

# Knowledge, Attitude and Practices toward Protection and Sustainable Management of Riverine Ecosystems in Goa and Mt. Isarog Territories

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**Abstract:** The extent of knowledge and attitude the people have over the riverine ecosystems and the practices they employ in using them significantly impact the sustainability of these ecosystems. The low level of knowledge on ecosystem dynamics and negative attitude towards riverine ecosystem protection aggravate unsustainable practices aside from abetting low compliance to rules for rationally managing rivers. A deeper understanding of people's knowledge, attitude and practices is crucial in developing interventions that promote sustainability of riverine ecosystems and resources. This paper characterizes the knowledge, attitude and practices of households on the conservation and sustainable management of riverine ecosystems. The data were generated using survey and analyzed employing descriptive statistics. Results indicated that some households are highly aware of the rivers but knowledge of its names, locations, and network connections are inadequate. Majority expressed positive attitude on aspects of ecosystem governance such as local knowledge, access to decision-making, participation in ecosystem governance, resources, environmental services to society, water quality monitoring, law enforcement, and livelihood. The practices employed by households are dominantly extractive in nature which include quarrying or sand mining (30%), throwing of garbage in the river (18%) and unsustainable fishing (45%). The mixed findings on households' knowledge, attitude and practices reflected their ambiguous relationship to resource management principles induced by distinct socio-economic and cultural realities of the area which include sociodemographic condition, land tenure and political complexities. This paper suggests that public officials may take advantage of the highly positive attitude of households as a good indication of a welcoming disposition towards riverine ecosystem conservation and management. It recommends that a holistic riverine ecosystem governance must be developed and implemented employing both evidence-based and local knowledge-based management, promoting multi-stakeholder participation in decision making, restoration of riverine ecosystem and supporting social enterprise development such as riverine ecotourism.

**Keywords**– knowledge, attitude, practices, riverine ecosystem, resource management

## I. INTRODUCTION

The municipality of Goa, one of the six municipalities that are nested on the foot of Mt. Isarog Natural Park, is probably the municipality that has the most number of communities that are settled close to the river. The geographical position of Goa being sandwiched by Mt. Isarog

Natural Park and Mt. Lagonoy Watersheds gave it the sole advantage of being blessed with riverine networks crisscrossing its communities.

The concept of sustainable governance of environmental assets and resources finds its utmost relevance to these communities being at the epicenter of integrated conservation and development program of many stakeholders owing to the status of Mt. Isarog and Lagonoy watershed as among the key biodiversity areas in the Southern Luzon faunal region. The coastal areas that border the municipality of Goa composed of San Miguel Bay in Tinambac and Lagonoy Gulf in San Jose and Lagonoy are also the hubs of coastal resource management initiatives in the recent years owing to their significance as both marine managed areas to promote sustainable fish productivity and conservation of marine biodiversity. An emerging holistic approach for the integrated management of these critical upland and coastal ecosystems is the ridge to reef approach advocating the interconnectivity of the upland and coastal ecosystems.

The riverine ecosystems whose headwaters emanate from the watersheds in the mountains and end up in the coastal area, provide the link between the ridge and the reef or the upland and the coastal ecosystems. This critical role of the riverine ecosystem and the strong influence of human interaction on these environments provide the relevant rationale for shifting the focus of inquiry on the riverine ecosystem and human interaction. The more common river-human interactions take the form of resource utilization, protection and conservation of riverine resources and ecosystem services. Of particular importance related with utilization, protection and conservation of riverine ecosystem services and resources is the assessment of people's knowledge, attitude and practices. Because the extent of knowledge and attitude the people have over the riverine ecosystems and the practices they employ in using them significantly impact the future integrity and sustainability of these ecosystems. A deeper understanding of the people's knowledge, attitude and practices is crucial in developing interventions that will promote the integrity and sustainability of riverine ecosystems and resources.

Some studies have been done describing the knowledge, attitude and practices of fishing house holds regarding the conservation of biodiversity and sustainable management of

coastal resources in Partido. To the best of our knowledge, no study has yet been implemented to characterize the knowledge, attitude and practices of households settled along riverine ecosystems on the conservation and sustainable management of riverine ecosystems. The information from this study will fill the gap needed to deeply understand the current state of knowledge, attitude and practices of households in the communities by the river of Goa as inputs to better managing the riverine environment as a critical link between the upland and coastal environments.

Knowledge, attitude and practices act as the three pillars which make up the dynamic system of human-environment interaction for effective resource governance.

Knowledge refers to the information that is acquired or gained. Knowledge, being the basic criterion that allows one to distinguish right and wrong, is a mixture of comprehension, experience, discernment, and skill.

