MANUAL FOR THE CREATION OF HUMAN WELL-BEING INDICATORS IN CHILEAN PROTECTED AREAS

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Acronym List

CONAF: National Forestry Corporation.

HWB: Human Well-being.

IPBES: Intergovernmental Panel on Biodiversity and Ecosystem Services.

IUCN: International Union for Conservation of Nature.

MMA: Ministry of the Environment.

OSPC: Open Standards for the Practice of Conservation.

PA: Protected Area.

SBAP: Biodiversity and Protected Areas Service.

SNASPE: National System of National Protected Areas.

FOREWORD

I am pleased to present you the manual for the creation of human well-being indicators linked to the protected areas of Chile. This manual is especially useful for those interested in delving into this field, which has awakened a growing interest regarding the importance of protected areas, both for human well-being and for the conservation of biodiversity and nature.

In an increasingly industrialized and urbanized world, the protection and preservation of nature has become a priority for human well-being. Protected areas offer an opportunity for a variety of benefits, from providing habitat for endangered species to providing clean air and water. In addition, these areas offer opportunities for recreation, spiritual exercises and also to support a diversity of local communities' livelihoods.

This manual presents clear and concise information that is easy to understand, both for those who are new to the subject of human well-being, and for those who seek to improve their knowledge. In these pages you will find detailed information on why it is important to use indicators, the conceptual bases for the evaluation of well-being and a proposal for the construction and application of indicators.

Creating indicators of human well-being for protected areas is no easy task and requires a deep understanding of the complex interactions between society and the natural environment, as well as a clear understanding of the goals and objectives of protected area management.

This manual provides a step-by-step guide for the selection of indicators applicable to different nature conservation realities within protected areas in Chile.

This manual is especially timely as Chile must respond to global and national requirements that certify that protected areas are managed equitably and efficiently, delivering successful long-term conservation results for both biodiversity and people. This manual responds to the need to have a roadmap for the construction of indicators that allow monitoring over time for the multiple contributions that Chile's protected areas make to human well-being.

The management of protected areas is fundamental to guarantee the survival of the species and ensure the ecological balance and the provision of ecosystem services for society. However, for effective management it is essential to include human well-being as a key component. This manual provides the guidance needed to develop indicators to help ensure that protected areas continue to provide benefits for both people and the environment, now and in the future. I hope this manual will become a valuable tool for your personal and professional growth.

Christian Little
Executive Director of CONAF

Key messages

- **Protected areas, both private and public, increasingly need to demonstrate their contribution to local well-being, beyond the intrinsic value of the biodiversity they protect.**

- **For this, it is necessary to have human well-being indicators that allow for monitoring protected areas' contribution.**

- **The selection of indicators is not a trivial exercise and requires a high level of knowledge of the reality in which protected areas are inserted.**

- **To a large extent, the indicators are case-specific, although the process and criteria for their selection may be generalizable.**

- **This manual provides a stepwise guide for the selection and application of effective human well-being indicators.**

1. WHY HUMAN WELL-BEING INDICATORS IN CHILEAN PROTECTED AREAS MANAGEMENT?

National governments are increasingly pursuing policies to secure biodiversity while ensuring human well-being (henceforth HWB) dimensions, including health, social relations and cultural values (Bottrill et al. 2014). Protected areas (henceforth PAs) are widely recognized to contribute to HWB through the provision of ecosystem services such as pollination, recreation opportunities, clean water, flood regulation, sense of place and inspiration, among others (MEA 2005). These services contribute to food security, mental and physical health, and sustainable livelihoods (Annis et al. 2017). This recognition has led to PA management practices that consider local communities and HWB in conservation. This shift includes HWB as a central conservation objective in PAs management plans.

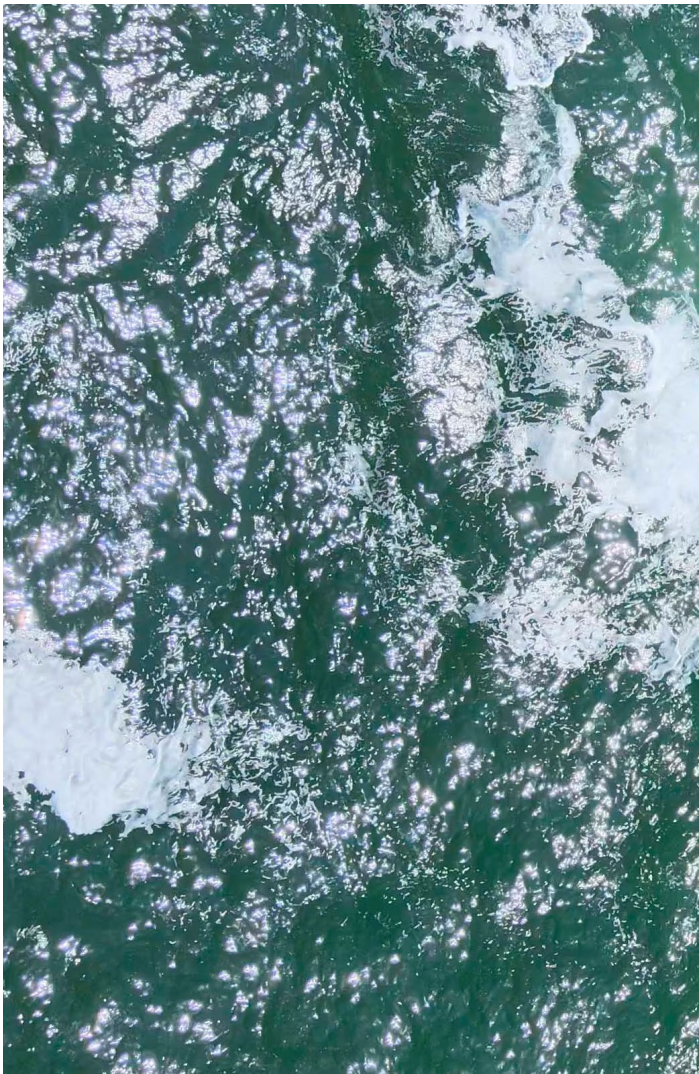
In Chile, most PAs are under the administration of the National System of State Protected Areas (SNASPE for its Spanish acronym), which in turn is administered by the National Forestry Corporation (CONAF for its Spanish acronym). The SNASPE is responsible for the management and conservation of legal PAs from the State of Chile that include the categories of National Parks, National Reserves and Natural Monuments (www.simbio.mma.gob.cl). The System currently has 105 PAs, which are distributed in 43 National Parks, 46 National Reserves and 18 Natural Monuments, covering

nearly 19 million hectares, 21% of Chile's continental territory. Nature Sanctuaries are another important PA category, managed by the National Monuments Council and the Ministry of Environment (MMA for its Spanish acronym). Currently, there are 93 Nature Sanctuaries adding approximately 700,000 hectares to the PA network.

SNASPE and Nature Sanctuaries promote the incorporation of HWB in its guidelines for developing PA management plans (CONAF 2017). Specifically, these guidelines recommend the incorporation of HWB in the preparation and conceptualization stage of PA management plans. The "Action Framework for Community Participation in SNASPE Management" (CONAF 2020) represented a step forward in the search for new guidelines and mechanisms for citizen participation in PA management.

In Chile the Open Standards for the Practice of Conservation (henceforth OSPC) methodology is officially being used by the MMA and CONAF in its planning guidelines to design and carry out PA management plans (Conservation Measures Partnership, CMP, 2020). The last version of OSPC considers HWB as part of the conservation targets. In addition, to certify compliance with effective management of PAs, external evaluation processes have been implemented through the use of verifiable indicators, including certification processes for PAs (Tacon et al. 2021). The most important initiative is the International Union for Conservation of Nature (IUCN) Green List program, which is a global standard based on four principles: good governance, solid design and planning, effective and successful management and (IUCN 2017).

