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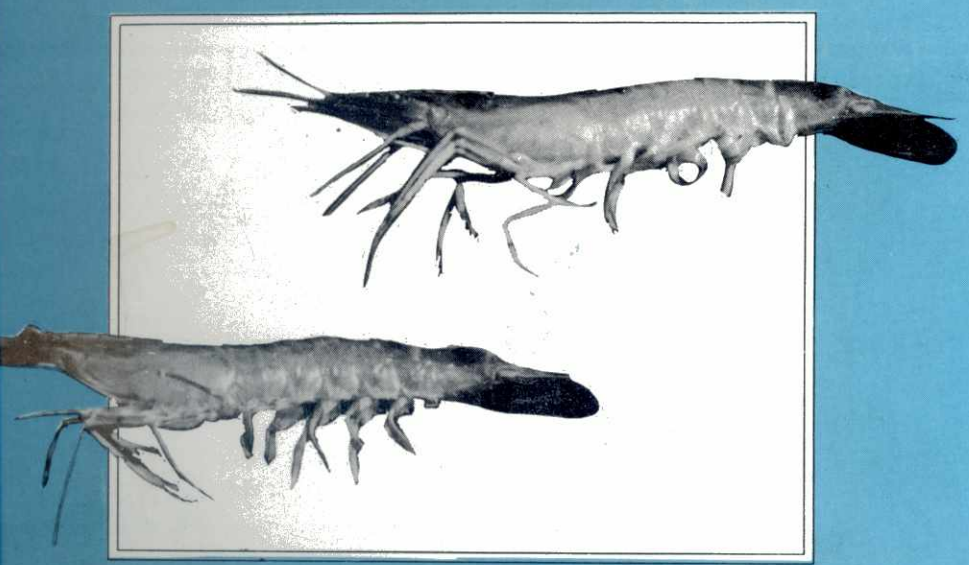

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Pollution in the Meycauayan River System

GLICERIA M. TUAZON
Supervising Fishery Biologist, BFAR

MILAGROS B. ANCHETA
Senior Fishery Biologist, BFAR

ABSTRACT

Monitoring of the water quality of the tributaries of the Meycauayan River System was conducted over a period of five years (1983-1988). Results of physico-chemical analyses of samples indicated the deterioration of the natural quality of the river waters. The major polluters of the rivers are the piggeries, poultries, duck farms, tanneries, slaughter houses, noodle factories and distilleries.

Adverse effects of pollutants on fishery resources resulted in the reduction in quantity and quality of aquatic life. The trend of pollution in the Meycauayan River System is worsening and may reach a point where the self-purification processes are exceeded.

Keywords: pollution, Meycauayan River System, physico-chemical analyses, pollutants, water quality.

INTRODUCTION

This study focused on monitoring the water quality of the tributaries comprising the lower reaches of the Meycauayan River System. These are the Bocaue, Balagtas, Guiguinto, Bulacan and Obando Rivers, which collectively drain almost one-third of the Province of Bulacan. The same surface waters supply water to the multi-million peso fishpond industry in this area and provide sustenance to over 6,000 subsistence fishermen.

Rapid industrialization, urbanization, and the exponential population growth rate pose serious threats to the maintenance of good water quality in the

Meycauayan River System. Since the productivity of any given body of water is a direct function of its water quality, the need for monitoring both the water regime and the different sources of pollution are clearly important.

Continuous monitoring is necessary in order to establish the current trend of pollution, to make it possible to initiate remedial measures, and to issue warnings of approaching critical conditions. Although an aquatic ecosystem, a river in particular, has the capacity to recover from many types of added pollution, an ecological and economic catastrophe results when this natural capacity of self-purification is exceeded.

The Meycauayan River System includes the Meycauayan River as its main artery and its seven tributaries, namely, Balagtas, Bocaue, Bulacan, Guiguinto, Marilao, Polo and Obando Rivers. The basin covers nearly all the municipalities bearing the same names as these rivers and the communities of Tala and San Jose del Monte. The drainage area is approximately 316 km^2 inhabited by 52,000 people.

