International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979
Impact Factor: RJIF 5.72
Received: 03-02-2018; Accepted: 09-03-2018
www.allsubjectjournal.com
Volume 5; Issue 3; March 2018; Page No. 110-112

Small island communities: Their environmental observations and experiences basis for policy intervention

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Abstract
Marinduque is an island province with almost 15 peripheral islands and majority of them have low lying communities with 5,146 residents. The study involved 83 residents from the small island communities with age bracket of 50 and above. They cited 10 observations and experiences they have encountered, which affect their environment and livelihoods. Results of the study revealed the following: felt intense heat in the surroundings, dwindling fish catch, bleaching of corals, low agricultural productivity, prevalence of diseases and pests and erosion of the foreshore areas. All of these were frequently observed and experienced by the community people, and there were no significant differences in ranking these 10 cases at 5% level of significance. The increasing salinity of deep wells, effects of strong typhoons and destruction of the mangrove forests, were all rated as occasionally observed and experienced in a quarterly basis. For the individual islands; intense heat, dwindling fish catch and increasing salinity of deep wells were frequently observed and experience by the community people of Maniwaya, Mompong and Salomague. This is same with the case of Polo Island, wherein the respondents made mentioned, intense heat, dwindling fish catch and increasing salinity of deep wells. The over-all rating for the 10 cited cases was highest in Salomague Island, followed by Mompong, Maniwaya, Polo Island. Lowest was in Gaspar Island. With these findings, policies on how to minimize the adverse effect of climate change on the community should be prioritized.

Keywords: climate change, experiences, Marinduque, observations, small island communities

1. Introduction
An 'island' is defined as "naturally formed area of land, surrounded by water, which is above water at high tide" [1]. But, for 'small islands', these are those with approximate area of 10,000 km² or less and with 500,000 or fewer residents [2]. Others suggest that 'small islands' are those smaller than 1,000 km² and/or with fewer than 100,000 people [3]. Whatever the size and population of 'small islands', they are all vulnerable to the impacts of climate change [4, 5, 6].

With the hot topics about climate change, many of the small island communities are at risk, especially for sea-level rise (SLR). The estimates of global mean sea-level rise in the Special Report on Emissions Scenarios of the Intergovernmental Panel on Climate Change (IPCC) range from 22 cm to 34 cm, between 1990 and the 2080s [7]. With such scenario, many of the small island communities will be affected, especially that they have poorly developed infrastructure and limited natural, human and economic resources. The inhabitants are dependent on marine resources to meet their daily needs and their economies are reliant on a limited resource base [6].

The corals that are surrounding small islands, which serve as the community peoples' primary resources for a living are affected. The increased in sea temperature in many tropical regions by almost 1°C over the past 100 years, and are currently increasing at ~1–2°C per century, have led to mass coral bleaching, losses of live corals8 and finally decrease in fish population. Many populations are also at risk from flooding, especially when high tides are combined with storm surges9. This will bring environmental damage in the shoreline areas, wherein most of the communities are located [7].

Parallel to these premises, Marinduque as an island province has peripheral 'small island' communities that are not exempted from the effects of climate change. Out of almost 15 'small islands' in the province, five have existing permanent communities, such as; Gaspar Island in the Tres Reyes Islands; Polo, Maniwaya and Mompong in Sta. Cruz Islands and Salomague Island between the municipalities of Sta. Cruz and Torrijos. As such, this study looked on the visual effects of climate change to the surroundings of small island communities based from their observations and experiences.

2. Materials and methods
Community people, especially the old ones remember changes that have taken place in their communities in their lifetime, or that their parents or grandparents talked about those changes that they had observed [5]. Thus, this study considered the experiences, visual observations and stories of the inhabitants of the small island communities of Marinduque. Through this method, it can be further reasoned out that the long experiences and observations of the people in dealing with their natural and social world can replaced the scientific methods and approaches in finding immediate answers to the problem [5].

