Journal of Coastal Conservation 7: 193-202, 2001
© EUCC; Opulus Press Uppsala. Printed in Sweden

Management priorities for Magdalena Bay, Baja California, Mexico

Hastings, R. Michael & Fischer, David W.

Facultad de Ciencias Marinas, UABC, Km 103 Carretera Tijuana-Ensenada, Ensenada, B.C. México; E-mail mikehastings101@yahoo.com; dfischer@faro.ens.uabc.mx

Abstract. The current lack of a working resource management plan in Magdalena Bay (southern Baja California, Mexico) has weakened attempts to set priorities among resource users and has contributed to: reduced fish stocks, land and marine contamination, and declines in the ecological integrity of the bay of 170 000 ha and its vast mangrove lagoon systems. The government agencies responsible for maintaining ecological integrity and managing marine resource use have not been successful in addressing these problems due to jurisdictional ambiguities, lack of community support, and lack of manpower for monitoring and enforcing policies. A framework was designed by the authors to work toward an approach for balancing between community development and conserving ecological integrity at the local level in the peripheral and central zones of the Magdalena Bay system. The goal of this framework was to suggest a basis for setting management priorities that included the perceptions and preferences of stakeholder groups with regard to direct threats to the environmental health of the study areas. To achieve this goal a cross-disciplinary study of the central and peripheral zones was used to examine factors that influence current resource use and the environmental state in these two regions of the bay system. Insights into the preferences and perceptions of stakeholder groups with regard to management priorities were acquired using the key informant technique. The results revealed potential conflicts with regard to preferred management priorities between stakeholder groups, as well as polarities within stakeholder groups themselves.

Keywords: Community development; Driving forces; Ecological integrity; Preference ranking; Resource use conflict; Stakeholder.

Introduction

Management plans are generally designed to support or modify human behavior that affects the status of natural resources (Margoluis & Salafsky 1998). These management plans often are designed and implemented by a central government authority without consulting the opinions of local stakeholders in developing countries, as in the case of Magdalena Bay, Mexico (Dedina & Young 1995). Even with 'draconian' style regulations and penalties, these plans often fail due to lack of local support, as well as lack of sufficient human and financial resources needed for monitoring and enforcement. While this failure can be linked to structural problems in the Mexican government (e.g. a history of strong centralized federal government coupled with uneven decentralization attempts that have failed to improve resource management), it should still be addressed at the local level. Facilitating community involvement and acceptance of a proposed plan is not only practical, but is essential for the effectiveness of resource management (Margoluis & Salafsky 1998; Dedina & Young 1995; Robadue 1995).

The lack of successful environmental management and regulation has contributed to the following impacts in the central and peripheral zones of the Magdalena Bay system:

- Conflicts within and between stakeholder groups involved in commercial fishing and ecotourism;
- Degradation and pending destruction of ecologically sensitive areas, including the largest intact coastal mangrove system in Baja California, Mexico; and
- Drastic reductions in local commercial fish stocks.

Institutions of investigation (i.e. universities and other research institutes) and other non-government organizations (NGOs) have documented this ongoing situation and projected that these issues, if left unchecked, will worsen in the near future (Dedina & Young 1995; Sáenz-Arroyo 1997; Enríquez-Andrade 1998; see also the 'Key Informant Interview' from 1999; see App. 1).

The Secretary of the Environment, Natural Resources and Fisheries (*Secretaria de Medio Ambiente, Recursos Naturales y Pesca*, SEMARNAP) and its sub-agencies, the National Institute of Ecology (*Instituto Nacional de Ecología*, INE) and the Federal Bureau of Environmental Protection (*Procuraduría Federal de Protección de Ambiente*, PROFEPA), are the government agencies responsible for maintaining ecological integrity and managing marine resource use in Mexico. With regard to Magdalena Bay, their efforts have not been successful

in addressing these problems due to jurisdictional ambiguities, lack of community acceptance, and lack of manpower for monitoring and enforcing its policies.

A framework was designed by the authors to provide an approach toward balancing community development with ecological integrity in the peripheral and central zones of Magdalena Bay. The goal of this framework was to establish a means for setting management priorities based upon the perceptions and preferences of stakeholder groups with regard to perceived direct threats to the environmental health of the study areas. To achieve this goal a cross-disciplinary study of the central and peripheral zones was prepared in order to examine socio-economic, environmental, cultural, and political factors that influence current resource use and the environmental state in these two regions of the bay.

Study area

Located in Southern Baja California, ca. 900 km south of the US/Mexican border, Magdalena Bay is the largest natural deep-water bay in Baja California. While most of the bay is accessible only by boat, the two main ports, Puerto Adolfo Lopez Mateos and Puerto San Carlos, are connected to Highway One by paved roads and are easily accessible. Comprised of 170 000 ha, the Magdalena Bay system can be divided into four main zones: north, central, south and peripheral (i.e. the western coast of Isla Magdalena which includes Santa Maria Bay). Although environmental degradation and resource use conflicts are present to some degree throughout all four zones, the large expansive nature of the bay system causes the characteristics of these impacts to vary from zone to zone. Some areas (i.e. the central and northern zones) can be characterized by intensive resource use (e.g. ecotourism, commercial fishing, maritime traffic) and anthropogenic impacts (e.g. pollution, extensive gillnetting in mangrove channels). While other areas in the bay system (i.e. the southern and peripheral zones) are left relatively untouched due to their remoteness from populated areas. Therefore, for a framework to be successful in terms of managing resource use in the entire Magdalena Bay system, it must be sensitive to existing and potential conflicts (between resource users) that can differ from zone to zone due to varying circumstances (e.g. access to and competition for marine fish stocks and whale-watching areas) that can be endemic to a specific zone in the bay system.