To meet the goals of the above initiatives and guidelines, there is a gap in understanding the development of locally-relevant HWB objectives and indicators in PA planning. This manual has been designed to more rigorously guide the incorporation of HWB dimensions for Chilean PA planning. By following the steps in this manual, PA managers can create indicators that will inform HWB impacts of PA management and meet the principles and criteria of the Green List. For example, HWB indicators can demonstrate meeting the transparency and accountability principle of good governance and the consideration of socio-economic conditions under the design and planning principle. Moreover, creating HWB indicators can meet the principle of effective management within the socioeconomic context, helping measure the success of conservation outcomes related to HWB. The inclusion of HWB in conservation has important implications for PA management, ensuring that the focus of conservation is not only on maintaining functioning ecosystems, but also the different livelihoods and well-being of local communities.



1.1 Objectives of this manual

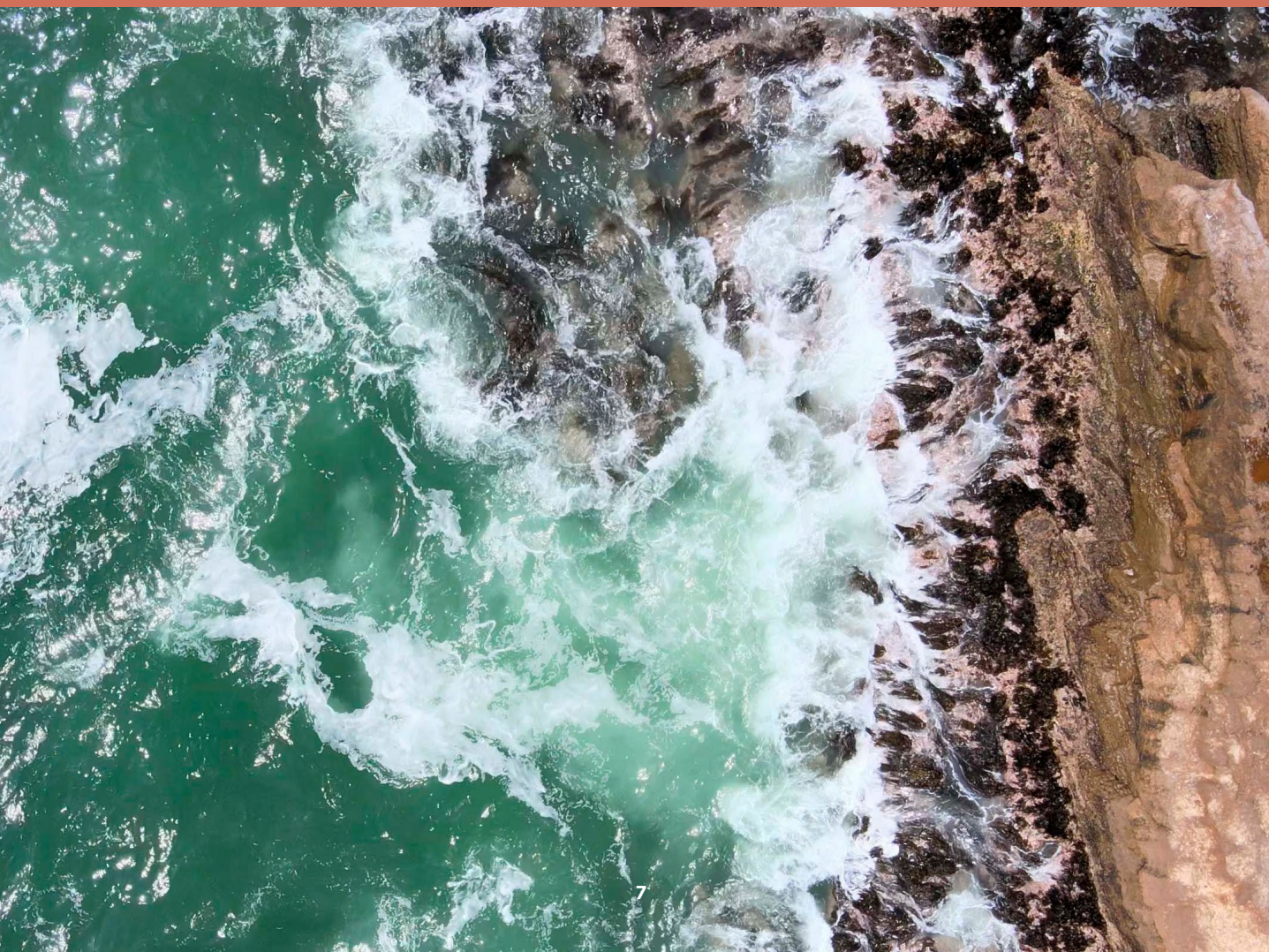
The central objective of this manual is to provide a practical guide for the selection of HWB indicators applicable to different realities of nature conservation within PAs (public or private) in Chile. Additionally, the document pursues the following specific objectives:

I. Provide some conceptual bases for the evaluation of HWB in the context of nature conservation.

II. Identify the characteristics of indicators capable of measuring material and immaterial HWB.

III. Identify the conditions under which it is necessary or not to measure HWB around the conservation of nature in PAs.

IV. Characterize the steps involved in HWB indicator selection and criteria for prioritization.



2. CONCEPTUAL BASES FOR WELL-BEING ASSESSMENT

Human well-being describes the multidimensional state of humans thriving, including essentially six domains: physical, psychological, social, cultural, economic, and governance (Figure 1). It is derived from the access to the basic materials for life including clean air, water, food and shelter, as well as the actual status of humans' physical, mental, and spiritual health. Human-well being is influenced by conservation in two ways: i) as a product of ecosystem components (e.g. ecosystem services) and ii) as a product of the social process of conservation (e.g., governance).

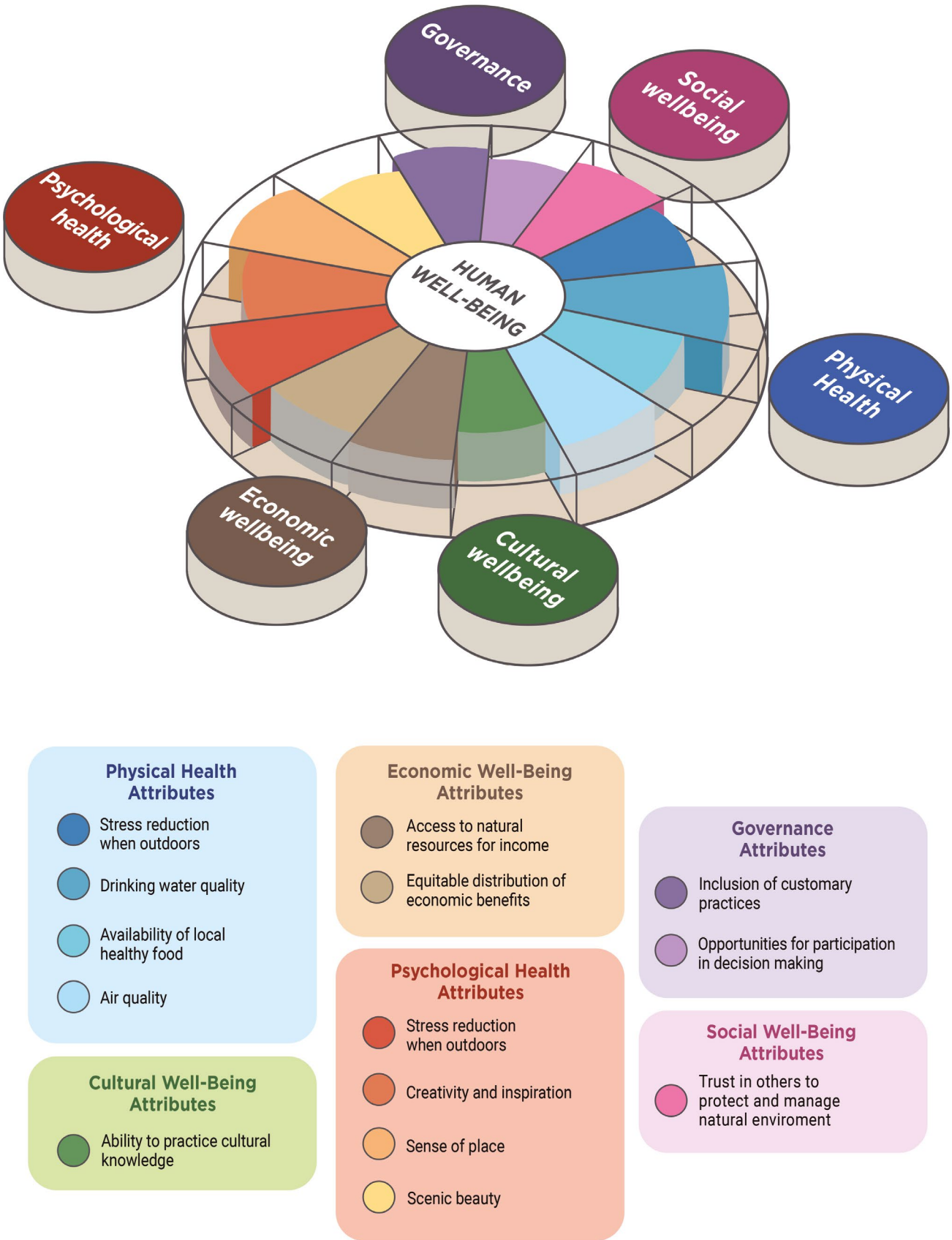


Figure 1. Visual representation of HWB domains. Source: Biedenweg et al. (2016)

