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RESEARCH PAPER

Role of Marine National Park for Sustainable Livelihoods of Artisan Fisherfolk: A Case Study of MNP, Jamnagar

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Abstract: Over the past few decades, marine conservation has become a global concern due to increasing anthropogenic activities in the vicinity of coastal areas, which has led to the development of the concept of Marine Protected Areas (MPAs) for the conservation of marine ecology and its biodiversity. Conservation and acceptance of MPAs can only be achieved if coastal communities and fisherfolk are included as significant stakeholders because MPAs have direct relevance to their livelihood. To capture their acceptance towards the Gulf of Kachchh Marine National Park (MNP), Jamnagar, artisanal fisherfolk fishing in and around the MNP were surveyed to determine whether the presence of a well-managed MNP has any positive effects on the adjacent fishing communities since its establishment. The survey was carried out at six sites along the coast of southern Gulf of Kachchh (Sachana, Jodiya, Sikka, Salaya, Arambada, and Bet Dwarka) using structured questionnaires. The findings showed that the total fish catch was observed to increase over the years, but there has been a perceived decline in total catch in recent years. Similarly, while the total fish catch data recorded an increasing trend, discussions with the fisherfolk revealed a sharp decline in "catch per unit

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effort" in recent years. Fisherfolk from all the study sites showed interest in the development of the MNP and were keen to be involved in conservation planning and the management of the MNP.

Keywords: Gulf of Kachchh, Marine National Park (MNP), Fisherfolk, Sustainable Livelihood, Community Based Management.

1. INTRODUCTION

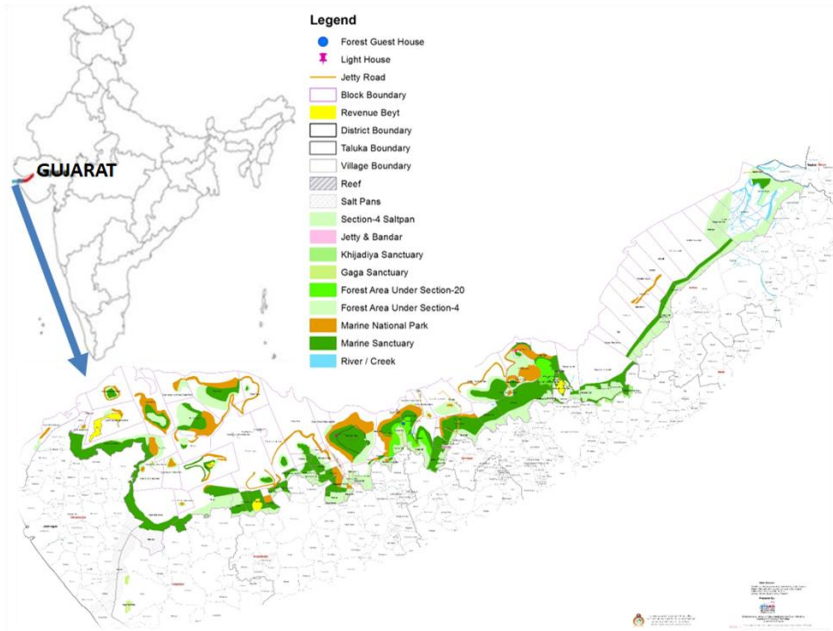
Establishing Marine Protected Areas (MPAs) in coastal and marine environments is considered essential for the conservation and protection of coastal and marine biodiversity. MPAs are governed by policy regulations that are meant to restrict and regulate human activities within a predefined area. As stated by the International Union for Conservation of Nature (IUCN) General Assembly in 1988, an MPA is "an area of intertidal or sub-tidal terrain together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment" [Resolution 17.38 of the IUCN General Assembly, 1988, reaffirmed in Resolution 19.46 (1994)].

Though they are mandated by government regulations, the success of an MPA depends on its acceptance by local stakeholders such as fisherfolk (Klein *et al.* 2008). In particular, the active participation of local stakeholders in the management and governance of MPAs greatly aids their functioning (Klein *et al.* 2008; Gleason *et al.* 2010). Examples from around the world show that MPAs were more successful in strengthening and protecting local marine biodiversity when their management strategy changed from a governmental, top–down approach to a co-management system involving locals along with the government (Alcala and Russ 2006; Uychiaoco *et al.* 2005). In addition, research also shows that excluding local stakeholders leads to the loss of trust and support among locals, thus consigning the MPA to failure (Himes 2003). However, MPAs are usually established by the government without consulting the locals. Therefore, it is important to periodically assess the role of MPAs in the lives of local stakeholders such as artisanal fisherfolk and their acceptance of MPAs as government institutions.

