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Water Quality Degradation and its Effect on Fishing Activities

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Key words: capture fisheries, pollution, fishing duration, catch composition

Abstract

The effects of pollution on fishing activities were evaluated. Using a prepared questionnaire, fishers, village heads and fishery officers in three study sites in Panay Island, Philippines were interviewed. Respondents identified sources of pollution in their area and described how these affected their fishing activities. Effects of pollution with reference to several indices in capture fisheries, e.g., catch volume, fishing frequency and duration, operation costs, and catch composition, were determined.

The rapid progress of developing nations resulted in the development and growth of many industries. Unfortunately, this economic transition also increased the volume of industrial and domestic discharges that threaten the aquatic environment. Studies done on the effect of environmental pollution to fish had focused largely on the acute and sub-lethal toxicity and behavioral studies.[1-4] In fisheries, damage as a result of environmental pollution had been reported mostly in the form of reduced catch, fish kills, abnormalities, reduced growth of cultured animals and poor reproduction.[5-10] Also, the general effect of pollution to fisheries may be difficult to assess and cannot be discerned on the basis of catch statistics alone.[11] It is therefore apparent that in order to evaluate, assess or predict the potential effect of pollution to fisheries, it is necessary to collect data and information regarding specific fishing gears and their target organisms, i.e., a meaningful assessment of the relationship between environmental pollution and capture process.

In this study, we investigated the effect of pollutants on the capture efficiency of fishing gears. We examined how pollution affects the following: amount of catch, income, duration and frequency of fishing, and fish species caught.

Materials and methods

The study was conducted in Panay Island, Philippines in February 2009. Three study sites were visited- Dumangas, Roxas City and Ibajay (Fig. 1). These sites were initially identified through secondary information. Using a prepared questionnaire, twelve fishermen, three village leaders, and three fishery officers were interviewed. The questionnaire included

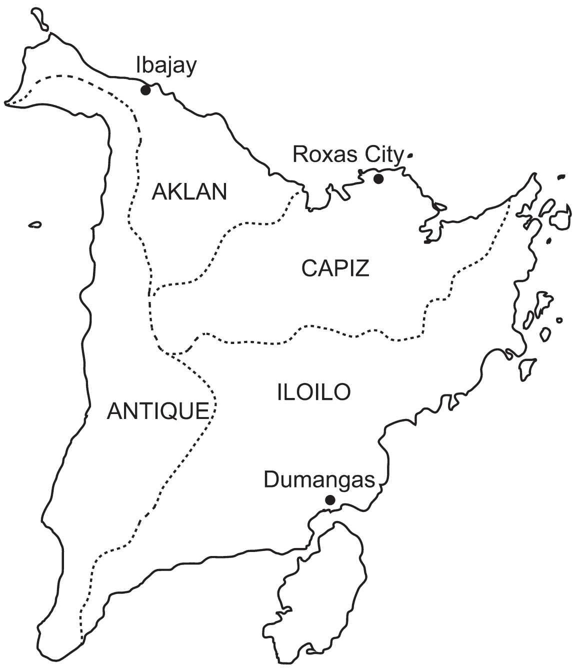

Fig. 1. Map of Panay Island, Philippines showing the three study sites: Dumangas, Roxas City and Ibajay.

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queries on the type of pollution that affected the area and how fishing activity, time spent fishing, species caught, amount of catch, and income were affected by pollution.

Results

Dumangas and Roxas City possess many rivers and estuaries where local fishers exploit aquatic resources. Table 1 lists the fishery resources exploited in the rivers and estuaries of these areas. Main target species included shrimps and mud crab because of the high prices these commodities command in the market. Other catch included mullet, shells and other small fish. To exploit these resources, local fishers employ a variety of fishing gears as listed in Table 2. For the purpose of this paper's discussion, we grouped the fishing gears into two. Fixed fishing gears use semi-permanent structures that are staked on the bottom of the river or estuary. Non-fixed fishing gears do not have such structures, and are easily retrieved and removed from the fishing ground. Dominant fishing gears included river filter nets, light-operated lift nets, crab lift nets, crab pots, shrimp pots and gillnet (Fig. 2). Filter nets, lift nets and shrimp pots were primarily used to capture shrimps; crab lift nets and crab pots were major gears to catch mud crab. Filter nets, lift nets, pots and gillnet also capture assorted fish species. Oyster culture, mussel culture, and fish cages were also important fishery activities. Ibajay lacks the extensive river system present in the other study sites, and most fishers operate nearshore. Small-scale fishers mainly use gillnets, longline and simple handline.

Respondents identified wastes coming from aquaculture activities, animal culture, mining, domestic households, garbage facilities, and navigation that have adverse impacts on their fishing grounds (Table 3). However, due to the lack of water quality tests, the identification and confirmation of pollutants affecting their fishing grounds were not available. Another issue raised was the high rate of sedimentation in the rivers of Roxas City and Dumangas caused by the proliferation of fish pens, oyster stakes and set nets, as well as the domestic and sewage wastes from residential areas. Respondents said this resulted to poor water exchange which caused oyster mortality and produced an "itchy" taste and bad texture.

