
PERCEPTIONS OF A FISHING COMMUNITY ABOUT BENEFITS, ENVIRONMENTAL IMPACTS AND USE OF RESOURCES OF ISLA CERRALVO, A PROTECTED ISLAND IN THE GULF OF CALIFORNIA, MEXICO

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SUMMARY

Perceptions about protected areas by local communities have a direct effect on their attitudes and can influence collective strategies of resource use. This study examines the knowledge of La Ventana fishing community about the protection status, perceived benefits and environmental impacts of Isla Cerralvo, a protected island in the Gulf of California, Mexico. It focuses on the reasons for hunting feral goats and reactions toward the hunting management policy, and evaluates the relationship between these concerns and the community's demographic and socio-economic variables. Data were collected through a questionnaire survey. The findings indicate that a substantial number of inhabitants do not know that the island had a protected status; therefore, reinforcement of environmen-

tal education programs is needed and alternatives are proposed. Perceived economic and non-economic benefits for the island were influenced by gender, and they can be used to encourage the local fishing community to support conservation. The main perceived environmental impact on Isla Cerralvo was the presence of garbage, and this was influenced by gender, age, and education level. A new management scheme about feral goat hunting is needed since the main use of goat meat was family consumption; inhabitants with low income actively hunted goats more frequently than those with higher incomes, reflecting a subsistence economy; and most inhabitants believe that goat hunting should be allowed.

PERCEPCIONES DE UNA COMUNIDAD PESQUERA ACERCA DE BENEFICIOS, IMPACTOS AMBIENTALES Y USO DE RECURSOS EN ISLA CERRALVO, ÁREA PROTEGIDA DEL GOLFO DE CALIFORNIA, MÉXICO

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RESUMEN

La percepción hacia las áreas protegidas de las comunidades locales afecta directamente sus actitudes y puede influenciar las estrategias colectivas del uso de los recursos. Este estudio evalúa el conocimiento de la comunidad pesquera local de La Ventana respecto al estatus de protección, beneficios e impactos ambientales percibidos de la Isla Cerralvo, área protegida del Golfo de California, México; las razones para cazar cabras ferales; y la opinión respecto a las políticas de manejo de esta práctica. La relación entre dichas percepciones y algunas variables demográficas y socio-económicas de la comunidad fue evaluada. Los datos fueron obtenidos a través de entrevistas aplicadas a los residentes de la comunidad. Los resultados indican que gran número de habitantes desconocen el estatus de protección de la isla, evidenciando la ne-

cesidad de reforzar los programas de educación ambiental, por lo que se proponen alternativas. Los beneficios económicos y no económicos percibidos variaron según el género y pueden ser usados para motivar a la comunidad a apoyar la conservación de la isla. El principal impacto ambiental percibido en la isla fue la presencia de basura, siendo esta percepción influida por género, edad y nivel educativo. Un nuevo esquema de manejo de cacería de cabras es necesario, considerando que el principal uso de la carne de cabra fue el consumo familiar; los habitantes con bajos ingresos activamente cazan cabras más frecuentemente que aquellos con un mayor ingreso, lo cual refleja una necesidad económica; y la mayoría opina que la cacería de cabras debería ser permitida.

Introduction

Most protected areas worldwide have been established on lands owned or used by local communities that depend

on the natural resources of these areas for their livelihood and survival or as their main economic alternative (Trakolis, 2001; Lü *et al.*, 2003). However, the approach to con-

ventional protected areas has been biased, considering local communities and nature as separate entities, and often ignoring the social, political and subsistence values for lo-

cal residents (Ortega-Rubio, 2000; Macleold, 2001; Allendorf, 2006).

