro palo with 52,517 tons and by the pelillo seaweed, with an annual landing of 49,109 tons.

Graph No. 6: Artisanal seaweed landings by species, 2024



Own elaboration (Source: (SERNAPESCA, 2024)



Infographic N° 2: Artisanal fishermen/ women organizations at national level, 2023

1850

ORGANIZATIONS REGISTERED IN ROA (RETURN ON ASSETS) 2023

1733 (2021) - 1779 (2022)

448
Composed only of men
444 (2021) - 448 (2022)

1.665
Women in positions in Organizations
1.453 (2021) - 1.544 (2022)

455
Presidents
392 (2021) - 416 (2022)

562
Treasurers
493 (2021) - 521 (2022)

648
Secretaries
568 (2021) - 607 (2022)

1.321
Composed of women and men
1.231 (2021) - 1.260 (2022)



81
Composed only by women
58 (2021) - 71 (2022)

3.744
Men with positions in Organizations
3.612 (2021) - 3.676 (2022)

1.390
Presidents
1.333 (2021) - 1.362 (2022)

1.172
Treasurers
1.137 (2021) - 1.157 (2022)

1.182
Secretaries
1.142 (2021) - 1.157 (2022)

Regarding landings figures, it is necessary to point out that **"Chilean seaweed production comes mainly from the extraction of natural meadows (97%) and only 3% from cultivation, (...) showing an inverse pattern to world production, where aquaculture production dominates"[15] and evidencing the current fishing effort of natural seaweed meadows in Chile.**

The cultivation of seaweed in Chile is reduced mainly to pelillo. Although this activity is developed in centers located in the regions of Atacama, Coquimbo, Biobío, Los Lagos and Aysén, it is the communes of Maullín and Ancud (Los Lagos Region) where the largest number of cultivation plots and a large part of the national production of this resource is concentrated. This reality was evidenced in the field visit made by the team in August 2024.

LAS ALGAS COMO UNA ALTERNATIVA PARA COMUNIDADES

Within the formally registered cultivation centers in Chilean territory, there are 3 groups of actors:

1.

LARGER SCALE BUSINESS OR INDUSTRIAL CROPS

2.

SMALL-SCALE CULTIVATION IN THE HANDS OF NATURAL PERSONS (ENTREPRENEURS OR SMALL BUSINESSMEN).

3.

SMALL-SCALE CULTIVATION IN THE HANDS OF LEGALLY CONSTITUTED ARTISANAL FISHERMEN'S ORGANIZATIONS (OPAS). THESE CAN CARRY OUT SEAWEED AQUACULTURE THROUGH AMERB AND CC.AA, WITH THE OBJECTIVE OF PROVIDING THEM WITH PRODUCTIVE DIVERSIFICATION ALTERNATIVES TO THEIR TRADITIONAL EXTRACTIVE PRACTICE.[16]

Based on this premise, the potential number of fishermen's associations that could opt for this productive diversification alternative is 1,850 registered organizations at the national level.

15. (Camus & Usandizaga, 2023)
16.(Camus & Usandizaga, 2023)

However, entering into seaweed cultivation or making the leap from extraction to cultivation could be a challenge for coastal communities. Among the challenges identified are the high investment costs, the validation of business models that can ensure the return on investment, aspects related to technical knowledge, the possibility of having culturally appropriate training that responds to the learning needs of the communities, the time required to obtain permits, among other aspects that are detailed later in the diagnostic stage of this report.

In relation to the cultivation of seaweed by indigenous communities, since the enactment of the Lafkenche Law in 2008, the Mapuche-Lafkenche people achieved the creation of coastal marine areas for indigenous peoples, based on their recognition as ancestral inhabitants of the coastal area. This allows them to request a marine coastal space for native peoples (ECMPO).[17]

This law has opened up opportunities for the cultivation and management of seaweed to members of indigenous populations, but it has also initiated a series of complaints or controversies over the use of these areas by non-indigenous Chileans.[18]

POTENTIAL IDENTIFIED FOR SEAWEED UTILIZATION

Currently, the main product exported from seaweed in Chile is as dry raw material without processing or added value[19]. At the national level, the use of seaweed is small in proportion to exports and is mainly destined for alginates and their derivatives, as well as for the production of biostimulants and agricultural inputs with the characteristics of "organic products".[20]

However, there are currently initiatives of Chilean companies that have sought to innovate with the development of value-added products, managing to work with different foods, ingredients or food inputs and even nutritional products in presentations such as flours or capsules. However, these products are not yet of mass consumption in Chile and entrepreneurs must overcome daily challenges of consumer education about the benefits of human consumption of seaweed or products enriched with seaweed.[21]

Likewise, although direct human consumption of seaweed in Chile is an ancestral food practice, it is only maintained in coves and coastal populations and is not yet considered a massive practice.[22]

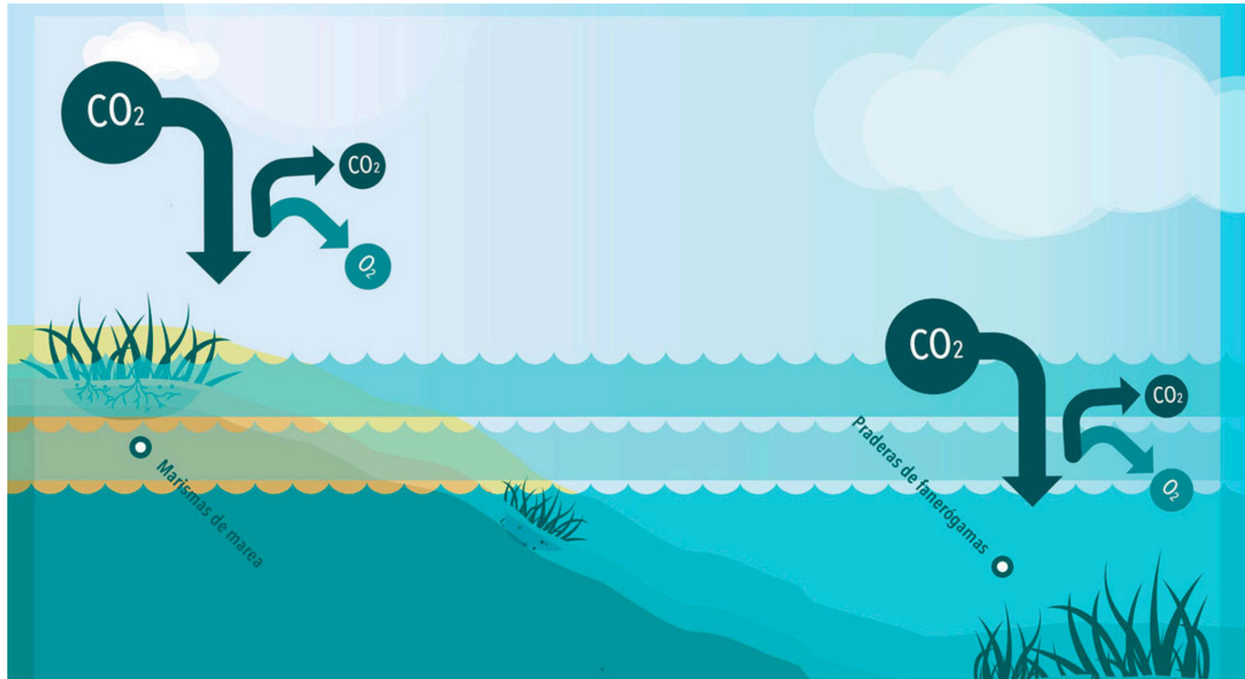
17. (Camus & Usandizaga, 2023)
18. Summary of reports and news on Lafkenche Law: (24 hours - TVN Chile, 2024)/ (Press Room, 2024)/ (Bio Bio, 2024)/ (Servicio país, 2020)
19. (Camus & Usandizaga, 2023)
20. (Camus & Usandizaga, 2023)
21. Web portals: Kollofken: (Kollofken, n.d.)/Amarea: (Amarea, n.d.)/Adama: (ADAMA, n.d.).
22.(Canal 13 Chile, 2022)
23. (World Bank, 2020)

SEAWEED AND THE FUTURE OF BLUE CARBON IN CHILE

Seaweed are also valued for being a key component when talking about blue economy models and the possibility of measuring and obtaining blue carbon from the management or expansion of their meadows, as well as the promotion of their cultivation. This implies that seaweed have the potential to sequester carbon through natural processes and therefore the need to measure this activity.[23]

This potential is not something new for the seaweed sector in Chile. The populations that have been linked to this activity for decades, as well as the members of the academy that have studied it, affirm that for them seaweed are a fantastic reSource, which in addition to their multiple potentialities of use by human beings, are a refuge and synonym of life for other species in the sea, at the same time that they are prairies with a high impact on the health of the ocean.

However, in order to talk about blue carbon, it is necessary to be able to quantify the contributions of seaweed in this line and determine the best strategies to take advantage of this specific benefit. This topic is definitely a possibility that the great powers are looking for, but it is still a methodology in validation for which there are no final and proven results.





In 2020, the World Bank elaborated a blue carbon roadmap for Chile, which took special care in aspects such as:

i) the adequate quantification of the contribution of marine ecosystems to blue carbon, which, in the case of seaweed, also implies quantifying their true contribution
ii) developing strategies to mobilize financing for these purposes,

iii) developing capacities and public policies that help generate a facilitating environment for blue carbon projects,

iv) carrying out pilot projects, among others[24]**.**

Although when talking about blue carbon we are not only talking about seaweed, these can be a species with potential for its capture. Studies related to this can also strengthen the value of seaweed as a species that contributes to the regeneration of aquatic areas. However, the measurement of these aspects must be adequate, in order to know what are the levels of contribution of seaweed and what would be the level of cultivation or the size of the meadows necessary to achieve these objectives. This is part of the concern of some of the actors interviewed in this study and which will be discussed in more detail in the diagnostic stage of this report.

Mayma team's own travel record in Chile, August 2024

24. ((World Bank, 2020)

SUMMARY OF SIMILAR/LINKED INITIATIVES IDENTIFIED

Throughout the study and the different stages of validation and co-creation with key stakeholders, a series of initiatives have been identified that are linked to, inspired by or add up to achieving a more sustainable seaweed farming industry in Chile. Below is a summary of these initiatives that have been taken into account and used as a reference throughout this process.

Global Principles of Restorative Aquaculture[25]

Responsible stakeholder: The Nature Conservancy

The document "Global Principles of Restorative Aquaculture" presents restorative aquaculture as an opportunity, promoting an aquaculture model that seeks to improve the health of aquatic ecosystems while enabling sustainable food production. The document highlights restorative aquaculture as an aquaculture practice (commercial or subsistence) that provides direct ecological benefits to the environment, with the potential to generate distinctly positive environmental outcomes.

