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Breeding Seabirds of Argentina: Conservation Tools for a More Integrated and Regional Approach

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Seabirds are important components of marine ecosystems and valuable economic resources. They are highly dependent on the complex marine environment and present several natural history traits that make them particularly vulnerable to human impacts (Furness & Monaghan 1987; Croxall & Rothery 1991). Seabirds are also wide ranging, several of them dispersing from hundreds to thousands of kilometres during foraging trips or winter migrations (Nelson 1980). For all these reasons the design of comprehensive seabird conservation and management strategies in almost any region is very challenging.

Argentina has a large and diverse coastline with many suitable sites for breeding seabirds. Along its 3400 km, 16 seabird species breed at more than 260 colonies consisting of one to eight species (Yorio et al. 1998a). Although, the Argentine coastal zone is one of the few relatively pristine coasts in the world, it is exposed to several threats and impacts due to economic activities (FPN 1996). The long coast, diversity of breeding species, large number of breeding sites, and the variety of threats seabirds are currently facing, make difficult the development of conservation actions at national and regional scales. In addition to a general knowledge of seabird population status and threats, specific identification of appropriate conservation and management tools are urgently needed. This paper presents: (1) a synthesis of the population status and priority breeding sites for seabird conservation in Argentina; (2) a review of the main threats and impacts seabirds face in this region; (3) a discussion of conservation and management tools, with emphasis on marine protected areas and integrated coastal zone management; and (4) an attempt to identify common problems and needs at an international scale, particularly in the American southern cone.

Seabird populations and priority breeding sites

Recent studies have assessed the distribution and abundance of breeding seabirds along the Argentine coast (Yorio et al. 1998a), showing that they differ greatly in abundance. Penguin populations are an order of magnitude larger than the rest (Yorio et al. 1999) (Table 1). Many species have relatively small population sizes and, while some are widely distributed and abundant others are restricted and rare (Yorio et al. 1999). In addition to the 16 breeding seabirds, there are more than forty non-breeding species which use the Argentine continental shelf as a foraging ground, mostly procellariiforms (Canevari et al. 1991). This paper focuses on breeding seabirds, as we have little knowledge of the non-breeding species. However, most of what is discussed here also applies to non-breeding seabirds.

Seabird colonies, many close together, are found at more than 260 locations along the Argentine coast. Given that resources for conservation and management are limited, such a large number of breeding sites is probably too great to expect that all could be protected, or even monitored, in an effective way as is the case for seabird populations worldwide (Duffy 1994). Therefore, the identification of priority breeding sites for conservation is needed to help decide where to allocate resources. Lloyd (1984) developed a method for assessing the relative national, regional or global importance of seabird breeding colonies, using a one-percent rule to identify significant sites (a site would be significant for conservation if it contained at least one percent or more of the population at a given scale). Other criteria such as colony size, rarity and diversity are then used to select key sites of special importance among those that meet the one-percent rule (Lloyd 1984). Of the sites considered along the Argentine coast, 94 include at

least one seabird species which meets the 1% threshold of the national breeding population, and should therefore be considered sites of national importance (PY unpubl. data). The application of the remaining criteria results in the identification of a total of 15 key sites of special importance (Fig. 1; PY unpubl. data).

Lloyd (1984) also suggested the identification of priority sites taking into account the regional and world abundance of seabird populations. Several seabird species which breed in Argentina also do so in other parts of the region (Table 2). Ideally, if seabirds breed in more than one country, breeding site priorities should be based on population sizes over a wider geographic area than the national scale, as populations do not respect political boundaries. However, information on population status from other coastal sectors in the region which share breeding species with Argentina is incomplete or unavailable, except for the Malvinas (Falkland) islands (Woods & Woods 1997).

Ideally, the identification of priority sites for conservation requires a knowledge of the degree of genetic relationship between populations at a wide regional scale. Recent studies, for example, have revealed genetic differences between morphologically similar populations of Rock Shags *Phalacrocorax magellanicus* in northern and southern Patagonia, and between these and populations in central Chile (Siegel-Causey 1997). Genetic studies aimed at defining conservation units will greatly contribute to the development of adequate seabird conservation and management actions. In cases where genetic differences exist between disjunct populations, the identification and designation of priority sites at a regional scale based only on criteria such as relative abundance, diversity or rarity, could be misleading.