Fishers residing in Dumangas and Roxas City reported more cases of pollution events than fishers in Ibajay. Fishers operating in rivers and estuaries raised concerns regarding all the pollution cases listed in Table 3, except mining, which was reported to affect nearshore waters in Ibajay. This suggests that water bodies close to land, e.g. rivers, mangrove areas and estuaries, were most affected by anthropogenic wastes while nearshore and offshore areas were least likely to be affected.

Table 4 shows the perception of local fishers on how pollution affected their fishing activities. Most of the fishers reported a reduction in catch, and consequently income, as a result of pollution. While no massive fish kill was reported in the study areas, fishers said their target species avoided polluted areas. In terms of duration of fishing operation, most of the fixed fishing gear operators said time spent on fishing did not change even during pollution events. This was because their fishing gears depend upon tidal cycles, and even in the presence or absence of pollution, they still start and end their fishing operations according to tidal cycles. Half of respondents operating non-fixed fishing gears (e.g. gillnets, traps) said

Table 1. List of important fishery resources exploited in Dumangas and Roxas City in Panay Island, Philippines

Local name	English name	Scientific name
Alimango	Mud crab	*Scylla* spp.
Balasugay	Shrimp	*Penaeus* sp.
Bangus	Milkfish	*Chanos chanos*
Gisao	Mullet	*Mugil* spp., *Liza* spp.
Hipon	Sergestids	*Acetes* spp.
Pasayan	Shrimp	*Metapenaeus* spp.
Sapsap	Slipmouth	*Leiognathus* spp.
Tahong	Mussels	*Perna viridis*
Talaba	Oyster	*Crassostrea* spp.

Table 2. List of major fishing gears used in Dumangas and Roxas City in Panay Island, Philippines

Type	Local name	English name	Main catch
Fixed gears	Arong	Lift net	Shrimp
	Saludan	River filter net	Shrimp
	Tangkop	Fish corral (small type)	Fish
Non-fixed gears	Bintol	Crab lift net	Mud crab
	Bubo	Fish pot	Fish
	Hudhod	Push net	Shrimp
	Kiming	Shrimp pot	Shrimp
	Lambat	Gillnet	Fish
	Likop	Encircling gillnet	Fish
	Pamunit	Hook and line	Fish
	Panggal	Crab pot	Mud crab
	Sira	Barrier net	Fish
	Surambao	Lift net (movable type)	Shrimp
	Taksay	Encircling gillnet	Fish

Table 3. Sources of pollution in Panay Island, Philippines that affect fishing activities

Category	Specific sources
Aquaculture	- Sedimentation caused by fish pen structures and oyster stakes
	- Excess feeds from pens and cages
	- Piscicides, herbicides, molluscides, lime from fishponds
Animal raising	- Waste from hog culture
Mining	- Sediments from silica and manganese mines
Garbage	- Household wastes
	- Use of chemicals to treat garbage in open dumps
Agriculture	- Herbicides from sugarcane plantation
Navigation	- Used oil

Table 4. Perception of local fishers on the effect of pollution on their fishing activities

	Increase	Decrease	No change	Changed
Volume of catch	0	90.9	9.1	
Time spent fishing: stationary gears	0	11.1	88.9	
Time spent fishing: non-stationary gears	50	0	50	
Frequency of fishing operation	0	36.4	63.6	
Type of fish caught			72.7	27.3