An attitude toward a concept is defined as a person’s general feeling of favor or disfavor toward that concept (Ajzen and Fishbein 1980). A person who believes that performing a given behavior will lead to positive outcomes will hold a favorable attitude towards performing the behavior.

Practice is the customary, habitual, or expected way of doing something. It is the contemplation of rules and knowledge that lead to action. Thus, right knowledge, positive attitude and good practice are necessary to guide human-riverine ecosystem interaction in the context of sustainable governance. The understanding of individual knowledge, attitude and practice plays an important role in the sustainable utilization and management of rivers.

The knowledge-attitude-practices (KAP) model offers a conceptual framework for analyzing human behavior and its effects on interventions by characterizing knowledge, feelings, and actions.

With this context, this paper assesses the knowledge, attitude and practice in the households settled close to the riverine ecosystems of Goa as they relate with the sustainable management of riverine ecosystems in Goa, Camarines Sur and the adjacent territories in Mt. Isarog Natural Park.

II. METHODOLOGY

A. Study Area

The study area is Goa, a second class municipality in the fourth district in the province of Camarines Sur. (Fig. 1). It is situated at 13.7° North latitude, 123.49° East longitude and at 55 meters elevation above the sea level. Goa has 34 barangays where 88% of which has tributaries, streams and creeks in the area.

B. Respondents

The list of household respondents in the study sites was taken from Local Government Unit (LGU) of Goa. A total number of 376 respondents were selected randomly. Of these, 17 were

from Barangay Abucayan, 12 from Bagumbayan Grande, 11 from Balaynan, 35 from Buyo, 18 from Cagaycay, 31 from Catagbacan, 22 from 22 from Digdigon, 16 from Hiwacloy, 13 from Lamon, 39 from Matacla, 14 from Maysalay, 14 from Napawon, 17 from Payatan, 14 from Pinaglabanan, 15 from Salog, 8 from San Isidro Poblacion, 7 from San Jose, 11 from San Pedro, 13 from San Benito, 8 from San Juan Evangelista, 17 from Tabgon, and 6 from Taytay (Table 1).

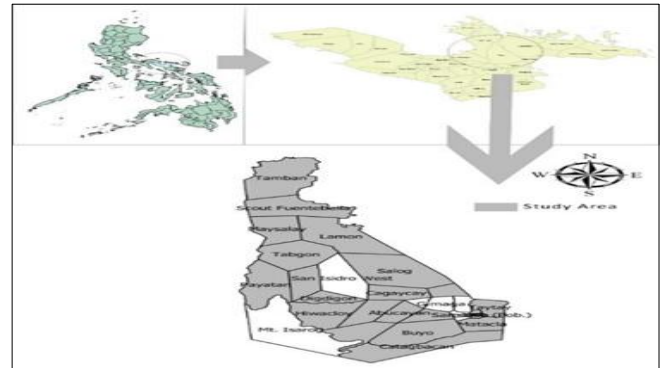


Fig1. SpotMapofthe StudyArea

Table I : Percentage of Household Respondents

	Number of Households	Number of Samples	Percentage (%)
Abucayan	400	17	5
BagumbayanGrande	285	12	3
Balaynan	265	11	3
Buyo	831	35	9
Cagaycay	425	18	5
Catagbacan	752	31	8
Digdigon	532	22	6
Hiwacloy	395	16	4
Lamon	303	13	3
Matacla	933	39	10
Maysalay	328	14	4
Napawon	329	14	4
Payatan	401	17	5
Pinaglabanan	333	14	4
Salog	363	15	4
San IsidroPoblacion	194	8	2
San Jose	174	7	2
SanPedro	260	11	3
SanBenito	305	13	3
San Juan Evangelista	195	8	2
ScoutFuentebella	100	0	0
Tabgon	394	17	5
Tamban	76	0	0
Taytay	572	24	6
Total	9,145	376	100

*C. Training of Enumerators*

Enumerators were trained on data gathering and conducting interview. A mock survey was done wherein enumerators interviewed respondents, while survey supervisors checked for the errors and incomplete responses on site.

The training also included data consolidation and processing using Microsoft Excel Spreadsheet program.

*D. Data Gathering Instruments*

The data gathering instrument made use of the Knowledge, Attitude and Practices (KAP) Survey Questionnaire modified from the USAID-CBCRM Project. A total of 40 questions were formulated and validated through field testing.

It also made use of secondary data collected from repositories of government institutions such as the municipal and barangay governments of Goa. Municipal and barangay profiles were secured from these institutions to generate the number of respondent samples and to enhance the quality of the data.

*E. Data Analysis*

The data generated were analyzed descriptively employing frequency count, weighted mean, and percentage.

**III. RESULTS**

*A. Knowledge on Riverine Ecosystem*

Almost all or 99% of household respondents are aware of the existence of the riverine ecosystems in their communities. However, when shown on maps, only more than one fourth or 28% of them could correctly identify the rivers they claim to be aware in the map.