Threats and impacts

Current threats to seabirds breeding in Argentina include commercial fisheries, pollution, human disturbance and, to a lesser extent, guano harvesting and the introduction of alien species (Yorio et al. 1999; Schiavini et al. 1999). Fishing is one of the most important economic activities along the Patagonian coast, with more than half a million tons harvested annually from the Argentine continental shelf. Penguins, albatrosses, petrels, shearwaters and cormorants are killed incidentally during offshore fishing operations, with some of the seabirds killed on the Argentine continental shelf coming from breeding grounds at subantarctic

Table 1 Estimated total breeding population (in breeding pairs) and number of breeding sites for each seabird species breeding in Argentina (modified from Yorio et al. 1999).

Species	Number of breeding sites	Estimated total population size
Magellanic Penguin *Spheniscus magellanicus*	59	964 000
Rockhopper Penguin *Eudyptes chrysocome*	3	174 200
Southern Giant Petrel *Macronectes giganteus*	4	2400
Imperial Cormorant *Phalacrocorax atriceps*	54	51 800
Rock Shag *P. magellanicus*	143	8100
Red-legged Cormorant *P. gaimardi*	13	1100
Olivaceous Cormorant *P. olivaceus*	12	1200
Guanay Cormorant *P. bougainvillii*	2	9
Kelp Gull *Larus dominicanus*	105	82 700
Dolphin Gull *L. scoresbii*	26	670
Olrog's Gull *L. atlanticus*	10	2300
South American Tern *Sterna hirundinacea*	26	24 600
Cayenne Tern *S. eurygnatha*	13	8900
Royal Tern *S. maxima*	5	3250
Antarctic Skua *Catharacta antarctica*	25	450
Chilean Skua *C. chilensis*	13	90

islands (Prince et al. 1997; Schiavini et al. 1997; Gandini et al. 1999). Frere et al. (1996) have suggested that, at least for the Magellanic Penguin *Spheniscus magellanicus*, conflicts with commercial fisheries through resource competition may occur in northern Patagonia.

A significant impact on seabird populations may also result from the regular dumping of fishing 'waste'. Quantitative information on by-catch and discard use at offshore fisheries is still lacking but over 20 seabirds, mainly Kelp Gulls *Larus dominicanus* and Black-browed Albatrosses *Thalassarche melanophrys*, regularly associate with coastal fishing activities to scavenge fishery waste (Yorio & Caille 1999). Kelp Gulls also feed on fishery wastes produced at fish processing plants and disposed of at city dumps (Yorio et al. 1996a; Giaccardi et al. 1997), and the use of this supplementary food source together with domestic refuse might be playing a significant role in the population increase observed in this widely distributed gull (Yorio et al. 1998b). Moreover, this population expansion may be resulting in negative impacts on other coastal species (Yorio et al. 1998b).

Oil pollution is also affecting several seabird species including valuable tourist resources such as the Magellanic Penguin. Thousands of adults and juveniles are killed every year as a result of chronic oil pollution (Gandini et al. 1994). Wildlife based ecotourism has shown a rapid growth in the last decade, and Magellanic Penguins have become one of the main tourist attractions. Besides penguin colonies, many other