Ignoring these concerns often leads to conflicts between communities and authorities protect-

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PERCEPÇÕES DE UMA COMUNIDADE PESQUEIRA SOBRE BENEFÍCIOS, IMPACTOS AMBIENTAIS E USO DE RECURSOS NA ILHA CERRALVO, ÁREA PROTEGIDA DO GOLFO DE CALIFORNIA, MÉXICO

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RESUMO

A percepção para as áreas protegidas das comunidades locais afeta diretamente suas atitudes e pode influenciar as estratégias coletivas do uso dos recursos. Este estudo avalia o conhecimento da comunidade pesqueira local de “La Ventana” em relação ao status de proteção, benefícios e impactos ambientais percebidos da Ilha Cerralvo, área protegida do Golfo de Califórnia, México; as razões para caçar cabras (Capra hircus); e a opinião em relação às políticas de manipulação desta prática. A relação entre ditas percepções e algumas variáveis demográficas e socioeconômicas da comunidade foi avaliada. Os dados foram obtidos a través de entrevistas aplicadas aos residentes da comunidade. Os resultados indicam que grande número de habitantes desconhece o status de proteção da ilha, evidenciando a

necessidade de reforçar os programas de educação ambiental, pelo que se propõem alternativas. Os benefícios econômicos e não econômicos percebidos variaram segundo o gênero e podem ser usados para motivar a comunidade a apoiar a conservação da ilha. O principal impacto ambiental percebido na ilha foi a presença de lixo, sendo esta percepção influenciada por gênero, idade e nível educativo. Um novo esquema de manejo de caçaria de cabras é necessário, considerando que o principal uso da carne de cabra foi o consumo familiar; os habitantes com baixos ingressos ativamente caçam cabras mais frequentemente que aqueles com um maior ingresso, o qual reflete uma necessidade econômica; e a maioria opina que a caçaria de cabras deveria ser permitida.

ing the areas, and frustrates management strategies (Fu *et al.*, 2004; Ormsby and Kaplin, 2005; Shekhar-Silori, 2007). Success in protecting areas depends not only on government support, but also on the cooperation and involvement of local communities who help avoid or mitigate conflicts and contribute to planning and management responsibilities (Trakolis, 2001; Rao *et al.*, 2003; Ormsby and Kaplin, 2005).

At present, most research on protected areas focuses on flora and fauna, but lacks information about the knowledge, perceptions, attitudes and needs of communities living in or adjacent to protected areas, and their view on the effectiveness of the administration management schemes. The analysis and understanding of these topics, as well as their relationship with specific demographic factors, provides useful information for developing appropriate management strategies for a successful conservation program (Rao *et al.*, 2003; Allendorf, 2006; Xu *et al.*, 2006).

The present study was conducted at La Ventana, Baja California Sur, Mexico, a fishing community with a long-standing relationship with Isla Cerralvo, a federally-protected island in the Gulf of California. La Ventana inhabitants depend mainly on fishing for sub-

sistence, which takes place around Isla Cerralvo and hunting feral goats on the island. One of the conflicts between the Isla Cerralvo protected area administrator (National Protected Areas Commission; CONANP) and La Ventana residents relates to the hunting of feral goats, which is a prohibited activity. Goats (*Capra hircus*) were introduced to the island from the mainland by pearl oyster fishermen who used them as a source of meat in the early 1930's. A feral goat population was established after the deliberate release or escape of domestic stock (Hernández-Ramírez, 2004). Feral goats impact native vegetation as they are herbivores with a generalist diet and are widely distributed on the island. Overgrazing reduces vegetation cover, affects the dynamics and composition of native plants, increases soil erosion and promotes the introduction of non-native plant species. Feral goats also cause indirect impacts on native insular fauna by altering the habitat or by competing for resources such as food, water and shelter (Courchamp *et al.*, 2003; Campbell and Donlan, 2005).

The fishermen believe that CONANP is responsible for the hunting prohibition and argue that goat hunting is part of their livelihood. In turn,

CONANP claims that, in addition to their authorization, permits from other agencies are necessary for legal hunting of feral goats; at present there is no goat eradication program for the island because of the high cost and effort this would require, but CONANP expects to implement such a program in the future (Roberto Espinoza, personal communication, 2007).