The central and peripheral zones were selected as the study areas due to their close proximity (they are separated by a relatively thin isthmus comprised of mangroves and sand dunes) to facilitate data gathering, as well as their contrasting natures (the peripheral zone being relatively pristine and isolated versus the central zone which contains an international port that serves as a commercial centre of southern Baja California) (Fig. 1)

Significant species in the Magdalena Bay region

While most lagoons in Baja California are characterized by fragmented mangrove stands, these stands in Magdalena Bay are the most extensive in Baja California (Enríquez-Andrade 1998). Magdalena Bay's mangrove lagoons contain tall, dense thickets of primarily red and white mangroves (*Loguncularia racemosa)* that serve as a valuable nursery for many fish species, such as Pacific sardines (*Saldinops sagax*) (Dedina & Young 1995). Commercially valuable shellfish species are harvested within the mangrove system and include oysters (*Crassostrea ireidescena*), chocolate clams (*Megapitoria squalida*), black abalone (*Holiotis cracherodii*), green

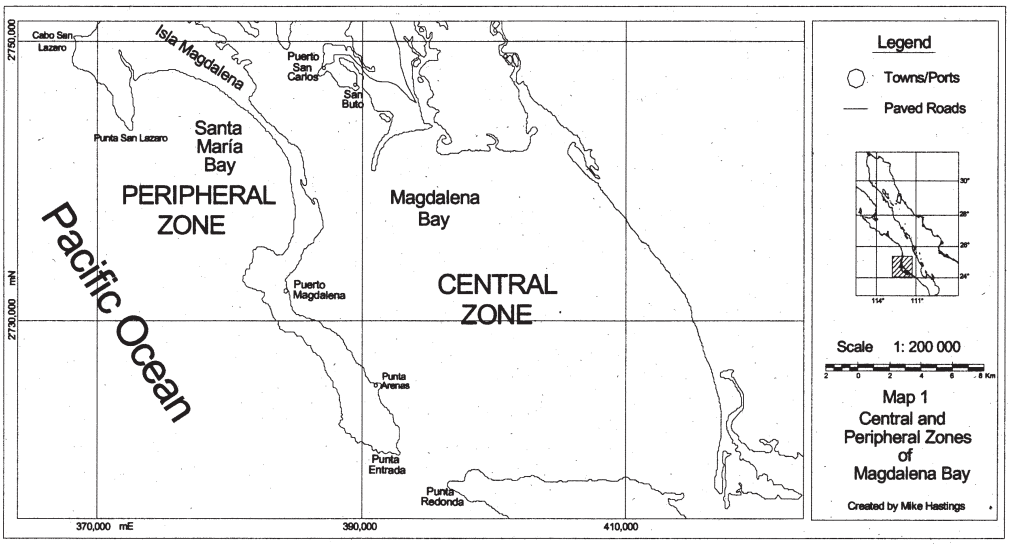

Fig. 1. The study area.

abalone (*Haliotis fulgens*), and pink abalone (*Holiotis corrugata*) (Dedina & Young 1995). Magdalena Bay's extensive mangrove system is also refuge to both migratory and local bird species. Osprey, great blue herons, as well as the largest colony of magnificent frigate birds (*Fregata magnificens*) and the only known nesting pair of bald eagles (*Haliaeetus leucocephalus*) in the Baja Peninsula inhabit the bay (Dedina & Young 1995).

Magdalena Bay serves as a main destination for gray whales migrating along the Baja Peninsula during the months of January through April and provides refuge for the third highest number of gray whales in Baja California, many of which are female-calf pairs (Dedina & Young 1995). The north zone usually has a higher density of whales per km^2 than other parts of Magdalena Bay due to its narrow width and smaller size. Concentrations of whales in the central zone of the bay tend be more dispersed due to the expansive nature of this zone.

The bay is also home to marine mammals, aside from gray whales, and sea turtles (Dedina & Young 1995). Magdalena Bay contains one of the largest colonies of California sea lions (*Zalophus californianus*), as well as the Bottlenose dolphin (*Tursiops truncatus*). Black turtles *(Chelonia agassizi*) feed both inside and outside of the bay, while Loggerhead turtles (*Caretta caretta*) migrate through Santa Maria Bay during the summer months (Dedina & Young 1995).

Demographic and socio-economic history

Magdalena Bay became 'modernized' with the construction of a fish cannery at Puerto Adolfo Lopez Mateos in the late 1950s, and the subsequent construction of the port and cannery facilities at San Carlos in the 1960s (Dedina & Young 1995). San Carlos was developed as a regional port in 1966 for shipping corn and wheat to mainland Mexico and surplus agricultural products to Japan and Korea. The decline in agricultural production in the Santo Domingo Valley during the 1970s coupled with the economic prosperity generated by the new commercial fishing sector in the bay attracted a wave of migrants to Magdalena Bay. Mostly from the interior of Mexico, these migrants began arriving in the Magdalena Bay area during the late 1970s to early 1990s (Dedina & Young 1995). Migration rates have slowed since the early 1990s due to diminishing financial gains within the commercial fishing sector, as well as increasing conflicts between established fishermen and newly arriving fishermen (Key Informant Interviews from 1999; see App. 1).

While many bay residents engage in subsistence and independent fishing practices, the majority of residents are employed by the 16 fishing cooperatives that work throughout the bay system. The large number of cooperatives has put a severe strain on local fisheries due to overharvesting and the use of illegal equipment such as gill nets and weighted seine nets used to drag the bottom for shrimp (Key Informant Interviews 1999). The once lucrative, natural stocks of Pacific calico, abalone, and fan scallops are becoming commercially extinct (Key Informant Interviews 1999; Dedina & Young 1995). Poaching of lobster and sea turtles is widespread as well (Key Informant Interviews 1999). Currently (1999), many fishing cooperatives have been forced to operate in the southern and peripheral zones due to decreasing commercial fish stocks in the central zone.