The Meycauayan River System originates from the hills of Sapang Palay and San Jose del Monte, and courses down into Manila Bay via its tributaries. The upper reaches, from the headwaters until San Jose del Monte, are freshwater and still relatively unpolluted. The lower reaches, especially Balagtas, Guiguinto and Bulacan Rivers, are heavily polluted by industrial effluents and waste waters from agro-based establishments such as piggeries, duck farms and poultries. The stretch of the river system, from Balagtas down to Bulacan, assumes importance not only ecologically but also economically, because these waters are vital to the lucrative fishpond industry in the area.

Classification of the Meycauayan River System was completed in 1974 by the National Pollution Control Commission (NPCC). The salient features of the NPCC Memo Circular categorizing the various tributaries into classes according to the best usage are shown in Table 1.

Those who used to benefit most from the rivers were the fishermen of nearby towns who fished in their waters and who also used the waterways for transportation of their fish products to the various fish landings in municipalities along the river banks. The tributaries also served as easy access routes to other fishing areas in Manila Bay. At present, fishing activities in some rivers have been limited and confined to the lowermost reaches due to pollution upstream, particularly at the intersections with the main river system.

WATER QUALITY

The over-all condition of the water quality in the tributaries may be described as fair to poor. Dissolved oxygen concentrations (DO) in some reaches and in the main artery were still within the levels specified in the NPCC criteria for Class "C" waters of 5 mg/l (Table 2). However, water samples from Balagtas River often failed to meet these standards especially when collected during the summer season. Zero DO was encountered in some sampling stations. The average bio-chemical oxygen demand (BOD) concentrations were found to be higher than the specifications for the same class in all rivers except in Binuangan, Obando, where the average BOD was still below the maximum 20 mg/l. Temperature and pH values of all rivers satisfied the standards for the same class, while total solids, color, chlorides, odor, turbidity and hardness all failed to meet NPCC specifications (Table 3).

The total solid concentration is influenced by the tides at the lower reaches of the river and the waste discharges from the different factories. The high chlorides content almost invariably carries a preponderance of dissolved solids, thus increasing also the total solid levels. The narrow range of the observed values reflects the ample buffering capacity of the river in spite of the variability in low and high pH of industrial effluents (Table 3).

SOURCES OF POLLUTION

Agro-Based Industries - The main polluters of the Meycauayan River System are poultries, piggeries, duck farms and cattle feed lots, varying in size of operation from commercial scale to backyard pen. Noodle-making factories, distilleries, tanneries, ceramic plants, a chemical factory, slaughter houses and sewage from residential areas contribute to the pollution loading of the tributaries (Table 4).

In the town of Sta. Maria alone, over two million chickens are produced annually and about half as many hogs. The amount of organic wastes being discharged by these animals into the rivers is substantial since a thousand pounds of chicken produce 59 pounds of manure daily with a BOD 5 of 4.4 lb per day (Table 5).

Industrial Firms - Industrial firms along the river banks dump untreated wastewaters into the river system, resulting in the further degradation of water quality. More than 20 noodle factories, at least four tanneries, and a slaughter house are responsible for introducing large amounts of putrescible organic

materials that cause zero DO and high BDO levels. The most notorious of these firms is a distillery that discharges its slops into the Balagtas River. Fish kills in the river and even some in some fishponds have occurred when this distillery empties its storage ponds of effluents.

Members of the *Samahan ng Maliliit na Mangingisda sa Lalawigan ng Bulacan* (Association of Small Fishermen of Bulacan), an association of 4000 subsistence fishermen, have voiced their complaints against the firm. The fishermen claimed that the distillery was directly responsible for the pollution of Balagtas River down to Matungao River, a stretch of 650 meters. This partition of the river system turns into a cesspool every summer. The waters become black with foul odor, a condition unfit for aquatic life.

Domestic pollution - The pollution loading being contributed by households all over the province is a serious but unrecognized cause of degradation of the river system. The rapid urbanization of most towns in Bulacan, particularly those adjacent to Metro Manila, has doubled the population of the province in a matter of only three years. In 1978, total population numbered 900,000; in 1980 it reached 1.5 million.

A negative consequence of this unprecedented population growth was an increased volume of sewage from households.