In this paper, we report the perceptions and opinions of the most important stakeholders in the Gulf of Kachchh Marine National Park and Sanctuary (MNP&S)—fisherfolk—about its establishment and impact in the Gulf of Kachchh (GoK), Gujarat, India. The GoK is a semi-enclosed basin located between the 20° 15' N and 23° 35' N latitudes and the 68° 15'

and 70° 22' E longitudes. It is one of two highly energetic, macro-tidal systems of the north-eastern Arabian Sea, where tidal ranges may go up to 7.2 m (Vethamony and Babu 2010). The southern coast of the GoK was first declared a Marine Sanctuary (MS) in 1980, and then some parts of it were made a Marine National Park (MNP) in 1982 to provide more protection to its marine ecology (Singh 2003). The MNP spans 162.89 sq km, whereas the MS covers an area of 457.92 sq km (see Figure 1). Administratively, the MNP&S stretches across the Jamnagar, Morbi, and Devbhumi Dwarka districts. There are 42 islands along the southern coast of the GoK, of which 37 islands fall in the MNP area and the remaining five islands under the MS area.

Figure 1: Location of Gulf of Kachchh Marine National Park and Sanctuary



Source: Office of the Chief Conservator of Forests, Marine National Park, Jamnagar

2. HYPOTHESIS AND OBJECTIVES OF THE STUDY

In this study, we investigate the hypothesis that establishing the MNP&S along the southern coast of the GoK is a sustainable option and is acceptable to local fishing communities. The objectives of the study are

- to assess how fisherfolk living along the southern coast of the GoK perceive the MNP&S;
- to examine perceived changes in marine life resulting from the establishment of the MNP&S, by means of a social survey of fisherfolk; and
- to assess, based on local perceptions, attitudes, knowledge, and resource-use patterns, the positive and negative impacts of the MNP&S on the fishing community.

3. LITERATURE REVIEW

MPAs can help in managing and conserving coastal and marine biodiversity if they are accepted by local communities. It is, therefore, important that local stakeholders—like fisherfolk—are consulted about such establishments. Locals can significantly contribute to making MPAs successful by providing historical catch trends, information about traditional practices, and data on changes in the local environment (Jentoft 2000; Himes 2003).

The literature from around the world shows that engaging with local people helps build trust in the government management of MPAs (Beaumont 1997; Himes 2003; Alcala and Puss 2006). In addition, involving local communities can help increase the ease and cost-effectiveness of MPA maintenance (Uychiaoco *et al.* 2005). Indeed, studies have shown that fishers are keen to participate in such endeavours and have a negative reaction to being excluded from decision-making (Pita *et al.* 2010). Further, Hamilton (2012) shows a high level of acceptance of MPAs among fisherfolk in Cambodia and the Philippines, while Mascia *et al.* (2010) demonstrate that MPAs affect the social well-being and political power of fishers by providing food security and control over the governance of local marine resources.

Mascia *et al.* (2010) reviewed the impact of MPAs across 11 countries on five aspects of fisherfolk's welfare: food security, resource rights, employment, community organization, and income. They found that MPAs affect the social well-being and political power of fishers by providing food security and control over the governance of local marine resources. They examined the data of 70 fishing subgroups from 20 MPAs located in 11 countries and reported that "Following MPA establishment, food security generally remained stable or increased ($df = 2$, $\chi^2 = 12.46$; $p = 0.002$), but it declined for 16% of the fishing subgroups" (1426). They concluded that

MPAs may be a viable strategy for empowering local communities and enhancing their food security; however, the study showed that their social impact varies within and among different groups and subgroups.

In India, Karnad *et al.* (2014) surveyed 342 fisherfolk in two states—154 from 39 villages in Maharashtra and 188 from 23 villages in Tamil Nadu—to examine the perceptions of fisherfolk about the state of fish stocks and current fishing practices and management strategies in the country. They reported that a majority of the fisherfolk surveyed—90% in Maharashtra and 83% in Tamil Nadu—perceived declines in total catch due to which they have modified their fishing practices. They found that the socio-economic characteristics of fisherfolk, like income and experience, influenced their perception of the state of fishery in the country. They concluded, "The convoluted interactions between ineffective community and state regulations guiding their actions has prevented fishermen from developing successful models of sustainable fisheries management" (218).

Sridhar (2017) studied the MPAs in India and highlighted the challenges in managing fisheries in such protected areas. She noted:

> The challenges of managing fisheries is not uncomplicated by any means. Traditional management systems based on restricting activities work well only where fishing communities are an integral part of the monitoring and enforcing mechanisms. The idea of intense resource-use was not organic to traditional fisher communities. There is an active effort to promote such a perspective from the hinterland (significantly through technology upgradation schemes of the state). These rapid technological advancements in fisheries and a noticeable systemic breakdown within the fishing communities make conformity to rules difficult. Only where fishing communities are better organised and the level of awareness and political representation greater have these communities been able to enforce some form of rules (traditional or official).