Another large segment of the economically active population is employed by the local cannery, which cans tuna and sardines and generates fishmeal (Dedina & Young 1995). Currently, the cannery employs 60 active workers in Puerto San Carlos at the average wage of 33.00 - 65.00 pesos per day (Key Informant Interviews 1999; Tovar-Vazquez 1997).

Gray-whale tourism only recently became an important part of the local economy, serving as a form of supplemental income during the depressed regional economy and large-scale unemployment caused by unproductive fishing and agriculture trends (Dedina & Young 1995). Magdalena Bay is the southernmost refuge for the migrating gray whales and experiences its largest concentration of tourists during the whale-watching season from January to April. Magdalena Bay also attracts numerous tourists outside of this season each year for sports fishing, kayaking, and surfing opportunities (Key Informant Interviews 1999). Currently, there are three tourist companies legally operating whale-watching tours in the central zone and one company operating surfing and nature camps in the peripheral zone. Table 1 shows the average incomes for the export/tourism sector of Puerto San Carlos for 1997. A brief description of each group operating in the export/tourism sector is provided in Table 1, along with the daily earnings present within the specified group.

Methods

Conceptual model

The model used in this paper is a modified version of the 'pressure-state-response' framework developed by the Organization of Economic Cooperation and Development (OECD) in 1993 to better integrate human activities and resource use. Driving forces can create various levels of pressure upon the state of the coastal zone that must be differentiated and classified in order to mitigate them effectively. Two main types of pressure were identified: potential pressures and significant

Table 1. Average income in Mexican pesos (MXP) for the export/tourism sector of Puerto San Carlos for 1997. Percentage values in brackets refer to workers within the subsector. Source: Tovar-Vázquez (1997).

Export/tourism subsector	Daily income (MXP)
Fishermen (cooperative & independent*):	17 - 32 (8%)
employs 137 active workers, making up	33 - 65 (24%)
ca. 55% of the sector	66 - 99 (22%) 99 -164 (23%) 165 -330 (11%)*
Local cannery (enlatadoras): 60 active workers, or ca. 24 % of the sector	17 - 32 (17%) 33 - 65 (63%)
Pier/docks: 9 active workers, or ca. 3.5 % of the sector	33 - 65 (67%)
Hotels, restaurants, and tourist services: 11 active workers, or ca. 4.5% of the sector	33 - 65 (55%)
Whale-watching: 32 active workers, or ca, 13% of the sector	165 - 330 (67%) > 330 (22%)

pressures. Reliable indicators must be established in order to set management priorities for the carrying capacities of the bay's zones to not only provide mediation for current crises, but to highlight potential crises as well. Therefore, Fig. 2 shows driving forces (box 1) first acting upon the coastal zone states (box 2) in order to create potential pressures (box 3a) and/or significant pressures (box 3b) that can result in impacts (box 4) that require a management response (box 5).

The 'State-Pressure-Response' model facilitates management decisions by creating a structure that links human activities in a logical way to environmental and socio-economic issues in the coastal zone. The first box, 'driving forces', contains the human activities (e.g. trends in population and economic sectors) that occur and/or operate in the coastal zone. Driving forces can be considered indirect threats to ecological integrity in that they do not directly create impacts, but can be considered as underlying causes for environmental impacts that occur. For example, poverty in a fishing community can be considered an indirect threat to the environmental integrity of the bay since it encourages the use of fishing techniques that maximize financial gains, but are destructive in nature. The characteristics and implementation of such techniques (e.g. widespread use of illegal gill nets in mangrove lagoons) creates the direct threat to ecological integrity.

The second box is referred to as the 'coastal zone state' and contains environmental variables (e.g. geophysical, biological, chemical) that describe the characteristics and conditions of coastal ecosystems. Furthermore, this box contains socio-economic and cultural conditions affecting the coastal zone in order to provide information that influences resource management priorities.

Box 3a provides a list of 'potential pressures' that are generated by the driving forces of human activities (box 1) that could stress or exceed the carrying capacities of systems operating in the coastal zone (box 2). The term 'potential pressures' is used to denote those instances where the carrying capacities of the coastal zone state are not stressed to the point of critical proportions. However, potential pressures could pose serious threats (i.e. become significant pressures) to the coastal zone states in the future if the trends are not reduced or reversed through pro-active management rather than mitigation. For example, the level of marine contamination created by discharges of organic waste by the local fish camps in the Peripheral Zone is currently affecting water quality in only a small area of the Santa Maria Bay. While this pressure is not currently considered a significant threat to the health of the entire bay, it could still be addressed through a pro-active response (e.g. creating storage facilities for the containment of organic waste that can be transported to the nearby agricultural valley for use as fertilizer).

Box 3b contains a list of 'significant pressures' that are generated by the driving forces of human activities (box 1) that now stress or exceed the carrying capacities of systems operating in the coastal zone (box 2). For example, the driving force of increasing population density along the coastline can overwhelm the socio-economic carrying capacity (e.g. land and job availability) present in a specific area of the coastal zone. This stress manifests itself through competition for land, resource use conflicts, and increased pollution due to lack of infrastructure (e.g. sewage collection and treatment).

Box 4 provides a list of anthropomorphic impacts that can be observed in the coastal zone. These impacts are the product of the causal chain of events: driving forces (box 1) stressing and/or exceeding the carrying capacities of the environmental, socio-economic, and cultural systems operating in the coastal zone (box 2) which create significant pressures (box 3b) that result in impacts (box 4) in the coastal zone.