NPCC asserts that of the total pollution loading in rivers and streams, industry contributes only around 45% while the remaining 55% is due to domestic sewage including refuse.

Agricultural activities - Bulacan is a prime agricultural province where the application of herbicides, fertilizers, and insecticides is both intensive and extensive. Although these inputs are widely used, gas chromatographic analyses of water and fish samples from the river systems and the Manila Bay indicate that these persistent chemicals have not yet exceeded tolerable levels in the rivers (Table 6 and 7). However, concentrations of the pollutants have surpassed limit values in Manila Bay.

Drainage problem - For an agricultural province, the need for adequate drainage and flood control structures is of utmost importance. The existing drainage systems in the various towns of Bulacan are inadequate and poorly planned, thereby increasing the severity of inundation and resulting in decreased agricultural and fishing activities in the province.

Rain, or surface run-off originating from mountains which have been carelessly denuded, carries with it large quantities of silt and suspended solid materials which are ultimately deposited in rivers and streams. Thus, tributaries of the Meycauayan River System turn milky brown in color even after only a slight rainfall. Transparency becomes zero during the rainy season.

EFFECTS OF POLLUTION ON FISHERIES

Degradation of water quality - Deterioration of the water quality of the Meycauayan River System was noted as early as 1973. The NPCC, after a comprehensive survey, had found the tributaries of Balagtas, Bulacan and Guiguinto to be polluted, but asserted in its report that water quality could still be improved. However, through the years further degradation of water quality has resulted and may have reached the point where a return to the former natural quality seems no longer feasible.

Decline in productivity - Poor water quality has also resulted in poor productivity in the tributaries. Subsistence fishermen have been complaining not only of meager catch but also of vanishing species of crustaceans, mollusks and fishes that used to abound in the river. Some minor fisheries that have been depleted over the span of two decades are the *alamang* fishery, *talangka* fishery, and the *isdang lubog*. The reduction in quantity and quality of fisheries in the tributaries, especially in the lower reaches and estuaries of Bulacan, Bulacan has serious economic repercussion.

Interview with members of the *Samahan ng Maliliit na Mangingisda sa Lalawigan ng Bulacan* disclosed that the serious problems in recent years are the marked decline in fish production and the disappearance of some crustaceans like shrimps, talangka, alamang, and blue crab (Neptunus pelagicus). Bivalve molluscs (clams, mussels and oysters) used to grow wild in beds along the estuaries of Taliptip, Bulacan, but they are very rare now. It was also gathered that some fish species, collectively called isdang lubog, disappeared from the brackishwater portion. These species were identified as kitang (Scatophacus argus); apahap or sea bass (Lates calcarifer); and samaral (siganus spp.).

From the upper portions up to the head waters, fishermen and residents in the area recall that great quantities of bangayngay and talimusak (Glossogobius sp.) used to be caught especially during the rainy months but have likewise become scarce.

From the results of the monitoring work in the Meycauayan River System, it is apparent that pollution not only affects the quantity of aquatic organisms but also limits the quality of life inhabiting the receiving waters.

CONCLUSION AND RECOMMENDATIONS

The present condition of the Meycauayan River System is a clear case in point that without strict enforcement of pollution laws and standards, an aquatic ecosystem will reach a point of no return. Once the self-purification capacity of a stream or river is exceeded, the natural water balance existing in that ecosystem is destroyed and a chain of reactions follows.

To protect and enhance the water quality of the Meycauayan River System in accordance with the recommended classification, a minimum of secondary treatment of all industrial liquid wastes and domestic sewage should be enforced in all existing and proposed establishments. Waste water treatment processes of all existing facilities should be improved to accomplish BOD removals better than 95%, including the removal of nutrients in the waste water. The enforcement of the effluent standards rather than the receiving water standards would be necessary to ensure the maintenance of the river quality in any period and in all reaches.

An aggressive public information dissemination campaign should be launched to educate the citizens at the grassroots level. Most importantly, the inculcation of proper values on environmental protection should be initiated at the primary school level in order to assure indoctrination of each and every citizen.