The document proposes a path to achieve this aquaculture model, which begins with reducing the negative impacts of aquaculture activities, continuing to grow towards sustainable aquaculture development and thus achieving a restorative aquaculture that strikes a balance between production and the generation of positive benefits for ecosystems.[26]

This is highly viable with species such as seaweed, since in addition to being a reSource that can be put to a variety of uses, they are wildlife refuges, temporary habitat for species in early stages of development, have the potential to clean up the oceans and mitigate climate change, and their cultivation can be combined with other species of high commercial value.

Finally, the document proposes 6 global principles of restorative aquaculture, which are: 1) Locate crops in places where environmental benefits can be generated. 2) Cultivate species that can provide environmental benefits, 3) Prioritize the use of aquaculture equipment with improved environmental benefits, 4) Adopt aquaculture practices that can enhance local environmental benefits, 5) Seek to farm at an intensity or scale that is appropriate to improve ecosystem outcomes, and 6) Recognize the social and economic value of the environmental benefits provided .[27]

Roadmap For Achieving The Kelp Forest Challenge[28]

Responsible stakeholder: Kelp Forest Alliance

The document "A roadmap for protecting and restoring 4 million hectares of kelp forest" is a global roadmap launched by the Kelp Forest Alliance with the aim of protecting and restoring four million hectares of kelp forests by 2040. These marine ecosystems are vital to biodiversity, coastal communities and the global economy, with an estimated value of at least $500 billion a year. However, they face serious threats such as climate change, pollution, overfishing and habitat loss. The initiative proposes coordinated and urgent global action to reverse their decline. The challenge proposes to protect three million hectares and restore additional areas through methods such as kelp planting, the elimination of invasive species, the integration of seaweed cultivation techniques and the use of new technologies. It highlights the need for collaboration between governments, communities at large, businesses, scientists and NGOs to achieve the goals, as well as the creation of strategic alliances and monitoring networks.

The importance of policy reforms at the local, regional and international levels is also raised. It is recommended to include kelp forests in marine conservation plans, implement policies that add to their management, and create innovative financial mechanisms to sustain projects in the long term, such as blue bonds and credits for ecosystem services.

The document highlights the crucial role of education, outreach and the creation of emotional ties with Kelp forests. Through art, gastronomy, media and citizen science, it seeks to raise public awareness and foster a culture of care for these underwater ecosystems, essential for a healthy ocean and a sustainable future. One of the objectives is to generate a global movement that will lead more people to the conservation of these habitats.

In relation to cultivation, the roadmap reflects on the benefits of being able to cultivate seaweed in adequate and controlled spaces, allowing its use for both products and conservation purposes.

25. (The Nature Conservancy, 2021)
26. (The Nature Conservancy, 2021)
27. (The Nature Conservancy, 2021) / For more information, please review the scientific article "Global principles for restorative aquaculture to foster aquaculture practices that Benefit environment" published in Conservation Science and Practice, 2023.
28. (Kelp Forest Alliance, 2023)

The Blue Revolution Fund (BRF)[29]

Responsible Actors: Hatch Blue and The Nature Conservancy

The Blue Revolution Fund (BRF) is an impact investment fund focused on sustainable aquaculture. Established by Hatch Blue and advised by The Nature Conservancy, the fund seeks to advance technologies and practices that improve ocean health, address the effects of climate change and support coastal communities.

BRF has already invested in six start-up companies developing innovative solutions in aquaculture. These investments aim to improve efficiency, reduce emissions and promote regenerative practices in the sector. In addition to financial aspects, the BRF incorporates environmental objectives into its investment structure. Hatch Blue manages the fund, leveraging its expertise in aquaculture and alternative foods, while The Nature Conservancy acts as conservation manager, ensuring that each investment generates significant environmental results.

As part of this alliance, Hatch Blue's consulting unit (Hatch Innovation Services) analyzed various stages of seaweed cultivation development in different regions, highlighting essential policy lessons.[30] This consultancy reviewed cases such as South Korea, a world leader in seaweed production. This case stands out for the support given by the government in aspects such as: seed, cultivation, processing, research, innovation and market studies.[31]

The Norwegian case was also reviewed, a case that stands out for the link between the government and the promotion of innovation and development processes. As well as for proposals that seek to promote combined cultivation of seaweed, shellfish and fish. In addition, as with other species, Norway is seeking integrated and sustainable development, which goes hand in hand with adequate infrastructure, the strengthening of technical and commercial capacities of stakeholders and support in attracting investors.[32]

Finally, the study presents the case of New Zealand, where the seaweed industry is still emerging. This case is highlighted by the initial detection of seaweed with commercial potential, as well as the promotion of sustainability and resilience. The New Zealand approach focuses on valuing the knowledge of indigenous peoples, simplifying regulations and boosting research funding.[33]

Guidelines for sustainable aquaculture[34]

Responsible Actors: FAO

FAO's "Guidelines for Sustainable Aquaculture" establishes a comprehensive voluntary framework to guide responsible, equitable, sustainable and food-secure aquaculture development worldwide. These guidelines respond to the rapid growth of the sector, highlighting its potential to contribute significantly to food security, nutrition and economic development, especially in vulnerable communities. They also recognize the social and environmental risks associated with this growth, and promote responsible practices appropriate to each ecosystem and an ecosystem approach that integrates aquaculture into sustainable food systems.

The guidelines cover principles such as environmental sustainability, social equity, rule of law, inclusiveness, participation and transparency. The need for coherent policy and institutional frameworks is underscored, along with strategies that ensure the sustainable use of water, land, genetic reSources, and the conservation of aquatic biodiversity. It also emphasizes the need for biosafety, animal welfare, and adaptation to climate change, including resilient and low environmental impact practices.

In addition, the document stresses the importance of sustainable aquaculture value chains, fair access to markets, and the reduction of food losses and waste. It promotes gender equality, youth empowerment, inclusion of marginalized groups and decent work at all stages of the aquaculture process. It is suggested that public-private cooperation and responsible investment be strengthened to improve the competitiveness and sustainability of the sector.[35]

29. (The Nature Conservancy, 2024)
30. (Rieve, 2025)
31. (Rieve, 2025) (The Fish Site, 2025)
32. (Rieve, 2025) (The Fish Site, 2025)
33. (Rieve, 2025) (The Fish Site, 2025)
34. (FAO, 2025)
35. (FAO, 2025)

Project CHILE 2050[36]

Responsible Actors: Congreso Futuro, Fundación Encuentros del Futuro, Fundación Chile

The project seeks to develop a shared vision for the future of Chile, focused on overcoming current and future challenges and identifying the changes that are necessary. To achieve this, different thematic working groups have been organized in order to bring together various key actors in different topics and to develop strategies for future work. One of these roundtables is entitled "seaweed: an opportunity for Chile". The objective of this roundtable is to develop a comprehensive strategy to promote the seaweed sector in Chile, considering its different uses, cultivation, conservation and sustainability. The Nature Conservancy Chile and Mayma are part of three sub-tables: Consumption and Valuation, Development and Cultivation, Conservation/Restoration/Sustainability.

For the work in these sub-tables, we have been coordinating with the main experts and specialists in the sector, holding meetings and work and co-creation sessions.

Dissemination and technology transfer of best practices in the development of value-added products based on regional seaweed harvested by coastal communities of Atacama.[37]

Responsible parties: Fundación Cocinamar and the Atacama Productive Development Committee.

This project aims to "strengthen and optimize the production and commercial chain of seaweed in the Atacama region, allowing to improve the technical, logistical and market capabilities of local producers and harvesters"[38]. In their first event held on April 7, 2025, they were able to count on the participation of 2 international experts specialized in seaweed, market trends and seaweed processing opportunities in models such as "biorefineries". This project aims to improve capacities and focus on the productive diversification of seaweed and aspects related to its commercialization and consumption.

36. (Proyecta Chile 2050, 2025)
37. (Corfo, 2025)
38. (Seafood Chile, 2025)

National Bonus Program for seaweed Re-stocking and Cultivation[39]

Responsible party: INDESPA

A national program that allocates $1.2 billion to support artisanal fishermen, their organizations and microenterprises in seaweed cultivation and restocking projects. This program seeks to increase the abundance of ecologically and economically important seaweed in Chile[40]. This program came into operation in 2018 and constitutes a benchmark of experiences in financing seaweed cultivation from the government.

Various projects funded in seaweed[41]

Actors involved: CORFO, FONDECYT, FONDEF

Since 2004, different entities have financed basic and applied research related to seaweed in Chile. For example, CORFO has executed projects related to seaweed, mainly innovations or projects related to the development of value-added products, innovation and technology for cultivation or processing, market studies, among others that have allowed different actors to make progress related to the seaweed value chain.

FONDECYT has projects such as the production of biohydrogen from seaweed, research on epidemiology or research that seeks to test whether some components of seaweed can help regulate the glycemic response generated by starch-rich foods. And in the case of FONDEF, projects related to biofertilizers and bioplastics stand out.
All these projects are an example of the efforts being made in the country to investigate more about the potential of seaweed and to innovate in relation to their uses.

39. (Subpesca, 2017)
40. (Subpesca, 2017)
41. (Corfo, 2025)

04.OBJECTIVES OF THE REPORT

This project has diagnostic and analytical components, as well as the development of a roadmap proposal and its respective Action Plan. Mayma's work includes desk research and the deployment of Mayma Azul experts in coastal communities, mainly in the X Region, to conduct virtual and face-to-face interviews with seaweed farming actors and validation and co-creation events.

With this, the Nature Conservancy will work in collaboration with academia and industry on pilot farms to demonstrate the operational, environmental and economic feasibility of community-based seaweed farming and to be able to consider using seaweed aquaculture to mitigate the impacts of other aquaculture activities on water quality.

The first component is focused on the preparation of a prospective study, an economic and market study, and a data analysis. The specific objectives are as follows:

- To carry out a survey of available Sources on the potential of seaweed cultivation with a regenerative approach in Chile.
- Interview key stakeholders involved in seaweed cultivation, including representatives from the public and private sectors.
- Conduct an economic and market study regarding a future sustainable and regenerative seaweed farming industry in Chile.
- Conduct an analysis of the information gathered in order to identify gaps to be overcome.

The second component's main objective is to draw up a roadmap that is validated by key stakeholders and whose content can be agreed upon and representative. To this end, the following specific objectives have been set:

- Development of the preliminary version of a shared vision and roadmap for a sustainable Chilean seaweed aquaculture industry that benefits the entire value chain (companies, marketers, suppliers, processors and seaweed communities); identifying social and livelihood opportunities, market challenges and opportunities; technical challenges and necessary investments in infrastructure and support services at scale, along with public policy development needs.
- Carry out actions to validate the content of the roadmap with key stakeholders in order to generate a shared vision.

The third component aims to develop an Action Plan for the fulfillment of the actions proposed in the roadmap. For this purpose, the following specific objectives have been established:

- Development of the preliminary version of the Action Plan, based on a work of co-creation with key stakeholders, so that they are the ones who propose the activities, plans, projects, regulations, among others, that are necessary to achieve the actions proposed in the agreed roadmap.
- Review the co-created version and enhance the most relevant actions.
- Carry out actions to validate the content of the Action Plan with key stakeholders and experts, thus seeking the involvement of those stakeholders who will have to carry out or implement the different activities proposed.
- Development of a timeline to visualize the action plan over time and to follow up on it.