Box 5 is labeled 'response'. This box contains the list of actions to be taken in order to reduce impacts upon the coastal zone. The objectives listed under 'response' will be directed at reducing existing significant pressures (box 3b) as well as reducing potential pressures (box 3a). Response actions aimed only at reducing impacts without addressing the underlying causes, e.g. the pressures and driving forces, would provide only short-term benefits (reductions in impacts) at best. Influencing the driving forces and/or the coastal zone states in Magdalena Bay would require scientific, political, financial, and human resources beyond what are available now.

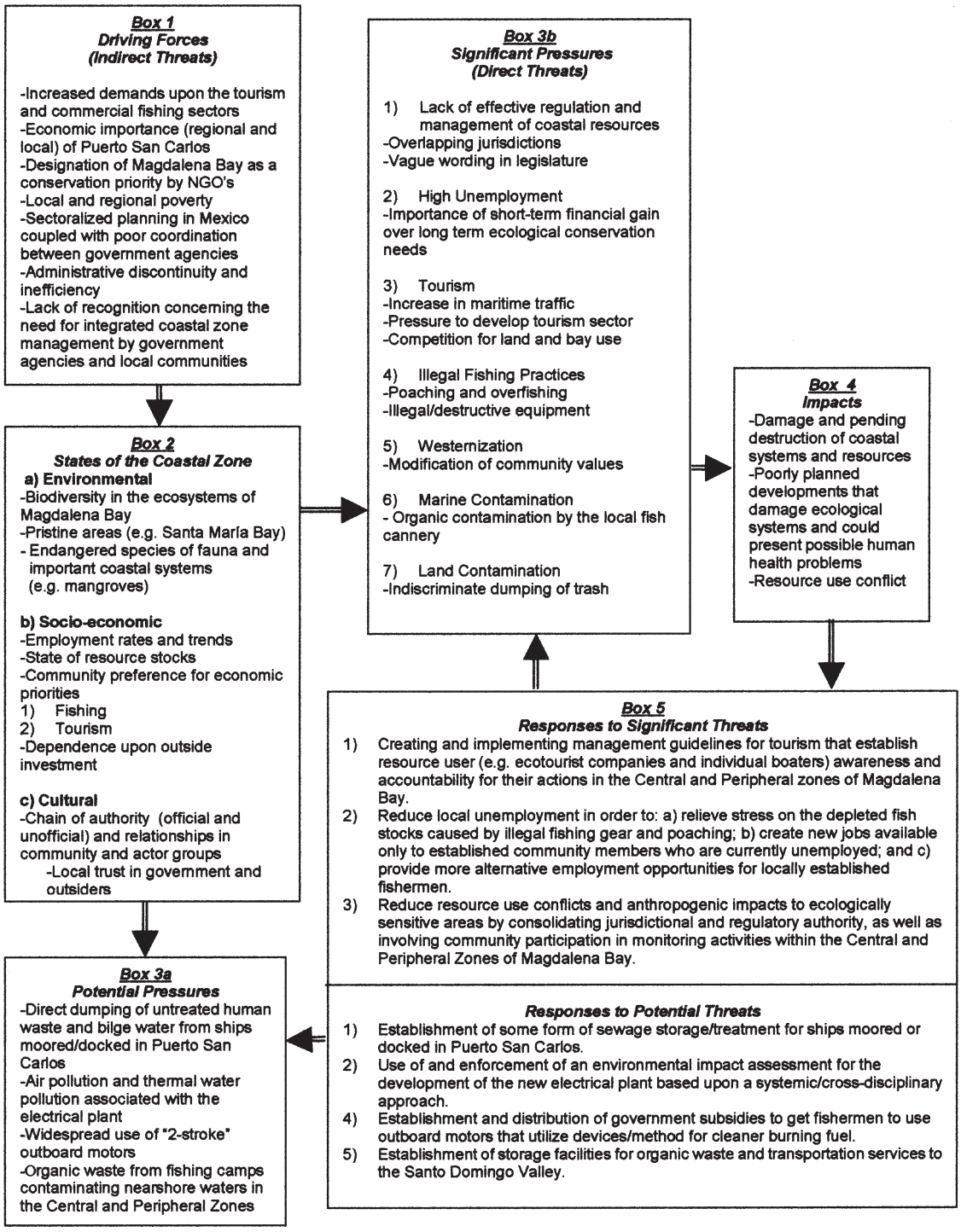

Fig. 2. State-Pressure-Response model.

Stakeholder groups

The following stakeholder groups were identified; they include those who influence and/or who are active users of resources in the peripheral and central zones of Magdalena Bay (Table 2). The key informant technique was used to obtain an understanding of local perceptions concerning the presence and severity of threats to the environmental health of the central and peripheral zones of the bay system (Margoluis & Salafsky 1998). Selected representatives were identified through previous NGO studies and initial interviews with community

members. Using interviews the following information was recorded and analysed:

- Assessments and preference rankings of perceived threats by stakeholder groups: government officials, local community members (e.g. commercial fishermen, tour operators etc.), academic experts, and other NGO representatives;
- Views and opinions of stakeholder groups concerning resource management and environmental awareness in the selected study areas; and
- Locations and descriptions of areas of resource use, resource use conflicts (current and potential), areas of importance concerning flora and fauna, and sources of land and marine contamination.

Information gained by the key informant technique was useful in assessing the validity of scientific research concerning resource use and threats to the environmental health of the Central and Peripheral Zones. Such information also facilitates the organizing of community workshops and opening avenues of dialogue between resource users, community members, NGOs, and regulatory agencies.