4. STUDY AREA

Of the various coastal states of India, Gujarat has the second-longest coastline (Rajawat *et al.* 2015) and is endowed with a bounty of natural resources. Two of the three gulf regions of the country lie in this state. The southern coast of the GoK, in particular, boasts a diversity of coastal and marine life. However, this region has been heavily exploited for human development activities dating back to the 1930s, when coral mining began (Magotra *et al.* 2017). Subsequent development in this region includes the establishment of Bedi Port in 1933, a unit of Tata Chemicals Ltd., along the coast in Mithapur village in 1937, Digvijay Cement Company at Sikka in 1940, Sikka Port in 1949, and Navlakhi Port in 1955. These occurrences led

to the clearing of large tracts of mangroves for the creation of salt pans in 1970 and the laying of the subsea pipeline of the Indian Oil Corporation Ltd. (IOCL) in 1978 (Magotra *et al.* 2017). These activities took a heavy toll on marine life in the region, and realizing its importance, the state government declared some parts of this coast a marine sanctuary in 1980. In 1982, the area of the MS was expanded, and some parts were declared an MNP to provide them with more protection. Overall, the MNP&S includes 118.32 sq km of reserved forests, 347.90 sq km of unclassified forests, and 98.20 sq km of Indian territorial waters (Biswas 2009). The Forest Department of Gujarat manages the whole area.

This region supports a variety of marine biodiversity due to the availability of a range of habitats, viz. coral reefs, mangrove forests, sandy beaches, mudflats, creeks, rocky coasts, seagrass beds, etc. The region is home to 108 species of algae, 70 species of sponges, 72 species of hard and soft corals, more than 200 species of fishes, 27 species of prawns, 30 species of crabs, 4 species of seagrass, 3 species of sea turtles, 3 species of sea mammals, over 200 species of molluscs, 94 species of water birds, 78 species of birds, 92 species of bivalves, 55 species of gastropods, and more (Magotra *et al.* 2017). Diverse habitats cater to the needs of thousands of species, providing them with suitable shelter and sustenance.

The two major coastal ecosystems of this MNP are mangroves and coral reefs. The total area of reefs in the MNP is 443.49 sq km, whereas mangroves occupy approximately 173 sq km (Kumar *et al.* 2017). These coral reefs are of immense importance and provide a range of goods and services that benefit the people and environment. As per an economic valuation by the Gujarat Ecological Commission (GEC), the total estimated annual value of the benefits from coral reefs (mainly in the MNP in the GoK region) is ₹220.024 crore (Dixit *et al.* 2010).

This area supports a diverse range of fishes. The vast intertidal mudflats also support traditional fishing operations using indigenously developed gear (Biswas 2009). In 2005–2006, the average value of the marine fish landed in Jamnagar (₹52.33) was over 70% higher than the average value of the catch for Gujarat (₹30.36) (Biswas 2009). During 2005–2006, Jamnagar contributed 10.01% of the total marine fish production in the state (Biswas 2009), and during the decade of 2004–2005 and 2014–2015, the district contributed 9.73% of the total share of the state (Sharma *et al.* 2016).

There are 110 villages along the southern coast of the GoK, which administratively fall under the Jamnagar, Morbi, and Devbhumi Dwarka districts of Gujarat. Of these 110 villages, 56 coastal villages were selected

for the World Bank–funded Integrated Coastal Zone Management (ICZM) Project launched in 2010. Its primary focus is capacity-building of local communities for the protection, conservation, and regeneration of mangroves of MNP&S (GEC 2009).

Based on the socio-economic information collected under the ICZM project and provided to us by the Office of the Gulf of Kachchh Marine National Park, we selected six villages located along the coast in the vicinity of the MNP—Sachana, Jodiya, Sikka, Salaya, Arambada, and Bet Dwarka (see Figure 2). Village selection was based on occupational structure, i.e., we chose villages with good fishing populations. We have provided the socio-economic details of the selected villages, along with their occupation-wise involvement, in Table 1.

Figure 2: Study sites of primary surveys

Source: Authors and Google Earth

Table 1: Socio-economic details of the villages selected for the primary survey

Village name	Total house-holds	Total population			Occupation-wise households						
		Male	Female	Total	Agri-culture	Animal husbandry	Fishing	Saltpans	Agriculture and animal husbandry	Misc.	Other work
Sachana	602	2, 292	2, 266	4, 558	107	12	405	0	0	68	10
Sikka	150	626	424	1, 050	0	0	150	0	0	0	0
Jodiya	600	1, 147	1, 053	2, 200	0	0	350	0	0	232	18
Salaya	600	1, 900	2, 100	4, 000	0	0	600	0	0	0	0
Arambada	750	2, 241	2, 259	4, 500	64	15	358	63	8	148	94
Bet Dwarka	407	1, 609	1, 338	2, 947	0	0	407	0	0	0	0

Source: Office of the Chief Conservator of Forests, Marine National Park, Jamnagar

5. QUESTIONNAIRE DESIGN AND SURVEY METHODOLOGY

We used a structured survey adapted from the literature (Hamilton 2012) and edited for site-specificity, with inputs from the Marine National Park Forest Department, Jamnagar, which added more detailed information (presented in the Annexure). The survey included open- and close-ended questions on household demographics, attitudes, awareness, and resource use. Focus group discussions (FGDs) were also held to gain a deeper understanding of the related issues. FGDs involved a discussion with fisherfolk belonging to one village and provided a glimpse of the common understanding of most of the fisherfolk of that village regarding MNP-related issues. It was a form of qualitative investigation where questions related to MNP were asked to find out about the perceptions, attitudes, beliefs, opinions, and ideas of fisherfolk.

