Water bodies Typology System: a Chilean case of scientific stakeholders and policy makers dialogue

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Abstract

A Typology System for the surface water bodies was developed for Chile, based on the knowledge built in the Water Framework Directive of the European Union. This methodology was adapted to local features. National ecoregions were developed as well as the abiotic variables of the Typology System, which were defined gathering the scientific knowledge together with the governmental requirements. The resulted Typology System for lakes and rivers was generated following an *a priori* and top down approach to difference biocenosis, based on geomorphologic, hydrologic and physic criteria. The working methodology used was bibliographic review, interviews to local experts in biocenosis and workshops, in all of these, stakeholders and policy makers were involved. The proposed system represents a scientific validated tool to support decision makers in public water management and meets institutional needs.

Keywords: water management, environmental policy, science policy interface

Introduction

In Chile, several interventions in surface continental waters have caused modifications in their physical and biological characteristics (Soto & Campos, 1997; Habit & Parra, 2001; Oyarzún & Huber, 2003; Parra et al*.,* 2003; Goodwin et al*.,* 2006; Habit et al*.,* 2006a, 2007, 2010; Barra et al*.,* 2009), to the point where it is not always possible to determine what the original natural conditions of such surface waters bodies were.

Although the country does not have the necessary knowledge concerning aquatic ecosystems, in order to make progress in management policies to conserve and rehabilitate them, Chilean institutions have developed important management tools that allow reaching such goals. In this context, some important measures are the development of a series of regulations called "Secondary Regulations of Environmental Quality" (*Normas Secundarias de Calidad Ambiental*, NSCA; CONAMA, 2004) and the process to obtain a scientists-validated Typology System, which allows to classify the surface waters bodies in Chile and to facilitate the environmental institutional management of the country (DCA & RNR 2010; DCA & RNR 2011). The classification of surface waters is useful not only to regulate, protect and manage aquatic ecosystems, but also to evaluate the ecological condition of these waters by means of biological markers, to plan the water monitoring and to identify the necessary measures so that the superficial waters can achieve good conditions. This, in turn, leads us to understand that the existence of a Typology System of surface waters bodies becomes an essential requisite for a suitable administration and management of the water resources from the country.

The development of a management tool, such as the elaboration of a Typology System of surface waters bodies, involves the participation of a group of agents that must integrate their knowledge, their visions, and their values coming from the different agent's specialized disciplines and actions. In this sense, it will be common that the collaborative practices among the various agents are not without the risk of having difficulties related to the competences, conflicts of interest, attitudes, beliefs (Oltra, 2009), and the several technical languages used by the different disciplines. In this context, among scientist, for example, it is possible to identify different lines of thought, preferences, beliefs, and biases which, finally, affect the definition of the problem and the approaching of its solutions (Cortner, 2000). This scenario is also common when the interaction is between the public agents in charge of the creation environmental policies and the scientific sphere. Regarding this situation, it is important to clarify the distinct roles that each agent plays if we want to identify the nature of the emerging conflicts and their potential solutions. In this respect, while the politicians are mainly demanding predictions to reduce uncertainty that is typical of natural systems and, therefore, to make decisions that affect these systems (Sarewitz & Pielke, 2000), scientists define problems, produce knowledge and look for the corresponding solutions (Huitema & Turhout, 2009). These differences that, at the same time, involve heterogeneous values, visions, and goals, make difficult the transmission of knowledge and solutions to take political decisions (Ottra, 2009).

Although the potential conflictive interaction that may occur among the different agents involved in the development of an environmental policy, it can be accepted and assumed that the application of this policy will result in positive benefits not only for the society but also for the environment only when it is based in scientific information (Steel et al., 2004). For this reason, the establishment of suitable frameworks that facilitate the flow of information in a clear manner among the different political and scientific agents (Hoppe 2010) is essential so that public decisions can be socially and environmentally efficient and these decisions can be legitimate from a scientific point of view.