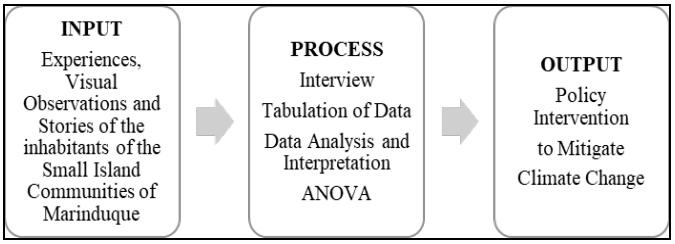

Fig 1: The conceptual framework of the study

The IPO model is used to guide the researcher in conducting the study. The Experiences, Visual Observations and Stories of the inhabitants of the Small Island Communities of Marinduque were used as input. The data collected through interview were tabulated, analyzed and interpreted using ANOVA. The results and findings were used to enhance existing policies in mitigating climate change.

As the people put their observations into form of language, they communicate them to the outside world to be understood and heard by other people [5]. As such, this study involved the residents in these small islands with age bracket of 55 and above and residency in the island for 20 years and beyond (Table 1).

Table 1: Social structure, population, number of households and participants in the study.

Social Structure	Island communities				
	Gaspar	Polo	Maniwaya	Mompong	Salomague
Population	214	977	1,753	2,078	124
No. households	67	216	297	366	21
No. participants	8	21	28	20	6
No. males	4	10	10	8	2
No. females	4	11	18	12	4

The participants were approached individually and asked about the changes they have observed and experienced about their communities that have affected their surroundings and livelihood. They were asked to give 10 observations and experiences and rate them from (0) to (4) based on the gravity that these affects their livelihood, where (4) is the most visible and perceptible one. Then, they were asked to rank the 10 observed and experienced effects of climate change to their small island communities.

4 = frequently observed and experienced (almost in a monthly basis)
3 = occasionally observed and experienced (every quarterly basis)
2 = hardly observed and experienced (once a year)
1 = rarely observed and experienced (every two years)
0 = not observed and experienced at all

The mean data for each observed and experienced manifestations of climate change were interpreted as follows:

3.55 – 4.00 = observed and experienced frequently
2.55 – 3.54 = observed and experienced quarterly
1.55 – 2.54 = observed and experienced occasionally or once in a year
0.55 – 1.54 = observed and experienced rarely or every two years
0.00 – 0.54 = not observed and experienced

Likewise, the ranking made by the participants were tabulated, analyzed and interpreted using ANOVA at 5% level of significance.

3. Results & Discussion

The highest mean ratings given by the 83 respondents from the five small island communities, based from their observed and experienced cases in relation to climate change were the following: felt intense heat in the surroundings (x = 3.966), dwindling fish catch (x = 3.912), bleaching of corals (x = 3.876), low agricultural productivity (x = 3.806), prevalence of diseases (x = 3.710), prevalence of pests (x = 3.662) and erosion of the foreshore areas (x = 3.623). All of these were frequently observed and experienced by the community people (Table 1).

Table 2: Island community peoples' rating for their observed and experienced manifestations of climate change.

Observed and experienced cases	Gaspar (N = 8)	Polo (N = 21)	Maniwaya (N = 28)	Mompong (N = 20)	Salomague (N = 6)	Total	Mean
1. Strong and frequent typhoons	2.63	3.33	3.43	3.85	3.67	14.28	2.856
2. Bleaching and destruction of corals	3.75	3.67	3.96	4.00	4.00	19.38	3.876
3. Erosion of foreshore areas	3.38	3.14	3.89	3.75	4.00	18.16	3.632
4. Low agricultural productivity	4.00	3.57	3.93	3.70	3.83	19.03	3.806
5. Dwindling fish catch	3.75	3.81	4.00	4.00	4.00	19.56	3.912
6. Destruction of mangrove areas	0	3.10	3.46	3.50	4.00	14.06	2.812
7. Increasing salinity of deep wells	0	3.76	4.00	4.00	4.00	15.76	3.152
8. Intense heat	3.88	3.95	4.00	4.00	4.00	19.83	3.966
9. Prevalence of diseases	3.50	3.76	3.89	3.90	3.50	18.55	3.710
10. Prevalence of pests	3.63	3.67	3.36	3.65	4.00	18.31	3.662
Total	25.89	35.76	37.92	38.35	39.00	176.92	35.384
Mean	2.589	3.576	3.792	3.835	3.900	17.692	3.5384

It can be noted that the first three observed and experienced cases are interrelated as most of the people are fishermen who are depending their livelihoods in the resources of the surrounding waters.