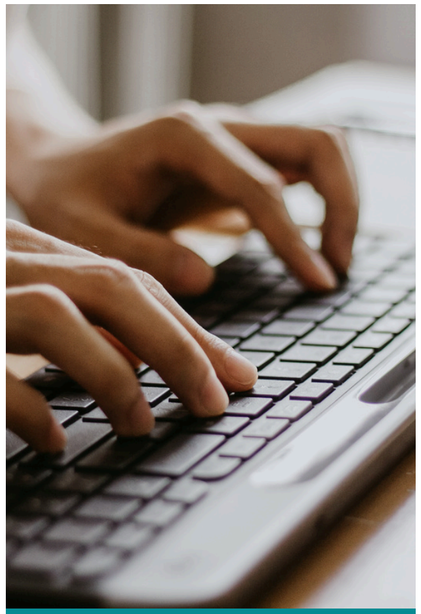


Mayma team's own travel record in Chile, August 2024

05.METHODOLOGICAL ASPECTS

For the preparation of this study, a survey methodology was designed and a roadmap was prepared[42], inspired by previous Mayma studies, as well as by the review of similar roadmaps published in the last 10 years in South Pacific countries. Likewise, participatory methodologies have been used for validation stages and for the design of a joint Action Plan to achieve the activities proposed in the Roadmap.

The methodology designed has 5 stages:



Documentary survey and bibliographic review



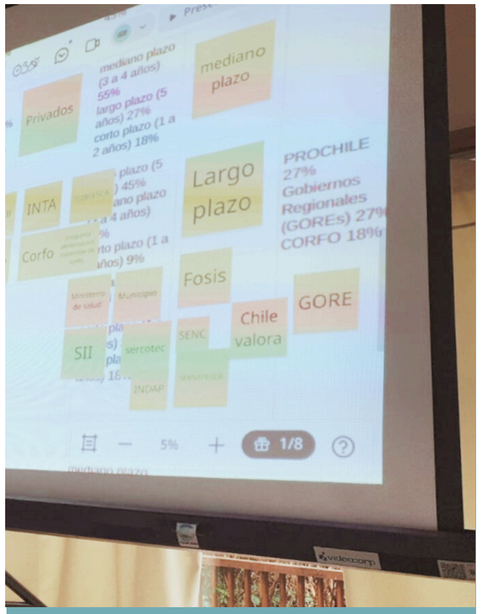
Interviews, meetings, surveys, visit to the territory and market study



Workshop to validate the diagnosis and co-creation of the roadmap



Validation with experts and drafting of the Final Roadmap and



Co-creation of the Action Plan.

42. For a detailed description of the Stakeholder Information Gathering Methodology, see Annex II.

During the process of designing the methodology to be applied in this study, the different groups of key stakeholders to be contacted were determined, as well as the characteristics to be analyzed and the different response categories or aspects to be consulted. This has allowed us to systematize the information gathered and to incorporate previous surveys conducted by the TNC team.

FIRST STAGE: DOCUMENTARY SURVEY AND BIBLIOGRAPHIC REVIEW.

The first step for the elaboration of this study was the review of available bibliography, its problems, the current situation of its extraction, its cultivation, main seaweed farming regions, studies and available statistics on landings. Instructive documentation on management plans and good farming practices. Studies on its regenerative potential. Among others that could be considered key for the development of the study. Although this is the stage with which this process began, the collection of useful Sources has been maintained throughout the study.

SECOND STAGE: DIAGNOSIS: INTERVIEWS, MEETINGS, SURVEYS, MARKET STUDY AND VISIT TO THE TERRITORY.

After the initial review of the bibliography and available Sources, the battery of questions for the forms for each type of stakeholder was designed.

The study started with 23 forms previously developed by the TNC Chile team. This served as a base and was complemented with additional questions that allowed us to expand the information base collected in each survey. Likewise, the number of interviewees was expanded.

Taking into account that the forms only provided us with raw data, each stakeholder was contacted for a call or meeting. In addition to the forms, we were able to learn more about each stakeholder's experience and vision, which helped us to better understand the answers that the different stakeholders left on their forms, not only their answers, but also the justification that allows us to understand each one of them.

In relation to the field work, from August 26 to 30, 2024, a week-long field visit was made to the seaweed communities in the X Region. During the trip, in addition to collecting information related to the forms, we were able to discuss with the actors their vision, identified bottlenecks and perspective with a view to a regenerative approach to the seaweed industry in Chile.
This trip allowed the team to access the accounts and experiences of actors who required face-to-face contact in order to gather their perspectives and experiences. Likewise, the trip helped in the collection of testimonies within the framework of the study.[43]

Although close contact was made with many of the stakeholders contacted, the final diagnosis was based on the 57 completed diagnostic forms. These online forms were to be filled out voluntarily and were sent to all the stakeholders contacted and to those invited to the face-to-face workshop. Although the information gathered in virtual and face-to-face meetings and interviews has been very valuable, the diagnostic form was the tool that allowed us to gather direct input from each stakeholder, ensuring that we could count on analysis inputs provided voluntarily, directly and completed personally by each participant.[44]

Finally, this diagnostic stage culminated with the preparation of a market study that has provided greater clarity on the seaweed market and the real growth space that a Chilean industry could have.[45]

Mayma team's own travel record in Chile, August 2024



43. For the results obtained in the diagnosis, see Annex III.
44. For the results obtained in the diagnosis, see Annex IV.
45. For the complete results of the Market Study, see Annex V.

THIRD STAGE: WORKSHOP FOR VALIDATION OF THE DIAGNOSIS AND CO-CREATION OF THE ROADMAP

With a first complete version of the analysis of the information gathered, we were able to prepare preliminary versions of: future vision, SWOT diagnosis, identification of objectives to be achieved and gaps to be overcome to achieve them, and a proposal of lines of action to be the backbone of a road map.

This information was worked on during a workshop with a methodology designed for validation and collaborative creation in which final and validated versions of the diagnostic information were obtained, as well as the key inputs for the design of the preliminary version of the roadmap for seaweed cultivation in Chile under a sustainable approach.

The methodology allowed the actors to work in an orderly, respectful and collaborative manner. Ensuring that everyone can provide their opinions and that the co-creation process is based on an attentive listening to the needs and expectations of all attendees, in order to obtain results that are the fruit of collaborative work.

This third stage has made it possible to generate spaces for intersectoral articulation between actors who had not previously sat down to talk. It has also helped the communities not only to feel heard (as was the case during the trip), but also to feel more effectively incorporated into decisions, listening to their concerns and aspirations and taking them into account in a sectoral plan and shared vision.

FOURTH STAGE: VALIDATION WITH EXPERTS AND DRAFTING OF THE FINAL ROADMAP

Based on the work of co-creation and validation of the diagnosis, the first version of the Roadmap was obtained, which had 7 axes . These axes were validated one by one with key actors and experts in the sector, allowing representatives of the main government and research entities to add their comments to the improvement of the initial roadmap. To carry out this validation, 2 actions were carried out, i) online validation forms and ii) virtual validation and dialogue sessions . The result of this process was an improved version of the roadmap, which has 4 axes and 22 actions, avoiding repetitions and aspects that are not linked to the reality of the value chain.

FIFTH STAGE: CO-DEVELOPMENT OF THE ACTION PLAN

A new workshop was held in order to present the final version of the roadmap and develop an Action Plan. This workshop was attended by 14 participants from the public-private-academia and NGO sectors. A day's work included talks with experts and plenary sessions that allowed reviewing the axes and actions of the final version of the roadmap, while reaching agreements on how to carry out each action, who would be responsible for carrying it out, what would be the estimated execution time (in a maximum of 5 years) and who will be the custodian to follow up on compliance. Finally, the event included a symbolic signing of a commitment by the participants to carry out the proposed actions.

Diagnostic Validation Workshop and Co-creation of the Roadmap /TNC and Mayma October 2024











46. To learn more about the methodology used and the results of this workshop, see Annexes VI and VII.
47. For the first version of the roadmap, see Annex VIII.
48. For the final report of this validation stage with experts, see Annex IX.
49. For the final report of this workshop, see Annex X.

TIMING OF THIS RESEARCH

The research was conducted from June 2024 to June 2025 according to the following schedule:

Table No. 1: Process Schedule

ACTIVITY	DATES ON WHICH IT HAS BEEN CARRIED OUT
Documentary survey and initial review of the available bibliography.	June 15 to September 6 of 2024
Interviews and virtual meetings	June 15 to September 6 of 2024
Field trip	August 26-30of 2024
Workshop for validation of the diagnosis and co-creation of the roadmap (working tables)	October 9, 2024
Presentation of report of first 3 stages	November 1, 2024
Final validation of Roadmap with key stakeholders	January to March 2025
Technical Validation and Action Plan Design Workshop	April 23, 2025
Design of the Action Plan	April to June 2025
Delivery of the Final Report	June 10, 2025

Source: Own elaboration.





Diagnostic Validation Workshop and Co-creation of the Roadmap /TNC and Mayma October 2024

06.APPLICABLE LEGAL FRAMEWORK

In Chile, fishing and aquaculture activities are regulated by Law 18892, General Law of Fisheries and Aquaculture[50]. This implies that the regulatory guidelines on the extraction and cultivation, processing, transformation, storage, transportation and commercialization of hydrobiological products are described in this law as well as in its regulations and various modifications.

Likewise, in relation to aquaculture activities, there are other laws that affect these activities. For example, environmental laws, the Environmental Regulation for Aquaculture (RAMA), the Regulation on Measures for the Protection, Control and Eradication of Diseases of High Sanitary Risk for Hydrobiological Species (RESA) and the Regulation on Aquaculture Concessions and Authorizations.[51]

The following governmental entities are involved in regulating, controlling, supervising and promoting aquaculture activities:

- **Undersecretariat of Fisheries and Aquaculture (SUBPESCA):** In charge of regulating and managing the fishing and aquaculture activity through the use of policies, standards and management measures under a precautionary principle with an ecosystemic approach and based on available scientific information.[52]
- **Undersecretariat for the Armed Forces (SSFA):** Entity in charge of granting aquaculture concessions, as well as determining the appropriate areas for this activity.[53]
- **Servicio de Evaluación Ambiental (SEA):** Environmental assessment of aquaculture projects.[54]
- **National Fisheries and Aquaculture Service (SERNAPESCA):** Responsible for the control and supervision of sanitary, environmental and operational matters in maritime and land aquaculture activities. It is in charge of monitoring, analyzing and issuing technical reports related to the development of aquaculture activities, from a sanitary and environmental point of view. It also proposes actions aimed at generating a balanced and smooth development of the aquaculture activity.[55]
- **General Directorate of Maritime Territory (DIRECTEMAR):** Includes oversight aspects related to entities such as the Chilean Port Captaincy, including concessions, environmental and safety issues.[56]
- **National Institute for the Sustainable Development of Artisanal Fishing and Small-Scale Aquaculture (INDESPA):** Seeks to promote the sustainable development of artisanal fishing and small-scale aquaculture, through productive development and coordination programs, under a sustainable, inclusive and gender-equitable approach .[57]

It should be noted that government entities, as well as affiliated entities that receive funds and play a public role, assume a series of specific functions in the seaweed value chain, which are detailed below so that they can be used as a reference in later stages of this report .

