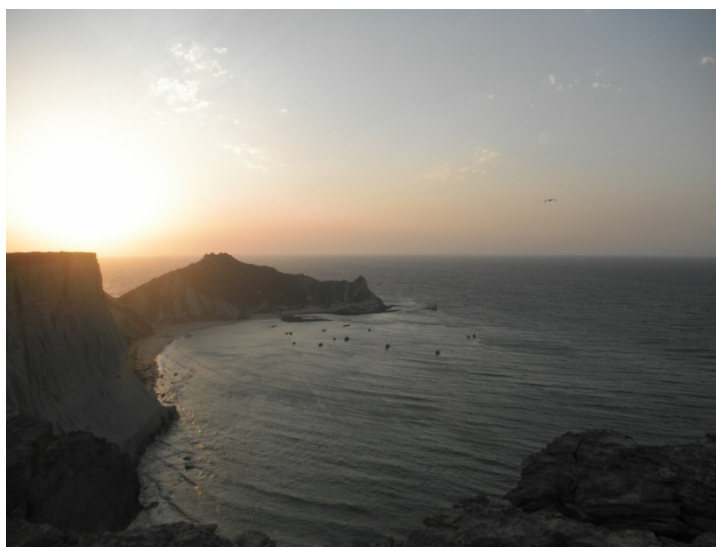


February, 2011

PAKISTAN
WETLANDS
PROGRAMME

SOCIO-ECONOMIC BASELINE
REPORT, ASTOLA ISLAND



by | Sadia Ayesha Hasan

Acronyms and Abbreviation

Balochistan Partnership for Sustainable Development	BPSD
Embassy of the Kingdom of Netherlands	EKN
Exclusive Economic Zone	EEZ
Global Environment Facility	GEF
The International Union for Conservation of Nature	IUCN
Maritime Disaster Management Plan	MDMP
Maritime Security Agency	MSA
Natural Resources	NR
Pakistan Poverty Alleviation Fund	PPAF
Pakistan Wetlands Programme	PWP
Rapid Assessment and Prioritisation of Protected Areas Management	RAPPAM
United Nations Development Programme	UNDP
World Wide Fund For Nature	WWF

Conversion Table

1 maund	40 Kg
1 nautical mile	1.852 km



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EXECUTIVE SUMMARY

Astola Island (Haft Talar) is located in the Arabian Sea south of Pasni and considering its high ecological importance it was declared as a Ramsar site on 10th May 2001. It hosts the endangered Green turtle (*Chelonia mydas*) and endemic reptiles such as the viper *Echis carinatus astoli*. It is an uninhabited island with fishermen frequently visiting throughout the year except for the monsoon season.

Under Pakistan Wetlands Programme (PWP) a socio-economic study was conducted in January 2011 to determine the dependence of various communities on the island. Secondary data helped in getting some information about the island prior to field survey. First hand information about natural resource use was gathered from the fishermen community present on the island and from various government and non government organisations (NGOs). Astola Island lies beyond the jurisdiction of Marine Fisheries Department Balochistan (i.e. upto 12 nautical miles) and thus is mainly managed by Maritime Security Agency and other departments of the Navy. They are also responsible for its natural resource management.

Fishermen coming to island include Baloch, Sindhi and Bengali. They catch fish, crabs and lobsters in its water. Few of them also collect sea shells from the area. At a time there are 10 to 15 boats near the island each boat having around 5 fishermen on the average. A boat mostly stays for around 7 to 10 near the island. Few fishermen live on the two huts present on the island for about two weeks. They use around 714 kg of fuelwood from the island in a year. The island is being polluted by solid waste (including damaged fishing gears, food wrappers etc) dumped on its coast by the fishermen who come to visit it. Nets sometimes get stuck to the corrals present near its coast and damage it.

Astola Island is facing tremendous pressure and is at threat from various anthropogenic activities occurring in the Arabian Sea such as oil pollution, illegal fishing, solid waste dumping, turtle and its egg hunting.

INTRODUCTION

Pakistan Wetlands Programme (PWP) was launched with financial assistance from the Global Environment Facility (GEF), United Nations Development Programme (UNDP) and the Embassy of the Kingdom of Netherlands (EKN) in July 2005. This \$11.8 million project is being implemented by WWF-Pakistan on behalf of the Ministry of Environment. It is a seven year project and aims at promoting conservation of freshwater, wetlands and the associated globally important biodiversity. Under this programme majority of the wetlands of Pakistan are being surveyed to gather baseline information. The main aim of PWP is to create an environment that would enable conservation of all major wetlands of Pakistan through equitable sharing of natural resources (NR), securing rights of access specially for poor communities, diversifying livelihoods, improving the income earning potential of stakeholders and creating incentives for sustainable wetlands management. This is being achieved through two objectives: the first deals with national level issues while the second would provide a replicable working example of wetlands conservation in the form of community-based management plans for four wetlands complexes (that are: Salt Range Wetlands Complex, Northern Alpine Wetlands Complex, Central Indus Wetlands Complex and Makran Coastal Wetlands Complex), each representing a specific eco-region.