In this context, this article describes the process of the development of the first Typology System of rivers and lakes for Chile, in which an interdisciplinary group of professionals that was constituted by agents from the public sector (policy makers) and scientists from different fields related to water resources participated. It was specially mentioned the participative processes and discussions in which all the agents involved were present, all of which resulted in the creation of a valid product from a scientific point of view and a product that is applicable to the necessities of the environmental institutions of the country.

Methodology

A typology of surface waters bodies can be generally elaborated from two approaches (Ferreól *et al*., 2005): a) the top-down approach, in which water bodies are grouped depending on the environmental variables that characterize them (Verdonschot & Nijboer, 2004; Sánchez-Montoya *et al.*, 2007) and b) the bottom-up approach, in which the classification is made depending on the distribution of biological communities to subsequently create models using the environmental variables that characterize the rivers, parts of them, lakes, or any other water body susceptible of classification. Therefore, this methodology uses environmental variables as well as taxonomic information (Heino *et al.*, 2003; Lorenz *et al.*, 2004). In general, the typologies generated using top-down approaches have been adjusted or corrected by means of the use of bottom-up methodologies (Böhmer *et al*., 2004; Hering *et al*., 2004; Lorenz *et al*., 2004).

In this case, the Typology System developed for lakes and rivers was generated following an *a priori* and a top-down methodology based exclusively on geomorphologic, hydrological, physical, and chemical criteria, which are recognized by experts as the most relevant obligatory factors that control the biocenosis of rivers and lakes of Chile. This decision is supported mainly because of the lack of documented information about fresh water biodiversity and the ecological processes that characterize Chilean rivers and lakes (Hauenstein, 2006; Jara *et al.*, 2006; Ortiz & Díaz-Paéz, 2006; Rivera, 2006; Villalobos, 2006), and which is information that allows elaborating the necessary models, all of which is supplied by the knowledge of experts in the corresponding areas who use top-down approaches.

From this approach, the process of generate a Typology System applicable to a national level had two phases:

Stage 1: Creation of a Typology System. A proposal of a series of criteria with their corresponding classes that could be evaluated by experts in biocenosis in the country was elaborated. These criteria and classes were selected taking into account the Annex II from the Water Framework Directive (WFD) of the European Parliament (WFD 2000), which was used as a reference to define this system. The criteria and ranges proposed by the WFD were modified taking into account a revision of the scientific literature in order to make a first adjustment of this system to the Chilean reality. The selected criteria were analyzed, discussed, and modified in one focus group which got together with a consultant group, fresh water ecosystem experts and decision-makers linked to the management of water resources. The result of this dialogue was a second proposal of criteria and ranges that were analyzed in a second focus group from which a first approach to this Typology System was defined. In Table 1, the total participants and the institutions represented in both focus groups are shown.

To gather the opinions of the parts involved, in each focus group, it was carried out an exposition of the initial proposals to work with to subsequently make key questions to the participants. These questions were recorded on tape and registered in paper. The discussion was moderated by the project manager, who was neutral in all the interventions and avoid influencing the participants. In this way, there was a dialogue that allowed producing a proposal regarding a Typology System based on the expert’s criteria and agreed by the potential users.

Table 1. Summary of participants in the focus group

	First focus group	Second focus group
Number of participants	26	22
Institutions	National Comitee of Environment, current Ministry of Environment (*Comisión Nacional del Medio Ambiente, Ministerio del Medio Ambiente*), Water General Managment (*Dirección General de Aguas*), Centre of Applied Ecology (*Centro de Ecología Aplicada*), National Centre of Environment (*Centro Nacional del Medio Ambiente*), National Museum of Natural History (*Museo de Historia Natural*), Southern University of Chile (*Universidad Austral de Chile*), University of Chile (*Universidad de Chile*), Metropolitan University of Educational Sciences (Universidad Metropolitana de Ciencias de la Educación)	National Comitee of Environment, current Ministry of Environment (*Comisión Nacional del Medio Ambiente, Ministerio del Medio Ambiente)*, Water General Managment (*Dirección General de Aguas*), Southern University of Chile (*Universidad Austral de Chile*), University of Chile (*Universidad de Chile),* Metropolitan University of Educational Sciences (*Universidad Metropolitana de Ciencias de la Educación*), Umweltburo Essen (Germany), GTZ, Universidad del Mar, Eco Hyd