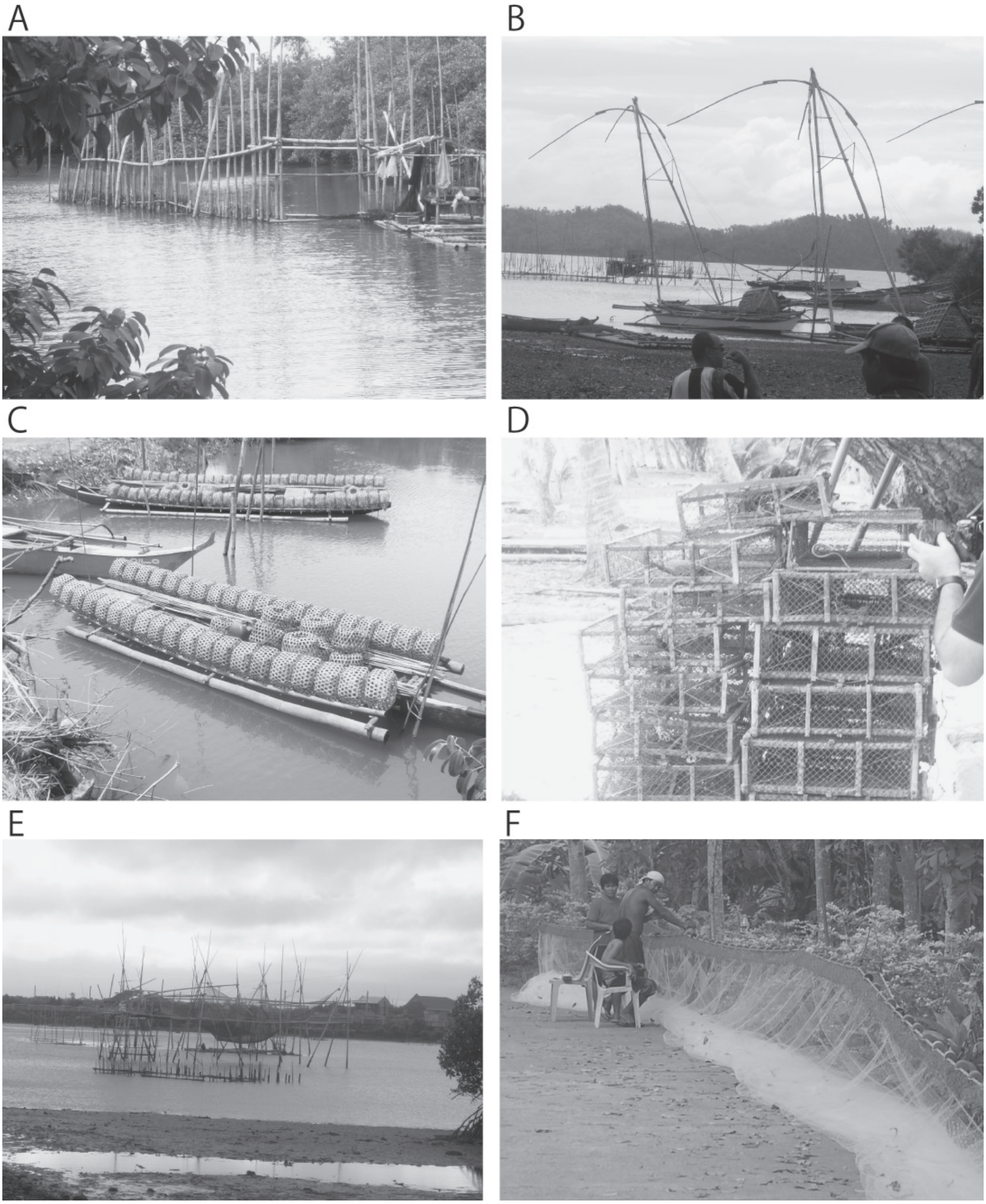

Fig. 2. Dominant fishing gears present in the study sites. A. Saludan (river filter net); B. Surambao (lift net); C. Panggal (crab pot); D. Bubo (crab pot); E. Arong (lift net); F. Lambat (gillnet).

amount of time spent fishing increased as a result of pollution because they had to move to relatively cleaner fishing grounds to catch fish. Many of the respondents continued fishing operation even when fishing ground was affected. According to the respondents, the type of fish species caught were mostly the same before, during and after pollution events. This was because most of the gears were species-specific and were designed to capture only certain species. However, shell gatherers perceived that some shell species had disappeared as a result of increased sedimentation rate when a silica mine was operated in Ibajay, Aklan.

Discussion

The coastal areas of Panay Island are generally free from chemical pollution.[12] Still, local fishers report cases of aquatic pollution, probably through episodic spills. Also, some of the pollution cases reported here occurred in the past but its effects on fisheries were still documented. Operators of fixed fishing gears are most affected by pollution, while operators of non-fixed fishing gears like crab pots and gillnets have the option to move fishing operations away from the polluted areas. In such case however, time spent fishing is considerably higher, with the fisher investing more on gasoline or energy (by rowing his boat) to search for unaffected areas. In the case of water pollution and its effects on fishing activities, we make the following conclusions:

(1) Water bodies close to land, e.g. rivers, mangrove areas, estuaries and nearshore areas, were most affected by anthropogenic wastes. Offshore areas were least likely to be affected;

(2) Fishing activity of fixed fishing gear operators were most affected when the fishing ground becomes polluted.

(3) Additional operating costs were incurred to search for alternative fishing grounds.

(4) Even if there was a perceived change in water quality, operators of fixed fishing gears continued their fishing operation because of lack of livelihood alternatives.

(5) Fishing duration remained unchanged for fishers using gears that depend upon lunar cycle.

(6) Due to the species selectivity of some fishing gears, the presence of pollution did not affect type of species caught.

(7) Agricultural and domestic wastes can pose serious consequences to fisheries and fishing activities.

Both fishing and pollution increase the mortality of fish stocks in a fishing ground. Some of the indices listed above are used by fishery biologists and managers to indicate rate of exploitation. For example, longer time spent on fishing, reduced fishing frequency, reduced catch, reduced size of fish caught, and a change in catch composition are being used as indicators of overexploitation.[13-16] Our study shows that in the case of fixed fishing gears, the duration of fishing operation and catch composition cannot be used as reliable indices to measure adverse changes in fishing activities as a consequence of pollution.

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