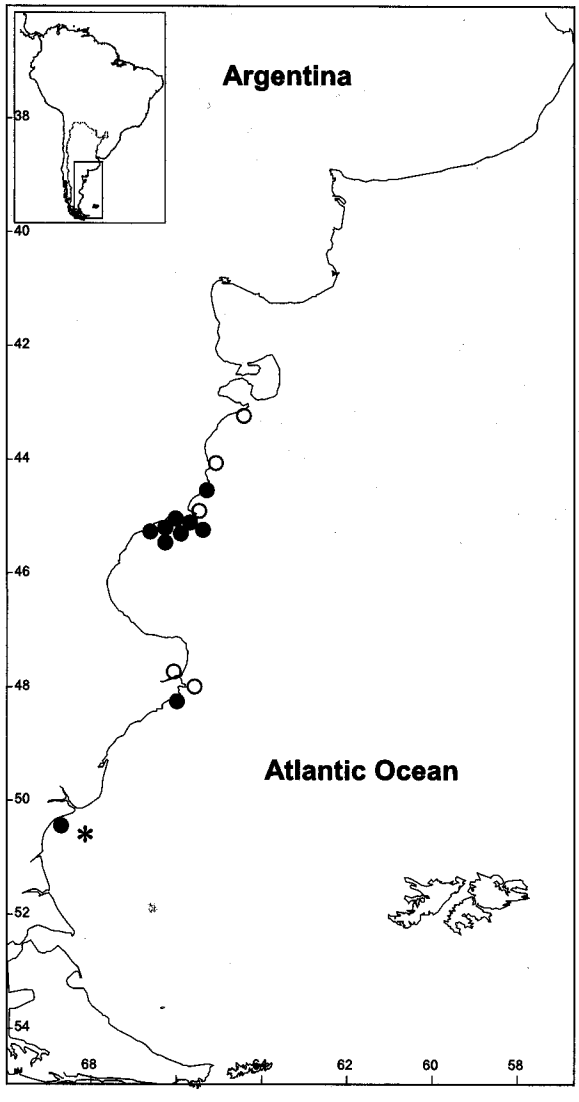

Figure 1 Location of selected key sites of special importance for seabirds breeding in Argentina. Open circles: included in coastal protected areas. Solid circles: not included. * partially protected.

Table 2 Breeding distribution in the American southern cone of seabirds which breed in Argentina (sources: [1] Woods & Woods 1997; [2] Schlatter1984; [3] Duffy et al. 1984; [4] Escalante 1991; [5] Antas 1991).

Species	Malvinas[1]	Chile[2]	Peru[3]	Uruguay[4]	Brazil[5]
Magellanic penguin		•			
Rockhopper Penguin	•	•			
Southern Giant Petrel	•	•			
Imperial Cormorant	•	•			
Rock Shag	•	•			
Red-legged Cormorant		•	•		
Olivaceous Cormorant	•	•	•	•	
Guanay Cormorant	•	•			
Kelp Gull	•	•	•	•	•
Dolphin Gull	•	•			
Olrog's Gull					
South American Tern	•	•			•
Cayenne Tern					•
Royal Tern					•
Antarctic Skua	•				
Chilean Skua		•			

seabird colonies are currently visited throughout their breeding seasons by national and international tourists. Even though current information suggests that ecotourism in Patagonia is compatible with the breeding of Magellanic Penguins, if the visits are controlled (Yorio & Boersma 1992, Gandini & Frere 1996), many seabirds are sensitive to human disturbance and inappropriate behaviour of tourists during their visits to colonies often result in reduced breeding success (Yorio et al. 1996b).

Conservation tools

Although there is a growing concern for seabird conservation, which has resulted in isolated action plans and the designation of nature reserves, there is currently no general plan for the conservation and management of breeding seabirds in Argentina. Given the current growth of human activities, a plan needs to be developed quickly. Several conservation tools are available, such as marine protected areas (MPAs), integrated coastal zone management (ICZM) and international agreements.

Marine protected areas

MPAs have been used and proposed as a tool for seabird conservation worldwide (Duffy 1994). By definition, a MPA is 'any area of intertidal or subtidal terrain, together with its overlaying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment' (Kelleher & Kenchington 1992). Under this definition, there are currently 34 coastal areas in Argentina with some kind of protected status, although in many cases protection measures are not adequately enforced (Yorio et al. 1998c). Many of these MPAs include seabird colonies.

Are species and sites adequately covered by the current system of MPAs? For the first time, new information on population status (Yorio et al. 1998a) allows us to evaluate how much protection breeding seabirds are afforded by existing reserves (Fig. 2). While some seabirds are relatively well protected, for example all Rockhopper Penguins *Eudyptes chrysocome* breed within wildlife reserves, only 25% of Rock Shags and 12% of Southern Giant Petrels *Macronectes giganteus* breed in protected areas. Several priority coastal sectors (see above; Fig. 1), including locations at Golfo San Jorge in Chubut or Punta Buque in Santa Cruz, still need legal and effective protection. Only six of the 15 identified key sites and one of the four identified alternative breeding sites are included within protected areas.