The questionnaire was divided into two sections: Section (A), which sought general information about the fisherfolk, including their basic profiles (such as their age, fishing methods, and the species they caught most frequently); and Section (B), which sought their opinions on the perceived impact of the MNP and their willingness to be involved in the management process. Most questions in Section (B) used a Likert scale answering system, with options ranging from "Strongly Disagree" to "Strongly Agree". Other questions had categorical answers, such as "Yes" or "No". We calculated an attitude score for each respondent based on their responses to the questions.

We tabulated the responses from Section (A) to show the mean and standard deviation of continuous data and the frequencies of occurrence (as percentages) of categorical data. We also tabulated data from Section (B) to show the percentage of each response to each question. In this study, we present categorical responses as "Yes", "No", and "Maybe", in which "Maybe" and "Don't know" responses are combined. We measured ordinal responses on a five-point Likert scale ranging from "Strongly agree" to "Strongly disagree" and then reduced it to a three-point Likert scale due to the small sample size; this contained only the responses "Agree", "Neutral" (neither agree nor disagree), and "Disagree". We present the Likert scale responses as percentages of each response from the fishers surveyed at each study site.

We carried out these surveys with the support of the Forest Department at Jamnagar, a local translator, the village-level fishing community head, and social scientists from the Office of the Marine National Park, Jamnagar. We chose fisherfolk randomly at all six sites along the coast and in landing centres. We conducted surveys opportunistically, as the fisherfolk could only be contacted in the morning, during the low tide. It took roughly 15–

20 minutes to complete each survey. We surveyed a total of 35 fisherfolk each in Sachana, Jodiya, Salaya, Okha, and Arambada taluka, and 24 in Sikka. Thus, we surveyed a total of 199 fisherfolk in the MNP&S.

6. RESULTS

We have summarized the information about the socio-economic backgrounds of the surveyed fisherfolk in Table 2. The mean age of all the surveyed fisherfolk was 43.5 years.

The mean age of surveyed fisherfolk ranged from 48 to 39 years in each of the sites. The mean number of years of experience ranged from 23 to 49.83 years. The traditional knowledge of fisherfolk is useful for successfully managing the MPA. The age of fishers can influence their actions and perceptions, including their opinions towards the management of their fishery (Tzanatos *et al.* 2006). Older and more experienced fishers may have better knowledge about coastal and marine resources than younger individuals. Therefore, we attempted to include a greater number of older and experienced fishermen. The fishing gear that they operated varied from one site to another; fixed bag nets, boat seines, and hooks and lines were common across all the sites, whereas in Salaya, our survey showed that most fisherfolk (45.71%) use trawl longlines for fishing. There were significant overlaps between the species they caught—at all sites, fisherfolk caught prawns, pomfret, blue fish, and crabs.

Most fisherfolk we surveyed across the six study sites did not have any occupation or sources of income outside of fishing. Of all the fisherfolk we surveyed in Salaya, Sachana, and Bet Dwarka, 2.86% informed us that apart from fishing activities, they did have other sources of income. In the other sites, the participants reported that they had no other income sources.

The mean boat length varied across sites: it was 26 m in Sachana, 36.46 m in Arambada, 35.09 m in Salaya, 25.77 m in Jodiya, 31.42 m in Sikka, and 38.6 m in Bet Dwarka. We found that the mean boat power was much higher in Salaya (84.86 HP),[1] Sikka (94.75 HP), Bet Dwarka (61.3 HP), and Arambada (54.03 HP) than in Sachana (39 HP) and Jodiya (17.10 HP). The mean distance that fisherfolk travelled to reach the fishing grounds was 79.7 km in Salaya, 56.88 km in Sikka, 46.81 km in Jodiya, 42.44 km in Bet Dwarka, 39.16 km in Arambada, and 36.23 km in Sachana. It seems that the fisherfolk at Salaya and Sikka used more powerful boats as they had to go further into the ocean to catch the fish. This indicates the dwindling availability of fish near the coast in Salaya and Sikka.

[1] HP = Horse Power.

Table 2: Primary survey findings

Village	Sachana (n = 35)		Salaya (n = 35)		Jodiya (n = 35)		Sikka (n = 24)		Bet Dwarka (n = 35)		Arambada (n = 35)	
Socio-economic characteristics												
	Mean (Std. Dev.)	%	Mean (Std. Dev.)	%	Mean (Std. Dev.)	%	Mean (Std. Dev.)	%	Mean (Std. Dev.)	%	Mean (Std. Dev.)	%
Age (years)	39 (14.82)	–	43.6 (10.23)	–	41.69 (13.08)	–	46.21 (9.09)	–	48 (8.86)	–	40.69 (9.67)	–
Experience fishing (years)	23 (14.13)	–	29.74 (9.98)	–	26.49 (12.81)	–	32.17 (8.20)	–	33.4 (14.5)	–	23.80 (7.12)	–
Any other occupation	–	2.86	–	2.86	–	0	–	0	–	2.86	–	0
Fishing characteristics												
	Mean (Std. Dev.)		Mean (Std. Dev.)		Mean (Std. Dev.)		Mean (Std. Dev.)		Mean (Std. Dev.)		Mean (Std. Dev.)	
Boat length (m)	26 (4.02)		35.09 (8.19)		25.77 (3.40)		31.42 (4.05)		38.6 (19.6)		36.46 (12.72)	
Boat power (HP)	39 (28.71)		84.86 (21.29)		17.90 (14.41)		94.75 (7.30)		61.3 (50.7)		54.03 (42.66)	