Stage 2: Validation of the Typology System. Once defined and a consensus reached about the Typology System, there was a process of validation that was carried out by means of semi-structured interviews (Hernández et al. 2006) and participative maps, both of which were presented to the fresh water experts depending on their experience in different areas of the country. The total number of potential experts in aquatic ecosystems to be interviewed was chosen taking into account the number of their international and national scientific publications that refer to aquatic ecosystems. From this total, 12 experts were interviewed. These were selected considering their time availability, and focusing on those experts who had a larger number of publications. The experts were differentiated following the criteria of expertise in specific areas and the surface water bodies categories (lakes or rivers) which they have more knowledge about. This information is detailed in Table 2.

Table 2. Experts interviewed to validate System Typology. They appear in order of interviewing.

Interviewed	Surface water categories		Country Areas		
	Rivers	Lakes	High Andes Plateau and Atacama	Mediterranean	Valdivian Lakes and Patagonia
I. 1	x	x	x		
I. 2		x			X
I. 3		x			X
I. 4	x			x	X
I. 5	x				X
I. 6		x	x		
I. 7	x		x		
I. 8		x	x	x	
I. 9	x	x	x	x	
I. 10	x	x		x	
I. 11	x	x		x	X
I. 12		x		x	X

Total Interviews	5	6	6
Total country areas	7	10	12
Interviews %	71.4%	60.0%	58.3%

Source: Own elaboration.

The semi-structured interviews (Hernández et al., 2006) are qualitative tools that allow gathering the interviewee perception by means of a dialogue with the interviewer about the dimensions that he, the interviewer, wanted to gather. In this case, the information that was looked for was about three dimensions defined in this project:

a) The relevance of the criteria ranges used to create the Typology System of surface waters bodies.
b) The logic and basis to redefine the criteria ranges depending on the local characteristics.
c) The adjustment of the boundaries of the ecoregions.

This tool was used in this investigation because incorporates open questions to gather the expert knowledge about the dimensions that is needed to evaluate, allowing making changes to emerging new elements in the interviewed proposals. Moreover, the semi-structured interviews are different from the surveys in that the former do not use a single iterative type of questions but gives a more reflexive approach suitable for the interviewee, allowing the talk to flow naturally (Spradley, 1979).

In turn, participative maps are methodological resources to allow gathering the spatial component of knowledge and are normally used to help the members of a community to visually illustrate how they perceive their territory (Rodriguez, s. a.). In this case, due to the experts training and the knowledge nature involved in this work, this tool is perfectly applicable as a complement to the interviews of the local experts.

The importance of the use of this tool in the process of gathering this expert knowledge lies in the fact that it allows defining differentiated spatial units that are part of the expert comprehension of the territory that he deals with. At the same time, this allows elaborating plans or processes of zoning (Rambaldi et al., 2006).

Each interview was asked to identified in a paper map of the application of the Typology System in the ecoregion they are most familiar with, if the classification there represented reflect or not the spatial distribution of the biocenosis, incentivizing them to draw the distribution that he/she recognizes in the territory. Thus, it was expected to reflect the expert knowledge in its spatial dimension, which in turn has a later cartographic expression.

The application of both tools required the participation of two professionals to avoid biased conclusions and to increase the possibilities of gathering the necessary information from each interview. The interviews and interactive maps were conducted by a biologist, who represented a valid interlocutor to guide the interviews, accompanied by one of the co-researchers of the team to help in the generation of the interactive maps. Basic materials were used, such as the interview guidelines, the cartography on paper of the surface water bodies' classification and its digital version, and a recording machine to facilitate the register of the interventions made during the interview and the work with the interactive map, the latter always after having received consent from the interviewed person (Blasco & Otero, 2008).

For the analysis of the interviews, the method known as content analysis was used. This is defined as a technique to study and analyze communication, searching for the systematization and objectivity of that which is communicated (Krippendorff 1990). This technique allows analyzing any form of human communication, especially the one emitted by particular subjects (Hernández *et al*. 2006). Content analysis is one of the procedures that more closely follows the quality premises of its purposes, it tries to analyze messages, worries and other subjective aspects.