As regards the knowledge of household respondents on the benefits of rivers to the communities, 31% or one third are aware that farmers and fishers are benefited by the rivers and tributaries in their communities.

As regards the knowledge of the household respondents that poor communities will be most affected if rivers and its tributaries will dry up or decrease its water volume, more than one half or 61% are aware that poor communities will be affected if rivers decrease its water volume (Table 2). These indicate that majority of the households along the riverine communities of Goa are aware of the existence of the riverine ecosystems in the area, but are not knowledgeable enough of their names and their detailed geographic locations. This could be explained by the inadequate information on the riverine ecosystems that can be communicated to the households. The lopsided proportion of positive response between the benefit of the river to the farmers and fishers, and the negative effect of the reduction of river water volume to the community reflected the pervasiveness of the threat of degradation of the riverine ecosystems in Goa which invited the relatively higher proportion of concerned household respondents to the perceived effect rather than the benefit from the river.

*B. Attitude Toward the Riverine Ecosystem*

The attitudes of households toward the riverine ecosystems of Goa are presented in Table 3. In general, relatively

Table II : Households’ Knowledge on the Presence, Name, Benefits of Rivers and Effects to Communities when Water Volume Decreases

	Variables	n	%						
1	Awareness of the presence of rivers in the barangay								
	Aware	374	99						
	Not aware	0	0						
	Don't like to answer	2	1						
		376	100						
2	Identification of river in the map								
	correctly identified river in map	104	28						
	incorrectly identified river in map	272	72						
		376	100						
3	Aware of benefits and effects of river in the community	Yes	No	No idea	Total				
		n	%	No	%	n	%	n	%
	Farmers and fishers are the ones who benefit from the rivers and tributaries	116	31	257	68	3	1	376	100
4	Poor communities will be most affected if rivers and its tributaries will dry up or decrease its water volume	228	61	144	38	4	1	376	100

Significant proportion of households have positive attitude toward riverine protection. In all variable statements, the positive responses strongly agree and agree posted combined proportions reflective of more than one half of the households expressing positive attitude such as: 53% in agreement and 2% in strong agreement toward the attitude of protecting riverine ecosystem because the consequence of soil erosion will contribute to water quality degradation; 51% in agreement and 23% in strong agreement towards the attitude protecting riverine ecosystem because dumping of garbage or sewerage into the river or its river banks will contribute to the degradation of water quality; 52% in agreement and 19% in strong agreement toward attitude to protect the river being convinced that sand and gravel quarrying contributes to water quality degradation; 56% are in agreement and 20% are in strong agreement toward attitude to protect rivers because degraded water quality will affect the growth of fishes. Also, 54% are in agreement and 18% are in strong agreement towards the positive attitude to protect the river because the

volume of water in rivers affects the supply of water in irrigated areas; 52% are in agreement and 26% are in strong agreement toward the positive attitude to protect the river because electro fishing and use of poison affect fish catch in the river.

Also, 53% are in agreement and 26% are in strong agreement toward positive attitude to protect the river because the loss of trees causes floods in the river. Seventy percent are in agreement and 23% are in strong agreement to the positive attitude of protecting the river and convinced that fish stock enhancement in rivers and streams could help households attain food security. Sixty five percent are in agreement and 18% are in strong agreement towards the attitude of protecting the river because dikes, spillways and other infrastructure development have altered hydrological regimes disrupting water flow pattern.

It is interesting to note the three variables posting the relatively higher proportion of response expressing agreement namely, fish stock enhancement in rivers and streams could help households attain food security (70%); dikes, spillways and other infrastructure development have altered hydrological regimes disrupting water flow pattern (65%); and degraded water quality affects growth of fishes (65%). These three expected outcomes from taking positive action that generated the larger proportion of respondents expressing positive attitude towards protecting the rivers in Goa depicted the most urgent concern held by the communities settling close or within the Goa riverine ecosystems. The positive expectation of outcome arising from stock enhancement of riverine ecosystems reveals the attitude of the households to support relevant directions and interventions for enhancing populations of fishes and invertebrates in the rivers to achieve food security. This is explained by the growing number of household population in these communities over years which provided the pressure for households to consider increasing the productivity of the rivers to meet basic need for fish protein. The negative expectation from the outcomes of constructing dikes, spillways and other infrastructure development revealed the households' support for interventions that will mitigate alteration of hydrological regimes and disruption of water flow pattern in the riverine ecosystems of Goa. This attitude of support is explained by the felt discomfort of many households in the lower urbanized communities of Goa that are now regularly experiencing floods. These flood occurrences are being attributed by the households to the massive pattern of covering every space in the growth areas of the municipality with concrete mix of sand and cement e.g. paved courts, commercial centers, terminals, etc. to make way for development and economic growth, reducing the capacity of the soil to absorb excessive rainwater that often result to flash floods. Dikes that are constructed along river banks in urbanized areas to reclaim lands for settlement and for drainage purposes constrict the natural passageways of rivers and streams during rainy months resulting to water overflows and altered trajectories of flood waters. Finally, the negative expectation of outcome of

degraded water quality affecting growth of fishes revealed the households' positive attitude to support riverine conservation. This indicated the households' appreciation of the relationship between aquatic food productivity and water quality. This attitude augur well for implementing riverine ecosystem protection and rational management of its resources.