Source: Authors

Note: % signifies frequency of occurrence

...continued

Village	Sachana (n = 35)	Salaya (n = 35)	Jodiya (n = 35)	Sikka (n = 24)	Bet Dwarka (n = 35)	Arambada (n = 35)
Fishing methods						
	%	%	%	%	%	%
Fixed bag net	65.71	68.57	82.86	–	42.86	25.71
Boat seine	31.43	11.43	62.86	–	–	–
Drift net		8.57	–	–	–	–
Gillnet (large)		–	71.43	100.00	57.14	68.57
Gillnet (small)		68.57	31.43	–	–	8.57
Hooks and line		11.43	5.71	70.83	34.29	5.71
Ring seine		–	–	–	–	–
Traps	25.71	–	11.43	–	–	–
Trawl longlines		45.71	–	8.33	–	–
Scoop net		–	–	–	–	–
Other	–	–	–	–	–	–
Fishing operations						
	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)
Distance from coast (km)	36.23 (13.54)	79.7 (46.65)	46.81 (33.35)	56.88 (14.43)	42.44 (33.07)	39.16 (32.60)
Times per week	4.11 (1.12)	4.26 (0.98)	4.77 (1.73)	4.33 (0.82)	4.8 (1.18)	4 (1.16)

Source: Authors
Note: % signifies frequency of occurrence

...continued

Village	Sachana (n = 35)	Salaya (n = 35)	Jodiya (n = 35)	Sikka (n = 24)	Bet Dwarka (n = 35)	Arambada (n = 35)
Species present in catch						
	%	%	%	%	%	%
Prawns	14.29	97.14	45.71	41.67	77.14	82.86
Shrimps	–	–	–	–	–	60.00
Pomfret	94.29	97.14	91.43	50.00	–	42.86
Crab	–	11.43	85.71	37.50	57.14	17.14
Bluefish (*surmai*)	48.57	25.71	14.29	33.33	45.71	51.43
Lobster	–	8.57	80	–	42.86	25.71
Threadfish (*Dara* fish)	42.86	–	–	–	5.71	25.71
Dutia	5.71	–	8.57	–	–	8.57
Bombay duck (*bumbla*)	–	–	–	8.33	20.00	40.00
Other clupeids (*palli*)	–	–	–	–	14.29	8.57
Kuth	8.57	14.29	–	–	–	–
Sak	–	–	–	–	8.57	–
Catfish	–	–	–	–	48.57	–
Goldfish	40.00	–	17.14	8.33	22.86	11.43
Tuna	–	–	–	–	5.71	–