In order to integrate the knowledge gathered in the Typology System with the concrete needs of the decision makers, it was created a working group that included international experts in the classification of bodies of water, members of public institutions as representatives of the Environment Ministry of Chile and the Water General Management and experts in aquatic ecosystems. In this instance, the proposed system was contrasted with the possibility of putting it in action according to the availability of information and the institution's means, considering as mandatory the considerations gathered by the experts through the interviews, allowing consolidating a typology system validated both at a scientific level and at an institutional level.

To complement the dialogue between the experts and decision makers, the results of this system were presented in two seminars and one congress, instances that are understood as validated for scientific circulation. These instances were:

- VII Congress of the Chilean Limnology Society, October 2010,
- Scientific Conference organized by the EULA of Universidad de Concepción,
- Seminar “River's and lake's Typology and Biological Indicators”, which was organized specially for the spreading and socialization of this tool, and in which experts in limnology at a national level were summoned.

Results and Discussion

The result of the processes of participation and discussion between the working team, professionals in charge of generating policies, and fresh water ecosystems experts during the two stages of the project, lead to the generation of a Typology System for rivers and lakes formed by means of a consensual work between all the participating sectors.

Stage 1: Generation of a Typology System

The generation of a Typology System starts in the premise that the number of types, whether it be lakes or rivers, needs to be as big as necessary and as small as it can possibly be. This premise established the framework to agree on the vision of the environmental institution to have a manageable system so much economically as technically, and the expert vision of obtaining a valid product from a scientific point of view. Once the scope of the work was defined, a first set of Chilean freshwater ecoregions and the first battery of classification criteria for the corresponding discussion in the first focus group were established.

First focus group: The first proposal of freshwater ecoregions for the country was presented (17 ecoregions), and was analyzed, discussed, and modified according to the opinions of the experts in freshwater ecosystems. The neutrality character maintained by the project director was successful in inducing an unbiased dialogue on behalf of the participants. Open dialogue generated proposals based on the experiences of each of the experts, especially the ones related to the projects and/or consultancies made for the environmental institutions of which they form part of. This focus group is transformed in the first instance in which the consulting team interacts with experts in biology, conditioning the proposals that might be delivered in the future. According to the concrete results, there was consensus on reevaluating the variables used and on decreasing the number of proposed ecoregions. The latter was decided because of the difficult applicability that this has for the consequent management and handling of the water resources. Criticisms and recommendations to the proposal are shared, thus, integrated as a base for the improvement of the product.

The discussion of the criteria of classification with their corresponding classes puts on the table the first discrepancies among the different individuals of how approaching the problem. Whereas for decision-making professionals the criteria and rates must be homogeneous for the whole country, for experts they have to be divided by macro-zones. The latter, stresses the first conflict between experts and politicians. Scientific thoroughness is understood in order to explain the reality of the country, however, the economic and human resources to negotiate require a simple system that is applicable to economic ends. On the other hand, it is insisted not to counterpart the WFD methodology, which establishes unique criteria and rates for the whole country. Finally, we agree on selecting criteria and classes that explain as much variability within the territory as possible. In this respect, and due to the lack of information, it is decided that the categorization of rates must be based on the empirical experience of the different experts.

Second Focus Group: Taking into account all the criticisms and suggestions made by the experts and professionals assisting to the first focus group, a second proposal of ecoregions and classification criteria is proposed. For the first time, the proposal receives recommendations from European Union experts about classifications of bodies of water. Due to the latter, it is assumed that the new products are better adjusted to the characteristics of a Typology System generated from the WFD guidelines. The absence of major conflicts during the group work with the international team, explains why there was relative clarity respect to the objectives of Typology System and to the chosen methodology.