Preference ranking technique

Preference ranking also was used to involve local stakeholders in the design of the management framework presented in this manuscript. Key informants questioned in this study were informed that their perceptions and preferences with regard to direct threats and management priorities were to be used merely as 'working examples' for the sake of this study and not as actual responses to be submitted for future government management attempts in the central and peripheral zones. Similar in structure to a simple ranking matrix, preference ranking allows a project team or investigator to gain an insight into preferences of individuals for resolving the main problems at a given site and enables the priorities of different individuals to be easily compared (Margoluis & Salasky 1998). The direct threats listed in the 'State-Pressure-Response' model (Fig. 2) resulted from (initial) preference ranking of key informants.

Threat reduction assessment

Threat reduction assessments (TRA) serve as an outline for direct threat mitigation and are comprised of (Margoluis & Salafsky 1998):

- An objective;
- Potential actions to reduce a direct threat;
- Potential measures to be used to document the success of the potential actions; and
- Underlying assumptions concerning factors (indirect threats) that may influence the success of the potential actions.

The benefit of the TRA is the simplification of a management framework by focusing on key problems (e.g. direct threats), as well as potential problems (e.g. potential threats) during the planning and monitoring phases. Furthermore, the TRA uses reliable indicators that enable one to measure its success in reducing the impact of these threats upon environmental and socio-economic states. Acknowledgement and differentiation between direct threats (significant pressures) and indirect threats (driving forces) is a key component in the TRA approach, especially when attempting to manage resource use in developing countries.

Pollution, habitat loss and fragmentation, and degradation of local resources due to overexploitation or destructive extraction techniques are common examples of direct threats to ecological integrity (Margoluis & Salafsky 1998). Common indirect threats often include

Table 2. Stakeholders involved in the development of a resource management framework.

Tourism	**Government: Federal**	**Government: State /Local**	**Research institutions, other NGOs**	**Local communities**
1. 'Viajes de Mar y Arena'	6. Secretary Tourism (Sectur)	12. Secretary Fisheries Development	18. UABC, La Paz	29. Puerto San Carlos
2. ULYSTURS (main tourist company)	7. Secretary Communication & Transportation (SCT) - Captain of the Port	13. Ministry Social Development	19. UABC, Ensenada	a. Permanent residents
3. Hotel Brennan (whale-watching tours)	8. Secretary Environment, Natural Resources, Fishing (SEMARNAP)	14. Secretariat health	20. CRIP, La Paz	b. Transient residents
4. Magbay Tours	a. Federal Bureau Environmental Protection (PROFEPA)	15. Governor southern Baja California	21. CIB, La Paz	30. Puerto Magdalena
5. Hotel Services for tourists	b. Secretary Fishing (Pesca)	**Municipal and Local:**	22. Center for Coastal Studies (Puerto San Carlos)	a. Permanent residents
a. Brennan, (Puerto San Carlos)	c. National Institute of Ecology (INE)	16. President of the Municipality of Comondú	23. Pro Natura	b. Transient residents
b. Cristina Rangel (Isla Magdalena)	9. Federal Electricity Commission	17. Mayor of Puerto San Carlos (Cannery, PSC)	24. Pro Esteros	31. Fishing Camp: Santa Maria Lagoon
c. Alcatraz (Puerto San Carlos)	10. Secretary Urban Development		**Commercial Fishing Sector**	a. Permanent residents
	11. Secretary of the Navy (Secretaria Marina)		25. Conservera	b. Transient residents
			26. Regional Federation of Cooperative Societies of the Fishing Industry (PSC)	32. Punta Arena
			27. Cooperatives of the Fishing Industry Corridor	a. Permanent residents
			28. Aquaculture	b. Transient residents

poverty, human population growth rates, cultural world views that complicate resource management, and economic policies that create insecurities in local economies (Margoluis & Salasfky 1998). Such indirect threats are characteristic of many developing countries and are present in resource use and management attempts in the Magdalena Bay region. Acknowledgement and understanding of direct and indirect threats (Fig. 2) are important in order to avoid treating a symptom (e.g. illegal fishing) while ignoring the larger problem (e.g. poverty, lack of education) that is partly responsible. While a management team cannot always expect to remedy or reduce indirect threats, awareness of the influence of indirect threats upon direct threats serve useful during 'windows of opportunity' in the future.

Windows of opportunity are those occasions when timing and circumstances are such that attempts at policy reform have a greater chance of success than during the status quo (Fischer in press). Windows of opportunity can manifest themselves during shifts or changes in environmental, political, economic, and/or social climates. In the case of Magdalena Bay, political shifts of power at the federal and state levels coupled with growing unrest concerning poverty, resource use conflicts, and collapsing commercial fish stocks at the community level could produce a window of opportunity for instituting reforms in resource management policies in the region through successfully politicizing such issues to gain the attention of candidates during future elections.

Threat reduction assessments should be prepared for all significant and potential threats to environmental health at a specific site or area. Preparing TRAs for all identified significant and potential threats allows management teams the flexibility needed to foster more effective resource management, since windows of opportunity are not always predictable and management priorities can change with time due to natural and/or anthropomorphic factors. Furthermore, a complete set of threat reduction assessments is useful to facilitate cooperation and compromise between local communities and government agencies in selecting those management priorities that are considered important by both groups. This final point is crucial when stakeholder groups have different value systems and expectations for establishing management priorities. Historically in Mexico, coastal communities have not been included in the planning process of local resource management plans. However, Mexico's growing democratic elections and current attempts by NGOs concerning information disclosure will prove valuable in terms of giving local communities more political influence that could help to influence regulatory management attempts in the future, as well as help to foster links between government agencies and local stakeholder groups.