Source: Authors
Note: % signifies frequency of occurrence

Figure 3: Fisherfolk's opinions about the MNP&S

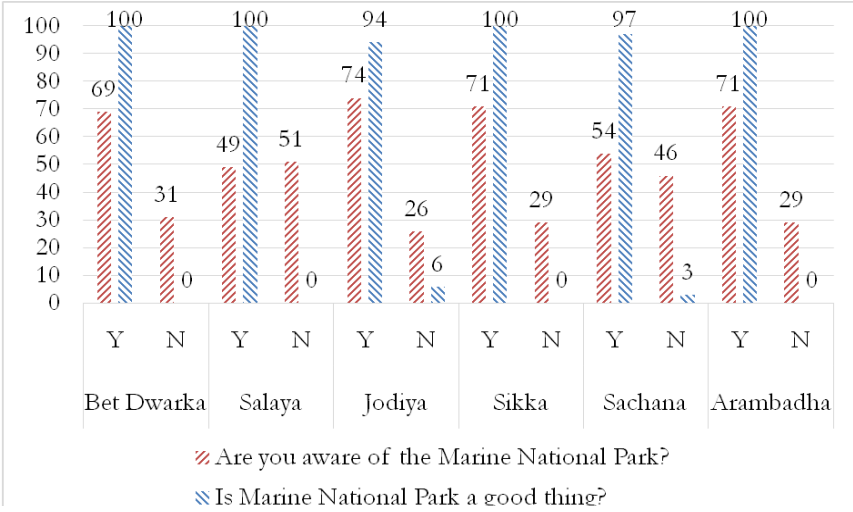
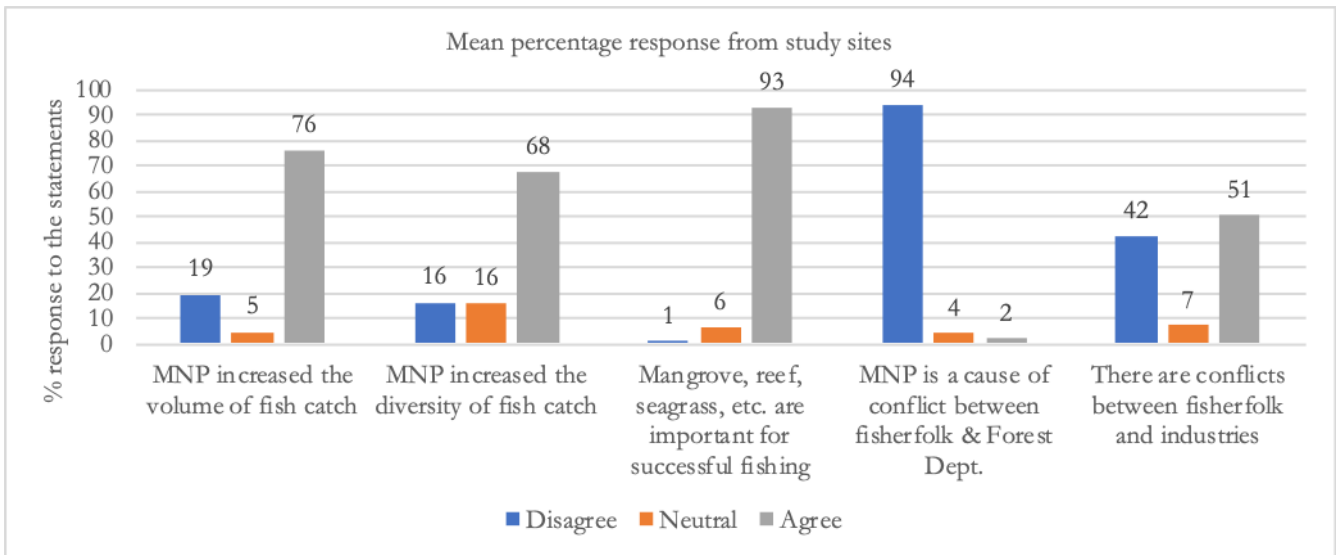


Figure 3 shows that a large percentage of fisherfolk are aware of the MNP; however, a significant minority (a mean of 35.34%) are not aware of the MNP and its importance. This highlights the failure of the regulating body to generate awareness among the general public living along the coast. During the survey, our team provided a brief description of the MNP to the respondents and their families, especially those who were not aware of its benefits. We asked respondents who were aware of the MNP: "Is the establishment of a marine national park/marine protected area a good thing?" About 98.10% of fisherfolk across all the study sites responded positively to the question, with 100% positive responses in Salaya and Sikka. But in Jodiya, some 5.71% of fisherfolk were not happy with mangrove plantation activities because mangrove roots trap sediments, which block creeks and prevent fish from entering; this means that the fisherfolk have to venture out into the open ocean for fishing. The fisherfolk's opinions on sedimentation due to mangroves do not reveal antagonism towards the MNP; rather, the fisherfolk suggested that the concerned regulatory body should work on removing excess sedimentation that is blocking the creeks.

Figure 4: Descriptive statistics on survey statements designed to quantify fisherfolk's opinions about the MNP



Source: Authors

Note: We measured responses to statements on a five-point Likert scale and subsequently reduced it to a three-point Likert scale: Disagree (D), Neutral/neither agree nor disagree (N), and Agree (A).

Figure 4 shows that when questioned about the impact of the MNP on the volume of catch and diversity of fish species caught, there were significant differences between the responses of the fisherfolk from each study site. Most fisherfolk from all six sites (ranging from 63% to 83%) agreed that the establishment of the MNP has increased the volume of their catch. Only in Bet Dwarka, 49% of fisherfolk responded that they had not found any different types of fish species in their catch because their fishing operations were not active near the MNP area; they go further out to sea, far from the MNP area, to fish. This should be a matter of concern for the MNP authorities as fishermen have to move out of the coastal belt for fishing, which may pose more risks for them. MNP authorities should take measures to increase the diversity and abundance of fish species near the coastal area of Bet Dwarka.

Most of the fisherfolk we surveyed—91% in Sachana, 100% in Sikka, 100% in Salaya, 100% in Arambada, 89% in Bet Dwarka, and 77% in Jodiya—felt that mangroves, coral reefs, and seagrasses are important for fishing and fish growth in coastal areas.

Fisherfolk reported positive relations with the Forest Department in all the areas surveyed. A small fraction (6% in Sachana and 6% in Bet Dwarka) reported conflicts with the Forest Department regarding the mismanagement of the monitoring activities of the MNP, the fishing gear that neighbouring villagers used, and the patrolling activities of the Indian Coast Guard near the coast in Bet Dwarka.