In this focus group was presented the European experience respect to the generation and putting into practice of the German Typology of surface waters bodies based on the WFD (Pottgiesser & Sommerhäuser 2004; Sommerhäuser & Pottgiesser 2005). Such presentation gave a theoretical basis by which the discussion of the improved proposal of the Typology System for Chile was based. The fact that the characteristics and objectives of a typology based on the WFD are described by a professional team involved directly in the generation process of this one in Germany, gave a major support to the proposal developed for Chile. Unlike the first focus group, the discussion was not focused on the benefit of applying a methodology created for a different reality to the one of the country, but it was focused on the appropriateness of selected criteria of classification. The latter is understood as a validation of the proposal, in methodological terms, by the experts.

The final product of this stage is the creation of a Typology System for rivers and lakes, system that includes as first level of classification a group of five ecoregions and a battery of five criteria of classification with their corresponding types, both for rivers and lakes. This preliminary Typology System achieved to combine scientific with political criteria, however, the fact that this was not submitted to a consulting expert process at a regional level, it was not considered as validated by the national scientific community.

Stage 2: Validation of the Typology Systems for rivers and lakes

During this second stage, the Typology Systems for rivers and lakes generated during stage 1 was validated, adjusted, and socialized. The validation phase carried out by means of semi-structured interviews allowed each expert to be involved more directly in the generation of the product. In this context, it was proved good willingness by each interviewee to get involved in the whole process, except for some reluctance, whose causes shown during each interview. Respect to the latter, and despite the expert knowledge obtained during the first stage was included in the final results of the system, it can be highlighted the way in which was used, which, according to the interviewee's opinion, was not included in a formal way. In this manner, it can be discussed the possibility of including, at a third stage, the Chilean Society of Limnology as an expert organism to assist the final typology of this project, separating the typology of rivers from the one of lakes.

The analyses of the interviews allows to conclude that the different visions of how classifying each body of water in the country, prevented the unanimous validation of the proposed methodology. The use of an elaborated methodology according to the characteristics of a different territory to the one of Chile, implies certain concern in the applicability of such, to the national reality (high geographic and climatic variability). This situation can be illustrated at the moment the classification of criteria are validated, when is possible to notice certain differences of opinion respect to whether is relevant to use them as valid variable of classification or not. Despite this scenario experimented during the first stage of this project, the agreement achieved in its end was not enough in order to change the perception of the experts in the second stage. This type of circumstance is common in the processes in which the active involvement of different performers (i.e. politicians and scientists) are involved, and this agents can be faced with conflicts that are explained mainly by limited visions to tackle and solve a problem (Huitema & Turnhout, 2009; Oltra 2009). Regarding this conflict, each expert has evidenced their methodological differences, which are subject to the amount of knowledge that they have on the ecological systems and the geographic area in which they work. So it was not surprising that experts tackled the typology from a "bottom-up" perspective, which contravenes the "top-down" perspective supported in this proposal of typology.

Alternatively, whenever this Typology System was presented (interviews, VII Congress of the Chilean Limnology Society, and scientific conference at EULA Center, Universidad de Concepción), it was expressed the need for clarifying the objectives that the institutions want to achieve with the typology for the classification of water bodies, since the level of accuracy and adjustment that the typology should have depends on the objectives aforementioned. Considering the type of management in which it will be applied, it is absolutely necessary to make this point clear.

Another example of this problem is the low level of understanding of those who attended the seminar "River's and lake's Typology and Biological Indicators", which was held at the end of this second phase, on what the typology was, its objective and its potential. This was evidenced in the questions about the inclusion of topics that are not part of the typology, such as the way of managing water in Chile (characteristics of the rights to water use, determination of ecological water level, among others)