Existing MPAs may provide relatively good protection for seabirds while they are on land during the breeding season, by controlling human visitation or preventing habitat modification or the harvesting of

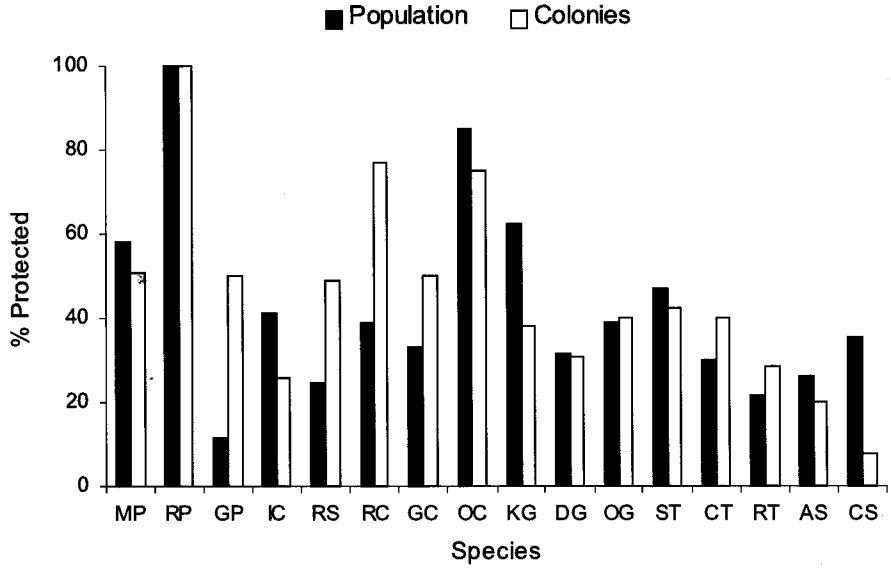

Figure 2 Percentage of total population and breeding colonies for each breeding seabird species protected by existing coastal and marine protected areas in Argentina. MP: Magellanic Penguin, RP: Rockhopper Penguin, GP: Southern Giant Petrel, IC: Imperial Cormorant, RS: Rock Shag, RC: Red-legged Cormorant, GC: Guanay Cormorant, OC: Olivaceous Cormorant, KG: Kelp Gull, DG: Dolphin Gull, OG: Olrog's Gull, ST: South American Tern, CT: Cayenne Tern, RT: Royal Tern, AS: Antarctic Skua, CS: Chilean Skua.

individuals and eggs. However, current knowledge indicates that, unless very large, MPAs are ineffective for the protection of highly mobile species or species with relative site fidelity but high dispersal abilities (Boersma & Parrish 1999), which are common seabird traits. Most current coastal reserves are relatively small and, surprisingly, only a few marine and coastal protected areas include significant areas of adjacent waters within their boundaries (Yorio et al. 1998c). In general only a small marine area is included and waters where seabirds forage, winter and/or migrate are not protected at all. Clearly, this situation must be improved.

A brief look at the ecology of eleven breeding seabirds of Patagonia reveals the complexities, possibilities and limitations of using MPAs as the only tool for seabird protection. Rock Shags, for example, have a small foraging range, generally less than 5 km (Punta et al. 1993; Quintana, in press). Red-legged Cormorants *Phalacrocorax gaimardi* also forage only a few kilometres from their colonies (E. Frere, P. Gandini & F. Quintana unpubl. data.). Although foraging ranges have not yet been fully defined, current information suggests that Imperial Cormorants *P. atriceps* forage relatively close to shore, probably less than 20 km (Punta et al. 1993; F. Quintana unpubl. data). Kelp Gulls are generalist and opportunist foragers which feed on or near the coast on a wide variety of prey, mainly marine invertebrates and fish (Bertellotti & Yorio 1999). Olrog's Gulls *L. atlanticus* and Dolphin Gulls *L. scoresbii* have a fairly specialised foraging ecology during the breeding season; Olrog's Gulls feed mainly on crabs along the intertidal zone (Herrera 1997) while Dolphin Gulls scavenge from other colonial species (Yorio et al. 1996c). Royal Terns *Sterna maxima* and Cayenne Terns *S. eurygnatha* feed mostly on relatively small coastal fish prey (Quintana & Yorio 1997).

On the other hand, Magellanic Penguins have a wide foraging range. Those breeding at Punta Tombo and Península Valdés can forage up to 600 and 300 km, respectively (Wilson et al. 1996; Boersma & Parrish 1999). Similarly, Southern Giant Petrels can forage between 400 and 600 km from their colonies in southern Chubut (Quintana et al. 2000).