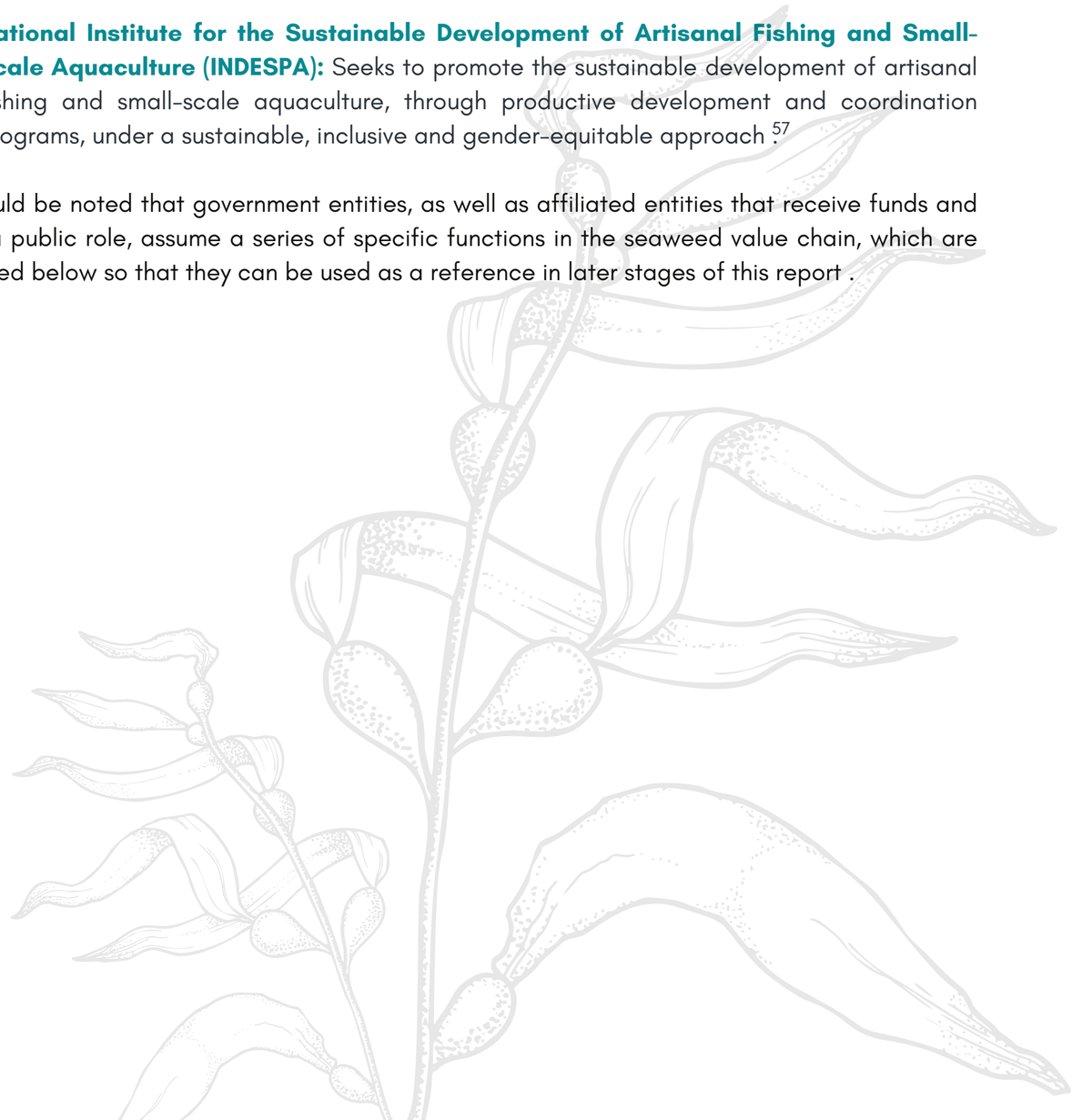


Table N° 2: Role and specific functions of the main public-private entities with influence and n the seaweed value chain.

ENTITY	MAIN ROLE	SPECIFIC FUNCTIONS IN CULTIVATION AND COLLECTION OF SEAWEED
SERNAPESCA	Auditing and control	Supervises regulatory compliance, oversees cultivation centers, authorizes harvests, keeps records.
SUBPESCA	Regulation and public policy	It designs policies, issues regulations, grants concessions, establishes closures and management plans.
INDESPA	Productive development	It finances projects, supports formalization, promotes value added and commercialization.
CORFO	Technology and investment promotion	It finances innovation, supports production chains and promotes biotechnology.
IFOP	Scientific and technical research	Biomass studies, environmental monitoring, technical support to SUBPESCA.
SMA	Environmental monitoring	Controls environmental compliance, monitors RCA, sanctions non-compliance.
SEIA (SEA)	Environmental assessment	Evaluates environmental impact, coordinates citizen participation, determines entry into the system.

Source: Own elaboration.

58. (Wiki INCAR, s.f.)/(Camus & Usandizaga, 2023)
59. (MINISTRY OF ECONOMY, DEVELOPMENT AND TOURISM, 2022)

Likewise, each key government entity participates in at least one or more stages of the value chain, as shown in the following table.

Table N°3 : Participation of key government entities, according to stage in the value chain

STAGE	KEY GOVERNMENT ENTITIES
Formalization and permits	SUBPESCA, SERNAPESCA, DIRECTEMAR, SEIA, CONADI (if applicable)
Cultivation and harvesting	SERNAPESCA, IFOP, SMA
Productive development	INDESPA, CORFO, GOREs
Processing and marketing	PROCHILE, CORFO, INDESPA
Export	PROCHILE, SAG, Customs
Environmental and sanitary control	SMA, SERNAPESCA, MMA, SEIA, SEIA

Source: Own elaboration.

Regarding aquaculture scales in Chile, 2 alternatives have been identified; large-scale aquaculture and small-scale aquaculture or APE.

Large-scale aquaculture includes mainly industrial-scale aquaculture operations. This is characterized by the volumes managed, which are much higher than those of a subsistence model. They require high levels of investment, operational management and control of compliance with technical and environmental aspects, due to the industrial nature of their activities[58]. In Chile, the main example of this type of aquaculture is found in industrial salmon farming.

On the other hand, small-scale aquaculture involves subsistence or lower impact activities, especially due to the size and productive capacity of its concessions. This implies that the total surface area of the sum of all the cultivation centers assigned to the same natural person must not exceed 10 hectares and their maximum annual production must be equal to or less than 500 tons. In the case that the concession is to an organization of artisanal fishermen, the total area must not exceed 50 hectares and the annual production must not exceed 2000 tons[59].

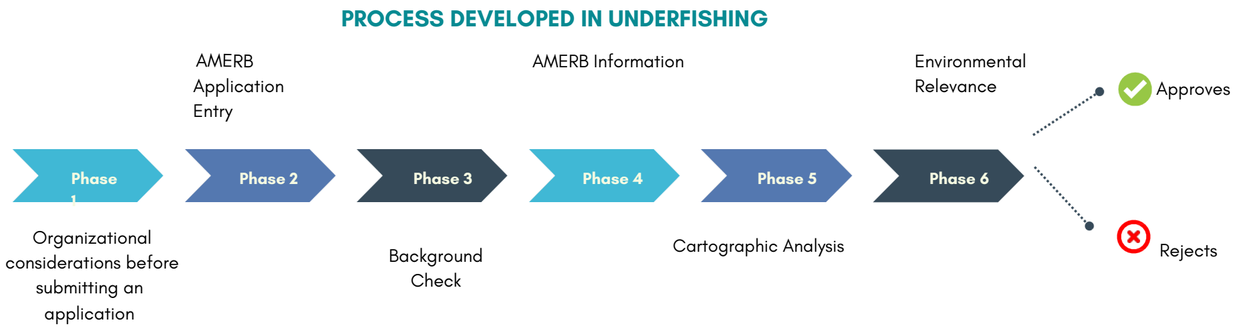
According to its regulations, it includes the following types of projects:

i) monoculture or polyculture projects in small and
delimited portions of water, bottom and beach,
ii) projects for the installation of ponds on land,
iii) temporary maintenance of hydrobiological resources from extraction or cultivation for subsequent transfer to restocking or commercialization, iv) exhibition of hydrobiological resources in aquariums for cultivation or exhibition purposes and
v) the collection of seed.[60]

In addition, it is worth mentioning that the regulation also mentions the possibility of using the Benthic Resources Management and Exploitation Areas (AMERB) as alternatives for productive diversification and exclusive use by artisanal fishermen grouped in legally constituted organizations.[61]

Camus and Usandizaga identified two instruments for the promotion of seaweed farming in Chile.[62] i) Decree No. 86 that regulates aquaculture activities in Benthic Resource Management and Exploitation Areas (AMERB) and[63] ii) Law No. 20,925 that creates bonuses for the restocking and cultivation of seaweed in Chile[64].

Infographic N° 3: Guide for the processing of macroseaweed aquaculture permits in Benthic Resources Management and Exploitation Areas (AMERB).

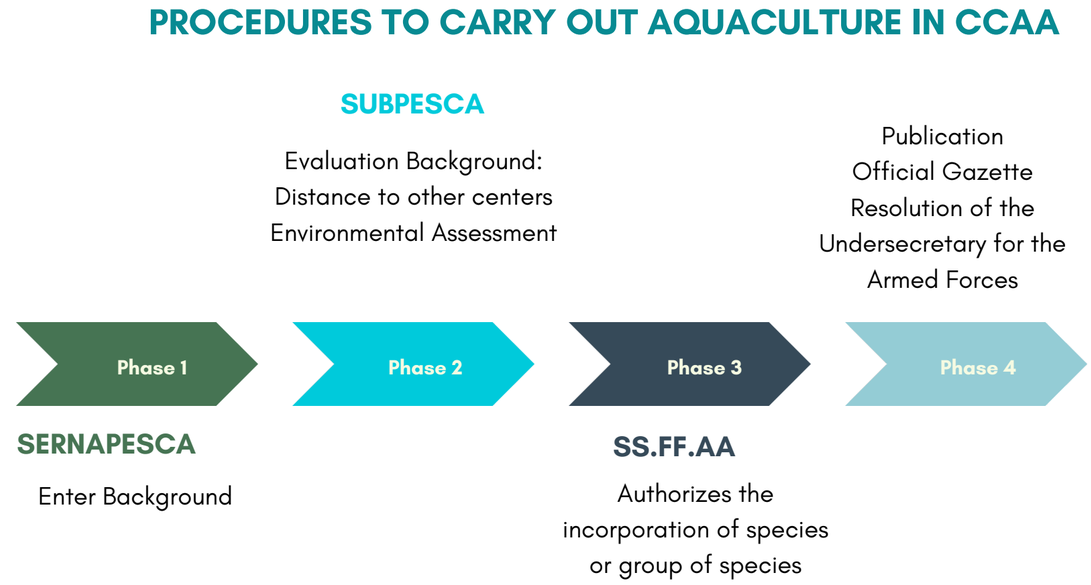


Source: (Galleguillos, y otros, 2019)

It should also be noted that the processing of the macroalgae aquaculture permit in AMERB, SUBPESCA indicates 6 steps to follow before approving or rejecting an application. In this case, the process is followed with SUBPESCA, and must take into account both the background to the submission of the application, how the process as such.