The salinity of water in the deep wells got a rating of (*x* = 3.152) or observed quarterly, because the data was affected by the peoples' response from Gaspar Island, wherein the island does not have a deep well and drinking water is fetched in the mainland. This case of deep water salinity was intensely observed in Maniwaya, Mompong and Salomague islands (*x* =

4.00), since they have deep wells in their communities, which have evident brackish Odour and taste.

Though the effects of strong typhoons during the 80s and 2000s were so devastating, the respondents rated it occasionally or quarterly (x = 2.856), since typhoons do not hit the province most of the time. The destruction of the mangrove forests was rated (x = 2.812), which is occasionally observed once in a year. They reasoned out that mangrove areas are only affected by strong typhoons that occasionally hit their home islands. Aside from this, the people are using only the dead stumps of mangroves in making charcoal. Likewise, they are much aware of the importance of the mangrove forests, thus their reforestation program is always pursued by the community people and the municipal governments concerned. Their level of knowledge about the protection and conservation of mangrove forests is high, since they know that these are serving as the spawning grounds for fish and other marine life species.

In Table 2, the 83 respondents from the five island communities have unified observations and experiences as far as the cited cases are concerned in relation to climate change, thus their responses are not significantly different at 5% level of significance. But, island-wise or location-wise, they have significant differences with regard to the 10 cited cases. This is true to the five island communities, because they have different geographical situations and biophysical conditions.

Gaspar Island does not have mangrove area and deep well for water supply. It also does not have big foreshore area, unlike that of the four islands. For them, the most observable ones, as they experienced them were low agricultural productivity (x = 4.00), intense heat (x = 3.88) and bleaching and destruction of corals (x = 3.75).

Table 3: Analysis of variance of the island community peoples' observed and experienced cases with regard to climate change.

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	Comp. F	Tab. F (5%)
Island SS	4	11.858132	2.9645330	4.756921444*	2.63
Observed SS	9	8.520592	0.9467324	1.519137033^{ns}	2.15
Error SS	36	22.435348	0.6232041		
Total	49	42.814072			

* = significant CV = 22.310445% ns = not significant

Intense heat, dwindling fish catch and increasing salinity of deep wells were frequently observed and experience by the community people from Maniwaya, Mompong and Salomague, (x = 4.00). This is the same with the case of Polo Island, wherein the respondents made mentioned, intense heat (x = 3.95), dwindling fish catch (x = 3.81) and increasing salinity of deep wells (x = 3.76). The over-all rating for the 10 cited cases was highest in Salomague Island (x = 3.90), followed by Mompong (x = 3.835), Maniwaya (x = 3.792) and Polo Island (x = 3.576). All them have observed and experienced the cited cases frequently or almost in a monthly bases, unlike the case of Gaspar Island with an over-all mean rating of (x = 2.589), meaning occasionally or quarterly.

4. Conclusions

As stated in the IPCC (2007) [6]. Many small islands are highly vulnerable to the impacts of climate change and sea-level rise, and these were observed and experienced also by the residents of small island communities in Marinduque. Majority of them felt the intense heat of their surroundings, dwindling fish catch, bleaching and death of corals and low agricultural productivity from which their livelihoods are anchored. When their income and food supply from fishing and farming are affected, then scarcity of food will likely occur. Coupled with prevalence of pests and diseases and increasing salinity of drinking water, in the long run will affect the people's health and physical well-being.

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