The above information shows that the foraging ecology of seabirds breeding in Patagonia is diverse, and that definition of both spatial and temporal scales is essential for the design of protected areas. Research in a wide area like Patagonia makes it clear that many seabirds are dependent on nearby coastal processes. Therefore, although far from perfect, much protection of seabird populations could be achieved by including marine areas adjacent to existing coastal reserves or by the designation of new coastal MPAs. This would require the inclusion of relatively small portions of adjacent sea, probably under provincial jurisdiction.

However, some seabirds such as penguins and giant petrels can not be easily protected by MPAs alone. Being central place foragers, these seabirds show higher bird concentrations closer to colonies. Thus, relatively small MPAs which include the waters adjacent to their breeding sites could afford some protection, particularly against events such as oil spills or the interaction with fishing operations. But foraging strategies of these species require vast areas of the ocean. In any event, the dependence of seabirds through all of their life stages on the marine environment, where currents may transport nutrients, materials, and organisms over large distances and boundaries are difficult to define, requires the protection of larger marine areas and/or the designation of reserve networks. Even though it has been argued that small reserves can be effective for some conservation targets (Schwartz 1999), the characteristics of both seabirds and their marine environment point toward the necessity of large-scale protection.

The difficulty of designing MPAs for Patagonian seabirds is also exemplified by the shifting nesting habits of some terns (Scolaro et al. 1996; Quintana & Yorio 1997). Because of their nomadic behaviour, adequate protection for tern species will require the inclusion in the reserve network of locations which do not hold breeding populations during some years (Yorio et al. 1999). Movements and exchanges of individuals between breeding sites also highlight the need for addressing metapopulation dynamics and the use of networks of protected areas for regional conservation.

Because of increasing economic interests in the marine environment, it is unlikely that either reserve networks or large-scale reserves for seabird protection will be easily achieved. Protection effort based only on seabird protection seems doomed to fail. It will take broader conservation and management goals to convince authorities and myriad stakeholders of the values of protecting marine resources and facilitate the creation and implementation of reserves. The costs of conservation action can be reduced by highly diverse or large-scale MPAs allowing the protection of several species. Therefore, the designation of protected areas with the broader objective of protecting many components of marine biodiversity, together with marine

processes and function, should be examined for their ability to also benefit seabird populations.

However, given that some seabirds are charismatic and of economic interest, they may help draw attention and resources into the development of a system of MPAs. In this respect, seabirds may be treated as flagship species (those with public appeal or charismatic) or umbrella species (those with large habitat requirements) (Schwarz 1999). Examples of such species in Argentina are Magellanic and Rockhopper Penguins. The history of reserve designation in coastal Patagonia shows that in many cases emphasis was placed on seabirds as wildlife that can easily be seen, disregarding other biodiversity components (Yorio et al. 1998c). Ecotourism, particularly, has favoured the creation of coastal reserves. At least in Patagonia, this will continue to be so facilitated by the growing interest in wildlife tourism, and this might also be the case for other regions.

What about the pelagic environment where several breeding seabirds forage? Seabirds depend on highly productive areas, which are also targets for commercial fisheries. MPAs, such as 'no-take reserves', have been recently proposed as fishery management tools in the pelagic realm, but the designation of 'no-take reserves' has not received appropriate attention in most regions of the world (Murray et al. 1999). While protecting targeted fish population, no-take reserves help also preserve marine processes and functioning, and may then benefit seabird populations.

In summary, MPAs appear to be one of the most successful tools available for seabird conservation. Small protected areas are adequate for the protection of species during specific life history phases, and have the potential of greatly benefiting many breeding seabird populations in Argentina. However, a knowledge of the ecology of the species to be protected is required for the decision of optimal reserve size and the correct design of MPA networks. Thus, the current system of MPAs in Argentina should be modified to allow for the observed species diversity and variability in ecological requirements. In addition, pursuing broader conservation goals during marine reserve design might be much more cost-effective for seabird protection. Other complementary approaches, such as the use of no-take reserves for fisheries management, should be also considered.