Results

Table 3 ranks initial management preferences of stakeholder groups according to their importance in terms of impacting the health of the central and peripheral zones of Magdalena Bay. It provides some interesting results concerning preferred management priorities in the central and peripheral zones of Magdalena Bay. Impacts generated by tourism ranked relatively low in terms of management priorities by all stakeholder groups with the exception of commercial fishing. The concern by the commercial fishing sector over the threat of tourism could be related to the fear that tourism will be given priority over commercial fishing during whale-watching season, resulting in increased restrictions placed upon commercial and independent fishermen operating in the central and peripheral zones. Illegal fishing practices were universally recognized as being a top priority by all of the stakeholder groups. Thus, management decisions designed to reduce this threat would, according to Table 3, receive the support of all stakeholders. However, marine contamination received varying results among stakeholder groups and could pose problems for future management decisions by government agencies that focus solely on reducing marine contamination without addressing other concerns, such as high unemployment, expressed by these groups.

The preference ranking technique also revealed the complexity involved with resource management at the local level. Interviews with stakeholders showed the lack of a homogeneous culture in the central and peripheral zones of Magdalena Bay. Rather, a significantly heterogeneous culture exists due to the mixing of migrant populations over the last 35 years. A major portion of the population of Puerto San Carlos and its outlying communities are comprised of residents from all over the Baja Peninsula and mainland Mexico, as well as expatriates from the USA and Australia. Of these residents, few have been in Puerto San Carlos for more than two generations. Puerto San Carlos (and its outlying communities) include a large, diversified transient population that resides in makeshift housing with insufficient sanitary sewage disposal. Many individuals of this transient population work as fishermen without having prior knowledge of fishing techniques or experience in handling fishing equipment. Such ignorance and lack of experience contributes to increased use of destructive fishing practices and creates significant issues with regard to ecological integrity and maritime safety. Thus, resource management in the central and peripheral zones will have to consider the role that this transient population will play in the success of future resource management plans in this area. Furthermore, the heterogeneous nature of the culture in the central and peripheral zones

Table 3. Preference ranking results (by stakeholder group). (eq) = equal ranking.

Tourism	**Government**	**Institutions of Investigation**
1. (eq)* Illegal fishing practices	1. Illegal fishing practices	1. Failed resource regulation and management
1. (eq) Failed resource regulation and management	2. (eq) High unemployment	2. Illegal fishing practices
2. Marine contamination	2. (eq) Failed resource regulation and management	3. High Unemployment
3. High unemployment	2. (eq) Marine contamination	4. Tourism
4. (eq) Westernization	3. Westernization	5. Marine contamination
4. (eq) Tourism	4. Tourism	6. (eq) Westernization
3. Land contamination	5. Land contamination	6. (eq) Land contamination
Commercial fishing	**NGO (non-academic)**	**Local Community**
1. (eq) Failed resource regulation and management	1. (eq) Failed resource regulation and management	1. Marine contamination
1. (eq) High unemployment	1. (eq) Illegal fishing practices	2. Illegal fishing practices
1. (eq) Illegal fishing practices		3. High unemployment
2. (eq) Tourism		4. Failed resource regulation and management
2. (eq) Westernization		5. Land contamination
		6. (eq) Tourism
		6. (eq) Westernization

could complicate attempts at community organization, education, and involvement with regard to resource management, since group backgrounds and expectations could be fragmented and conflicting.

The points highlighted in the previous paragraphs raise certain questions that must be considered before effective resource management decisions can be made for the central and peripheral zones of Magdalena Bay: to what extent must the local community and stakeholders become involved for resource management to be effective? Should each group identified in Table 3 be given equal weight in the decision-making process, or should certain groups that have more at stake in the decision-making process, such as the local community, be favored over others, such as the institutions of investigation? These questions are not easily answered and require further research that is beyond the scope of this paper.

Discussion

Prioritization of the direct threats is an important first step in designing a management framework because it allows stakeholder participation in the identification of direct threats and the order in which they should be addressed by future management plan. While the level of participation of stakeholder groups in establishing management priorities might vary from project area to project area, their participation in general is important when access to the resources is fairly unrestricted and adequate enforcement of environmental regulations by government agencies is problematic.

This study has shown that the limited nature of contact with some of the stakeholder groups reduced the effectiveness of this technique into providing only a quick insight into stakeholder preferences with regard to the setting of management priorities in the central and peripheral zones of Magdalena Bay. Contact with all of the stakeholder groups was limited due to temporal constraints placed upon this study, the remote (and sometimes reclusive) nature of some of the stakeholder groups (i.e. outlying fishing camps), and the fact that government elections complicated access to representatives of certain state agencies involved in resource management since they were campaigning in various regions of Baja California at the time of the study. The authors believe that this study would have generated a more accurate documentation and assessment of the perceptions of management priorities by all stakeholder groups involved in resource use in the Magdalena Bay system had there been more time (i.e. months/years rather than weeks) on the site and financial resources needed to reach all stakeholder groups and to establish reliable contacts within each group. Establishing and maintaining reliable contacts within each stakeholder group is crucial since they often serve as both representatives and informants for their groups, shedding light on the group's perceptions of environmental conditions and management priorities, perceptions which are not always readily observable to the interviewer.

Several factors (e.g. social standing in the community, personal relationships within the stakeholder group and with other stakeholder groups) can influence an informant's responses during the interview process and create an inaccurate representation of the group's perception of management priorities. Developing and maintaining relationships with reliable contacts is often a very time consuming process, especially in remote areas that are populated by stakeholder groups characteristically distrustful of outsiders. However, establishing relationships with reliable informants can provide improved accuracy and increased value with regard to

understanding the preferences of their stakeholder group as they relate to resource use and management needs. While the authors recognize the limitations inherent in this manuscript, this study does provide a useful first step in displaying the value and inherent complexities involved in accurately recording and prioritizing stakeholder preferences to resource management in the Magdalena Bay system, as well as highlighting areas of real and potential conflict between these resource users.