### C. Attitude Toward River Management

The households' attitudes toward sustainable river governance are presented in Table 3.

In general, more than one half of the household respondents expressed agreement on all variables used that captured their attitudes supporting riverine governance. This suggests that majority of the households in the communities settled close to the riverine ecosystems of Goa express positive attitude toward the sustainable governance of the ecosystems. The variables used to capture attitude towards riverine governance covered aspects of ecosystem governance such as local knowledge (var.1), access of all stakeholders to decision-making (var.5), mainstreaming marginalized sectors in ecosystem governance (var.6), resources (var.2), environmental services with direct and indirect benefits to society (var.3), monitoring and law enforcement (var.4), and livelihood (var. 7).

The relatively heavy loadings on agreement scale (response scale=3) among the responses to these variables tend to suggest the existence of the tendency for approval among households of the positive expected outcomes from these aspects of riverine governance that influenced positive attitudes.

These foreseen positive outcomes though not as comprehensible to their current understanding, but are considered to be appropriate in addressing the observed issues that confront the riverine ecosystem, appeared to be reflected in the decision of more than one half of the respondents to choose the response rating scale of 3 equivalent to an adjective rating of agree depicting approval with sort of preservation. This preservation in the decision to skip the strong agreement response with rating of 4 seemed to explain the hypothesized complete information on these aspects of ecosystem governance that will require extensive effort of public education among the households in the future.

Among the attitude variables used, two posted the highest proportion of agreement such as: (1) local knowledge and practices are not helpful in riverine planning and management (73%), and (2) both fish and crops are equally important to consider in riverine management (74%). The former observation tends to suggest the respondents' discreet clamor for evidence-based decision-making in riverine ecosystem management, apart from the existing taboos and norms that govern the current behaviors of most of the households in the area. The second observation tend to suggest the respondents' discreet appreciation for a holistic approach for riverine governance that balances the use of water for sustaining the population of fish stocks in the river, and the use of water for

irrigation purposes to support farm production.

Interestingly, four of the variables used posted the highest proportion of strong agreement response (response scale=4) these are: water quality monitoring for rivers is important (28%); declining water quality risks the poor's livelihood

(27%), everybody should have access and stake in riverine management and in rivers as common pool resource (26%), and women have stake in riverine management and in rivers as common pool resources (24%).

Table III: Residents' Attitude to Protect the River Ecosystem

	Variables	Weight	Frequency	%	Wtd Frequency	Wtd Mean	Adjectival Rating
1	Soil erosion contributes to riverine water quality degradation.						
	Strongly Agree	4	80	21%	320	0.9	
	Agree	3	199	53%	597	1.6	
	Disagree	2	95	25%	190	0.5	
	Disagree Strongly	1	0	0%	0	0.0	
	Refuses to answer	0	2	1%	0	0.0	
			376	100%		3	Agree
2	Dumping of garbage and or sewage into the river or its banks contributes to water quality degradation.						
	Strongly Agree	4	86	23%	344	0.9	
	Agree	3	190	51%	570	1.5	
	Disagree	2	98	26%	196	0.5	
	Disagree Strongly	1	0	0%	0	0.0	
	Refuses to answer	0	2	1%	0	0.0	
			376	100%		3	Agree
3	Sand/Gravel quarrying contributes to water quality degradation.						
	Strongly Agree	4	71	19%	284	0.8	
	Agree	3	195	52%	585	1.6	
	Disagree	2	108	29%	216	0.6	
	Disagree Strongly	1	0	0%	0	0.0	
	Refuses to answer	0	2	1%	0	0.0	
			376	100%		3	Agree
4	Degraded water quality affects growth of fishes.						
	Strongly Agree	4	77	20%	308	0.8	
	Agree	3	209	56%	627	1.7	
	Disagree	2	88	23%	176	0.5	
	Disagree Strongly	1	0	0%	0	0.0	
	Refuses to answer	0	2	1%	0	0.0	
			376	100%		3	Agree
5	The loss of trees along river causes flood.						
	Strongly Agree	4	96	26%	384	1.0	
	Agree	3	201	53%	603	1.6	
	Disagree	2	76	20%	152	0.4	
	Disagree Strongly	1	2	1%	2	0.0	
	Refuses to answer	0	1	0%	0	0.0	
			376	100%		3	Agree