2.1 Current human well-being conceptual frameworks

I. Ecosystem services based frameworks

The concept of ecosystem services emphasizes the multiple connections between ecosystems and people (MEA 2005). One of the most widely used frameworks connecting ecosystem services and HWB is the one proposed by the Millennium Ecosystem Assessment in 2005 (MEA 2005). This framework depicts how changes in ecosystem services influence five dimensions of HWB, including basic materials for a good life, such as secure and adequate livelihoods, enough food at all times, shelter, clothing, and access to goods; health, including feeling well and having a healthy physical environment, such as clean air and access to clean water; good social relations, including social cohesion, mutual respect, and the ability to help others and provide for children; security, including secure access to natural and other resources, personal safety, and security from natural and human-made disasters; and freedom of choice and action, including the opportunity to achieve what an individual values doing and being.

More recently the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services (IPBES) proposed the concept of nature's contributions to people, which builds on the ecosystem service concept but claims to recognize the central role that culture plays in defining links between people and nature (Díaz et al. 2018).

II. Social indicators and capabilities frameworks

Another approach emerged from the development literature, which focuses on social processes and social indicators. This literature identifies the frequent negative impacts of development and conservation projects that limit people's access to resources and decision-making. It acknowledges that a fundamental source of cognitive, emotional, spiritual, and social well-being is through the freedom to make decisions about one's own life and to feel included in important processes affecting one's life. It is through this literature that we identify another source of HWB in conservation: the process of conservation strategies themselves. For example, conservation strategies that limit fishing activities can be considered to have a positive effect on BH in the long term, by ensuring a sustainable supply of fish in the future. But the action itself implies that in a tangible way, fishers have lost access to food, economic and cultural resources. In turn, in an intangible way, they have lost their voice if the process to decide the closure of the fishery was not based on a transparent and democratic dialogue. This intangible impact on HWB is just as likely to result in HWB decline and conservation conflicts as is the degradation of ecosystem components.

2.2 Why do we need human well-being indicators?

There are four primary reasons managers might choose to implement HWB indicators (Figure 2):

I. To assess and demonstrate meeting legal objectives and goals. These goals may be formal or informal. They may be established at a local, national, or international scale. For example, the creation of a specific park may state the explicit intention to benefit humans through conservation. At a national level, Chilean laws require the participation of society in all public processes, including conservation. In turn, at an international scale, for a PA to be certified as complying with the IUCN Green List it must demonstrate meeting several criteria, including those related to human impacts. To evaluate whether these goals are being met and demonstrate compliance with these policies, data is required in the form of relevant indicators.

II. To improve social justice. Without data, there is no way to know if conservation strategies are negatively impacting some social groups more than others. All HWB indicators should be collected along with demographic data to be able to disaggregate across vulnerable groups. An indicator focused on economic benefits from natural resource products may tell us that recreational fishing businesses are benefiting from conservation strategies, while subsistence fishing communities are losing. This information can help us consider how to modify strategies either geographically or conceptually to mitigate negative impacts on this community.

III. To identify multi-benefit strategies. By identifying the most important indicators for HWB related to a PA, it is possible to discover and prioritize strategies that have a better chance of obtaining multiple social and ecological benefits. For example, a traditional strategy for conservation might have been to close off all access to fisheries. Yet this strategy often ignores the conflicts created by disregarding economic and cultural dependencies on fisheries, and frequently results in people continuing activities, albeit illegally. Acknowledging and monitoring these sources of HWB has helped many PAs create more effective strategies, such as seasonal and geographical regulations, that maximize both social and ecological benefits in addition to having a higher likelihood of compliance.

IV. To gain the trust and support of people who live around a PA or use the PA. Many hypothesize that this trust can facilitate implementation of the PA by preventing negative actions on the area and encouraging stewardship behaviors in support of the management plan. This hypothesis is not necessarily tested, but is intuitive. The act of adopting HWB indicators demonstrates an interest in the users, not just in the natural system, and the act of collecting data creates opportunities for interaction and further demonstration of a commitment to user needs.

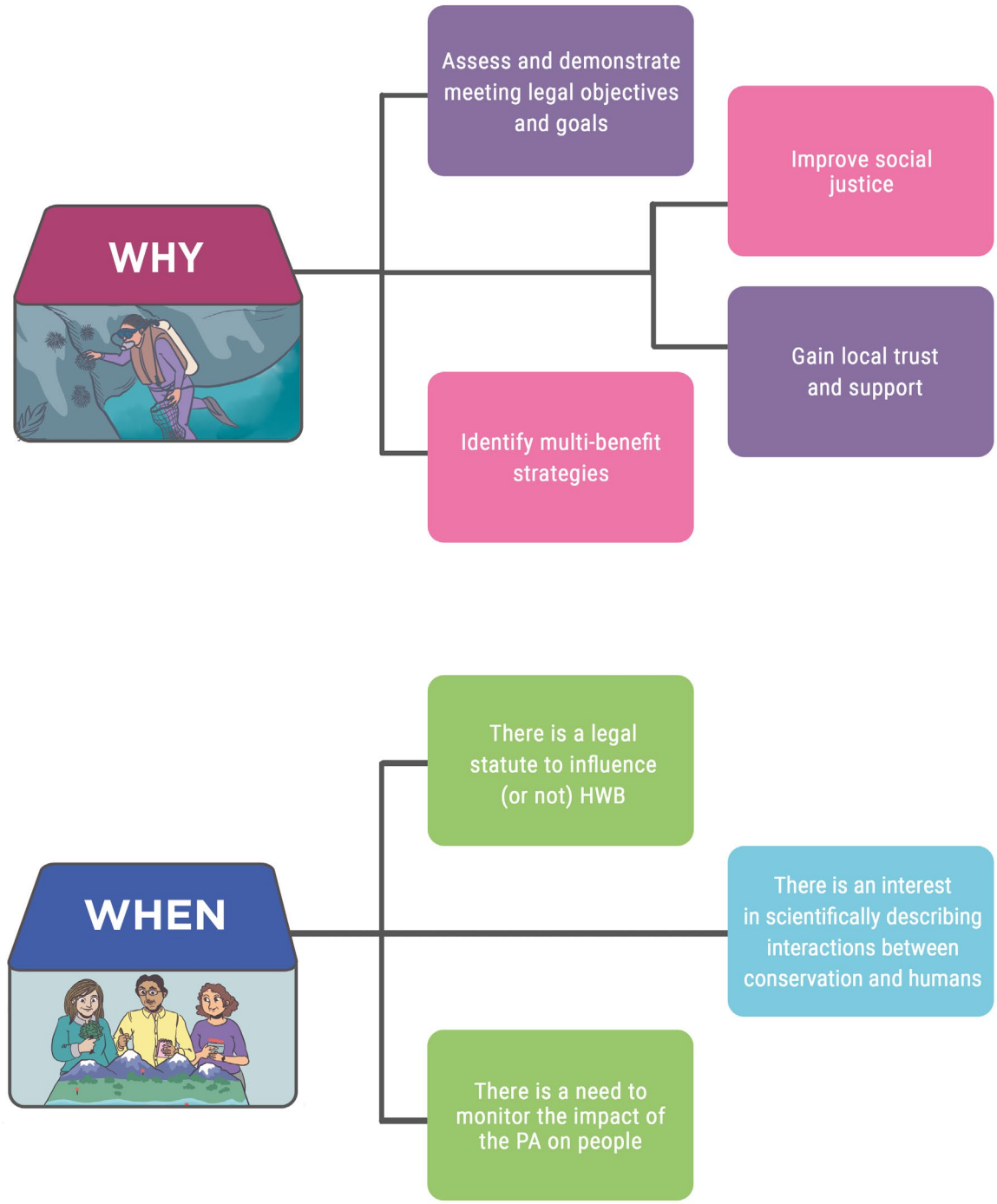


Figure 2. Why and when human well-being indicators might be needed.