Future resource management studies in this region should involve a more comprehensive, ongoing pursuit of the key informant technique in order to: better qualify (select) key informants; increase confidence within stakeholder groups with regard to future resource management attempts; identify those stakeholder groups which could be regarded as being 'power players' with regard to resource use and management; identify peripheral groups that could influence resource management attempts; identify legitimate polarities within stakeholder groups; and to document possible shifts in preferences within stakeholder groups and economic sectors.

Although Magdalena Bay possesses important and unique environmental resources and is considered to be a priority for conservation by certain NGOs, it has not been legally recognized as a marine protected area (*Area natural protegida*: ANP) in Mexico (Enríquez-Andrade 1998). Therefore, SEMARNAP and its sub-agencies cannot control human activities in the bay in a comprehensive manner, but are limited to sectoralized management of commercial tourism, ecological integrity, and commercial fishing. While the establishment of ANPs in Mexico can help to conserve ecological integrity, such management attempts cannot ignore the needs of the local stakeholders by restricting the region's use to providing only recreation, protecting aesthetics, or preserving natural areas (Margoluis & Salafsky 1998; Gilman 1997; Clark 1997; Olsen et al. 1997; Amante-Helmeg 1996; Krause 1995). The economic importance of Puerto San Carlos will complicate future attempts to designate the central zone as an ANP. While the peripheral zone does offer certain characteristics that would justify its designation as an ANP, the reality of the current political and socio-economic conditions in Baja California prevent it from being viable. The main reason is a considerable portion of the peninsula already has been declared as ANPs and national parks. Currently, 41% (4 200 745 ha) of all protected natural areas in Mexico are located in Baja California, with southern Baja California containing 29% (3 022 919 ha) of the national total. Furthermore, Baja California contains the largest biosphere reserve in Mexico, the Vizcaíno Biosphere Reserve. While protected areas serve the interests of the scientific and tourist sectors, other groups (e.g. local communities, government agencies, and pro-development constituents) have impeded current attempts to designate more areas for conservation, including Magdalena Bay and its lagoon systems (Enríquez-Andrade pers. comm. 1999). Thus, for successful resource management to occur in Magdalena Bay an integrated approach to balancing local community needs with national and international management desires is paramount.

Acknowledgements. The authors wish to acknowledge the Universidad Autónoma de Baja California, Ensenada for providing financial support for this study; Larry Hildebrand for his much valued insights; and to Steve Warren and Olga Hernandez Mendoza for their hospitality and support.

References

Anon. 1982. *Ley general de bienes nacionales*. Diario Oficial, Viernes 8 de Enero de 1982, Secretaría de Obras Publicas y Asentamientos Humanos, México.

Anon. (SEDUE) 1988. *Manual de ordenamiento ecológico del territorio*. Secretaría de Desarollo Urbano y Ecología, México.

Anon. (SEMARNAP) 1992. Ley general del equilibrio ecológico y la protección al ambiente de los Estados Unidos Mexicanos. In: Porrua, S.A. (ed.) *Leyes y códigos de México*. Secretaría de Medio Ambiente, Recursos Naturales y Pesca, México.

Anon. (SEMARNAP) 1996. *Programa de areas naturales protegidas de México, 1995-2000*. Secretaría de Medio Ambiente, Recursos Naturales y Pesca, México

Agardy, T. 1993. Accommodating ecotourism in multiple use planning of coastal and marine protected areas. *Ocean Coastal Manage*. 20: 219-239.

Amante-Helmeg, V. 1996. Ecotourist beliefs and knowledge about dolphins and the development of Cetacean ecotourism. *Aquat. Mamm*. 22: 131-140.

Bromley, D.W. 1995. Property rights and natural resource damage assessment. *Ecol. Econ*. 14: 129-135.

Cendrero, A., 1989. Mapping and evaluation of coastal areas for planning. *Ocean Shoreline Manage*. 12: 427-462.

Cendrero, A & Charlier, R.M. 1980. Resources, land-use and management of the coastal fringe. *Geolis* 3: 40-50.

Cendrero, A. & Fischer, D. 1997. A procedure for assessing the environmental quality of coastal areas for planning and management. *J. Coastal Res*. 13: 732-744.

Cician-Sain, B. & Knecht, R. 1998. *Integrated coastal and ocean management: Concepts and practices*. Island Press, Washington, DC.

Ciriacy-Wantrup, S.V. & Bishop, R.C. 1975. 'Common Property' as a concept in natural resources policy. *Nat. Resour. J*. 15: 713-727.

Clark, J. 1997. Coastal zone management for the new century. *Ocean Coastal Manage*. 37: 191-216.

Dedina, S. & Young, E. 1995. *Conservation and development in the Gray Whale lagoons of Baja California Sur, Mexico*. Final Report to the U.S. Marine Mammal Commission,

Department of Geography and Regional Development, University of Arizona, Tucson, AZ.

Edwards, S.F. 1994. Ownership of renewable ocean resources. *Mar. Resour. Econ.* 9: 253-273.

Enríquez-Andrade, R.R. 1998. *Resumen Ejecutivo del Programa de acciones y áreas prioritarias para la conservación en la Península de Baja California 1998-2007*. ProNatura, Península de Baja California, Ensenada, Baja California.

Enríquez-Andrade, R.R. Danemann, G.D., Ramirez, S. & Lozano, E. 1998. *Acciones prioritarias de conservación y de uso sostenible de los recursos marinos y costeras de Bahía Magdalena, B.C.S., México*. ProNatura, Península de Baja California, Ensenada, Baja California. Unpublished Internal Document.