6	The volume of water in rivers affects the supply of water in irrigated areas.						
	Strongly Agree	4	69	18%	276	0.7	
	Agree	3	203	54%	609	1.6	
	Disagree	2	101	27%	202	0.5	
	Disagree Strongly	1	0	0%	0	0.0	
	Refuses to answer	0	3	1%	0	0.0	
7	Electrofishing and use of poison affect fish catch in the river.			376	100%	3	Agree
	Strongly Agree	4	96	26%	384	1.0	
	Agree	3	197	52%	591	1.6	
	Disagree	2	81	22%	162	0.4	
	Disagree Strongly	1	0	0%	0	0.0	
	Refuses to answer	0	2	1%	0	0.0	
			376	100%		3	Agree
8	Fish stock enhancement in rivers and streams could help households attain food security.						
	Strongly Agree	4	85	23%	340	0.9	
	Agree	3	265	70%	795	2.1	
	Disagree	2	23	6%	46	0.1	
	Disagree Strongly	1	1	0%	1	0.0	
	Refuses to answer	0	2	1%	0	0.0	
			376	100%		3	Agree
9	Dikes, spillways and other infrastructure development have altered hydrological regimes disrupting waterflow pattern.						
	Strongly Agree	4	67	18%	268	0.7	
	Agree	3	246	65%	738	2.0	
	Disagree	2	59	16%	118	0.3	
	Disagree Strongly	1	0	0%	0	0.0	
	Refuses to answer	0	4	1%	0	0.0	
			376	100%		3	Agree

Table IV :Attitude of Households toward Management Interventions to Sustain the Ecosystem Services of Rivers

	Variables	Weight	Frequency	%	Wtd Frequency	Wtd Mean
1	Local knowledge and practices are not helpful in riverine planning andmanagement.					
	Strongly Agree	4	87	23%	348	0.9
	Agree	3	275	73%	825	2.2
	Disagree	2	11	3%	22	0.1
	Disagree Strongly	1	0	0%	0	0.0
	Refuses to answer	0	3	1%	0	0.0
			376	100%		3 (Agree)
2	Both fish and crops are equally important to consider in riverine management.					
	Strongly Agree	4	85	23%	340	0.9
	Agree	3	277	74%	831	2.2
	Disagree	2	13	3%	26	0.1
	Disagree Strongly	1	0	0%	0	0.0
	Refuses to answer	0	1	0%	0	0.0
			376	100%		3 (Agree)

3	Recreational services is important to consider in riverine management.					
	Strongly Agree	4	66	18%	264	0.7
	Agree	3	292	78%	876	2.3
	Disagree	2	17	5%	34	0.1
	Disagree Strongly	1	0	0%	0	0.0
	Refuses to answer	0	1	0%	0	0.0
			376	100%		3 (Agree)
4	Water quality monitoring for rivers is important.					
	Strongly Agree	4	106	28%	424	1.1
	Agree	3	258	69%	774	2.1
	Disagree	2	11	3%	22	0.1
	Disagree Strongly	1	0	0%	0	0.0
	Refuses to answer	0	1	0%	0	0.0
			376	100%		3 (Agree)
5	Everybody should have access and stake in riverine management and in rivers as common pool resource.					
	Strongly Agree	4	96	26%	384	1.02
	Agree	3	201	53%	603	1.6
	Disagree	1	76	20%	152	0.4
	Disagree Strongly	1	2	1%	2	0.005
	Refuses to answer	0	1	0%	0	0.0
			376	100%		3 (Agree)
6	Women have stake in riverine management and in rivers as common pool resource.					
	Strongly Agree	4	89	24%	356	0.9
	Agree	3	211	56%	633	1.7
	Disagree	2	75	20%	150	0.4
	Disagree Strongly	1	0	0%	0	0.0
	Refuses to answer	0	1	0%	0	0.0
			376	100%		3 (Agree)
7	Declining water quality risks the poor's livelihood.					
	Strongly Agree	4	101	27%	404	1.1
	Agree	3	223	59%	669	1.8
	Disagree	2	50	13%	100	0.3
	Disagree Strongly	1	0	0%	0	0.0
	Refuses to answer	0	2	1%	0	0.0
			376	100%		3 (Agree)

These highlighted the households' top consideration which dictated their positive attitude supporting riverine ecosystem governance expressed in strong agreement response. These top priorities include water quality monitoring, access over riverine benefits from ecosystem services, women's participation in decision-making process, and promotion of livelihood for the poor households residing in the communities close to the riverine systems of Goa. The discreet expectation of positive outcome from water quality monitoring which influenced the positive attitude of the households could be explained by their perceptions of the change in water quality which they deem to require interventions for monitoring.