Human well-being indicators are metrics that measure the actual status of HWB. They are not general concepts (e.g., 'income'), but specific metrics that can be measured over time (e.g., per capita household income from fisheries in a community'). We call these general concepts "Attributes" and the specific metrics "Indicators". Both the attributes and indicators are further grouped in broad concepts called domains (see Appendix 1, available online at Biedenweg et al. 2023).

Human well-being indicators for conservation also have a logical connection to the process of conservation. For example, while PA managers are interested in indicators of economic well-being, they are more interested in an indicator of fisheries income than an indicator of total economic productivity. Similarly, to measure physical health PA managers would be more interested in indicators such as clean air, drinking water, and recreational activities that can be derived from conservation activities, than measures of obesity that can be largely influenced by genetic factors.

Lastly, HWB indicators are not the same as the information that comes from a customer satisfaction survey. HWB indicators are not meant to measure what people think about a PA, but rather indicators need to demonstrate impact in the most objective way possible at a moment in time that can be replicated over time. We are not asking people for their opinions or attitudes about the PA. We may, however, ask about their current assessment of participation opportunities as an indicator of governance.

There are three types of metrics commonly considered for indicators: Natural, Proxy and Constructed (Table 1).

Natural measures are those that directly measure different dimensions of HWB. These include things like life satisfaction assessments (a measure of subjective well-being), measures of asthma (a measure of physical well-being), and direct measures of household income (a measure of material well-being). Natural metrics are the ultimate measure of HWB, but may be influenced by many factors far beyond conservation.

As a result, managers often use proxy and constructed metrics that assume a link to the natural metrics based on prior research. For example, air quality can be a proxy metric for asthma rates whereas number of fishing licenses can be a proxy metric for fisheries-based income.

When neither proxy nor natural metrics are available, managers often use constructed metrics, which are generally statements that researchers ask people to rate based on their knowledge of the indicator of interest. This may be from a sample of the general population (e.g., "On a scale of 1-10, how much does being in nature contribute to your emotional health?") or from designated experts (e.g., "Participation in Community Councils has been high, average, low"). Constructed metrics can be informative as they often include interpretive elements of the indicator.

Table 1. Examples of metrics of human well-being.

Attribute	Natural metric	Proxy metric	Constructed metric
Physical	·Obesity incidence ·Asthma rates	·Frequency of physical activity ·Air quality	·Self-rated score of physical health
Emotional	·Suicide rates	·Number of social connections	·Self-rated score of stress
Economic	·Household income ·Employment status	·Commercial fishing licenses	·Work satisfaction

Finally, indicators can be both quantitative (numeric) or qualitative (assessments of good/bad/better/worse). This choice often depends on the availability of data and ability to collect data.
It is important to distinguish the difference between an indicator and a target. Targets are goals we set for 'how much' or 'in which direction' we want to see indicators change by a specific date. They should have a stated goal date, clearly express geographic and demographic specifications, and be realistic for the managing agency. While an indicator may be frequency of outdoor recreation, the target could be to see 60% of the nearby population recreating outdoors at least once per week by the year 2030. Setting targets requires a separate process than developing indicators, as it relies on scientific understanding of the mechanisms that influence change in the indicator. It is not very common to have a target developed along with indicators, but that does not mean it can not be done. PA managers would just need to invest more time and resources to do so.

2.3 When do we need human well-being indicators?

Not all PAs will require the development of HWB indicators. For example, in a context where there are no communities near the area or where there is simply no capacity to implement data collection or reporting, it would not make sense to invest in indicator development. Multiple use PAs are the strongest candidates for implementing HWB measurement and monitoring through indicators.

However, if any of the "Whys" above (section 2.2) are true in a particular context, then that PA is a good candidate for HWB indicators. PA managers should consider developing and collecting data for HWB indicators if any of the following are true (Figure 2):

I. When there is a legal statute mandating to consider HWB. If, for example, the creation of a park states that conservation activities should not limit human benefits from the area, or that it should limit human actions in the area, this would suggest the need to monitor compliance with this policy.

II. When there is a need to monitor the impact of the PA on people for either evaluation or conservation strategy development purposes. Even without legal obligation, one may simply be interested to know how the PA's activities are influencing different stakeholder groups. This type of information can help improve management strategies in the long term, and identify potential sources of injustice or conflict. While one-time evaluative interviews might give some insight to people's perceptions of PAs, they do not provide the long-term monitoring required for more confident assessments.

III. When there is an interest in scientifically describing interactions between conservation and humans. This leads to the scientific reason for developing and monitoring HWB indicators. Conservation scientists consistently identify a lack of social data for testing any hypotheses about social-ecological interactions and conservation impacts on people. Most social data is based on either anecdotal evidence or singular studies that rely on the memory of interviewees. Neither of these are particularly rigorous strategies for looking at long-term interactions. For example, without longitudinal data on cultural practices that are collected apart from people's evaluation of the PA, it is difficult to scientifically tease apart the causality of conservation activities in the PA on these social objectives. This is the same logic as collecting biodiversity data over time. Rather than simply asking people if the PA has made the place more biodiverse to determine ecological impacts, we use metrics collected over time to test these changes. If the PA has the goal of being a place for high quality science, HWB indicators should also be considered as part of the research portfolio.

3. CONSTRUCTION OF HUMAN WELL-BEING INDICATORS FOR PROTECTED AREAS

3.1 How to select and apply indicators

This section provides a brief step-by-step guide to identifying appropriate HWB indicators for PAs. People who are most likely to identify relevant indicator topics are those likely to be impacted (positively or negatively) by conservation. Thus, the ideal ways to collect the following information are through social scientific interviews using a representative sample of different stakeholders and rights holders. These could be individual interviews or focus group discussions. This input must be balanced with practicality, however, so a consultative approach with a combination of representative local experts in relevant social services should also be used. These might include park managers, local leaders, local educators, or local public service employees.

In order to identify potential indicators, the following steps are recommended (Figure 3):

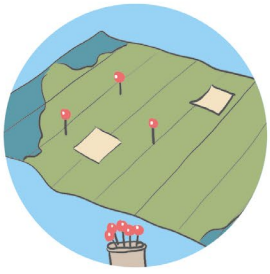
Step by Step:
Construction of human well-being indicators

Redesign indicators on the basis of new human groups of interest in the PA

Step 1:
Clearly identify existing formal and informal rights to the PA

Step 2:
Clearly identify the social benefits from the PA

Step 3:
Identify potential winners and losers from the specific conservation strategies



Step 4:
Identify available data sources

Step 5:
Develop and implement ranking criteria to rank and select final indicators

Step 6:
Collect data

Step 7:
Report data

Figure 3. Steps in the selection of potential human well-being indicators.

3.2 Step by Step: Construction of human well-being indicators

Step 1: Clearly identify existing formal and informal rights to the PA

What social groups have legal access to the area currently? What social groups have been informally accessing the area? Be careful with individual biases at this stage that may result in ignoring a group because some people do not see their activities as worthy or see them as a detriment. It is important to get a full picture of all the social actors: winners/losers, affected/those who affect others.

Step 2: Clearly identify the social benefits from the PA

What do specific social groups use or benefit from in the area that will become a PA? This includes the benefits they received prior to creation of the PA as well as potential additional benefits upon implementation. Ideally, all HWB domains should be considered (Figure 1): physical, psychological, social, cultural, economic, and governance (Appendix 1, Biedenweg et al. 2023). It is very important that the identified benefits can be linked to the ecosystem services provided by the PA.