In addition, the species to be cultivated should be made clear, ensuring that the seed will come from formal centers and considering that only up to 40% of the surface area of the AMERB can be cultivated for seaweed[65].
On the other hand, the procedures to carry out aquaculture in the CAAC require 4 steps and the participation of 3 different organizations: SERNAPESCA, SUBPESCA and SS.FF.AA.

Infographic N°4: Procedures for aquaculture in Aquaculture Concessions (CCAA)



Source: (Galleguillos, y otros, 2019)

60. (MINISTRY OF ECONOMY, DEVELOPMENT AND TOURISM, 2022)
61. (Camus & Usandizaga, 2023)
62. (Camus & Usandizaga, 2023)
63. (SUBPESCA, 2016)
64. (MINISTRY OF ECONOMY, DEVELOPMENT AND TOURISM, 2016).
65. (Galleguillos, et al., 2019)

07.IDENTIFICATION OF KEY STAKEHOLDERS

In order to prepare this diagnosis and roadmap, it has been necessary to identify the key stakeholder groups involved in seaweed farming, as well as those with the potential to be involved in sustainable seaweed farming practices in Chile in the future.
The following are the groups or types of key stakeholders identified:

- Academic: Universities and research centers related to seaweed cultivation or seaweed studies in Chile.
- Government: National, regional and municipal governments, community councils, public entities for project and/or innovation financing, governmental research entities, sectoral government, oversight entities and sectoral authorities.
- NGO/Non-profit entity: Non-profit organizations, citizen collectives or non-governmental associations.
- Farming: Companies, associations or syndicates engaged in commercial or experimental salmon or seaweed farming.
- Wild seaweed harvesting: Artisanal fishing unions, harvesters organized as OPAs.
- Traders: Companies or agents in charge of marketing the seaweed between the producer/fisherman and the processors.
- Company: companies dedicated to produce products and/or provide services to the seaweed sector in Chile. Processors, companies providing services or products to the chain, among others.
- Other: Independent researchers, foundations, other companies and associations, among other actors that cannot be identified in the previously indicated groups.



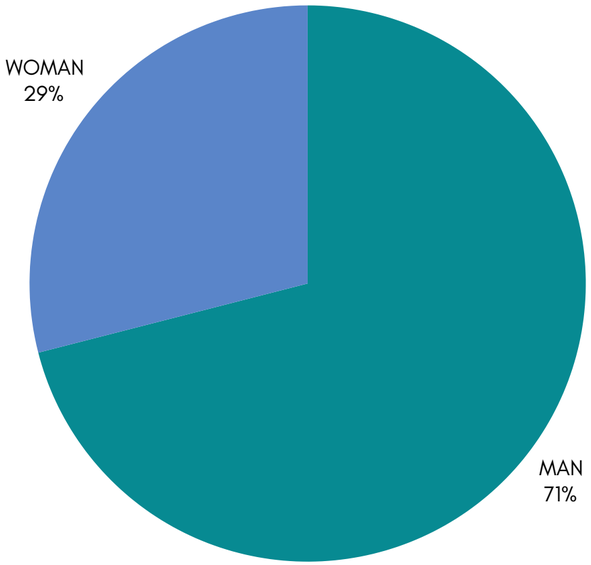
Mayma team's own travel record in Chile, August 2024

SUMMARY OF THE ACTORS AND ENTITIES THAT HAVE PARTICIPATED IN THE DIFFERENT STAGES OF THE PROJECT

During the execution of the project, the main actors linked to the seaweed industry in Chile have been contacted. This has been achieved through different mechanisms such as virtual and face-to-face meetings and interviews, diagnostic forms, visits to the territory and participation in the validation and co-creation workshop.

In order to adequately systematize the diagnostic information, at each stage of the diagnostic, we have counted the stakeholders who have participated in that stage, where the overall scope of the project during each stage has been greater than expected. In this sense, 86 different stakeholders have been contacted, all of whom have participated in at least one of the stages of the study. These 86 stakeholders represent 65 different entities, including public and private organizations.

Figure N°7: People participating in the different stages of the project



Source: Own elaboration

Of these, 29% have been women and 71% men, with the academy and seaweed harvesting areas having the highest participation of women.

Taking into account these general figures, the participation of women has been in most of the groups of entities, highlighting their majority role as leaders or representatives of associations or unions of seaweed harvesters.

Table N°4: Number of participants in the different stages of the project, according to the type of stakeholder they represent and gender.

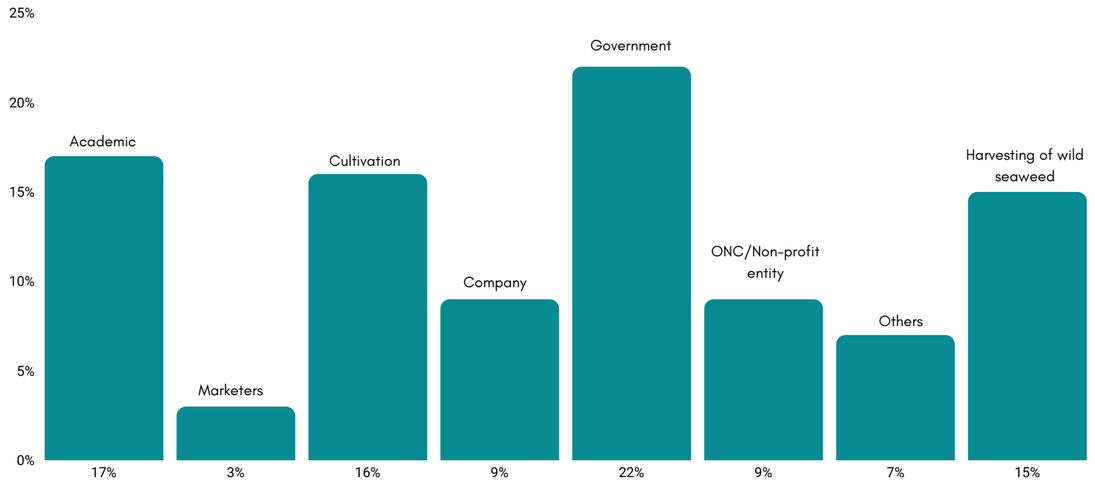
TYPE OF ACTOR	MAN	WOMAN	TOTAL
Academic	9	6	15
Marketers	3		3
Cultivation	12	2	14
Company	8		8
Government	14	5	19
NGO/Non-profit entity	5	3	8
Others	5	1	6
Harvesting of wild seaweed	5	8	13

Source: Own elaboration.

Regarding the total number of entities that have participated in the different stages of this project, the greatest participation has been on the part of entities linked to the collection of wild seaweed, representing 20% of different entities. This participation was mainly in the first, second and third stages of this project, highlighting their participation in the Workshop for the validation of the diagnosis and co-creation of the roadmap, held in October 2024.

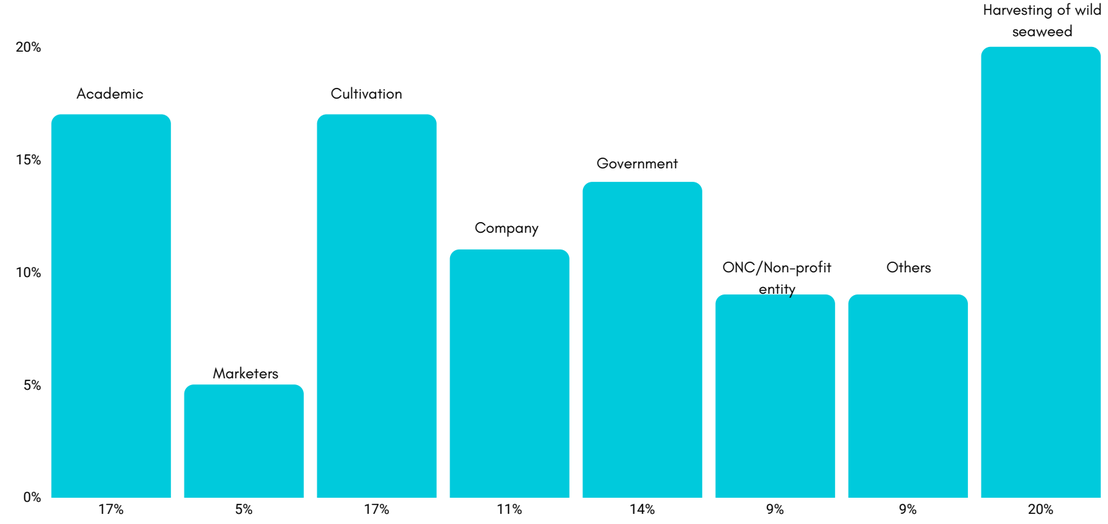
This was followed by academia and cultivation entities with 17% of the participation. The academy has been a key player throughout the process, accompanying both in research and advances in innovation, as well as in the potential of seaweed and the advances linked to the measurement of their ecosystem services.
Finally, another key stakeholder throughout the process has been government entities with 14% participation. Government actors have been key in the diagnosis, as well as in the co-creation of the Roadmap, the Action Plan and the different validation processes. This has been especially necessary since the government entities are the ones that will take the lead in the execution of the project.

Graph N° 8: Entities participating in the different stages of the project



Source: Own elaboration

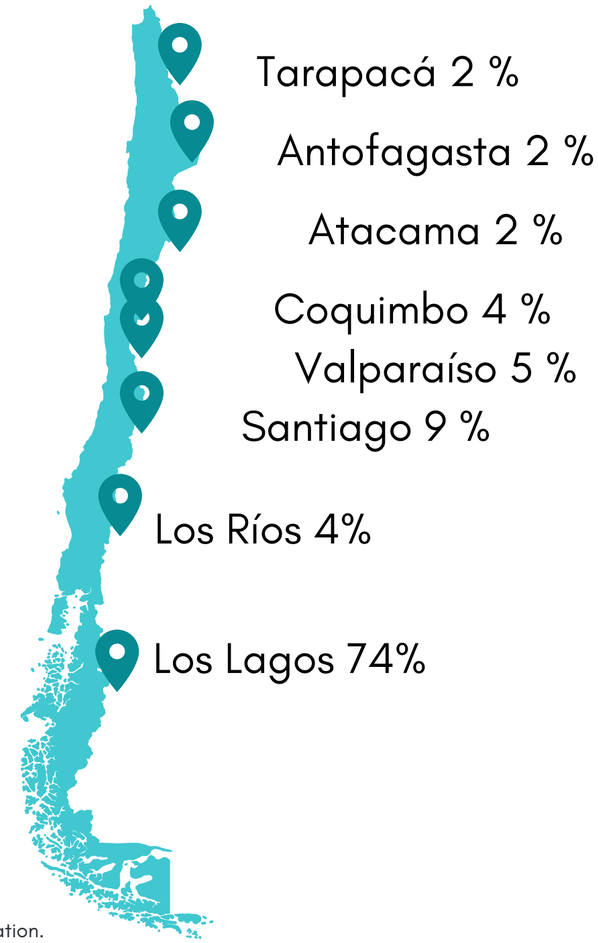
Graph N° 9: People participating in the different stages of the project



Source: Own elaboration

Taking into account the leadership role that government stakeholders will assume in the Roadmap and Action Plan, we have sought to have their active participation, thus achieving 22% of the total of 86 participating stakeholders.
The region with the largest number of participants was the Los Lagos region, to which 70% of the participating stakeholders belong.