The aims of this study were 1) to determine the community's knowledge and perceptions about benefits and environmental impacts of Isla Cerralvo, 2) to analyze the relationship between demographic and socio-economic variables and community knowledge and perceptions, and 3) to make recommendations for improving management policies that incorporate the needs and values of the La Ventana fishing community.

Study site

Isla Cerralvo is located along the southwest coast of the Gulf of California (Figure 1). The island is 29km long, has a maximum width of 7km and an area of 137.4km². Dominant vegetation on the is-

land is desert scrub, yet it is relatively rich in plant and animal species; with 14 endemic species and 32 endangered species, according to government records (Hernández-Ramírez, 2004).

Isla Cerralvo is uninhabited and 16km offshore to the northeast of the La Ventana fishing community, which relies on the island for activities related to subsistence (Figure 1). The island is part of the 'Islands of the Gulf of California', a protected area since 1978, nominated World Heritage site in 2005 (CONANP, 2000; UNESCO, 2005).

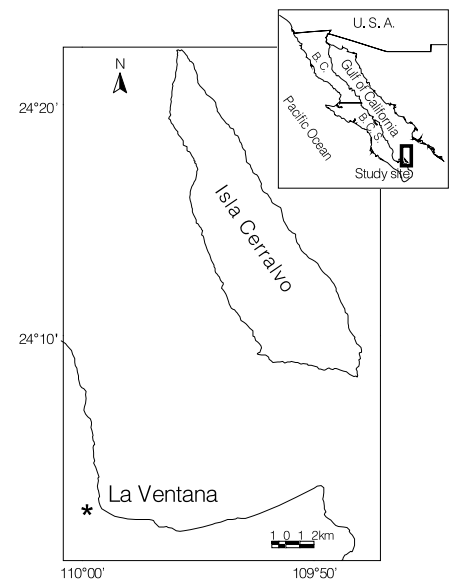


Figure 1. Map that shows the geographic location of Isla Cerralvo and La Ventana fishing community in Baja California Sur, Mexico.

TABLE I
DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS OF SURVEY
RESPONDENTS AT LA VENTANA, B.C.S., MEXICO

Age group	(%)	Education level	(%)	Occupation	(%)	Monthly income*	(%)
18-20	19.0	Primary	45.2	Housewife	33.3	0	9.5
21-30	26.2	Secondary	26.2	Fisherman	33.3	<120	21.4
31-40	21.4	High school	14.3	Employed	9.5	121-240	33.3
41-50	21.4	Professional	14.3	Owner	2.4	241-360	16.7
51-60	4.8			Student, retired	12.0	361-600	11.9
>60	7.1			Other	9.5	>600	7.2
Total	100		100		100		100

* USD

Methods

The survey questionnaire was administered as personal interviews to residents of La Ventana community. Initially, a pilot questionnaire was tested on local residents to design and improve it. To calculate sample size, Cochran (1989) equations were used and 42 questionnaires were applied on weekends in August 2005.

Weekends were selected to insure that women and men had the same probability of being interviewed, since most men are fishermen working around the island and camp on the island during the week. House-to-house interviews focused on one adult person over 18 years old who represented one of 42 randomly selected households. All respondents were permanent inhabitants.

The questionnaire covered six areas: 1) demographic and socio-economic (gender, age, education level, occupation, and average individual monthly income); 2) frequency of visits to the island; 3) knowledge of the protection status of Isla Cerralvo; 4) perceptions of the benefits obtained from Isla Cerralvo and the surrounding marine area; 5) perceptions about environmental impacts on and around Isla Cerralvo; and 6) reasons for hunting feral goats on the island and reactions to management's hunting policy.

Within the answers related to benefits obtained from Isla Cerralvo, we asked about perception of scenic beauty (attractiveness of the landscape) of Isla Cerralvo to estimate to what degree it is perceived as

beneficial. The response was ranked using a ten-point scale (Swaffield and Foster, 2000; Ribe, 2002), ranging from very ugly (1) to very beautiful (10).