BOX 1. Who are beneficiaries (winners) and losers in conservation.

Who is a direct beneficiary (winner)?
A direct beneficiary, sometimes called a primary beneficiary, is someone who is directly involved with the PA project and benefits from it. Depending on the PA vision and goals, this could be people who participated in a training, students of a local school that received environmental education, or women foragers that increased their income. The important thing is that the direct beneficiaries are connected with the PA project. Since they are so closely intertwined with the PA, direct beneficiaries should be easy to count and describe. HWB indicators usually involve describing this type of beneficiary.

Who is an indirect beneficiary (winner)?
An indirect beneficiary, sometimes called a secondary beneficiary, is someone who is not directly connected with the PA project, but will still benefit from it. This could be other members of the community or the general public who benefit from natural heritage. Most PA projects are not planned around indirect beneficiaries, because they are more difficult to describe precisely. PA managers may or may not decide to have HWB indicators for these groups. This is a case-specific decision.

Who are losers?
They are people who will be negatively impacted by either the process of conservation (e.g., will lose access to resources) or who might suffer negative impacts from increasing conservation targets (e.g., certain species protected by the PA, such as the 'puma' or mountain lion, can become livestock predators in the surroundings of a PA when their population increases).

Step 3: Identify potential winners and losers from the specific conservation strategies

This can happen simultaneously with the prior steps, or as a participatory workshop process with representatives of all the social benefits identified prior. After completing the OSPC process of identifying conservation strategies and how they will address threats to conservation objectives, it should become clear which HWB objectives are likely to be impacted (positively or negatively) by the activities in the PA. These are the HWB objectives for which PA managers will want to create indicators.

Do not forget the governance aspect of human well-being. These are objectives relevant to the type of PA management process to be implemented. Does the PA want people to participate in the process? They may want an indicator that quantifies participation. Do managers hope that people see their needs represented in the management of the PA? If so, they may want an indicator about the percent of actors who perceive their needs to be represented in the management plan. Do they want people to trust the management process? If so, they may want an indicator about the percent of actors who trust the managers to conserve the PA.

Step 4: Identify available data sources

A first step to narrowing what may be a large set of potential indicators is to identify the practicality of collecting data for them. Some data may be available through secondary sources (e.g., fishing licenses or access to use zones in the PA). Some data may already be part of the monitoring plan (e.g., water quality). Other data could be collected through public interviews/surveys (e.g., frequency of collecting local products from the area). It will be helpful

to identify this availability prior to moving to the next step.

Secondary data
Data that is already being collected is considered secondary data. One difficulty presented by secondary data, especially those from official sources, is the scale of aggregation. Many of these data are collected at the municipal or district level and do not reflect the potential universe of direct beneficiaries of a particular PA, especially when it is small. In cases where a municipality contains a single large PA, as occurs with the national parks of southern Chile, the municipality's statistics of employment and salary in tourism (e.g., database of the Internal Revenue Service, SII), the rate of visits (e.g., database of the National Tourism Service, SERNATUR), artisanal catches (e.g., SUBPESCA database) and artisanal fishing records, RPA, (SUBPESCA), can be useful for the construction of economically based indicators. There are also statistics on health, education, environmental quality, and social organization (SINIM.cl) at the municipality level, but this information is more difficult to link to the existence of a PA. Thus, the most important aspect of compiling information from these secondary data sources is to make sure that they are at the right geographic scale. If data are available at the scale of municipality, but the PA occupies only 25% of that municipality, the planning team will need to decide how to disaggregate the data. They could take 25% of the metric if it is likely that the indicator is evenly distributed across the municipality, or they may make a subjective determination to include 100% of the data for the indicator because it is likely that all measurements are related to the PA (e.g., if all fishing licenses reflect fishing that only occurs in a multiple use area). The benefit of secondary data use is that most data processing happens in the office.

Primary data
Primary data are data collected by the planning team to measure the indicator. The benefit of primary data is that the team knows exactly what is being measured and exactly who is represented in the data. The drawbacks of primary data are time, resources, and the willingness of people to participate in monitoring activities.

BOX 2. Indigenous data sovereignty

Concerns about secondary use of data and limited opportunities for benefit-sharing have focused attention on the tension that indigenous communities feel between (1) protecting indigenous rights and interests in indigenous data (including traditional knowledge) and (2) supporting data sharing initiatives (Carrol et al. 2020). This might not be an issue in Chile yet, but it is in other countries with empowered indigenous organizations. Under indigenous data sovereignty premises, all data collected from indigenous individuals or working groups belong to these populations. Thus, collecting information from or about indigenous populations should be done with great care. Explicit permission must be given by them to use the data for PA monitoring and reporting. If indigenous populations will be impacted by the PA, it is important to meet with representatives directly to determine whether collecting HWB data is appropriate. If so, the planning team should work with indigenous representatives to establish a mutual agreement on how to best collect and report on the data and how to manage data ownership.

Step 5: Develop and implement ranking criteria to rank and select final indicators

Develop and implement ranking criteria to rank and select final indicators. There are common criteria used for ranking indicators (Table 2), but the planning group should select those most relevant to the context. One option is to individually or collectively rank each proposed indicator in some numeric or qualitative (low, medium, high) fashion for each criterion. The overall ranking of the indicator across all criteria can be used to determine whether it is a strong candidate for long-term monitoring or not.

Table 2. Potential criteria for the selection of human well-being indicators.

Conceptual validity	
1. Theoretically sound	Scientific, peer-reviewed findings should demonstrate that indicators can act as reliable surrogates for HWB attribute(s).
2. Predictable and sufficiently sensitive	Indicators should respond unambiguously to variation in the attribute(s) they are intended to measure, in a theoretically or empirically-expected direction.
3. Pertinent to state and condition of the area's HWB	Indicators should be measures of the status of HWB related to or dependent on the PA's ecosystems (habitats, species, ecological processes, and ecosystem services).
Feasibility	
4. Operationally simple	The methods for sampling, measuring, processing, and analyzing the indicator data should be technically feasible.
5. Cost-effective	Sampling, measuring, processing, and analyzing the indicator data should make effective use of limited financial resources.
Data and statistical properties	
6. Consistently measurable	Indicators should be directly and consistently measureable.
7. Demographic, temporal, spatial variation is understood and/or detectable	Diel, seasonal, annual, and decadal variability in the indicators should ideally be understood, as should spatial and demographic heterogeneity in indicator values.
Management and reporting needs	
8. Responds to specific management action(s) or pressure(s)	Indicators should provide information related to specific management goals and strategies.
9. Linkable to scientifically-defined reference points and progress targets	It should be possible to link indicator values to quantitative or qualitative reference points and target reference points, which imply positive progress toward ecosystem goals.
10. Communication power	Indicators should be simple to interpret, easy to communicate, and public understanding should be consistent with technical definitions.

Step 6: Collect data

Determining sample size

As with secondary data, managers will need to determine the population for which they want to collect well-being data. A population can be determined by geography (e.g., a municipality) or by livelihood (e.g., shellfish harvesters). Not all indicators need to come from the same human population. For example, an indicator about maintaining traditional shellfishing practices only needs to represent the shellfish community that has historically used the PA. Yet, one may want an indicator on sense of place (see Appendix 1, Biedenweg et al. 2023) that represents the entire population of Chile's connection to the PA because they are legal beneficiaries (though the authors do not recommend this approach). In the short term, the human populations most likely to have changes in HWB related to the PA are those who live closest to and interact with the area.