This socio-economic baseline report will provide information about the dependence of various communities on the natural resources of Astola Island (also known as Haft talar meaning seven hills) and the role being played by different government departments in its management.

PROBLEM STATEMENT

Astola Island is a Ramsar site of international importance as it hosts the endangered Green turtle (*Chelonia mydas*) and endemic reptiles such as the viper *Echis carinatus astoli*. Possibly the Hawksbill turtle (*Eretmochelys imbricata*) also nests on the beach at the foot of cliffs.¹ However, human intervention in the area such as introduction of feral cats and unsustainable fishing practices is posing threats to natural wildlife. Major reason for this is lack of awareness amongst fishermen and lack of ownership of government departments.

ASTOLA ISLAND

Astola Island (Haft Talar) is 4 km long and 0.6 km wide island present in the Arabian Sea south of Pasni. Its south face has various caves while on the top of Astola Island there is a Hindu Temple and on the north face of Astola Island there is also a mosque used by fishermen community.

Astola Island does not have any fresh water supply thus making the environment less favourable for human and animal population. However, fishermen come to the island occasionally and stay here for a few weeks. Vegetation on Astola Island comprises of shrubs and bushes.

¹ The Annotated Ramsar List of Wetlands of International Importance

OBJECTIVE

This socio-economic baseline report provides information regarding natural resource dependency of the people who visit Astola Island and role of different government departments in the management of its natural resources. The main objective of the study is:

“The development of indicators and mapping of socio-economic information including demography, settlement, livelihoods and natural resource use for Astola Island.”

Rapid Assessment and Prioritisation of Protected Areas Management (RAPPAM)² questionnaire was used to get an idea of threats and pressures to the natural resources of the area. It has been developed by WWF International to determine the effectiveness of management of a protected area (PA). Internationally, this methodology has been tested and implemented in Algeria, Bhutan, Cameroon, China, France, Gabon, Mexico, Russia, South Africa and Swaziland. In Pakistan, RAPPAM methodology has been used for determining the pressures, threats and management activities in not only some protected areas but also in some ecologically significant wetlands. A slightly modified questionnaire of RAPPAM (Questionnaire attached in Annexure II) has also been used to determine the existing pressures, future threats and management activities conducted at the Ramsar site. Various officials interviewed with the aid of modified RAPPAM questionnaire are listed in Table 2:

Table 2: Names of officials interviewed with the aid of RAPPAM

Names	Designation
Anayat Ullah	Assistant Director Fisheries Marine, Pasni
Asghar Shah	District Coordinator, IUCN

(Source: Socio-economic Survey, January 2011)

There are no permanent settlements on Astola Island and fishermen merely visit the island from August to May. Thus information regarding natural resource dependency and economic conditions of those fishermen were gathered with the aid of a structured questionnaire (Attached in Annexure I) and formal discussions. A total of nine fishermen working on different boats were interviewed.

DATA ASSESSMENT

Primary and secondary data was collected and analysed to determine socio-economic dependency of fishermen community on the natural resources of Astola Island. The sustainable and unsustainable practices of communities dependent on its natural resources were also determined. The role played by different government departments, MSA and NGOs in natural resource management individually and in liaison with one another and fishermen was also identified.

² Rapid Assessment and Prioritization of Protected Areas Management is a methodology developed by WWF – International to determine the effectiveness of management system of Protected Areas.

The International Union for Conservation of Nature is playing a very important role in the management of natural resources of Makran coast. Balochistan Partnership for Sustainable Development (BPSD) is being executed in the whole of Balochistan coast and a few other districts of the province. Under Pakistan Wetlands Programme, WWF – Pakistan is also working in specific sites along the Makran Coast. Thus the area and some activities being conducted by both IUCN and WWF – Pakistan are similar. To avoid overlapping of activities and for effective NR management both of these organisations are working in coordination and supporting each other.

UNSUSTAINABLE PRACTICES AT ASTOLA ISLAND

Astola Island is not included in the project area of IUCN, however according to the information provided by the official of IUCN the island is degrading due to a number of anthropogenic activities. Fishermen from Balochistan and Sindh come to fish around the Island. They stay there for a few days and dump damaged nets and other types of non degradable waste on its coast. Further they are not aware of sustainable fishing practices due to which fish in Arabian Sea is depleting at a high pace.