Linear regression was used to define population growth at La Ventana. To overcome the relatively small sample size, nonparametric statistical tests were used. The variation in responses among different groups was evaluated by cross-tabulating the relevant variables. Data were analyzed using SPSS (Statistical Package for the Social Sciences) ver. 13.0.

Results

Demography and socio-economic status

At present, La Ventana has 183 inhabitants (INEGI, 2006). Annual population growth was about 1.8% (3.55 habitants per year) between 1995 and 2005, and tended to have a linear growth.

Among respondents (n=42), 47.6% were female and 52.4% were male. The largest group of respondents was 21-30 years old (26.2%) and slightly smaller numbers were in the 31-40 and 41-50 year groups (21.4% each). About 45.2% had only a primary education (<6 years), 26.2% had secondary education (7-9 years), and only 14.3% had received high school (10-12 years) and professional (13-17 years) training. The majority of the respondents were housewives (33.3%) or fishermen (33.3%). La Ventana is a poor fishing community, with

only visited for family recreation (100%). The beach most frequently used for family recreational visits was "Los Viejos", located in the southwest end of the island.

Knowledge about the protected area

When people were asked if they knew that Isla Cerralvo is a natural protected area, more than half of the respondents (54.8%) answered affirmatively; women (65.0%) did so more often than men (45.5%). There was no relationship between knowledge of the protection status and visits to the island or resident's level of education. Of the respondents who had visited the island, 89.5% had no knowledge about its protected status. Only 33.3% of respondents

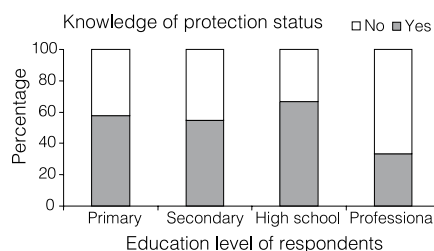


Figure 2. Relationship between knowledge of Isla Cerralvo protected status and education (primary (<6 years), secondary (7-9 years), high school (10-12 years), professional studies (13-17 years)) of the respondents living in La Ventana, B.C.S., Mexico.

21.4% receiving an average individual monthly income of less than USD120 and 33.3% between 121 and 240 USD (Table I).

Visits to Isla Cerralvo

Almost all inhabitants of La Ventana (95.2%) have visited Isla Cerralvo at least once in their lifetime. All men had visited the island and only 10.0% of women had never visited it. However, there are significant differences in the number of times women and men visited the island. The percentage of men that visited the island every month of the year was 72.7%, while 40.0% of women answered that they had visited the island only 1-5 times a year. About 45% of the women had visited the island only 1-5 times during their life.

Respondents who had visited the island were asked to state why they had visited it. Men visited for fishing (95.4%), family recreation (45.4%), and feral goat hunting (22.7%), while women

who had professional studies had knowledge about the island's protection status and 57.9% of respondents with primary education knew about it (Figure 2).

Perceived benefits from Isla Cerralvo

Of La Ventana's inhabitants, 69% think that food resources was the main benefit Isla Cerralvo brought them, fish being the primary item (100.0%) followed by feral goat meat (51.7%). Recreational use was listed as the second benefit (66.7%) and the island's scenic landscape was in third place (26.2%). Women perceived the primary benefit as recreation (94.7%), followed by food resources (52.6%) and scenic landscape (42.1%), while males perceived the primary benefit as food resources (86.4%), followed by recreation (45.4%) and scenic landscape (13.6%).