Unless it is a small population, it is usually impossible to collect data from every person in a population. Therefore managers must select a sample from which to collect data to represent the relevant population affected by the PA. There are a few ways to do this, depending on practicality.

i) The most scientific and rigorous approach is a randomized sample. With randomized sampling, PA managers can be more confident that any variability in collected data is due to chance rather than a biased sample of people who choose to participate in the survey or is selected by convenience. As such, a randomized sample can be important for long-term comparisons. The largest barrier to collecting from a randomized sample is knowing the full population from which to select a random sample. Census data may identify that the town nearest to the PA has 3,000 people. Social scientists know that a random sample of about 300 responses is an outstanding representation of this population. If a manager were to implement an in person questionnaire, they could create a grid of the town and randomly select 300 houses from which to attempt data collection. Similarly, if managers know all the owners of artisanal fishing licenses (RPA holders), they could randomly select a sample from this list.

ii) If it is not possible to fully randomize a sample, a manager can create quota sampling. For each important demographic group they establish a quota of people who need to be interviewed from that group. In natural resources monitoring scientists often use gender, age, and economic status or livelihood. For example, if a manager wants 100 interviews from a population, they might decide that 50 of those need to be from women and 50 from men. And that of those 50, there should be an even representation of older and younger populations.

iii) If none of these options are available, researchers still commonly use convenience or snowball sampling, where a manager can collect data from those who have been recommended to them and those who are available at the data collection site. An online questionnaire often uses a combination of convenience and snowball sampling to reach as many people as possible. It is important to recognize, though, that this sampling approach is the least likely to represent a population as only certain groups use social media and people often recommend other participants based on their affinity with each other. To alleviate this, a manager can combine quota sampling with convenience sampling, randomly selecting from a convenience sample those who fill the determined quotas.

Develop data collection tool
Once managers have a determined sample, they need to develop the data collection instrument. Most primary data collection happens through a questionnaire or observations. Questionnaires can be implemented as in-person interviews, paper surveys, or online surveys. Observations can be collected through in person observation or remote sensing (e.g., camera) observations. Online questionnaires are easily accessible through platforms such as Survey Monkey or Google forms. Depending on the sample population and time and resources, PA managers will have to determine the most appropriate tool to collect data.

BOX 3. The importance of a well-developed data collection tool.

Remember that designing a questionnaire is a very specific skillset that people spend years learning. It is unfortunately too easy to design a questionnaire that results in useless data because of the way statements are worded and response options provided. Managers should always work with a social scientist with training in questionnaire development if they choose this approach. This investment pays off because once the HWB monitoring questionnaire is created, it can (and ideally should) be used indefinitely, unless there are key modifications required from experience (see examples of questionnaires in Appendix 2, Biedenweg et al. 2023).

One of the most important design aspects to remember with questionnaires is that it should only include the questions that are absolutely needed for indicators. The shorter the survey, the more likely people will complete it and the less time it will take the planning team to implement and analyze. Remember that more questions do not make a better survey. Secondly, demographic questions should be asked after all the important indicator-specific questions. These questions allow PA managers to look for differences in impacts across economic class, formal education, race, time lived in the region, gender identity, age and other factors, but the survey should not start with these types of questions. Third, if the indicators reference a specific PA, a map should be provided of the PA's boundaries in relation to other things people know, like the town where they live.

There are risks to collecting all data from the same instrument. The biases that are inherent in any instrument multiply if managers rely on monitoring all HWB indicators with the same data sources. It is better to have, for example, two to three indicators based on secondary data and two to five indicators based on a survey with the same human population.

Who should collect data

While it may be common for PAs'guards and staff to collect biophysical monitoring data, they are not the ideal data collectors for social data. This is because people are less likely to share what they really experience the more they think the interviewer wants to hear a specific response. One common way to collect this type of data is through early career researchers or student internships. Students in natural resources, social services, rural development, and agronomy are frequently looking for practical experience to put on their resumes. PAs' guards or managers could work together or independently to establish a process to recruit and train social data collectors once every four years. Considering that park guards are not trained social scientists, data collection and analysis can be done through a previously established protocol.

Frequency of data collection

With the data collection tool and sampling procedure determined, the team is ready to collect data for the indicators! We recommend developing a regular data collection schedule to maintain a HWB monitoring program, as one would do for biological indicators. Human experiences do not change quickly, but managers will want data over enough time to be able to link changes to activities that have occurred in the PA. Collecting data every four to five years would probably be sufficient.

Step 7: Report data

Reporting on well-being could be incorporated in the available environmental monitoring platforms that already exist in Chile. The Biodiversity Information and Monitoring System (SIMBIO) is a free access platform from the Ministry of Environment (simbio.mma.gob.cl) that could be an excellent candidate to incorporate and monitor HWB indicators in PAs because it already has the capacity to connect with different types of existing data. The website has georeferenced data on terrestrial, wetlands, and marine ecosystems, and PAs. It also has information about species management plans, ecological restoration plans, and regulation instruments. The platform includes an indicators section for PAs, ecological restoration, and biodiversity and could potentially be expanded to incorporate data on ecosystem services and HWB indicators.

CONAF has also developed an online platform for PAs with information developed from SNASPE addressing three components: ecosystems, fauna and vegetation. Currently, CONAF is focusing on camera trap monitoring, satellite monitoring, vegetation and wetland monitoring and also could potentially be expanded to report on HWB indicators.

Ideally, the well-being report could be integrated across existing collaboration platforms such as SIMBIO or a new open access public platform, to share information on PA recovery priorities, management, investments, achievements and progress towards PA objectives. short and long term conservation that include BH indicators.
HWB data can be reported using graphs, tables and maps on available public platforms such as those mentioned by CONAF or SIMBIO of the MMA. It is also very important to take into consideration the feedback to the participants involved in the co-creation of HWB indicators. This feedback can be done through participatory workshops in locations close to the PA or online, and also through communication campaigns with didactic information about the indicators report. On certain occasions it will be necessary to redesign or reevaluate the design of the indicators based, for example, on the appearance of new social groups of interest - whether they are winners or losers in that same PA (eg, migrants).

Finally, an institutional and regulatory framework appropriate to the management needs of the different existing PAs figures that include HWB is required. The soon to be created Biodiversity and Protected Areas Service (SBAP) will be key in this regard and also to reinforce biodiversity and ecosystem services monitoring systems. The SBAP, if approved, will make it possible to enforce the conservation of Chile's biodiversity and comprehensively address the management of PAs (both public and private), ensuring the conservation of species and ecosystems and also the sustainable flow of ecosystem services to HWB.

4. CASE STUDY

In this section we present the case of the privately owned PA Las Salinas de Pullally-Longotoma Dunes Coastal Wetland Nature Sanctuary in order to illustrate the application of the contents in Section 3. The Sanctuary has approximately 1,500 hectares and is located in the municipalities of La Ligua and Papudo, in the V region of Chile. It is characterized by an extensive dune field crossed by the Petorca and La Ligua rivers, which at their confluence form an estuary which sometimes flows into the ocean. It has a strong archaeological component, low real estate development, great natural attractions, moderate agricultural development and great biodiversity, which makes it a space with unique ecological conditions.

The interest in generating HWB indicators was identified by the planning team with confirmation from the owners of the Sanctuary. There were two main reasons why they opted to build HWB indicators: 1) to measure and demonstrate the best way to manage a PA with diverse actors and 2) to build trust with the surrounding community.

While it is ideal to create HWB indicators in the initial development of a PA management plan, the fact that HWB indicators are not legally required by Chilean authorities often results in their implementation after a management plan has been drafted. In this case, the planning team (Photosintesis Consultores), chose to develop indicators after the Sanctuary was approved, but before finishing the management plan, according to the following timeline:

BOX 4. Timeline of the Sanctuary's creation, building of the management plan, and selection of human well-being indicators.

2015:
· Initiation of activities to provide official protection to the area.
· Beginning of environmental and public perception data collection.

2016:
· Completion of the environmental baseline and user groups perception survey.
· First draft of management plan (one original landowner).

2017:
· Development of the study "Diagnostic of high value conservation sites in the Valparaiso Region"
· Incorporation of four additional landowners to the Sanctuary and preparation of a single solicitation for all landowners.

2018:
· The Natural Sanctuary solicitation is presented to the Ministry of Environment.

2020:
· The Council of Monuments approves the creation of the Sanctuary.

2022:
· Development of the management plan for the Sanctuary using OSPC.
· Selection of HWB indicators to include in different stages of the management plan.

The selection of HWB indicators was conducted by the Photosisntesis team and two experts. Yet, in public PAs managers should consider more participatory processes that include representatives of different social groups in the selection of indicators. Ideally, indicators development should be assisted by experts.