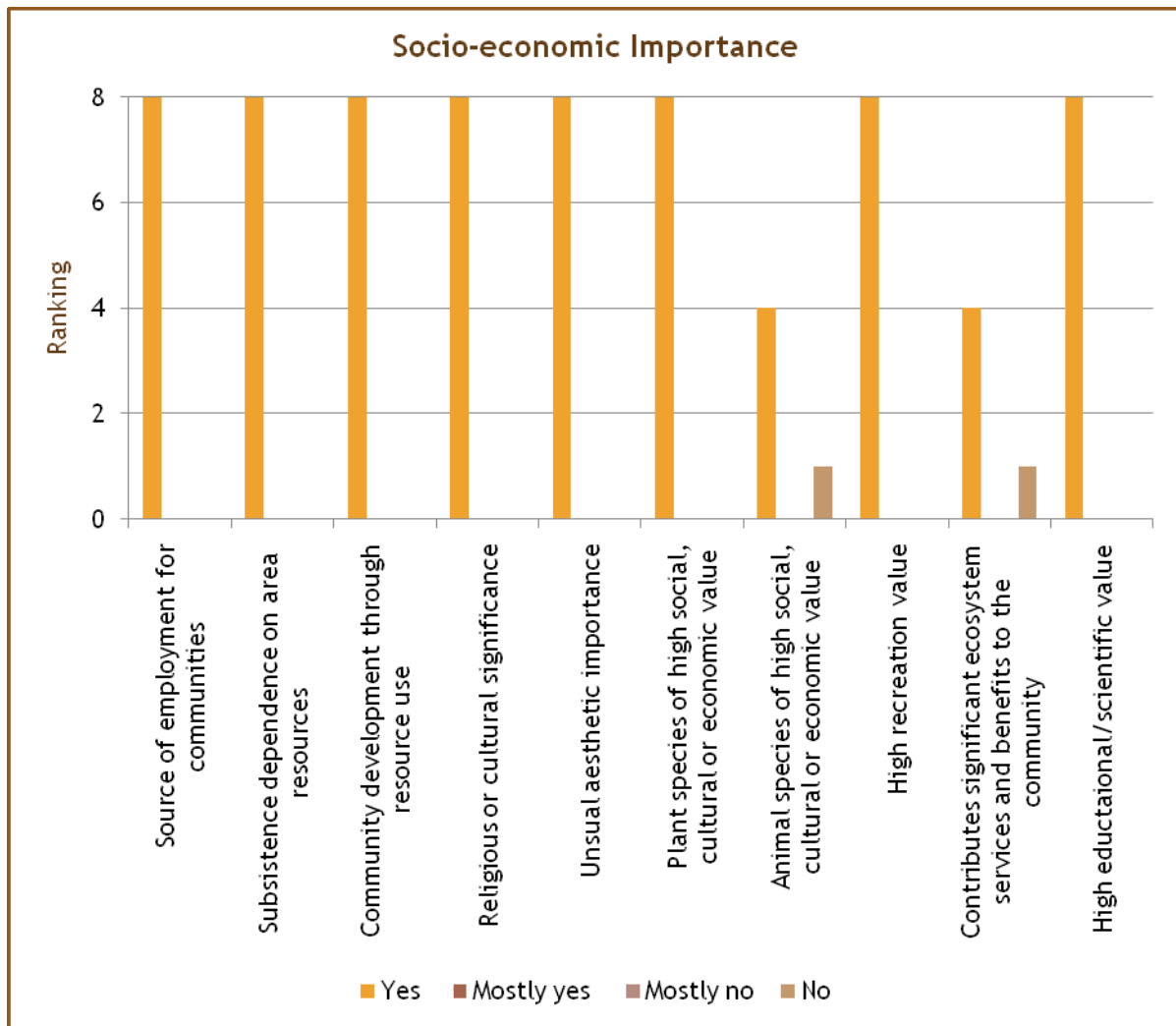
There is a vast diversity of corals near Astola Island and its market value is high. Some fishermen are engaged in coral mining activity. However, a study needs to be conducted to determine the level of coral mining activity done in the area and its impact. Corals are also damaged by ghost nets (nets that get trapped in corals). Near corals there is a lot of fish thus sometimes the nets thrown by fishermen in such areas get trapped in corals.

Apart from illegal fishing and coral mining, marine life is also being adversely affected by oil being spilt in the sea by trawlers. Big fish trawlers dump their crude oil bars in the sea. However, details on its impact cannot be clearly stated as it depends a lot on ocean currents and a detailed study needs to be conducted to assess the damage caused by it. Another source of small amount of oil spill in the sea is during exchange of illegally smuggled oil from one boat to another in an inappropriate way.

DEPENDENCE ON NATURAL RESOURCES OF ASTOLA ISLAND

Astola Island present south of Pasni has natural resources of high economic value. Fishermen of Sindh and Balochistan are dependent on them for their livelihood. Use of these natural resources within the carrying capacity of the ecosystem will provide them with long term economic benefit. However, lack of awareness amongst the fishermen results in excessive and unsustainable NR use. Dumping of non degradable waste such as nets, plastic bags etc degrades the natural habitat of various marine species and the beauty of the island.

Fishermen coming from Sindh and Balochistan not only catch fish, lobsters and crabs but also collect sea shells for commercial purpose. Sea shells are a very important integral part of the ecosystem as they provide home to Hermit Crabs and snails (shell making animals). Hermit Crabs do not have a shell of their own and to protect themselves from predators they live in shells left by dead snails. During its lifetime Hermit Crab changes its shell a number of time that is when the shell gets damaged or when the Hermit Crab over grows it. Collecting excessive amounts of sea shells for commercial purposes can result in reduction in Hermit Crab population apart from depleting a major CaCO_3 providing source to the sea thus affecting the whole aquatic life. Field survey revealed that on the average a fishing boat collects 2,479 kg of sea shells in a month which is a fairly high amount.