The clamor to assert one's right over the resource' multifunctional benefits as resource user more likely explained for the household respondents positive attitude to support riverine governance as discreetly expressed in the decision to choose the strong agreement response scale option for the variable that depicts access. The clamor for empowerment in resource governance and participation of women in decision-making process over their riverine resources similarly explained for the observed proportion of responses under the strong agreement scale option.

#### D. Practices Related With Use of Riverine Ecosystem

As shown in Tables 5A and 5B the practices employed by households in the riverine ecosystems of Goa are dominantly extractive in nature with 30% of the household respondents' identifying the practice of quarrying followed by domestic nature which posted 18% of the responses. Practices that relate with food production and livelihood comprise 16% in total with 8% registered response under subsistence fishing practice and 8% under agricultural crop raising. A measly 10% of the responses pointed to recreational activity among the non-extractive, non-production practice, while 26% of the households indicated non-use of the riverine ecosystems.

Resulting from these practices, the household respondents hold the view that stocks of fish and invertebrate populations are decreasing with 60% expressing affirmation with a relatively lower proportion of response challenging the dominant observation. The opposite observation that it is increasing is merely shared by 18% of the household respondents, with a relatively higher proportion of response (82%) expressing non-affirmation on this observation. These suggest that there are more households who are convinced that the population of fishes and invertebrates in the river are not increasing than those who observed that the population of these species are increasing in the riverine environments of Goa due to the unsustainable practices in the river known to them.

Although more than one half of the household respondents observed the practice of sustainable fishing in the river, close to one half observed the practice of unsustainable fishing in the river with 37% reporting the practice of electric fishing and 2% reporting the practice of poison fishing.

Close to one half of the households observed practices that negatively impact the riverine ecosystem which include throwing garbage (49%), and unsustainable fishing using electric fishing and poison fishing methods (45%). These observations are consistent with less than one half of the respondents who attribute the negative impacts to throwing garbage in the river (34%) and electro fishing and poison fishing (40%). In comparison to the above practices with negative impacts to the riverine ecosystem, the disposal of sewerage from piggery and poultry farms to the river appeared to be relatively lower with 29% affirming. However, the higher percentage of no response may indicate that the practice could only be restricted to the minor proportion of residents who own piggeries and poultrys in the area.

It appeared that the practice of throwing garbage in the river is practiced almost daily as confirmed by the relatively higher proportion of response under the daily basis (32%) than the weekly (8%) or monthly (1%) response categories. The same holds true with the frequency of sewerage disposal (28%). The 45% proportion of response under not applicable response option may suggest that this practice does not hold true to less than one half of the households in the area.

As practiced, the garbage dumped into the river commonly

belongs to the biodegradable, recyclable and residual categories which have almost identical proportion of response. This is explained by the observed dominance of proportion of domestic, residential establishments over the proportion of industrial, commercial establishment in the area although there are no available data presented in this paper to support this observation.



Fig. 2.: Washing clothes and fishing as household's major uses of river

#### IV. DISCUSSION

This paper described the current knowledge, attitude and practices of households living close to the riverine networks of Goa. The articulation in this paper contributes in understanding the knowledge, attitude and practices in the context of establishing a path for sustainable management of riverine related resources, while maintaining the integrity of the ecosystem.

The study showed that while some households are very much aware of the existence of the river close to their residences, their grasp of its names, locations, and networks is inadequate. According to Frisk et al. (2004), knowledge is regarded as a means to overcome psychological barriers such as ignorance and misinformation. It is viewed as a necessary, though generally insufficient, precondition for successful action. In other words, although knowledge does not always have the intended effect on a target behavior itself, it may at least fuel other mechanisms that facilitate behavior change. The implication of the current status of knowledge of households in Goa about the riverine ecosystems in their communities resonates with this observation. Given the multifunctionality of the riverine ecosystems, conflicting uses of various stakeholders may comprise a barrier in pursuing the agenda for sustainable governance of the riverine ecosystems of Goa. This is evident in the relatively higher proportion of households who have expressed awareness on the negative effect of reduction in water volume to their livelihood, rather than the benefits derived from the river as a natural resource that supports economic production. The shallowness or depth of knowledge of stakeholder households on the nature and dynamics of the riverine ecosystem may spell the direction in which the barrier can be confronted to suit the goals of riverine conservation and management in Goa.