There were significant differences in the responses of fisherfolk regarding the presence of conflicts with the industries operating along the coast in southern GoK. Fisherfolk in all the areas we surveyed reported negative relationships with the industries because of their polluting production processes and the dumping of their wastes into the sea, which cause a reduction in fish catch around the coast. According to them, industrial growth benefits some people, but it should not pollute the environment. We found that 86% of the fisherfolk we surveyed in Salaya and 92% in Sikka reported that due to the establishment of industries along the coast, the condition of fish and marine life has deteriorated over a period of three decades, affecting catch size, fish size, and weight. However, in Bet Dwarka and Arambada, only 23% and 34% of fisherfolk, respectively, responded negatively to the establishment of industries; this could be because they have adapted to the changes. According to them, large industries have been operating there for the last 60–70 years, and people living in their vicinity know that they will rarely find fish within 1–2 km of these industries.

Table 3: Fisherfolk's opinions about the state of resources

% response in	Bet Dwarka		Salaya		Jodiya		Sikka		Sachana		Aram-badha	
In the last five years, compared to 10–15 years ago, I've noticed a difference in the catch	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Number of (most fished species in) the catch	91	9	97	3	86	29	100	0	71	29	83	17
Size of (most fished species in) the catch	86	14	97	3	77	23	100	0	77	23	83	17
Number of species present in the catch	80	20	83	17	77	23	88	12	71	29	91	9

Source: Authors

Table 3 shows the fisherfolk's opinions about the state of fisheries in and around the MNP. We gathered opinions from all the study sites, comparing changes that the fisherfolk had noticed in the last five years to those they had seen over 10–15 years. Most fisherfolk reported that they had noticed a difference in the state of marine resources over the last 10–15 years. The most common response to a perceived change in the number of fish was "Yes"; most fisherfolk reported an increase in the fished species present in their catch (ranging from 71% in Sachana to 100% in Sikka), the sizes of the most targeted species (ranging from 77 % to 100%) and the number of different species caught (71% to 91%) (see Table 3). All fisherfolk who reported that they had noticed a difference in the state of resources felt that there had been better resources 10–15 years ago. Reasons may vary from area to area; for example, in Sachana, most respondents identified industrial pollution as the major threat to fish in and around their fishing area and the use of small nets by big trawlers from Salaya village as the reason for a decrease in the number of fish and size of their catch. Biswas (2009, 26) also noted similar observations: "Traditional fishers point out that trawler owners are often able to use political and money power to escape penalties. In most places, traditional fishers identified trawling as one of the key reasons for the depletion of fish stocks and destruction of their gear. In the industrialized coastal belt, oil and chemical contamination, salt works and increasing port activity were stated as the reasons for declining catches".

Most fisherfolk in all six study sites stated that they had been asked to change their fishing methods and gear (63% in Bet Dwarka, 86% in Salaya, 77% in Jodiya, 100% in Sikka, 86% in Arambada, and 89% in Sachana). The Department of Fisheries has prohibited them from using small nets for fishing because they capture too many small fish that are not big enough to eat; the catch is therefore wasteful, as these small fish will not have the opportunity to grow large enough to provide a good meal or a good price. Though 86% of the fisherfolk surveyed in Salaya said that they have been asked to stop fishing with small nets, most still use them. During the survey, we observed that fisherfolk from the neighbouring villages, like Sachana and Jodiya, also responded negatively to the Salaya villagers' use of small fishing nets, and demanded that they be banned indefinitely.

Most fisherfolk (ranging from 89% in Bet Dwarka to 100% in Sachana) claimed that they were not aware of any of the MNP's management strategies. However, almost all of them (94% in Bet Dwarka, 94% in Jodiya, and 100% in Arambada, Salaya, Sikka, and Sachana) were keen on being involved in conservation and management planning procedures. Fishing community residents at all six sites responded positively and said that they were ready to support the government in any kind of conservation activities, but being among the key stakeholders, fisherfolk and the fishing community want to be consulted and involved in the preparation of any management or conservation plan.

7. DISCUSSIONS

The hypothesis we investigated in our survey concerned fisherfolk's acceptance of an MNP, based on a survey of fisherfolk at six sites along the coast. The results showed the differences in fisherfolk's attitudes towards the MNP and highlighted factors that influenced their opinions. The small sample size (35 in Sachana, 35 in Jodiya, 24 in Sikka, 35 in Salaya, 35 in Arambada, and 35 in Bet Dwarka) was the main limitation of this study. However, the study does provide some insights into fisherfolk's opinions and acceptance of MPAs—like MNPs—at all the sites we surveyed, and may act as a pilot that could aid the design of more comprehensive research in the future. Any future studies should aim to collect data from a larger sample size of fishers for more robust statistical outputs.

The fishers at all the sites in our survey were concerned about better MNP management to help conserve coral reefs and mangroves. According to the fisherfolk, while the total fish catch has shown an overall increasing trend over the years, there has been a decline in their "catch per unit effort" in

recent years. This is mainly owing to the overall environmental degradation of fishing areas due to rapid industrial development and the construction of breakwaters for ports, jetties, and single point mooring (SPM) stations.