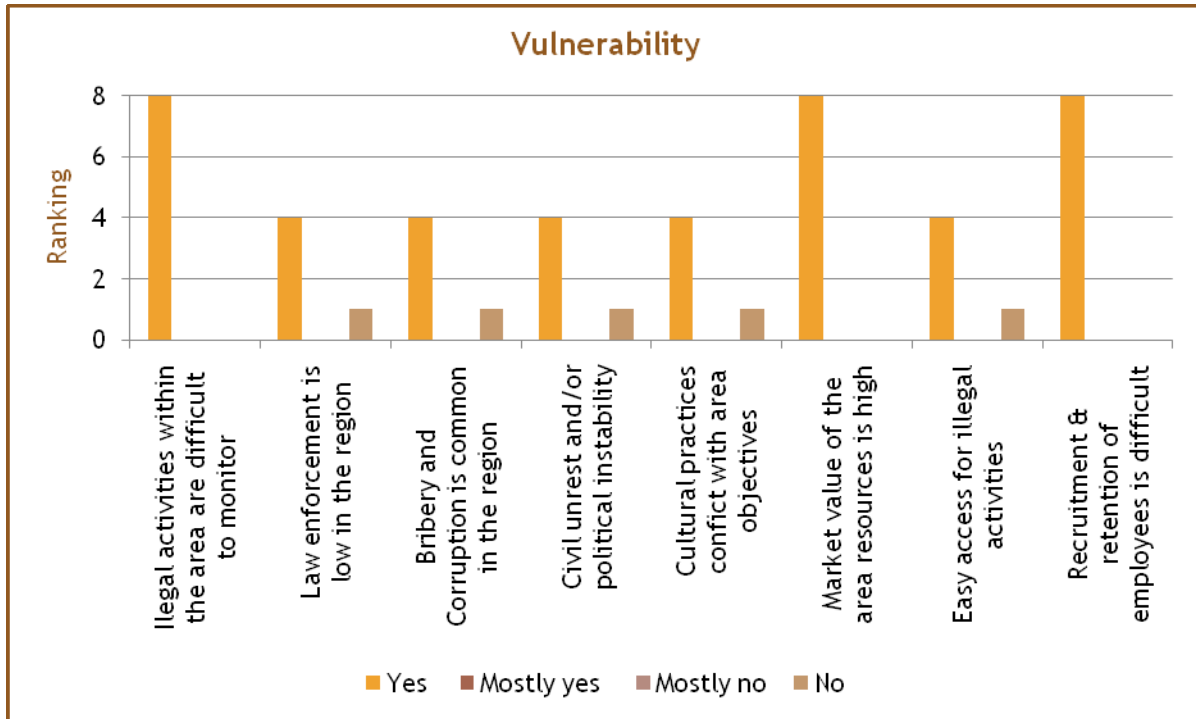


(Source: Socio-economic Survey, January 2011)

Graph 6: RAPPAM assessment for socio-economic importance

VULNERABILITY

Astola Island is a Ramsar site and has high international ecological importance. However legally as it has not been given any protection status the illegal activities in the area are difficult to monitor. Market value of its resources i.e. fish and corals is high and the recruitment and retention of employees is difficult (Score = 8). Details regarding vulnerability of the Ramsar site are given in Graph 7.



(Source: Socio-economic Survey, January 2011)