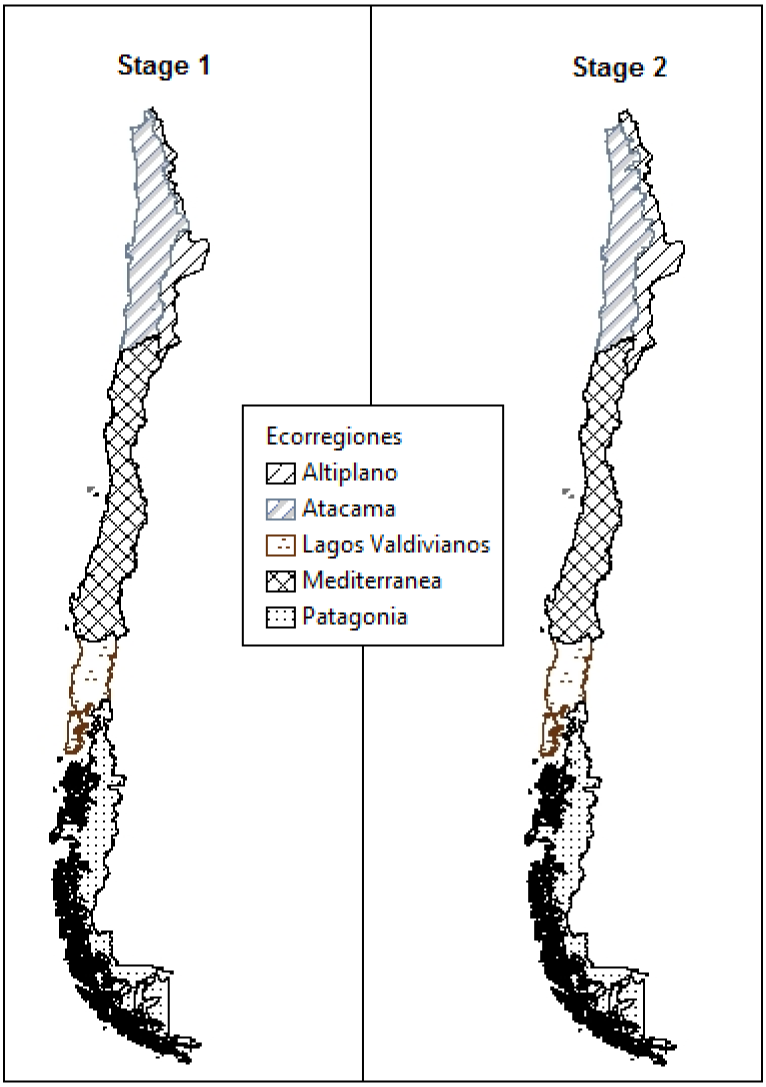
From this phase of validation and socialization that was characterized by the high level of interaction among scientists specialized in freshwater biological systems, public administration professionals, and the consulting team, it was obtained an improved Typology System in comparison with the one obtained in stage 1 and pertinent to the national current situation, that has five fresh water ecoregions (Figure 1), and a set of five criteria with their ranges or classes for rivers and lakes (Table 3). The validity of the Typology Systems strengthens the idea that this tool can become the frame of reference for the conservation of water resources if it's well developed. However, it is worth mentioning that the practical validation of this tool is subject to a third stage in which there are two key elements to consider: first, the will to summon the biology experts as active members in the implementation and validation of the typology in the field; and second, the objective of developing maps using criteria that do not have them.

Table 3. Criteria and classes of Chilean surface waters bodies Typology System. Criteria and classes A: determined at the end of stage 1. Criteria and classes B: determined at the end of stage 2.