4.1 Conservation objects and strategies

In the Sanctuary decree, seven generic conservation objects or targets were identified: wetlands, dunes, birds, amphibians, freshwater fish, native plants and archaeological patrimony. Based on these targets, the planning team identified five primary conservation strategies, including: education; planning; strengthening local institutions; regulating threatening activities; and investing in basic infrastructure. While identifying these conservation objectives and strategies can help identify the potential social impacts of conservation, it is not critical to link specific conservation targets with specific HWB impacts. However, the impacts should overall be related to the management plan. As such, after this step is an appropriate time to begin considering HWB indicators.

4.2 Construction of human well-being indicators

At this point the planning team worked with two experts (authors of this manual) to follow the steps described in section 3. First, we discussed the conservation vision promoted by the owners. Since the Sanctuary is a private PA there were no other legal rights to be considered for monitoring purposes, nor specific stakeholders to include in the indicator development process. We used data from the public workshops and surveys taken since 2015 (BOX 4) and followed forthcoming steps.

Step 1. Identify existing formal and informal rights to the PA

This information was collected in 2018 as part of the preparation for the Sanctuary's solicitation. Since the lands of the Sanctuary were previously private, the only formal property titles were associated with the owners. There were no ancestral or customary rights. Informally, public uses of this area included surfing, river kayaking, fishing, zodiac boating, jeep riding, and bathing.

Step 2. Identify the social benefits from the PA

By creating the Sanctuary, it was determined that the same and new benefits could be provided to society in a more sustainable manner over time. These benefits included the protection of archaeological sites, opportunities for environmental education, opportunities for outdoor recreation such as walking, surfing, bodyboarding, stand-up paddle boarding, kayaking, sailing, and other low-impact activities. Opportunities for ecotourism, such as bird watching and visiting archaeological sites would be more formalized, and scientific research opportunities would be supported. While fishing may still be allowed in the Sanctuary, it would be regulated. Hunting and agricultural activities would probably be eliminated.

Step 3. Identify potential winners and losers from the specific conservation strategies.

We identified the types of actors who could benefit or lose through the creation of the Sanctuary, based on the identification of actual uses of the area and the proposed conservation strategies. We also identified the HWB attributes most likely to be gained or lost (Table 3). In some cases, actors could win or lose with the same attribute. That distinction is not important for the development of indicators, as the consideration of both winners and losers is simply to be sure we create indicators that can measure potential outcomes.

Table 3. Potential winners and losers from the Sanctuary's conservation strategies.

Actor	Potential winners, losers or both?	Potential well-being attributes affected by the Sanctuary
Tour companies (surf, trekking, hospitality)	both	1) Economic 2) Water for recreation and farming 3) Participation in governance
Quinoa growers	losers	
Flower growers	losers	
Real estate companies	losers	
Desalinating industry	both	
Cattle ranchers	losers	1) Economic 2) Cultural Traditions 3) Sense of Place 4) Participation in governance
Artisanal fishers	both	
Visitors (beach)	both	1) Recreational opportunities 2) Mental health 3) Participation in governance
All terrain vehicle users	losers	
Recreational fishers	both	
Archaeologists	winners	1) Scientific information source 2) Teaching opportunities 3) Participation in governance
Universities/Schools	winners	
Bird researchers	winners	
Environmental committees	winners	1) Participation in governance 2) Sense of place
Territorial defense groups	losers	1) Property rights 2) Sense of place 3) Participation in governance
Landowners in the surroundings	both	
Neighborhood organizations	both	

As sometimes happens, we noticed at the end of our discussion of winners and losers that we had not focused as much on the governance impacts on different actors. We discussed this briefly and agreed that we need indicators reflecting satisfaction with opportunities to participate in decision-making and with the availability of information about the Sanctuary.

Step 4: Identify available data sources

Throughout the conversation about attributes associated with winners and losers, we discussed the extent to which data were available to measure the attributes. It was determined that no information existed at the right scale for secondary data and that the planning team would implement field-based surveys to collect primary HWB data. Based on this, the social science assistant identified potential indicators for the next steps.

Step 5: Ranking criteria for indicators

Once the winners and losers were identified and data sources considered, we identified four criteria through which to rate potential indicators. These four are modifications to the example criteria in Table 4.

Table 4. Criteria chosen to rate potential well-being indicators.

Criteria	Description
1. Pertinent to Conservation	The indicator is related to the conservation objects or the governance process.
2. Measurable	The indicator is measurable (theoretically, practically, and consistently).
3. Pertinent to HWB	The indicator is represents HWB of winners or losers.
4. Understandable	The indicator is understandable by the owners/managers of the Sanctuary.

These criteria were then used to rank potential indicators addressing the winners and losers of the PA. The planning team (n=9) individually ranked each indicator using an online survey. Each indicator was ranked by each criterion on a scale of 1 to 5, where 1 was in complete disagreement with the criterion and 5 in complete agreement. We then calculated the mean and standard deviation for each criterion for group discussion (Table 5).

Table 5. Results of criteria ranking for each proposed indicator.

Proposed indicator	Criterion 1: Relevant	Criterion 2: Measurable	Criterion 3: Important	Criterion 4: Understandable	Mean
# participants in environmental education programs	4.56 (0.5)	4.33 (0.67)	4.3 (0.67)	4.67 (0.47)	4.47
Annual estimate of people who participate in trekking, kayak, SUP (stand up paddle), & surf	3.89 (0.87)	4.33 (0.47)	4.56 (0.5)	4.78 (0.42)	4.39
Annual estimate of artisanal and recreational fishers	4.25 (0.83)	3.88 (0.78)	4.63 (0.48)	4.50 (0.71)	4.3
# of scientific research projects in the Sanctuary	4.44 (0.96)	4.56 (0.68)	3.56 (1.17)	4.67 (0.67)	4.3
Annual net income (or # businesses or jobs) in ecotourism focused on midden fields, birds or recreation	4.33 (0.47)	3.89 (0.87)	4.22 (0.63)	4.56 (0.50)	4.25
Amount of salt in the aquifer	4.22 (0.92)	4.33 (0.67)	4.11 (1.10)	4.33 (0.82)	4.24
% visitors who perceive a natural beautyl	4.2 (0.92)	3.67 (0.82)	4.0 (0.67)	3.78 (0.92)	3.9
% of archaeological sites in good condition	Data for this indicator were not viable for comparison				

The ratings in Table 5 were used to guide a final discussion to select indicators. The discussion confirmed that we had correctly identified the winners and losers, that we had appropriately covered the HWB attributes, and that each indicator could feasibly be measured. Based on this discussion, we made decisions including that:

I. Archaeological sites are not an indicator of HWB but rather a conservation target in itself. In other cases where archaeological sites have not been previously identified as a conservation object, and where they are a key representation of the needs of potential winners or losers, this could be an indicator of HWB.

II. Incorporating more subjective indicators was desired, including indicators of satisfaction with participation in the Sanctuary conservation process.

The final indicators are described in Table 6 including a brief description of data sources for each indicator.

Table 6. Final indicator list for the Sanctuary.

Attribute	Indicator	Data source
Environmental education	# participantes en programas de educación ambiental % visitors that are satisfied with their visit % of visitors that know something about the conservation objects after their visit	Count of participants in environmental education by providers Interviews with visitors
Scientific research	# of researchers working in the Sanctuary % of researchers satisfied with their ability to do their research in the Sanctuary	Interviews with researchers
Tourism	Annual estimate of #persons that trek, kayak, SUP, surf and use ATVs Annual net income in ecotourism focused on midden fields, birds or recreation # of ecotourism businesses that use the area # of tourism workers employed by these businesses	Field observations and modeling Interviews with tourism service providers
Fishing	Annual estimate of artisanal fishers Annual estimate of recreational fishers % de fishers satisfied with their fishing opportunities in the Sanctuary	Field observations and modeling Interviews with fishers
Aesthetics	Area of the wetland's water mirror	Remote image analysis
Sense of place	**Sense of place index** % of users with a high sense of place based on two questions representing: · Place identity · Place dependence	Interviews with all users
Spirituality	% of users who have a spiritual experience after visiting the Sanctuary	Interviews with all users
Participation	**Index of governance participation** % of users that agree that there is participatory governance of the area based on five indicators: · Opportunity to influence decisions · Transparent management of the area · Trust in the managers · Interests represented in the management plan ·Access to information	Interviews with all users

Step 6: Data collection plans

Most indicators will be measured using primary data collection tools as there is no relevant secondary data. The two primary tools the team will use are in person interviews and observations from a sample of four populations: local fishers, tourism operators, scientists, and environmental educators. Observations will allow the team to estimate use for tourism and fishing, while interviews will allow them to measure sense of place, perceived participation, and other subjective indicators. We provide an example of a data collection instrument in Appendix 2 for one of the actor groups: fishers (Biedenweg et al. 2023). The data collection instrument differs for each actor group, although some of the metrics might be identical.