This study is the first attempt to describe the knowledge, attitude and practices of households toward conservation and management of the riverine ecosystems in Goa and Mt. Isarog territories. In general, more than one half of the household respondents expressed agreement on all variables used that captured their attitudes supportive to riverine governance. This suggest that majority of the households in the communities settled close to the riverine ecosystems of Goa and Mt. Isarog territories express positive attitude toward the sustainable management of the ecosystems. The variables used to capture attitude towards riverine governance covered aspects of ecosystem governance such as local knowledge, access of all stakeholders to decision-making, mainstreaming marginalized sectors in ecosystem governance, resources, environmental services with direct and indirect benefits to society, monitoring, law enforcement, and livelihood.

These results imply a general positive attitude of the households for riverine conservation and management in Goa communities which augur well for the achievement of the goals of sustainable ecosystem governance.

However, some literature (Arbiol et al, 2016) cautioned that a highly positive attitude is not sufficient alone to transform behavioral practices. Positive attitude should be complemented with knowledge to enhance the ability of individuals to integrate management measures into practice. Nevertheless, this study has revealed the households' good adherence to standard resource management attitudes expected for stakeholders in ecosystem governance. It is believed that these results can be generalized to the wider communities that are similarly situated.

Table V :Practices of Households in using the River, Exploiting its Resources, Observed Unsustainable Practices, Frequency and Categories of Wastes Dumped

1	Households' major uses of rivers	Number of positive response	%								
	recreation	119	10								
	agriculture	95	8								
	drinking and cooking	14	1								
	cultural and religious	2	0								
	fishing and gleaning	93	8								
	washing clothes and bathing	223	18								
	quarrying	369	30								
	Do not use	316	26								
		1231	100								
2	Observation on the number of fishes and invertebrates in the river	Number of Yes response	%	Number of No response	%						
	seriously increased	3	1	373	99						
	increased	69	18	310	82						
	decreased	225	60	151	40						
	seriously decreased	23	4	353	94						
	no change	11	3	365	97						
		331	86								
3	Methods used to catch fish in the river	Number of yes response	%								
	electrofishing	108	37								
	use of crab pot and fish pot	5	2								
	use of poison	7	2								
	rod and reel	170	58								
	use of traps	1	0								
		291	100								

4	Observed activities in the riverine ecosystem bycommunity	Number of Yes response	%	Number of No response	%	Number of I don't know response	%				
	throwing garbage into the river	184	49	127	34	65	17				
	electrofishing and fishing using poison	171	45	152	40	53	14				
	sewerage disposal from piggeries and poultry	110	29	29	87	79	21				
5	Frequency of households or persons seen, heard, and observed practice	Daily		Weekly		Monthly		Never		Not Applicable	
		n	%	n	%	n	%	n	%	n	%
	throwing garbage into the river or river banks	121	32	29	8	5	1	110	29	111	30
	electrofishing and or fishing using poison	16	4	51	14	67	18	107	28	135	36
	Sewerage disposal from piggeries and poultries	105	28	3	1	0	0	97	26	171	45
6	Kind of garbage dumped into the river or river banks	Number of positive response	%								
	biodegradable	195	26								
	recyclable	179	27								
	residual	153	27								
	special wastes	69	10								
	effluent from piggeries and toilets	72	11								
		668	100								

The practices of a large proportion of households' response relative to the utilization of the riverine resources as documented by this study reflected the most common unsustainable behaviors of resource users directed at riverine ecosystems. It was found that the practices employed by households in the riverine ecosystems of Goa are dominantly extractive in nature with 30% of the household respondents identifying the practice of quarrying, followed by domestic activities which posted 18% of the responses. Quarrying or sand mining in rivers by households fueled by the demand for sand due to the shift to constructing concrete houses as adaptation strategy to increasing frequency of typhoon in the area potentially endangers river bank stability. Hackney et al. (2020) provided empirical evidence to prove that when the rate of extraction of sand due to sand mining overtakes the rate at which the annual sediment load is transported from upstream to replenish the sand in river beds, can sufficiently lower the river beds. This can induce river bank instability, potentially damaging housing and infrastructure and threatening lives.

Aside from quarrying, other unsustainable practices have also been documented such as throwing of garbage into the river and fishing using electric fishing and poison fishing methods as affirmed by 49% and 45% of the respondents respectively.

The literatures in resource management and conservation commonly elaborate attitude towards natural resource management as an inclination to undertake specific

sustainable resources management practices. However, the current practices of households in Goa seemed to be at odds with the pervading attitude for riverine governance in the area. This observation is parallel with the studies by various scholars in Malaysia who have generally found that the attitude of the public towards environment or level of concern for environment was high; however, it was not in concert with sustainable practices (Aini et al., 2006).

Many studies have investigated factors related to sustainable resource governance such as knowledge, attitude, awareness and related activities. These studies have demonstrated that the quality of the environment depends critically on the level of knowledge, attitude, and practices of the people. However, findings on relationship between these variables have been mixed. These mixed findings could be attributed to the fact that knowledge, attitude and practices are culture-dependent being impacted by local networks, access to extension, and attendance to education meetings, level of income, access to credit, land tenure and proximity to stream.