Scenic beauty of Isla Cerralvo received a score of 10 from 57.0% of the respondents, of 9 from 26.2%, and 8 from 14.3%; no score below 7 was registered. More women

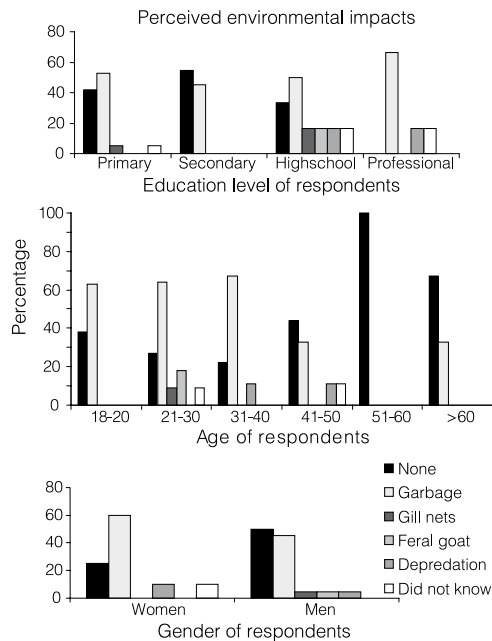


Figure 3. Perceived environmental impacts at Isla Cerralvo according to the education level, age and gender of the respondents living in La Ventana, B.C.S., Mexico.

(75.0%) gave scenic beauty a 10 than did men (40.9%).

Perceptions of environmental impact about Isla Cerralvo

Inhabitants with a lower level of education were more likely to indicate that they did not perceive any environmental impact, considering that the island had a high conservation state. Respondents with a higher level of education (high school and professional) perceived a number of impacts, such as garbage from tourists and fishermen, feral goats eat-

ing the local flora, depredation of wild fauna, and presence of gill nets. A small percentage (10.0%) of women, who had never visited the island, had no knowledge about environmental impacts on the island (Figure 3).

Reasons for hunting feral goats and reactions to the hunting management policy

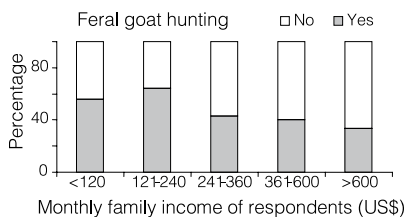


Figure 4. Feral goat hunting on Isla Cerralvo according to income of the respondents living in La Ventana, B.C.S., Mexico.

ing the local flora, depredation of wild fauna, and presence of gill nets (Figure 3). Gill nets are left anchored, floating at a particular site for a considerable time. In general, the inhabitants consider gill nets

to have a negative environmental impact because they are not selective. Younger respondents (≤ 40 years) perceived garbage from tourists and fishermen as the main environmental impact on the island, and only their answers mentioned the presence of feral goats grazing the local flora and presence of gill nets. Older respondents (>40) perceived no environmental impacts on the island (Figure 3). More men (50.0%) than women (25.0%) think that there were no environmental impacts. Of the respondents who mentioned garbage from tourists and fishermen, 60.0% were women and 45.3% were men. Only the answers from men included a mention of gill nets and depredation of wild fauna. A small percentage (10.0%) of women, who had never visited the island, had no knowledge about environmental impacts on the island (Figure 3). Approximately half of the respondents (47.6%) admitted they had hunted feral goats. All respondents answered that food for the family was the main use of goat meat and only 10.0% sold feral goat meat. Respondents who earned the lowest income (55.6%) or the second lowest income (64.3%) hunted goats more often than respondents whose income was higher (42.9% in the USD241–360 group, 40.0% in the USD361–600 group, and 33.3% earning $>$ USD600; Figure 4).

Concerning the goat hunting management policy, 72.2% of respondents want the authority to give them permission to hunt goats and 22.2% expressed no opinion. Only 5.6% think that hunting goats should not be allowed. The principal reason given for requesting hunting permits is to obtain food for the family (96.3%). Respondents who had not hunted goats think that permission to hunt goats should be denied.

Discussion

The annual population growth of $\sim 1.8\%$ for La Ventana fishing community is high compared to the overall rate of 1.0% for Mexico in 2005 (INEGI, 2006). This is of importance since as human populations increase and the demand for resources grows, the frequency and intensity of conflicts between protected area administrators and local people increase (Newmark *et al.*, 1993).