Graph 7: RAPPAM assessment for vulnerability

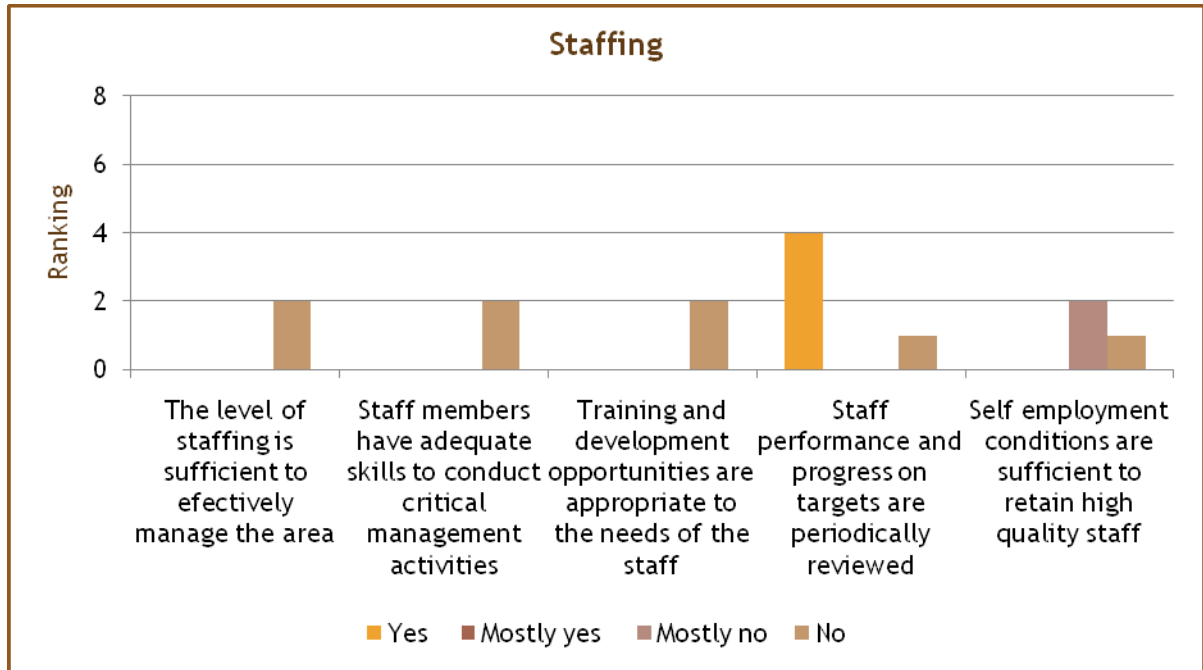
OBJECTIVES AND LEGAL SECURITY

As mentioned above Astola Island has not been declared as a protected area by the government. It does not have any clearly management objectives that would provide for the protection and maintenance of biodiversity.

Staff and financial resources are not adequate to conduct critical law enforcement activities. Conflicts with local community are resolved fairly and effectively.

STAFFING AND FINANCES

The level of staffing is not sufficient to effectively manage the area. Staff members do not have adequate skills to conduct critical management activities. Training and development opportunities are not appropriate to the needs of the staff (Score 2). Details on staffing are given in Graph 8.



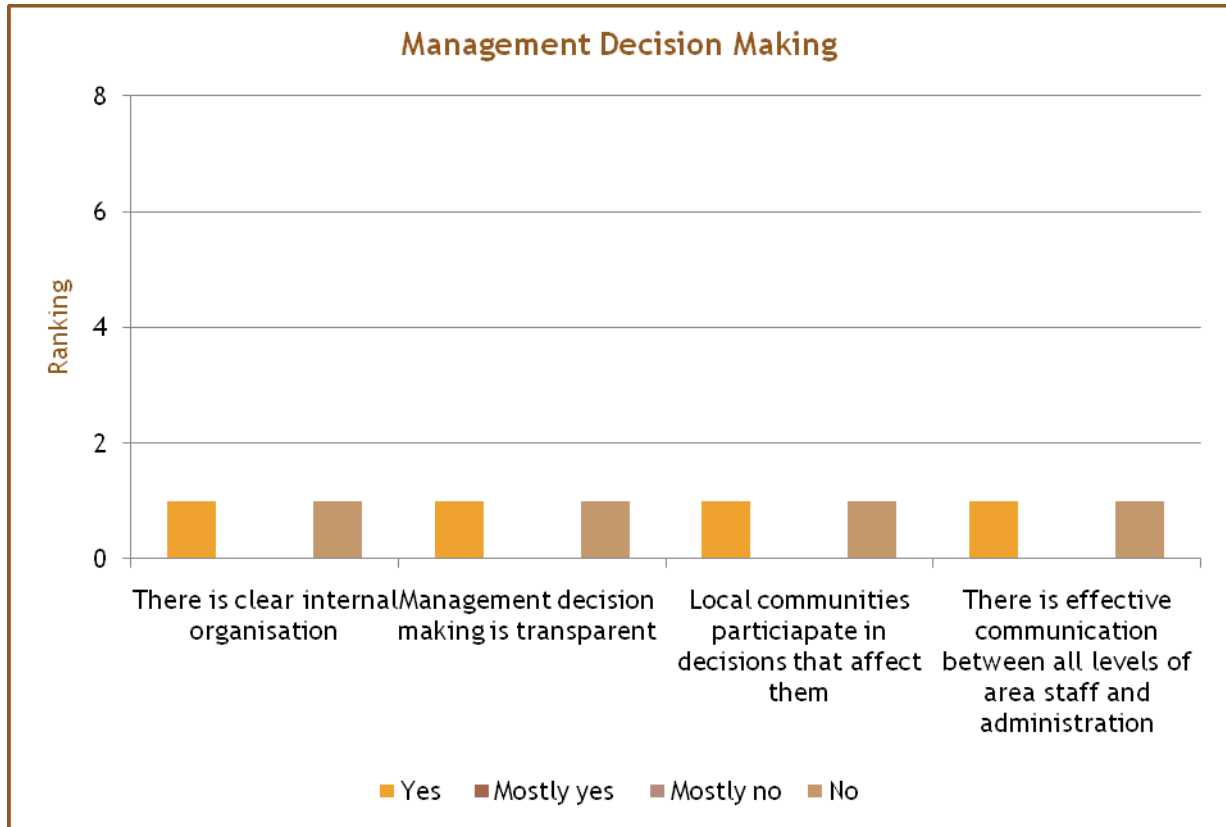
(Source: Socio-economic Survey, January 2011)

Graph 8: RAPPAM assessment for staffing

Funding in the past 5 years and in the next five years is not adequate to conduct critical management activities. Financial management practices do not enable efficient and effective area management. The long term financial outlook of the area is not stable.