Fermán-Almada, J.L. & Gómez-Morin, L. 1993. Legal and regulatory aspects to support a Mexican coastal zone management program. In: Fermán-Almada, J.L., Gómez-Morin, L. & Fischer, D.W. (eds.) *Coastal management in Mexico: The Baja California Experience*, pp. 7-13. Coastlines of the World series, and Proceedings of the eighth Symposium on Coastal Ocean Management. American Society of Civil Engineers, New York, NY.

Fermán-Almada, J.L., Fischer, D. W., & Espejel, I. 1999. Coastal use policy and its future in Baja California. In: Anon. (ed.) *Coastal zone proceedings 1999*, pp. 506-507. Coastal Zone 99 Conference Abstracts, San Diego, CA.

Fischer, D. In press. *Techniques for coastal zone policy formation*. Autonomous University of Baja California, Mexicali.

Gilman, E. 1997. Community based and multiple purpose protected areas: A model to select and manage protected areas with lessons from the Pacific Islands. *Coastal Manage*. 25: 59-91.

Hardi, P. & Pinter, L. 1995. *Models and methods of measuring sustainable development performance: revised draft discussion report prepared for the Sustainable Development Coordination Unit, Executive Council, Government of Manitoba*. International Institute for Sustainable Development (IISD), Winnipeg.

Krause, G. 1995. Sustainable tourism for remote atolls in the Pacific. *Int. J. Sustain. Dev.* 2: 166-181.

Maravilla, C. 1991. La ballena gris de California (*Eschrichtius robustus*). In: Ortega, A. & Arriaga, L. (eds.) *La reserva de la biosfera El Vizcaíno en la península de Baja California,* pp. 213-230. Centro de Investigaciones Biológicas de Baja California Sur, La Paz, Baja California Sur.

Margoluis, R. & Salafsky, N. 1998. *Measures of success: designing, managing, and monitoring conservation and development projects*. Island Press, Washington, DC.

Merino, M. 1987. The coastal zone of Mexico. *Coastal Manage*. 15: 27-42.

Olsen, S. et al. 1997. A common framework for learning from ICZM experience. *Ocean Coastal Manage* 37: 155-174.

Rivas, V., Fischer, D. & Cendrero, A. 1994. Perception of indicators of coastal environment quality by municipal officials in northern Spain. *Int. J. Environ. Stud.* 45: 217-225.

Rivas, V., González, A., Fischer, D. & Cendrero, A. 1994. An approach to environmental assessment within the land-use planning process: northern Spanish experiences. *J. Environ. Plann. Manage*. 37: 305-322.

Robadue Jr., D. (ed.) 1995. *Eight years in Ecuador: The road to integrated coastal management*. Coastal Resources Center, University of Rhode Island, Narragansett, RI.

Sáenz, M.A. 1997. *Evaluación de los escenarios para la desarrollo de las actividades económicas en las poblaciones de Puerto San Carlos y Puerto Adolfo Lopez Mateos en Bahía Magdalena Baja California Sur, México, durante la temporada de reproducción de la ballena gris*. ProNatura Península de Baja California, Ensenada, BC.

Schlager, E. & Ostrum, E. 1992. Property-rights regimes and natural resources: A conceptual analysis. *Land Econ.* 63: 249-262.

Sorenson, J. & Brandani, A. 1987. An overview of coastal management efforts in Latin America. *Coastal Manage*. 15: 1-25.

Tovar-Vázquez, J.U. 1997. *Diagnostico socioeconómico de las localidades de Puerto Chale, Adolfo Lopez Mateos y Puerto San Carlos, Involucradas en el manejo del recurso Ballena Gris en Bahía Magdalena*. Pro Natura, Península de Baja California, Ensenada, BC.

Turner, R.K., Adger, W.N. & Lorenzi, I. 1998. *Land-ocean interactions in the coastal zone (LOICZ) – Towards integrated modelling and analysis in coastal zones: Principles and practice*. LOICZ Reports and Studies 11.

Zar, J. 1984. *Biostatistical analysis*. 2nd. ed. Prentice-Hall, Englewood Cliffs, NJ.

Received 27 April 2000;
Revision received 28 November 2001;
Accepted 28 November 2001.
Coordinating Editor: W. Ritchie.

App. 1. Key Informant Interviews.

These interviews were conducted during the period of April - May 1999. The following list contains Key Informant Interviews cited in the text.

1. Steve Warren: Magbay Tours, Puerto San Carlos;1999-04-29
2. M.S. Francisco (Paco) Olleruides: University of Texas A&M/Center for Coastal Studies (Puerto San Carlos); 1999-05-03
3. Adolfo 'Fito' Gonzalez Agundez: Viajes de Mar y Arena, Puerto San Carlos;1999-05-04
4. Sabina Widmann: Center for Coastal Studies, Puerto San Carlos; 1999-05-07
5. Gubriel Velazques: SEMARNAP, La Paz; 1999-05-07
6. Luis Caldena: Center for Coastal Studies, Puerto San Carlos; 1999-05-04
7. Greg Brennan: Hotel Brennan, Puerto San Carlos; 1999-05-04
8. Grant Hensen: Aquaculture, San Buto; 1999-05-04
9. Enrique Soto: ULYSTURS, Puerto San Carlos; 1999-05-04
10. Eligio Mayoral Amador: Mayor of Puerto San Carlos; 1999-05-06
11. Jorge Torres Robles: Pesca, Puerto San Carlos; 1999-05-06
12. Mario Raul Hernandez: School teacher, Puerto San Carlos; 1999-05-06
13. Adán Hernandez Mendoza: R.A.R.E. guide, Puerto San Carlos; 1999-05-06
14. Alfonso Rodriguez Loaiza: Captain of the Port, Puerto San Carlos; 1999-05-04
15. Gustavo D. Danemann: Pro Natura, Ensenada; 1999-05-15