Figure Nº 1: Percentage of participants in the survey stage by region



Source: Own elaboration.

Table N°8: Number of participants in the different stages of the project, by region and gender.

REGION	MAN	WOMEN	TOTAL
Antofagasta	1		1
Atacama	1	1	2
Coquimbo	1	1	2
Los Lagos	48	21	69
Los Ríos	2		2
Santiago de Chile	4	2	6
Tarapacá	1		1
Valparaíso	3		3
Total	**61**	**25**	**86**

Source: Own elaboration.

This majority participation of actors from the Los Lagos region is due to the importance of this region, mainly in relation to the cultivation and harvesting of seaweed, as well as the advances and studies that are being carried out in the area related to polyculture or measurement of the ecosystem services of seaweed.

SHARED VISION

During the workshop held in the city of Puerto Varas on October 24, a shared vision for a sustainable seaweed farming industry in Chile was jointly developed. This vision was built from a compilation of key insights gathered throughout the interviews and stakeholder meetings. In these spaces, we dialogue with the actors and consulted on their vision in order to have preliminary versions that are a starting point for the co-design carried out.

After the teamwork carried out throughout the diagnosis and workshop process, the following vision was achieved:

"**Chile will position itself as a global leader in sustainable seaweed farming, with a diversified and resilient industry that generates economic, environmental and social value. Through an integrated value chain—from cultivation to the commercialization of high value-added products—this industry will promote the development of coastal communities, the conservation of marine biodiversity and the generation of innovative solutions to global challenges, such as food security and climate change mitigation.**"



08. VALIDATED SWOT ANALYSIS

Based on the information obtained during the diagnostic stage, a SWOT analysis matrix was developed. During the workshop, thanks to the collaborative work at the working tables, the following SWOT was validated and improved, reflecting both the information gathered during the diagnostic stage and the work done by the workshop participants.

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STRENGTHS

- Natural wealth of species with cultivation potential and technological packages developed or under development in Chile.
- Tradition of seaweed harvesting and cultivation, especially in coastal communities, which provides valuable knowledge on the management of these resources.
- Current interest of coastal communities, businessmen and entrepreneurs in the development of seaweed cultivation.
- There are actors in the sector that have a family connection with the species. As well as a cultural connection with its importance and use.
- Stakeholders' interest in having a seaweed industry with a sustainable approach.
- Species easily compatible with others for polyculture models.
- Studies on the potential of algae for the regeneration of ecosystems have been initiated.
- There is a growing international market for algae and a growing demand for it worldwide.

S O

SWOT ANALYSIS

OPPORTUNITIES

- Actors in the sector do not work with a shared vision and there is a lack of intersectoral coordination.
- Decision-making in the capital city, typical of a unitary model, complicates the revision of regulations in accordance with regional realities.
- Lack of valid business models for both raw materials and value-added products (for direct and indirect human consumption).
- Insufficient training experiences in cultivation with a local approach in coastal communities.
- Lack of available financing for innovation and working capital (credit modalities or non-reimbursable funds).
- Lack of landing, processing and hatchery infrastructure.
- The consumption of seaweed in Chile is not massive and there are no tools in place that are working to achieve this objective. The location of the concessions is remote and there are areas with few spaces available for new concessionaires.
- Legislation and regulations for cultivation require improvements to provide an adequate enabling environment for an algae aquaculture industry. Greater dynamism is required in relation to permits.
- Lack of knowledge and/or technology for off-shore cultivation.
- Challenge of adherence of seedlings to the substrate in restoration stages.
- Lack of technology adaptable to local conditions.

WEAKNESSES

- Improvement of water quality from the benefits of algae in marine ecosystems.
- Possibility of carbon sequestration and obtaining blue bonds from algae management and cultivation.
- Protection of biodiversity that finds refuge in seaweed meadows.
- Reduction of fishing pressure or effort on natural seaweed meadows.
- Productive diversification alternatives for coastal communities and entrepreneurs.
- Nutraceutical potential of seaweed that can be used for domestic consumption.
- Development of polycultures to expand the range of productive diversification possibilities in Chile.
- Algae are seen as an opportunity for some young people within communities.

W T

THREATS

- Climate change and its possible impact on seaweed crops or natural meadows.
- Extensive international competition in Asian countries that does not leave an international market for Chilean seaweed.
- That water pollution affects the chemical composition of seaweed, making it unsafe for consumption.
- Possible social conflicts derived from an inequitable distribution of the benefits of an algae industry or from a non-inclusive management of spaces and business models.
- That the environmental, economic and water quality benefits are not as expected and are not reflected against the investment effort for these purposes.
- That the business models have not been validated and are no longer profitable, thus affecting the investment recovery capacity of growers at different levels.
- Regulatory and infrastructure improvement needs do not keep pace with the development of the industry, becoming a bottleneck for development.

Source: Own elaboration

IDENTIFICATION OF GAPS TO BE OVERCOME

Based on the SWOT analysis conducted during the diagnostic phase, a series of key gaps were identified that must be addressed to enable the development of a sustainable seaweed farming industry in Chile.
These gaps were identified through various stages of the research process and reflect the current structural and operational barriers within the sector:

- Lack of official identification of the best species for cultivation by zone, as well as of the most appropriate validated technological packages for community or micro-entrepreneurial crops and large-scale crops.
- Lack of market studies or commercial pilots to ensure that the seaweed market, in the future, will allow the development of a viable Chilean cultivation industry.
- There are not enough valid business models for seaweed cultivation in Chile.
- Current legislation is not perceived as adequate and sufficient to support the needs and enabling environment necessary for a sustainable seaweed farming industry in Chile.
- Inadequate and insufficient infrastructure to support the requirements of an seaweed aquaculture industry.
- Insufficient financing mechanisms and funding sources tailored to small-scale producers and community-based initiatives
- The communities do not have sufficient alternatives for training in farming or business that are accessible to them and work under an intercultural approach and adequate to their learning needs.
- Need for recognition of the role of women in the seaweed sector. Including their leadership in community-based initiatives, research, and entrepreneurship. Need to develop new value-added products based on seaweed.
- Human consumption of seaweed in Chile is considered insufficient and does not currently allow us to think of a domestic market that would represent a real opportunity for seaweed farmers.



09.ROADMAP FOR A SUSTAINABLE SEAWEED FARMING INDUSTRY IN CHILE

During the diagnostic stage, it was possible to organize the objectives and gaps to be overcome for a proposed roadmap for a sustainable seaweed farming industry in Chile. This identification was validated during the workshop and working groups.



Mayma team's own travel record in Chile, August 2024

Once the strategic pillars that are the backbone of the roadmap were agreed upon, the attendees presented proposals for actions. During this process, 7 possible lines of action and more than 50 actions were identified for a first version of the Roadmap. The first version of the Roadmap was the result of an articulated and collaborative work developed by key stakeholders and the Mayma team throughout the 3 stages of the project.

This first version was validated with key stakeholders during stage 4 of this project, focusing on pillars and actions, avoiding repetitions and ensuring clarity and viability in the Roadmap, which would allow the design of an Action Plan to ensure compliance with the objectives set. Thanks to the joint work between the actors participating in this validation stage, Mayma and TNC Chile, the Roadmap version was obtained, which has 4 strategic pillars: i) Innovation, research and technology transfer, ii) Market Development, Value Addition, and Applications, iii) Governance, Public Policy and Regulations, and vi) Skills Development and Social Inclusion. These 4 stretegic pillars have 20 key actions that will be the center of the Action Plan developed.

In relation to the sustainability and regeneration potential of seaweed, all the axes have been based on the idea that this should be the pillar for the implementation of the proposed actions, considering it as a cross-cutting and key aspect.



Diagnostic Validation Workshop and Co-creation of the Roadmap /TNC and Mayma October 2024



STRATEGIC PILLAR 1: INNOVATION, RESEARCH AND TECHNOLOGY TRANSFER

OBJECTIVE

To generate validated knowledge on commercially valuable species, improve the technological foundation of seaweed farming, and consolidate innovative solutions adapted to diverse territorial contexts, while developing effective strategies for transferring this knowledge throughout the value chain.

KEY ACTIONS

- Promote basic and applied research (including pilot projects)) on production cycles, biotechnological potential, sampling and monitoring of ecosystem services, development of applications and performance of seaweed species identified as being of commercial interest.
- Strengthen installed capacity and infrastructure for the production and processing of seaweed, incorporating technological development, logistics and renewable energies.
- Develop and validate efficient cultivation protocols (including polycultures and new planting methodologies for different scales, populations and territorial realities), and valuation and certification methodologies for measuring ecosystem services, in order to transfer these technologies and methodologies to communities and companies for productive and restorative purposes.
- Update and consolidate databases on commercial seaweed species, ecosystem carrying capacity for aquaculture, natural seaweed banks, and areas suitable for seaweed farming (AAA). Ensure this information is made publicly accessible in a user-friendly platform.
- Generate spaces for dissemination and disclosure (congresses, seminars, publications) of technical and scientific advances along the value chain.



STRATEGIC PILLAR 2: MARKET DEVELOPMENT, VALUE ADDITION, AND APPLICATIONS

OBJECTIVE

To position Chile as a leader in differentiated seaweed-based products with value-added applications, aimed at both domestic and international markets, while promoting innovative uses of seaweed across multiple sectors.

KEY ACTIONS

- Promote the development of international markets for Chilean seaweed through technical assistance, certifications, market research/intelligence, sustainable business models/plans and trade tours.
- Promote production and disseminate new applications of seaweed (e.g., gourmet, marine ingredients, cosmetics, nutraceuticals and bioinputs), with quality and traceability standards.
- Promote commercial positioning strategies at the national level, encouraging domestic use through food education campaigns, raising awareness of the nutritional value of seaweed and highlighting other key uses for various industries.
- Generate and/or strengthen multisectoral coordination spaces to ensure that the products destined for the different uses and applications of seaweed have the corresponding authorizations from the competent authorities, thus allowing their commercialization and use in the international and national markets.
- Certifying and commercializing the ecosystem services generated by seaweed farms (such as carbon sequestration, water quality improvement, biodiversity conservation, etc.). Articulating with voluntary markets and climate impact programs and developing ecosystem services transaction pilots.