Criteria	Class	Criteria	Class
Rivers and Lakes			
Altitude (masl)	Class 1: Low (< 500) Class 2: Middle Low (500 - 1000) Class 3: Middle High (1000 - 2500) Class 4: High (> 2500)	Geology	Class 1: Siliceous and high mineral content Class 2: Siliceous and low mineral content Class 3: Calcareous and high mineral content Class 4: Calcareous and low mineral content
Electric conductivity	Class 1: Low Class 2: Middle Class 3: High Class 4: Very High		
Only Rivers			
Slope (%)	Class 1: Low (< 2) Class 2: Middle (2 - 4) Class 3: High (> 4)	Slope (%)	Class 1: Low (< 2) Class 2: Middle (2 - 4) Class 3: High (> 4)
Substrate	Class 1: Silt Class 2: Sand Class 3: Gravel Class 4: Stone	Substrate	Class 1: Silt Class 2: Sand Class 3: Gravel Class 4: Stone
Discharge (m^3/s)	Class 1: Low (< 10) Class 2: Middle (10 - 200) Class 3: High (> 200)	Discharge (m^3/s)	Class 1: < 5 Class 2: 5 - 50 Class 3: 50 - 200 Class 4: > 200
		Altitude (masl)	Class 1: Very low (< 100) Class 2: Low (100 to 800) Class 3: Middle High (800 - 1500) Class 4: High (1500 - 3500) Class 4: Very high (> 3500)
Only Lakes			
Lake size (area) (km²)	Class 1: Very Small (< 1 km^2) Class 2: Small (1 a 10 km^2) Class 3: Middle (10-100 km^2) Class 3: Large (> 100 km^2)	Lake size (area) (km²)	Class 1: Very Small (< 1) Class 2: Small (1 - 10) Class 3: Middle (10 - 100) Class 3: Large (> 100)
Depth (m)	Class 1: < 10 Class 2: 10 - 50 Class 3: > 50	Depth (m)	Class 1: < 10 Class 2: 10 - 50 Class 3: > 50
Mix regime and water stratification	Class 1: Amictic Class 2: Polimictic Class 3: Monomíctic Class 4: Meromíctic**	Mix regime and water stratification	Class 1: Amictic Class 2: Polimictic Class 3: Monomictic Class 4: Meromictic**
		Altitude (masl)	Class 1: Very low (< 50) Class 2: Low (50 - 800) Class 3: Middle High (800 - 1500) Class 4: High (1500 - 3500) Class 4: Very high (> 3500)

Source: All criteria and classes based on expert criteria. Mix regime and water stratification classes based on expert criteria and scientific literature (Campos 1984; Soto 2002; Parra et al. 2003; Villalobos et al. 2003; Márquez-García et al*.* 2009) **Particular class: Incomplete water circulation is incomplete due to non-termic salinity gradient. Substrate, discharge, depth and mix regime, and water stratification are criteria without cartography.

Figure 1. Ecoregions determined in stage 1 and stage 2



Source: Own elaboration**.**

Although the main objective of our research was the achievement of the first system of typology for rivers and lakes, the successful dialogue between the academic sphere represented by scientists, and the public sector represented by decision makers, became one of the most relevant results in this process. This setting, which was favored by the environmental institutions, was brought about by recognizing that the participation of scientists is an element that increases the quality of the decision-making process (Functowicz & Ravetz, 1999). This is consistent with the idea that scientific knowledge is the only true way to the actual situation since it provides objective knowledge to it (Steel *et al*. 2004). Alternatively, it seems that many of the participant researchers attributed positive elements to the collaboration among different parts, despite the conflicts that appeared during the process. Even though Oltra (2009) showed that the collaboration between scientists and politicians is a desirable yet complicated element, in this occasion, the positive attitude of the participants favored a stable environment of collaboration during the whole process, which made it possible to have a product that everybody agreed on and that they validated.

Conclusion

This project comes to an end with the creation of a Typology System of surface waters bodies for Chile that can be considered in tune with the state of the arts of the country's freshwater systems. In this typology's elaboration process, communication between decision makers (in this case the Environmental Ministry) and the fresh water ecosystems expert, experimented an evolution since the beginnings when the disagreements related to the Typology's objective y en the regional scale required by the decision makers wasn't understood by the experts, until a final stage when the understanding of the objectives y and the agreements about the relevance of having a Typology System show the dialogue reached between the actors.

As a product of this dialogue, scientific data and expert knowledge gathered and systematized, which, together with supporting the decisions that were made during the planning of the system's design, transformed into a valuable source of reference for future research on the field.

However, despite the experts who were consulted in this investigation agreed with the need of having a Typology of rivers and lakes for the country, they have also evidenced that the results that have been obtained so far are not enough and require more development. The process of dialogue have made of this need of research development a shared goal between decision makers and experts, since they have come to understand each other point of view and have came to similar conclusions, strengthen the results reached in the development of this Typology System.

Communication between scientists and politicians is a relevant factor to the elaboration of more efficient and effective environmental policies, which should integrate not only management and economic issues, but also more technical aspects that can influence in the final success of any long term strategy. For this reason, registering successful experience in these matters, as well as stimulate the instance of communication between these actors, can contribute to reduce the gap between science and politics.

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