The planning, implementation, and management of any MPA is dependent on stakeholders' opinions on conservation. There is a need to pay adequate attention to gaining the acceptance of those dependent on the resources in that area. A high level of acceptance of the MNP is important for effective, community-based management and conservation. Attempts to conserve the ecology of this marine area could become ineffective if the regulator has low levels of support from artisanal fisherfolk and other related stakeholders. Our survey observations suggest that fisherfolk with little or no knowledge about MNPs are ready to support it and be part of its planning and management, so that conservation efforts do not affect fishing activities. Results from our survey also indicate that most respondents—an average of 98.10% from all surveyed sites—felt that an MPA or MNP is good for the marine ecosystem and for their livelihoods; this is likely due to the fisherfolk having already seen the benefits of the Jamnagar MNP reflected in their catches. Though "catch per unit effort" has declined, an overall increasing trend has been perceived. The decline was noticed because of industrial pollution and big trawlers. As a legally protected area, these activities should be strictly regulated in the MNP. However, at present, these activities are not strictly regulated. The fisherfolk further suggested that they would like to be involved in the management or conservation planning of the MNP.

8. CONCLUSIONS AND RECOMMENDATIONS

We found similarities and differences in the responses of fisherfolk from each study site. The widespread acceptance of MNPs or MPAs in all study sites is encouraging. Our survey shows that fisherfolk from all six study sites support MNPs or MPAs as a conservation management strategy as long as they feel that their fishing activities will not be affected. The MNP&S in GoK is an economic and ecological hotspot; its establishment has certainly slowed down ecological exploitation and contributed to the conservation of biodiversity. Without the creation of the MNP&S, this fragile ecosystem might have been at risk of endangerment or even extinction. Fisherfolk livelihoods might also have been compromised in its absence.

One possible trade-off of setting up an MPA along the southern coast of GoK is the restriction it may pose to uncontrolled resource utilization.

Earlier, extensive utilization of mangroves and coral reefs led to a significant reduction in the area of these two important coastal ecosystems (Kumar *et al.* 2017). However, their degradation has been controlled substantially after the area was declared "legally protected" (Kumar *et al.* 2017). Still, one of the major reasons for the loss of biodiversity in fishing catches and the fall in catch size is the degradation of ecological support structures, such as coral reefs and mangroves. The Central Marine Fisheries Research Institute (CMFRI) has indicated that the most conspicuous change in resource composition over the years was the replacement of quality fish like pomfret and large sciaenid and penaeid prawns with lower-value fish such as ribbon fishes, threadfin breams, carangids, non-penaeid prawns, and smaller crabs (Mohanraj *et al.* 2009). Therefore, conserving mangroves and coral reefs will eventually help increase the biodiversity and the number of fishes in the MNP. Another possible trade-off could be that the fisheries in the GoK are managed so that local fishing as well as open water fishing are practised, and certain areas are regulated to create nursery areas for fish by creating protective mangroves and coral reefs (Singh 2003). This could, however, propel fisherfolk to fish at greater distances in the open ocean, putting them at greater risk. Some fishermen in Jodiya also complained that mangrove plantation activities have resulted in the blocking of creeks, so fisherfolk have to move further out to sea to fish.

Although the fisherfolk had mixed views about some aspects of the MNP (such as the issues causing conflict), in general, they welcomed it and acknowledged the benefits they had received from it in the past. Fisherfolk at all six sites favoured community-based management of MNPs or MPAs. Effective management and local involvement are important for optimal success, and community-based management may be the method favoured by small, artisanal fishing communities in other areas.

The Forest Department should increase the involvement of local communities and village panchayats by assigning them roles and responsibilities in the management and conservation framework of the MPA. This will also decrease conflicts among local communities and other stakeholders. The Forest Department should ensure effective participation of local communities in management and conservation activities, such as mangrove planting, considering the understanding and knowledge that communities have about their ecosystems and how their economic activities relate to their social environment. Local people should be made aware of types of mangroves, the environmental conditions required for their planting, and their contribution to the water table. Local communities should not be used just as labour; rather, they should be trained in mangrove planting and be involved in the long term, so that after planting

they will be able to take care of the mangroves. The department and the local community must have a dialogue on the ecosystem services that the mangroves provide.

We received positive opinions about awareness campaigns from fisherfolk in all our study areas. During FGDs, fisherfolk suggested that there is a need for more awareness campaigns among fishing villages so that wrongful fishing methods can be stopped to increase the fish production in and around the MNP. The Forest Department should consider organizing more awareness campaigns.

This study provides lessons and inputs on the perceived importance and value of the MNP&S. Future work should include studies with larger sample sizes to investigate the opinions of fisherfolk living in the vicinity of MPAs, not only in Gujarat, but also in other states of India that have MNPs. This can provide important policy inputs for promoting the co-existence of economic and ecological hotspots. These two hotspots can co-exist, if rules of co-existence can be sharpened, followed, and strictly monitored. This requires capacity-building of fisherfolk and institutions that work with them on a regular basis. Strict guidelines and monitoring mechanisms need to be in place. International protocols that could be adjusted to local situations should be the starting point.

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