STRATEGIC PILLAR 3: GOVERNANCE, PUBLIC POLICY AND REGULATION

OBJECTIVE

To have adequate legislation and regulations that allow a correct governance of the seaweed value chain in Chile. Ensuring administrative efficiency, legal certainty and active participation of stakeholders in sectoral governance.

KEY ACTIONS

- Streamline and simplify processing times for aquaculture concessions, AMERBs, permits and environmental declarations, incorporating a multi-sector digital platform.
- Actively incorporate all stakeholders of the seaweed value chain in governance and decision-making spaces, processes for updating or improving regulations, as well as in different strategies for planning and monitoring progress and agreements.
- Promote the inclusion of seaweed in integrated farming systems and recognize its ecosystem services within the legal framework, including the development of mechanisms for access to biodiversity and carbon credit markets.
- Develop regional planning instruments to optimize coastal zone management, including the cultivation, processing, commercialization, and infrastructure needed to support these activities in coastal communities.



STRATEGIC PILLAR N°4: SKILLS DEVELOPMENT AND SOCIAL INCLUSION

OBJECTIVE

To foster an inclusive seaweed farming industry by expanding access to training, technology, and resources, while recognizing and empowering the roles of women, youth, and local communities in sustainable development.

KEY ACTIONS

- Create extension programs for members of coastal communities and cooperatives through an autonomous organization with the necessary technical and economic capabilities for its implementation in the marine-territorial level..
- Strengthen associative models such as cooperatives and productive consortiums to improve marketing and negotiation conditions.
- Incorporation of inclusive strategies in the different training or citizen participation processes linked to the seaweed value chain. Considering the time and place needs of the actors, as well as their learning needs, in order to ensure that the information provided is adequately delivered to the target population.
- Generate a program for access to financing, credit or seed capital for seaweed-related ventures in Chile, taking into account the possibilities of members of coastal communities and small entrepreneurs.
- To disseminate the role and participation of women in the seaweed value chain, as well as to generate spaces for the exchange of experiences and to highlight the value of the contributions they are making.
- Encourage the incorporation of young people into the seaweed value chain or associated chains in the different regions, in order to ensure their interest and participation in the value chain.

10.ACTION PLAN – ROADMAP FOR A SUSTAINABLE SEAWEED FARMING INDUSTRY IN CHILE

Based on the Roadmap, it is necessary to have an Action Plan that identifies, for each of the 20 key actions of the 4 strategic pillars , the following points:

- Implementation proposals: This presents the "how" each action will be achieved.
- Instruments of execution: Once the "how" was determined, a proposed name was sought for each implementation proposal. Although the names of these instruments are proposals that can be readjusted, they are intended to describe the key aspects of this implementation.
- Responsible parties and implementation partners: Responds to the "who" will be in charge of executing this action, as well as the actors that should accompany the execution process.
- Estimated execution time: Indicates the "when" the proposed actions could be carried out. Proposed execution deadlines are presented, which will make it possible to follow up on the Plan's progress.
- Execution custodian: This is an actor proposed by the project participants and who is entrusted with the role of following up on the progress of the actions of each axis.

The body of this Action Plan was developed at the Technical Validation and Action Plan Design Workshop in April 2025. This version, together with comments made by stakeholders and sources analyzed throughout the process, have allowed the presentation of an Action Plan for a Roadmap for a sustainable seaweed farming industry in Chile. This document will be a guide for the different actors in the value chain during the process of implementation and monitoring of the Roadmap.
The importance of this document lies in its collaborative preparation process, as well as in the active participation of key stakeholders who will assume leadership responsibilities in its execution and follow-up. It is also expected that this document will be a reference for the value chain's growth and a guide for coordinated development that will be taken into account by future government actors.



Mayma team's own travel record in Chile, August 2024



STRATEGIC PILLAR 1: INNOVATION, RESEARCH AND TECHNOLOGY TRANSFER

OBJECTIVE To generate validated knowledge on commercially valuable species, improve the technological foundation of seaweed farming, and consolidate innovative solutions adapted to diverse territorial contexts, while developing effective strategies for transferring this knowledge throughout the value chain.

KEY ACTIONS	IMPLEMENTATION PROPOSAL	SPECIFIC INSTRUMENT	RESPONSIBLE FOR IMPLEMENTATION	IMPLEMENTATION PARTNER	ESTIMATED EXECUTION TIME
Promote basic and applied research (including pilot projects) on production cycles, biotechnological potential, sampling and monitoring of ecosystem services, development of applications and performance of seaweedalgae species identified as being of commercial interest.	Design and implementation of a program (or strategy) for the development and co-financing of projects linked to the seaweed value chain. Focused on the development of new solutions, key logistical improvements, and validation and transfer of technologies related to the cultivation or processing of seaweed, as well as the preservation of natural grasslands and measurement of related ecosystem services.	National Program to Promote the cultivation, use and restoration of seaweed in Chile	CORFO Regional Government Ministry of Science Ifop	Academy Private	Medium Term (3 to 4 years)
Strengthen installed capacity and infrastructure for the production and processing of seaweed, incorporating technological development, logistics and renewable energies.					
Develop and validate efficient cultivation protocols (including polycultures and new planting methodologies for different scales, populations and territorial realities), and valuation and certification methodologies for measuring ecosystem services, in order to transfer these technologies and methodologies to communities and companies for productive and restorative purposes.					
Update and consolidate databases on commercial seaweed species, ecosystem carrying capacity for aquaculture, natural seaweed banks, and areas suitable for seaweed farming (AAA). Ensure this information is made publicly accessible in a user-friendly platform.	Project for the integration and updating of inter-institutional databases, with public, agile and free access.	Web portal "Seaweed in Chile".	Subpesca	Academy Sernapesca Regional Government Private (aquaculture industry) National Assets	Short term (1 to 2 years)
Generate spaces for dissemination and disclosure (congresses, seminars, publications) of technical and scientific advances along the value chain.	National Congress on innovation and advances in the seaweed value chain. Semi face-to-face modality, public access and free of charge.	National seaweed Congress in Chile	Academy	Corfo	Short term (1 to 2 years)

RESPONSIBLE PARTY :REGIONAL GOVERNMENT



STRATEGIC PILLAR 2: MARKET DEVELOPMENT, VALUE ADDITION, AND APPLICATIONS

OBJECTIVE

To position Chile as a leader in differentiated seaweed-based products with value-added applications, aimed at both domestic and international markets, while promoting innovative uses of seaweed across multiple sectors.

KEY ACTIONS	IMPLEMENTATION PROPOSAL	SPECIFIC INSTRUMENT	RESPONSIBLE FOR IMPLEMENTATION	IMPLEMENTATION PARTNER	ESTIMATED EXECUTION TIME
Promote the development of international markets for Chilean seaweed through technical assistance, certifications, market research/intelligence, sustainable business models/plans and trade tours.	Design and implementation of a country strategy for the use, exploitation and commercialization of seaweed in Chile and its by-products. This should be focused on determining actions to enable international markets (technical assistance, certifications, market intelligence, sustainable business plans), on promoting the production of new products and applications, on positioning products in external and internal markets, and on multisectoral coordination for the different marketing processes of seaweed and its related products.	National strategy for productive diversification, commercialization , dissemination and certification of seaweed in Chile	ProChile Regional Government Corfo Sercotec Indespa Ministry of Health Regional Governments and Coastal Municipalities	Privados	Medium Term (3 to 4 years)
Promote production and disseminate new applications of seaweed (e.g., gourmet, marine ingredients, cosmetics, nutraceuticals and bioinputs), with quality and traceability standards.				Privados	
Promote commercial positioning strategies at the national level, encouraging domestic use through food education campaigns, raising awareness of the nutritional value of seaweed and highlighting other key uses for various industries.				Institute of Nutrition and Food Technology of the Academy of Nutrition and Food Technology. Subpesca - Corfo - Juaneb - Private - Ministry of Health IBS - Sercotec - Indap - Sernapesca -Chile Valora - Fosis Sense	
Generate and/or strengthen multisectoral coordination spaces to ensure that the products destined for the different uses and applications of seaweed have the corresponding authorizations from the competent authorities, thus allowing their commercialization and use in the international and national markets.	Establish a multi-sectoral roundtable to design a protocol for the certification and commercialization of ecosystem services generated by seaweed crops.	Multisectoral roundtable "seaweed and their ecosystem services".	Ifop Ministry of Environment	Private Academy	Short term (1 to 2 years)
Certifying and commercializing the ecosystem services generated by seaweed farms (such as carbon sequestration, water quality improvement, biodiversity conservation, etc.). Articulating with voluntary markets and climate impact programs and developing ecosystem services transaction pilots.					

RESPONSIBLE PARTY :REGIONAL GOVERNMENT



STRATEGIC PILLAR 3: GOVERNANCE, PUBLIC POLICY AND REGULATION

OBJECTIVE

To have adequate legislation and regulations that allow a correct governance of the seaweed value chain in Chile. Ensuring administrative efficiency, legal certainty and active participation of stakeholders in sectoral governance.

KEY ACTIONS	IMPLEMENTATION PROPOSAL	SPECIFIC INSTRUMENT	RESPONSIBLE FOR IMPLEMENTATION	IMPLEMENTATION PARTNER	ESTIMATED EXECUTION TIME
Streamline and simplify processing times for aquaculture concessions, AMERBs, permits and environmental declarations, incorporating a multi-sector digital platform.	Design and implementation of the multisectoral digital window for the management of aquaculture concessions and permits.	Digital one-stop-shop for aquaculture management	Subpesca	Undersecretariat of the Armed Forces (SSFFAA) - Ministry of the Environment (MMA)- Producers Group - Subpesca - Sernapesca - SSFFAA - MMA - Regional Government - National Assets- Conadi	Short term (1 to 2 years)
Actively incorporate all stakeholders of the seaweed value chain in governance and decision-making spaces, processes for updating or improving regulations, as well as in different strategies for planning and monitoring progress and agreements.	Implementation of quarterly multisectoral coordination roundtables.	Multisectoral coordination roundtables "Governance of seaweed in Chile".	Regional Government Subpesca Sernapesca	Producer group Members of the seaweed value chain	Short term (1 to 2 years)
Promote the inclusion of seaweed in integrated farming systems and recognize its ecosystem services within the legal framework, including the development of mechanisms for access to biodiversity and carbon credit markets.	Design and implementation of the technical standard for the promotion and commercialization of ecosystem services linked to seaweed cultivation.	Technical standard for the promotion, measurement and commercialization of ecosystem services linked to seaweed.	IFOP Ministry of Environment	Subpesca Academy	Long Term (5 years)
Develop regional planning instruments to optimize coastal zone management, including the cultivation, processing, commercialization, and infrastructure needed to support these activities in coastal communities.	Design and development of Integrated Coastal Development Plans for algal communities.	(3) Integrated Coastal Development Plans for coastal communities	Regional Government	Coastal Municipalities Private -Academy Regional Commission for the Coastal Zone	Medium Term (3 to 4 years)

RESPONSIBLE PARTY :SERNAPESCA



STRATEGIC PILLAR N°4: SKILLS DEVELOPMENT AND SOCIAL INCLUSION

OBJECTIVE

To foster an inclusive seaweed farming industry by expanding access to training, technology, and resources, while recognizing and empowering the roles of women, youth, and local communities in sustainable development.