Resource users have better knowledge of ICDPs if they are better educated, more affluent, belong to a local network, and have access to extension services. The predictive factors for attitude and practices towards ecosystem governance are similar to the ones predicting knowledge. These include levels of income, membership to local networks and access to extension. However, proximity to the riverine ecosystem, land tenure and access to credit have strong influence on attitude

and practices.

The mixed findings on knowledge, attitude and practices of households in the riverine to resource management principles demonstrated a similarity with the observations in the literatures induced by the area's distinct socio-cultural realities.

The households' fair understanding but generally poor rating in the identification of the riverine systems in Goa is not only explained by the inadequate information supplied but also by the proximity of the residents to the rivers and the level of education of the average households in the study area. Better educated individuals are better able to understand local environmental challenges and more likely to express concerns about the deteriorating environmental conditions suggesting their sensitivity to changes in water quantity and quality. Similarly, individuals with low education and income may encounter various stressors that limit their knowledge and engagement in water management issues.

The unsustainable practices towards riverine ecosystems pervading among the farming households is explained by the land tenure system, and inadequate social networks in the area. Most farming households in Goa do not own the farms they till, nor the lot they occupy. A lot of them are tenants if not leasing the agricultural land for production purposes. Studies showed that farmers who rent agricultural land under tenure rights that permit cultivation for a specified period were less inclined to engage in water harvesting and riverine resource management practices (Oremo et al., 2019). Poorly defined land rights can limit sustainable investments in agricultural land and water management. A lot of the people are politicized, more keen to be engaged in politically-oriented activities than in community-based organizations that promote self-reliance. Participation in community networks can enhance knowledge and understanding of riverine management issues.

Participation in community networks can improve issue on awareness and cultivate support for policies and sustainable practices promoting sustainable utilization of riverine resources. Limited participation in social networks but heavy engagements in politicized organizations could stall the growth of social capital in the community which have negative influence on social learning and sharing of information.

The results on KAP pose the challenges on increasing one's knowledge to increase engagement in sustainable practices, and how one's highly positive attitude be taken advantage to encourage promotion of sustainable riverine resource utilization and management intervention initiatives in Goa.

## V. CONCLUSION AND RECOMMENDATIONS

This study on KAP demonstrated in the overall that, while a large proportion of household respondents posted positive attitudes for riverine management and conservation, the results for knowledge and practice indicated much room for

improvement.

A highly positive attitude of resource users is not sufficient alone to transform behavioral practices. Increasing households' deeper understanding or knowledge on the dynamics of the riverine ecosystem and the concept of sustainable resource utilization and governance needs to be implemented. These may take the form of community-based riverine environmental education and promotion activities to increase knowledge about riverine ecosystems and subsequently encourage more sustainable practices. Potential delivery strategies could include using broadcast media to disseminate well defined, behaviorally focused sustainable riverine resource utilization behavior messages, and improving the capacity of the municipal and barangay government environmental management units to conduct river conservation and protection promotion activities.

It was also found that higher proportion of response was registered for observations on the pervasiveness of domestic quarrying, illegal fishing and dumping of wastes into the river. Strengthened monitoring and strict enforcement of regulatory measures should address these unsustainable practices.

Considering that the nature of the resource as a common property that is vulnerable to abusive use and exploitation with serious implication for ensuring the long-term utilization and benefits of the resource, incentive system that rewards and recognizes good practices and behavior need to be developed and implemented to positively change behavior and encourage sustainable practices in utilizing the riverine resources and ecosystem services.

The identified gaps in knowledge and practices must be addressed holistically capitalizing on the respondent households' positive attitude toward riverine management and conservation in the wider ridge to reef context of sustainable ecosystem governance.

The results of the study highlighted a general positive attitude of the households on aspects of ecosystem governance such as local knowledge, access of all stakeholders to decision-making, mainstreaming marginalized sectors in ecosystem governance, resources, environmental services with direct and indirect benefits to society, water quality monitoring, law enforcement, and livelihood. This paper suggests that public officials may take advantage of the highly positive attitude among respondents as a good indication of a welcoming disposition towards riverine ecosystem conservation and management intervention initiatives in Goa.

A holistic riverine ecosystem governance adopting the ridge to reef approach to integrated management must be developed and implemented employing both evidence-based and local knowledge-based management, empowerment of marginalized sectors and multi-stakeholder participation in decision making. This governance system must promote accountability and strict law enforcement, strictly pursue water quality monitoring, and promote access to all resource users. It must also pursue enhancement and restoration of

riverine resources and ecosystem services and vigorously support sustainable livelihood and social enterprise development in the communities settled close to the riverine ecosystems.

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