MANAGEMENT PLANNING AND MANAGEMENT DECISION MAKING

As Astola Island is not a protected area thus management plan for it does not exist. Details on management decision making are given in Graph 9.



(Source: Socio-economic Survey, January 2011)

Graph 9: RAPPAM assessment for management decision making

RESEARCH EVALUATION AND MONITORING

Astola Island has high ecological importance however research on key ecological and social issues is not consistent with its needs. Staff does not have regular access to scientific research and advice. Critical research and monitoring needs have not been identified and prioritized either.

RAPPAM ANALYSIS

Astola Island has high ecological and socio-economic importance. However it is facing numerous pressures and its natural resources are at threat due to various anthropogenic activities. Oil pollution of the sea seems to be the biggest pressure on and threat to marine ecology. Oil pollution along with illegal fishing practices is resulting in a tremendous decline in fish production.

Turtle and its egg hunting are also one of the major pressures existing in the area. Corrals present near the island add tremendous beauty and increase its ecological value. However corral mining for commercial purposes and ghost nets are excessively damaging them. All of these pressures on the island are due to lack of any protection status and absence of management plan for the area. Lack of staffing and financial resources makes it difficult to monitor the illegal activities. Recruitment and retention of employees is also difficult. Market value of the area resources is high making it further vulnerable.

Astola Island is an important source of employment for fishing communities. It has high religious, cultural and aesthetic importance. Plant and animal species have high social, cultural or economic value. Research on key social and ecological issues is not according to the needs of the area and further research should be conducted for its effective management.

CONCLUSION AND INTERVENTIONS

CONCLUSION

Field survey revealed that there are no permanent settlements on Astola Island. However, fishermen frequently visit the island except during monsoon season when the sea is very turbid and thus the island becomes inaccessible. Fishermen catch fish, crabs, lobsters and sell them to middlemen either in Pasni or Karachi. However some of the fishermen also catch fish and as per information provided by an official they are also involved in corral mining. Few fishermen that stay on the island for some weeks collect wood and use it as fuel for burning.

Major pressures on the natural resources of the Ramsar site are:

- Pollution of the island by disposal of non biodegradable solid waste on its coast by the fishermen.
- Damaging of corrals by nets that get stuck in the corrals (ghost nets)
- Reduction in fish population due to illegal fishing practices. Illegal fishing gears of very small size used by huge trawlers also catch of small fingerlings resulting in long term impact on the fish population.
- Sea water pollution by oil spillage during transferring of smuggled oil from one boat into another
- Turtle hunting by fishermen

INTERVENTIONS

Astola Island has tremendous beauty however due to lack of facilities, awareness and security issues there is hardly any tourism activity in the area. Eco-tourism should be promoted as it would provide as another income source for the people of Pasni. Thus their dependency on fishing would reduce.

Awareness regarding importance of corrals for ecosystem, proper disposal of waste and use of sustainable fishing practices needs to be given to the local fishermen of Balochistan. Strict law enforcement needs to be placed to prevent usage of illegal fishing gears and spillage of oil into the sea.

Considering tremendous ecological importance the Ramsar site should be declared as a protected area and a management plan should be made to manage the ecosystem.

REFERENCES

- Ervin, J. 2003 *WWF Rapid Assessment and Prioritisation of Protected Areas Management*
- WWF – Pakistan, 1995 *Astola Island A Potential Site for Marine National Park*
- The Annotated Ramsar List of Wetlands of International Importance
http://www.ramsar.org/cda/en/ramsar-pubs-annolist/main/ramsar/1-30-168_4000_0__

ANNEXURE I FISHERMEN SURVEY QUESTIONNAIRE**Questionnaire Socio-economic Baseline****(Astola Island) PWP**

1. Date _____
2. Name of Interviewer _____
3. Name of Respondent _____
4. Age of Respondent _____
5. Place of Origin _____
6. Boat Size (Feet) _____

7. Fishing Gears

Type	Number	Description

8. Fishing Months _____
9. Fishing Area _____

10. Fishermen on Boat

Designation	Age	Education	Village / Area of Residence

11. Fishing

No.	Names of Fish Species	Names of Months it is Fished	Amount of Fish Caught (kg/month)	Domestic Consumption (kg/month)	Amount of Fish Sold (kg/month)	Price(Rs/Kg)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						

12. Gross Income (Rs) _____

13. Total Expense (Rs) _____

14. Net Income (Rs) _____

15. Division of Income (Patti System)

Owner _____

Nakhuda / Nakho _____

Boat Operator _____

Cook _____

Khalasi _____

16. Remarks _____

ANNEXURE II MAP OF ASTOLA ISLAND

- 1.5 Threat -----
- 1.6 Will it be a threat in the next 5 years?
 (1) Yes (2) No
- 1.7 The probability of the threat occurring is?
 (1) Very high (2) High (3) Medium (4) Low (5) Very low
- 1.8 The overall severity of this over the next five years is likely to be?