The present findings indicate that 27 years after the designation of the area as protected there is still a substantial part of La Ventana community that is unaware of the island's status. The lack of knowledge by local communities about designations of protected areas over the years has been documented for sites around the world (Trakolis, 2001). This becomes an obstacle for area managers, as the limited knowledge implies poor public participation and communication with reserve managers (Xu *et al.*, 2006). Around 45% of male respondents did not know what the status of Isla Cerralvo was. Increasing this knowledge at La Ventana community could be an initial step necessary to improve conservation efforts, since knowledge about protected areas has been correlated with positive perceptions and attitudes toward conservation (Ormsby and Kaplin, 2005; Moorman, 2006; Xu *et al.*, 2006).

Women had a greater knowledge of the protected

status of the island than men, in spite of visiting the island less frequently. This seems to be related to an environmental educational program established in 2000 by CONANP, mainly focused on primary and secondary school students and women (Ernesto Vásquez, personal communication, 2007).

There appears to be no relationship between knowledge about the island's protected status and education level, probably because the environmental program is a relatively new one and it is not implemented at all school levels. These results are similar to those reported by Moorman (2006), who found that education level in a community was not significantly related to their knowledge of conservation issues in local protected areas. On the other hand, Filallo and Jacobson (1995) and Trakolis (2001) found that respondents with a higher education level had more knowledge about the protected areas and more positive attitudes towards them, which the authors attributed to environmental education programs introduced in the formal curricula of schools at all levels for at least 15 years.

There was no relationship between local residents visiting the island and their knowledge of its protected status. Moorman (2006) found that guided visits to protected areas (where park staff explains conservation issues) provide an educational experience for local people and this knowledge generates a positive perception. On Isla Cerralvo, conservation information is limited to signs on two beaches that declare the island's protected status. When La Ventana residents visited the island, there was no qualified person available to explain the protected status of the island or other conservation concerns. In the study by Trakolis (2001), the main source of information about a local protected area was an information center in the area. Moorman (2006) reported that

television was the main source of information on protected area topics. For Isla Cerralvo, the area administrator could complement and reinforce its existing environmental education programs by producing regional television spots about the island, offering guided tours to the island to teach desired ecological and conservation concepts, and creating a permanent information center in a central location in La Ventana.

Most respondents believe that they benefit from Isla Cerralvo. This is important, since various studies (Newmark *et al.*, 1993; Fiallo and Jacobson, 1995; Infield, 2001; Bauer, 2003; Ormsby and Kaplin, 2005; Xu *et al.*, 2006) found that one of the factors strongly influencing positive residents' perceptions and attitudes towards protected areas is the benefit perceived by the community.

Allendorf (2006) reported similar perceived benefits from protected areas in Nepal: non-economic (recreation and esthetic) and economic benefits (natural resource extraction), which were significant predictors of positive attitudes. Heinen (1993) found that residents in a local protected area like it because of the pleasing views and leisure opportunities.

The importance of non-economic benefits to La Ventana community was reflected in the results, the perceptions of recreation and esthetic benefits being high. Yet, non-economic benefits are ignored or rarely considered when designing conservation strategies for protected areas, unlike economic benefits, which are usually considered as the prime factor to increase support for conservation of protected areas (Raval, 1994). Recognizing and incorporating the non-economic benefits may be critical to long-term conservation of protected areas (Infield, 2001; Ormsby and Kaplin, 2005), since they can provide an important complement to economic benefits that encourage people to support a

protected area (Bauer, 2003; Allendorf, 2006).

Differences related to gender and perceived benefits refer to activities and social roles each sex represents in the community. Men in La Ventana are traditionally considered providers and concentrate their activities towards that purpose. Women are mainly in charge of home, children, and recreation.