KEY ACTIONS	IMPLEMENTATION PROPOSAL	SPECIFIC INSTRUMENT	RESPONSIBLE FOR IMPLEMENTATION	IMPLEMENTATION PARTNER	ESTIMATED EXECUTION TIME
Create extension programs for members of coastal communities and cooperatives through an autonomous organization with the necessary technical and economic capabilities for its implementation in the maritorio.	Design and implementation of the multisectoral digital window for the management of aquaculture concessions and permits.	Technical professionalization program for seaweed farmers	Sercotec Indespa	Coastal Municipalities (convene and guide) Groupings - Guilds Social Organizations Ong - Foundations - Private	Short term (1 to 2 years)
Strengthen associative models such as cooperatives and productive consortiums to improve marketing and negotiation conditions.	Design and implementation of an incentive and support plan for associativity	Incentives and support plan for associativity in coastal communities	Regional Government Regional Committee for Productive Development (CRDP)	Indespa - Cooperatives Groupings - Coastal Municipalities	Short term (1 to 2 years)
Incorporation of inclusive strategies in the different training or citizen participation processes linked to the seaweed value chain. Considering the time and place needs of the actors, as well as their learning needs, in order to ensure that the information provided is adequately delivered to the target population.	Design and application of a guide or manual on inclusive action strategies and impact measurement for work in coastal communities.	Handbook on inclusive action strategies and impact measurement for work in coastal communities	Indespa	Regional Councilors (Core) Coastal Municipalities	Short term (1 to 2 years)
Generate a program for access to financing, credit or seed capital for seaweed-related ventures in Chile, taking into account the possibilities of members of coastal communities and small entrepreneurs.	Design and implementation of a collaboration and articulation plan with business incubators to facilitate access to financing for seaweed entrepreneurship.	Multi-stakeholder collaboration and articulation plan for the incubation of seaweed-related businesses in Chile	Business Development Center "Sercotec".	Private	Medium term (3 to 4 years)
To disseminate the role and participation of women in the seaweed value chain, as well as to generate spaces for the exchange of experiences and to highlight the value of the contributions they are making.	Sectoral strategy for the dissemination and enhancement of the role of women in the seaweed value chain.	Sectoral strategy for the dissemination and enhancement of the role of women in the seaweed value chain.	Sernapesca	Sernameg - Prodemu community leaders (fisherwomen, collectors, etc.) Coastal Municipalities (convene)	Short term (1 to 2 years)
Encourage the incorporation of young people into the seaweed value chain or associated chains in the different regions, in order to ensure their interest and participation in the value chain.	Incorporation and strengthening of technical careers related to aquaculture activities in regional technical and technological education centers.	New curriculum for aquaculture technical careers available in the regions.	Seremi of Education Regional Government	Universities - Technical Institutes - Vocational Technical High Schools - State Technical Training Center - Private (for mentoring and internships) - NGOs (specific training)- Foundations (specific training)	Long Term (5 years)

RESPONSIBLE PARTY :REGIONAL GOVERNMENT

TIMELINE - ACTION PLAN FOR A SUSTAINABLE SEAWEED FARMING INDUSTRY IN CHILE



To achieve the Roadmap, it was necessary to prepare a 5-year Action Plan, which contains the list of specific instruments to be implemented, as well as the estimated years in which they should be implemented or developed.
Three time frames have been considered for the design of this Timeline: short (1 to 2 years), medium (3 to 4 years) and long (5 years). The starting year is proposed as 2026, thus achieving compliance with the most complex actions by 2030.
During the collaborative process of determining the deadlines and years to achieve each proposed instrument, aspects such as: ease of operation, budget requirements, ease of articulation, consensus needs and estimated deadlines in regular processes were taken into account.

Mayma team's own travel record in Chile, August 2024

2026

- Web portal "seaweed in Chile".
- National seaweed Congress in Chile
- Multisectoral roundtable "seaweed and their ecosystem services".
- Digital one-stop-shop for aquaculture management
- Multisectoral coordination roundtables "Governance of seaweed in Chile".
- Handbook on inclusive action strategies and impact measurement for work in coastal communities

2028

- National strategy for productive diversification, commercialization, dissemination and certification of seaweed in Chile
- Multi-stakeholder collaboration and articulation plan for the incubation of seaweed-related businesses in Chile

2030

- Technical standard for the promotion, measurement and commercialization of ecosystem services linked to seaweed.
- New curriculum for aquaculture technical careers available in the regions.











2027

- Technical professionalization program for the alguero
- Incentives and support plan for associativity in coastal communities
- Sectoral strategy for the dissemination and enhancement of the role of women in the seaweed value chain.

2029

- National Program to Promote the cultivation, use and restoration of seaweed in Chile
- (3 pilots) Integrated Coastal Development Plans for fishing communities

SHORT TERM (1 TO 2 YEARS) **MEDIUM TERM (3 TO 4 YEARS)** **LONG TERM (5 YEARS)**

11.RECOMMENDATIONS FOR NEXT STEPS



Mayma team's own travel record in Chile, August 2024

Chile's seaweed aquaculture sector holds high potential; however, its sustainable growth requires effective coordination among coastal communities, entrepreneurs, academic institutions, government agencies, non-profit organizations, and innovation and financing entities. It also demands regulatory frameworks that are agile, clear, and coherent, along with adequate infrastructure. In this context, the co-creation of a roadmap and action plan becomes essential to chart a path toward sustainable development of the seaweed sector over the next five years.

Despite the co-creation effort made throughout all the stages of this project, it is essential to maintain the articulated work and active participation to ensure that the actions to be implemented can be developed considering the needs of the stakeholders, in coordination with the technical and scientific base that can be strengthened and grow in the coming years.
Taking into account this shared vision, SWOT analysis, the gaps to be overcome, the roadmap and action plan prepared, it is recommended that the following recomendations be taken into account, to be applied in the implementation and follow-up stages of the proposed instruments:

1. Strengthen intersectoral coordination: Strengthen collaborative and recurrent work spaces between actors to align efforts and promote strategic alliances. A committee will be formed to follow up on the objectives set out in the roadmap, as well as the actions that are part of the action plan.
2. Regulations and concessions: Simplify processes and improve the incorporation of citizens and technical professionals in the development or updating of rules and regulations. Ensure that the regulations allow the generation of a facilitating and decentralized environment for the execution of the objectives of the roadmap and action plan.
3. Infrastructure, logistics and operations: Ensure access to hatcheries and processing centers, promoting shared management. As well as ensuring that the operational and transportation infrastructure is adapted to the needs of the seaweed and its proper handling.
4. Triple impact business training: Integrate local knowledge with entrepreneurial training to facilitate access to impact financing. Foster a shared understanding among all actors in the value chain of what it means to operate under a triple impact approach—economic, social, and environmental—through engagement with academia and public institutions.
5. Support networks and mentoring: Implement continuous mentoring and collaborative spaces to strengthen the sustainability of the ventures.
6. Innovation and new markets: Develop innovative products and connect producers with consumers, promoting domestic consumption and exports.
7. Productive diversification: Promote polycultures and encourage the regeneration of ecosystems.
8. Strategic dissemination and motorization of the participatory process: Design and implement a comprehensive communication and mobilization strategy to make the roadmap visible, strengthen the commitment of stakeholders and attract new allies. This strategy should include public dissemination campaigns, accessible materials (executive summaries, infographics, audiovisual capsules), presence in digital and traditional media, and the organization of periodic meetings (face-to-face and virtual) to keep the collaborative spirit of the process alive. It is also recommended to enable a digital follow-up platform where the progress of the action plan can be monitored in real time by all stakeholders, reinforcing transparency, social ownership and political continuity beyond electoral cycles.

It should be noted that the plan seeks to position the sector as an engine of sustainable development, guaranteeing its viability through innovation, accessible financing and the active participation of new generations. It also seeks to enable the seaweed value chain in Chile to adapt and even lead processes related to restorative aquaculture and measurement of seaweed ecosystem services.

With respect to next steps and taking into account that the proposed timeframe for the execution of the action plan ranges from 2026 to 2030, it is recommended that the roadmap and action plan be formally shared by all those who aspire to positions in the Chilean executive in the next elections. So that they are informed of the work carried out by the value chain and can take into consideration the actions proposed

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ANNEXES

Annex N° 1: Total list of actors and entities participating in the different stages of the project.
Public download link:
https://drive.google.com/file/d/1X0rNSeWHv0MW5XBdrp9_waaUqZYhO-3g/view?usp=sharing

Annex N° 2: Stakeholder information gathering methodology.
Public download link:
https://drive.google.com/file/d/1SVkEQ8DnfQuzUEDTEyBly7vsktIXJfUB/view?usp=drive_link

Annex N° 3: Visit to the Chilean maritime coastal communities in the Los Lagos Region
Public download link:
https://drive.google.com/file/d/1eMzI5CuJeeGfwrbHekRdWwF8rqZOaPED/view?usp=drive_link

Annex N° 4: Results obtained during the diagnostic process
Public download link:
https://docs.google.com/document/d/1zQRJYbU8Me8W2VGfJjYQagpN3DxTH8jfpv0uYv-HKog/edit?usp=drive_link

Annex N° 5: Market and economic feasibility study
Public download link:
https://drive.google.com/file/d/19GeSqzvtF4w_I8YAs4iuXAcPAmsPSpM8/view?usp=drive_link

Annex N° 6: Final Report - Working Groups: "Dialogue and Action" Workshop and workshop results.
Public download link:
https://drive.google.com/file/d/1RWZHCe3KcnnLgBKjwG_PrRa1rzxmP0fk/view?usp=sharing

Annex N° 7: Summary of participation: Workshop "Dialogue and Action".
Public download link:
https://drive.google.com/file/d/1u5PZxD3rinWTSCwSR8MyGsJA8N_j28OD/view?usp=drive_link

Annex N° 8: First version: Roadmap for a sustainable seaweed farming industry in Chile
Public download link:
https://drive.google.com/file/d/12ZXGNjdtk6XiYIB8ariokAC-zucP_WFw/view?usp=drive_link

Annex N° 9: Report: Validation and Dissemination of the "Road Map for the Development of seaweed Cultivation in Chile
Public download link:
https://drive.google.com/file/d/18uDHw22OPsDwsYfKA2F4TVsECUq5ooy-/view?usp=drive_link

Annex N° 10: Technical validation workshop report and Action Plan design.
Public download link:
https://drive.google.com/file/d/1kUCDEWBgWBcrFPNTFjp2bRUCh8Wu9vgy/view?usp=sharing


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