Extent		Impact		Permanence	
	Throughout (>50%)		Severe		Permanent (>100 years)
	Widespread (15-50%)		High		Long term (20-100 years)
	Scattered (5-15%)		Moderate		Medium term (5-20 years)
	Localized (<5%)		Mild		Short term (<5 years)

2 PRESSURES AND THREATS

- 2.1 Pressure -----
- 2.2 Has it been a pressure in the last five years?
 (1) Yes (2) No
- 2.3 In the last five years this activity has?
 (1) Increased sharply
 (2) Increased slightly
 (3) Remained constant
 (4) Decreased slightly
 (5) Decreased sharply
- 2.4 The overall severity of the pressure over the last five years has been?

Extent		Impact		Permanence	
	Throughout (>50%)		Severe		Permanent (>100 years)
	Widespread (15-50%)		High		Long term (20-100 years)
	Scattered (5-15%)		Moderate		Medium term (5-20 years)
	Localized (<5%)		Mild		Short term (<5 years)

- 2.5 Threat -----
- 2.6 Will it be a threat in the next 5 years?

- (1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.3 Bribery and corruption is common throughout the region.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.4 The area is experiencing civil unrest and/or political instability.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.5 Cultural practices, beliefs and traditional uses conflict with the AREA objectives.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.6 The market value of area resources is high.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.7 The area is easily accessible for illegal activities.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.8 There is a strong demand for vulnerable AREA resources.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.9 The area manager is under pressure to unduly exploit the area resources.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 6.10 Recruitment and retention of employees is difficult.
(1) Yes (2) Mostly yes (3) Mostly no (4) No

7 OBJECTIVES

- 7.1 Area objectives provide for the protection and maintenance of biodiversity
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 7.2 Area employees and administrators understand the area objectives and policies
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 7.3 Local communities support the overall objectives of the area
(1) Yes (2) Mostly yes (3) Mostly no (4) No

8 LEGAL SECURITY

- 8.1 Staff and financial resources are adequate to conduct critical law enforcement activities.
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 8.2 Conflicts with the local community are resolved fairly and effectively.
(1) Yes (2) Mostly yes (3) Mostly no (4) No

9 MANAGEMENT PLANNING

- 9.1 There is a comprehensive inventory of natural and cultural resources
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 9.2 There is an analysis of, and strategy for addressing, area threats and pressures

(1) Yes (2) Mostly yes (3) Mostly no (4) No

10 MANAGEMENT DECISION MAKING

10.1 There is a clear internal organization.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

10.2 Management decision making is transparent.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

10.3 Local communities participate in decisions that affect them.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

10.4 There is effective communication between all levels of area staff and administration.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

11 STAFFING

11.1 The level of staffing is sufficient to effectively manage the area.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

11.2 Staff members have adequate skills to conduct critical management activities.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

11.3 Training and development opportunities are appropriate to the needs of the staff.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

11.4 Staff performance and progress on targets are periodically reviewed.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

11.5 Staff employment conditions are sufficient to retain high-quality staff.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

12 FINANCES

12.1 Funding in the past 5 years has been adequate to conduct critical management activities.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

12.2 Funding for the next 5 years is adequate to conduct critical management activities.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

12.3 Financial management practices enable efficient and effective area management.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

12.4 The long-term financial outlook for the area is stable.

(1) Yes (2) Mostly yes (3) Mostly no (4) No

13 RESEARCH EVALUATION AND MOINITORING

13.1 The impact of legal and illegal uses of the area are accurately monitored and recorded

- (1) Yes (2) Mostly yes (3) Mostly no (4) No
- 13.2 Research on key ecological issues is consistent with the needs of the area
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 13.3 Research on key social issues is consistent with the needs of the area
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 13.4 Area staffing have regular access to scientific research and advice
(1) Yes (2) Mostly yes (3) Mostly no (4) No
- 13.5 Critical research and monitoring needs are identified and prioritised
(1) Yes (2) Mostly yes (3) Mostly no (4) No