The planning team intends to collect this data themselves every 4-5 years. As described in the tool, they will randomly select specific days during high use season for observations to then calculate estimated use. They will also interview everyone they encounter from their desired actor groups during these observations.

Paso 7. Data report

The information from HWB indicators will be part of the Sanctuary management plan. It should be noted that on this occasion what is reported is the status of an indicator, but in order to measure the influence of the PA on HWB, at least one monitoring will be necessary with which to compare the baseline. Only in this way can the changes in HWB resulting from the conservation of the Sanctuary be measured.

In relation to the indicators built based on primary information, the technical team must decide if the results are reported disaggregated by group or added in a kind of HWB index (for specific domains).

Beyond the fact that the information on HWB indicators is contained in the management plan, the technical team and, in the future, the managers, can decide to communicate the results to other audiences in different formats (written, oral) or manage that the information remains contained in information platforms (see step 7 in section 3.1).

It should be noted that, in the case of private PAs, both the construction of HWB indicators and the reporting of their results arose largely from the vision and conservation strategy of the owners and/or administrators and is therefore voluntary, while , in the case of state PAs, the generation of indicators and their reporting could not be optional.

Conclusion

The creation of HWB indicators is an important step towards promoting conservation practices that prioritize the well-being of both local communities and biodiversity in PA. This manual provides a step-by-step guide for planners to create comprehensive and context-specific indicators at any stage of the management plan implementation. The application of this manual could inform decision-making processes and policy development in PA, leading to better conservation outcomes and improved HWB, especially when integrated into adaptive management processes.

By following the steps outlined in this manual, stakeholders such as PA managers, community leaders and policymakers can work together to ensure that HWB is prioritized in conservation efforts, leading to a more sustainable future for all.
The following policy recommendations can be drawn from this manual:

• The creation of HWB indicators should be developed in a participatory manner, involving stakeholders and local communities (both winners and losers), to ensure that the HWB indicators are context-specific and reflect the needs and values of the people living in and around the PA.

• This step-by-step guide can be very useful for conservation planners to start creating HWB indicators, regardless of the stage in the PA management plan implementation, even if they are just in the beginning of the management plan or if they already have implemented it.

• In practical terms, for the effective creation and application of HWB indicators it is important to have someone from the planning team dedicated to the creation and application of HWB indicators ideally advised by a social scientist.

• HWB indicators should be conceptually valid, measurable, and respond to management and reporting needs so that they can be easily understood by stakeholders and the public.

• Regular monitoring and evaluation of HWB indicators should be a mandatory component of PA management plans to ensure their effectiveness and relevance over time.

• Continuous engagement with stakeholders and regular review of the HWB indicators can facilitate adaptive management and improve their effectiveness.

• Finally, governments and policymakers should ensure that the use of HWB indicators is integrated into wider conservation policies and strategies to ensure it benefits the people living in and around the PA.

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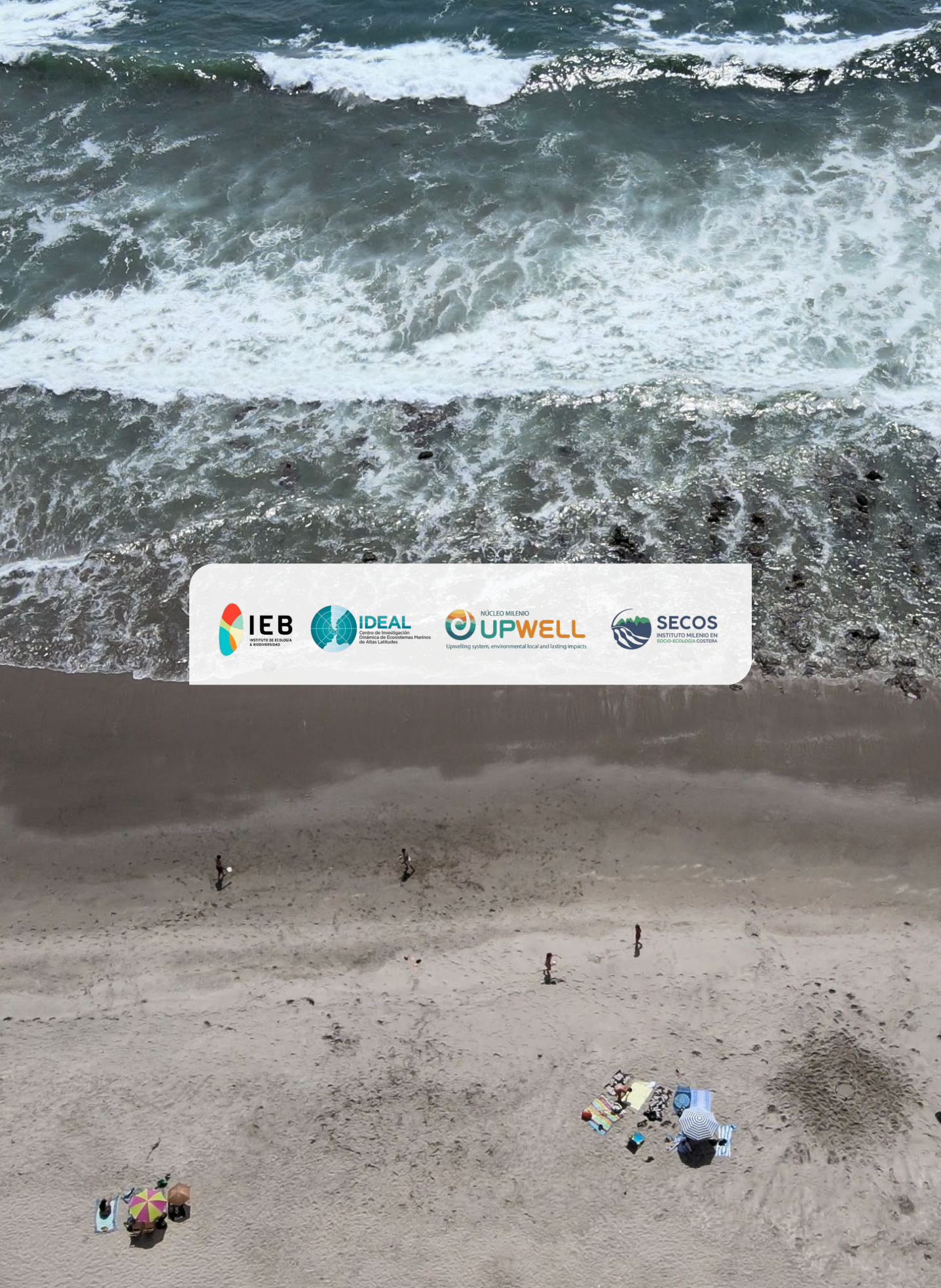
Suplementary Material

Biedenweg K, Martínez-Harms MJ, Nahuelhual L (2023) Supplementary material for: Manual for Creation Of Human Well-being Indicators in Chilean Protected Areas, Zenodo, V1, https://doi.org/10.5281/zenodo.8221891. Appendix 1. Examples of domains, attributes and common sources of data for the construction of indicators of human well-being. Appendix 2. This document includes an example of a human well-being data collection instrument for fishers.


IEB
INSTITUTO DE ECOLOGÍA & BIODIVERSIDAD
IDEAL
Centro de Investigación Dinámica de Ecosistemas Marinos de Altas Latitudes
NÚCLEO MILENIO
UPWELL
Upwelling system, environmental local and lasting impacts
SECOS
INSTITUTO MILENIO EN SOCIO-ECOLOGÍA COSTERA