Nevertheless, MPAs are not a viable alternative for the protection of certain seabird species and sites. The appropriate size and shape of protected areas also depend on conditions outside reserves. Human utilisation of areas adjacent to marine reserves may have a significant adverse effect upon them. These facts highlight the need for off-reserve conservation.

Integrated coastal zone management

The information presented above (in Threats and Impacts) shows the degree of potential conflict between economic activities and their direct and indirect effects on seabird populations. In addition, both the marine environment and coastal zone that seabirds depend upon are under the management and jurisdiction of many authorities. The solution of some of these conservation and management issues will require a regional, multisectoral and interdisciplinary approach. This is where integrated coastal zone management becomes useful.

Integrated coastal zone management. (ICZM) is 'a dynamic process in which a coordinated strategy is developed and implemented for the allocation of environmental, socio-cultural, and institutional resources to achieve the conservation and sustainable multiple use of the coastal zone' (Coastal Area Management and Planning Network 1989). ICZM allows for the coordination of different management or conservation actions across sectors and levels, and it is currently believed that this is more effective than traditional sectoral approaches to the management of resources (Hildebrand & Norrena 1992; Post & Lundin 1996). Most importantly, the process includes the participation of stakeholders and communities, facilitating future implementation of guidelines. Management guidelines can be more quickly accepted if conflicting economic interests are also considered during the decision-making process. For example, simple guidelines such as moving tanker routes further offshore, away from sensitive wildlife areas which are highly valuable tourist attractions, has been agreed upon only recently. Background information and the participatory processes leading to an agreement were facilitated by the Patagonian Coastal Zone Management Plan, a Global Environmental Facility and PNUD project implemented by Fundación Patagonia Natural, a local NGO, and Wildlife Conservation Society and with the participation of local governments and institutions. The first phase of diagnosis and information synthesis developed between 1993 and 1996 will be followed by an implementation phase during the next five years. As in the case of MPAs, results will help protect several biodiversity components and, indirectly, seabird populations.

International cooperation

There is another issue related to the ecology of Patagonian seabirds which deserves a careful analysis of spatial and temporal scales during the design of conservation strategies, and which also applies to many species breeding in other parts of the region. Many seabirds migrate or disperse over very large distances outside their breeding season, crossing international boundaries. For example, Magellanic Penguins migrate north, many of them reaching up to Uruguay and southern Brazil (Boersma et al. 1990). Olrog's Gull, Royal Terns and Cayenne Terns also migrate north reaching the coasts of Uruguay and even Brazil (Escalante 1984; Collar et al. 1992).

The treatment of issues related to natural history traits such as wide-range dispersion and migration requires the use of legal instruments which allow conservation action at an international level. Several international conventions, treaties and agreements currently exist, many of which the Argentine government has ratified. However, full use of their benefits for seabird conservation has not been made, although the Olrog's Gull has been recently included in Appendix I of the Convention for the Conservation of Migratory Species. Much work is needed to develop more efficient mechanisms of cooperation between Argentina, Brazil, Uruguay, Chile and the Malvinas (Falkland) Islands.

Conclusions

Clearly, ecological information is very valuable for the design of proper conservation and management actions. Current needs include the completion of information on basic seabird requirements and the development of a better conceptual framework which could allow a more thorough analysis of spatial and temporal scales. This may help decide, depending on the species, which of the available tools such as MPAs, ICZM, international treaties, or a combination of them, is best applied. Problems and threats to some species cross local and national borders, and will require the coordination of actions in the southern cone and ocean. In this respect, it would be very helpful to create a permanent international forum for seabird conservation so that seabird ecologists can share and discuss common problems. Despite their obvious values, seabird conservation should not be done only through single species or sectoral approaches. Examples of important contributions using sectoral approaches can be found in the work and recommendations on seabird-fisheries interactions (e.g. Brothers et al. 1999) or tourist management (Nimon & Stonehouse 1995 and references therein). However, given the number and diversity of seabird species, the complexity of spatial and temporal scales due to their natural history traits, and the variety of economic pressures on the marine environment, a broader and more integrated approach is needed. Sectoral approaches may be more effective, for example, if included in integrated coastal management plans. It is also time for seabird ecologists and conservationists to complement their research and actions with that of marine conservationists and integrate in interdisciplinary working teams to contribute to the general protection and integrated management of the marine environment, if the long-term conservation of seabird populations is to be achieved.

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