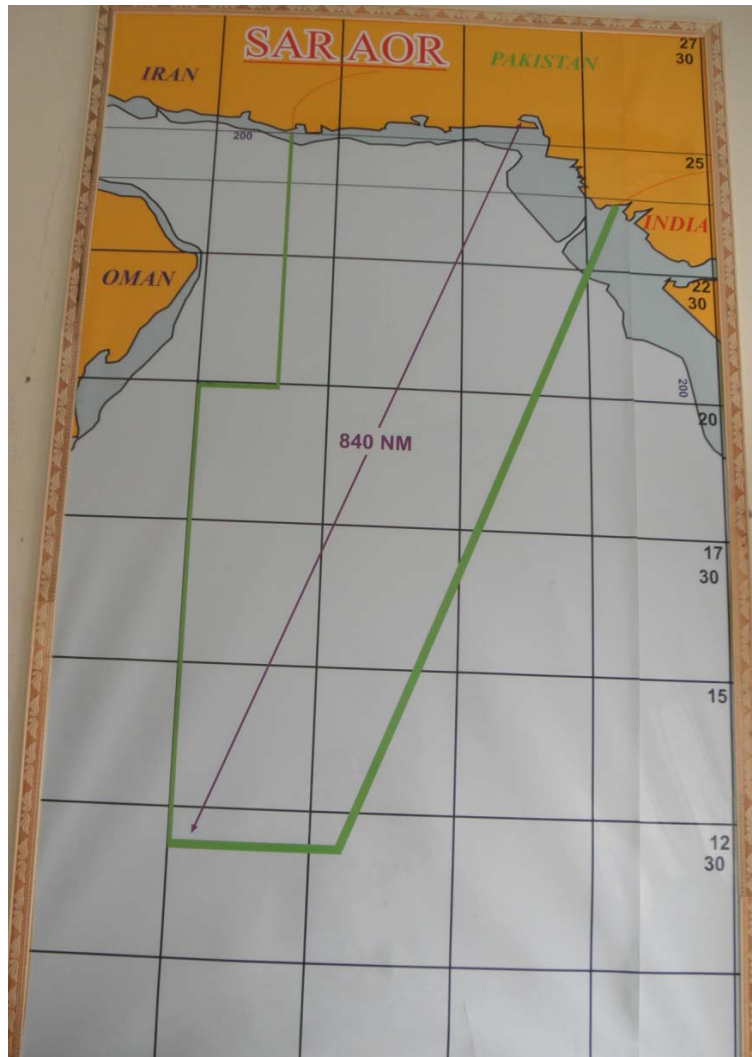
ANNEXURE IV SOCIO-ECONOMIC BASELINE SURVEY PICTURES



Picture 1: Meeting with Fisheries Department Officers, Pasni



Picture 2: Meeting with District Coordinator IUCN



Picture 3: Map showing the 840 nautical mile area of Pakistan



Picture 4: Interview with Bengali Community



Picture 5: Fishermen in a boat near Astola Island



Picture 6: Damaged nets discarded at the coast of Astola Island



Picture 7: Fishing boats nears the coast of Astola Island



Picture 8: Mosque used by fishermen present at Astola Island



Picture 9: Fish catch of fishermen living in the hut on Astola Island

ANNEXURE V RAPPAM METHODOLOGY

The RAPPAM Methodology can:

- Identify management strengths and weaknesses
- Analyse the scope, severity, prevalence, and distribution of a variety of threats and pressures
- Identify areas of high ecological and social importance and vulnerability
- Indicate the urgency and conservation priority for individual protected areas
- Help to develop and prioritise appropriate policy interventions and follow-up steps to improve protected area management effectiveness.

RAPPAM Methodology is basically designed for broad level comparisons among various PAs. Although it can be applied to a single protected area, the RAPPAM Methodology is not designed to provide detailed, site-level adaptive management guidance to protected area managers. It can however be used as a framework for developing a site-level monitoring tool⁴. It can however be used with slight modification on sites that are not protected but have significant ecological importance.

Pressures and Threats

The first section of the modified RAPPAM questionnaire addresses pressures and threats to the Ramsar site. Illegal or legal activities and events which have an adverse affect on the integrity of the area are termed as pressures. Over the past five years various forces have been exerting pressure over Astola Island, which were identified by the respondents. Trend of pressure, extent, impact and permanence for each pressure was determined. Trend is always measured over a specific time period, which in this case was past five years. It was determined as to whether over the past 5 years the identified pressure has increased decreased or is still the same as it was five years back.

Threats are probable or imminent pressures, which are likely to occur and would have a detrimental impact on the integrity of the area in future. Threats which are likely to occur in the next five years along with their probability of occurrence, extent, impact and permanence were determined.

The overall severity of a pressure and a threat is measured by three parameters:

- Extent
- Impact
- Permanence

Extent is the percentage of the area which will be impacted and is assessed in relation to its possible occurrence. For example the extent of fishing activity would be measured taking into consideration only the fishable water. "Throughout" means that an activity occurs in more than 50% area of its potential range, "Widespread" is when an activity occurs from 15 to 50% area, "Scattered" is 5 to 15 % area while if an activity occurs in less than 5% area of its potential range it is termed as "Localized".

A pressure may directly or indirectly affect the resources of an area. The degree or level of its affect is termed as impact and is categorized as severe, high, moderate and mild. Serious damage or loss to the resources of a protected area is a "Severe" impact. Significant damage to the area resources is termed as "High". "Moderate" impact is when the damage to the natural resources of a area which is

⁴ J Ervin, 2003

detected but it is very significant. "Mild" impact is damage which is considered insignificant as it is not easily detected.

The time required by a protected area to recover from the damages of a pressure or a threat naturally or by human intervention is given by permanence. Recovery is defined as the restoration of ecological structures, functions and processes to levels that existed prior to the activity's occurrence or existence as a threat. Recovery time assumes that the activity ceases, and that either management interventions take place or natural processes are allowed to occur. "Permanent" damage is damage to a resource that cannot recover, either by natural processes or with human interventions, within 100 years. "Long term" damage can recover in 20 to 100 years. "Medium term" damage can recover in 5 to 20 years. "Short Term" damage can recover in less than 5 years.⁵

⁵ J. Ervin, 2003