A significant correspondence was found between perceptions of environmental impact and education, age, and gender. Other authors (Padilla y Sotelo and Luna-Moliner, 2003; Robertson and Lawes, 2005; Xu *et al.*, 2006) similarly found that perceptions of environmental impact are influenced by demographic factors, such as education level, age and residence location.

Respondents under 40 years of age and with a higher level of education (high school or professional) perceived environmental impacts on the island, whereas almost all older respondents claimed that there were none. Padilla y Sotelo and Luna-Moliner (2003) found that residents with higher education, such as students or professionals, were aware of environmental problems, while residents with less education, such as housewives, fishermen, and farmers, were not aware of environmental problems.

In general, younger residents showed more awareness about environmental concerns because they had received more education than older inhabitants. Education permits to establish links that evidence higher environmental impacts on the scenery. People's perceptions have a direct effect on their attitudes toward protected areas, and can influence collective strategies of resource use (De Albuquerque and De Albuquerque, 2005; Allendorf *et al.*, 2006). Respondents perceiving environmental problems on the island can play an important role in their community to prevent or mitigate activities that cause environmental impacts.

The gender difference in perceptions towards environmental impacts could relate to men having different interactions than women, due to their fishing and hunting activities. Half the men did not perceive any impact on the island's environment, probably because their constant contact with the area makes them less sensitive to changes in the environment. Over half the women and almost half the men commented on the presence of garbage on the island. This perception is largely related to recreational visits to "Los Viejos" beach, which has easy access and is frequently visited by tourists. Also, this beach is the principal camp site for La Ventana fishermen (Hernández-Ramírez, 2004). Hence, activities concentrate and negative effects are more apparent in this area.

Almost half the residents admitted to illegal hunting of goats, which has been practiced by the community for over 100 years. The true numbers are probably higher, but there was no way to determine if all respondents were telling the truth, as this is a restricted activity.

The National Protected Areas Commission (CONANP) should reevaluate the existing policy on goat hunting on Isla Cerralvo, considering that a) all respondents who hunt feral goats use the meat for family consumption, and only ten percent use it for sale; b) respondents at the lower income levels hunt goats more frequently than those with higher income, which reflects a subsistence need; and c) over half of the residents believe that permits should be given for goat hunting because it directly contributes to the economic well being of the family, either by providing food or by receiving cash from the sale of meat. The well-being of local communities in protected areas should be among the first concerns of conservation management authorities (Trakolis, 2001). Fiallo and Jacobson (1995) report that local communities

believed that restrictions on use of natural resources and traditional economic activities had lowered their standard of living and that negative attitudes of the communities stem from these perceived restrictions. Management practices must include a balance between biodiversity conservation and meeting the basic socio-economic needs of the resource-dependent communities (Allendorf, 2006). In this context, a controlled hunting program based on scientific information should be considered, giving hunting permits only for family consumption, and establishing regulations to control hunting, such as defining the number of goats per family per season and the hunting methods.

If the administration is contemplating total goat eradication in the long term, it must develop alternatives for the community that compensate for the loss of a staple food and income. Additionally, this alternative subsistence would contribute to the reduction of human pressure on natural resources (Fu *et al.*, 2004). Allendorf (2006) mentioned that sustainable extraction and alternative livelihood strategies may enhance the local residents' perceptions of protected areas and strengthen their support for them.

Recommendations

1- The National Protected Areas Commission (CONANP) should reinforce its existing environmental education programs, by producing regional television spots about the island, offering guided tours to the island to teach desired ecological and conservation concepts, and creating a permanent information center in a central location in La Ventana.

2- A new management scheme is needed, considering the subsistence resources required by local communities. A controlled feral goat hunting program based on scientific information is proposed, giving hunting permits only to cover family consumption to

La Ventana inhabitants until a total goat eradication program is established.

3- Before implementing a total goat eradication program, subsistence alternatives for the fishing community must be made evident or developed (such as sustainable aquaculture or ecotourism).

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