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Table 1. **Classification of the Meycauayan River System**

Name of River		Classification
Bambang River		Class "C"
Balagtas River		Class "C"
Binuangan		Class "C'
Bocaue River	- upper reach	Class "A"
	- lower reach	Class "C"
Bulacan River		Class "C"
Guguinto River		Class "C"
Marilao River	- upper reach	Class "A"
	- lower reach	Class "C"
Meycauayan River		Class "C"
Polo River		Class "C"

(Source: Rules 28 and 29, NPCC Rules and Regulation: NPCC Memo Circular No. 001, S.1975)

Class "A" - Best usage for source of water that will require compete treatment (coagulation, sedimentation, filtration, and disinfection) in order to meet the National Standards for Drinking Water (NSDW).

Class "C" - Propagation and growth of fish and other aquatic resources.

Table 2. **Water quality criteria for various classes of water**

Quality parameters	Specifications	
	For Class "A" waters	For Class "C" waters
Color	75	50
Temperature	30	-
Dissolved oxygen	not less than 5mg/l	not less than 5mg/l
BOD (20 °C)	not more than 10mg/l	not more than 20mg/l
Total Solids	NSDW	1000mg/l
pH	not less than 6.5 nor more than 8.5	not more than 6.5 nor more than 8.5
Bacteria	Bacteria of the coliform group shall not exceed a monthly ave. MPN of 5,000 per 1,000 ml	MPN of 5000/100 ml
Phenolic substances	NSDW	0.02 mg/l
Radio active substances		
Ra - 226	NSDW	
Sr - 90	NSDW	
Beta-emitter	NSDW	
Trace Elements	Not to exceed the ff. units:	(in mg/l)
Arsenic	0.05	0.05
Barium	NSDW	0.05
Cadium	NSDW	0.01
Chromium	NSDW	0.05
Copper	NSDW	0.02
Cyanide	0.05	0.05
Flouride	NSDW	0.05
Iron	NSDW	0.002
Lead	0.05	0.05
Manganese	NSDW	0.05
Mercury	0.002	
Selenium	0.05	
Silver	0.05	
Zinc	NSDW	
Organic Chemicals		
Synthetic Detergents (MBAS)	0.5	0.05
Oil and Grease	2.0	5.0
Persistent Pesticides		
Aldrin	0.001	0.01
DDT	0.05	0.02
Dieldrin	0.001	0.003
Chlordane	0.003	0.04
Endrin	0.0002	0.002
Heptachlor	0.0001	0.01
Lindane	0.004	0.02
Toxaphane	0.003	0.01
Methoxychlor	0.1	0.003
2, 4-D	0.1	4.0
2, 4, 5 - TD	0.01	
PCB	0.001	
Other chemicals	0.01	
Ammonia	NSDW	
Calcium	NSDW	
Magnesium	NSDW	
Nitrate	NSDW	
Sulfate		
Nutrients	Shall not be present in concentrations to cause deleterious or abnormal biotic growth.	

Source: Official Gazette: Rules and Regulations of the National Pollution Control Commission, 1978.

NSDW - National Standards for Drinking Water

Table 3. **Mean values of water quality parameters of samples collected from tributaries of teh Meycauayan River System, May 1983- February 1988**

River and Station No.	Parameters					
	DO mg/l	BOD mg/l	Chlorides mg/l	Total Solids mg/l	Alkalinity mg/l	pH units
Bocaue River I	6.2	45	240	2,800	60	6.7
Guiguinto River II	4.0	60	380	3,500	120	6.1
Balagtas River III	3.1	120	420	3,200	230	6.0
Matungao River (Bulacan, Bulacan) IV	3.5	96	470	4,350	280	6.2
Bambang River V	5.0	58	420	3,800	180	6.3
Taliptip River VI	6.0	45	300	4,500	240	7.0
Binuangan River VII	6.0	30	240	4,200	86	7.3

Table 4. **Checklist of pollutive firms per municipality in Bulacan Province**

Municipality	Type and Number of Establishments							
	Agro-based		Food		Industrial			
	Piggery	Duck farm	Poultry	Bijon making	Distillery	Tannery	Textile	Chemical Plant
Balagtas				6	1	1		1
Bocaue							1	
Bulacan	20	120	30	35		2		
Guiguinto	10	10			16			
Marilao								
Obando								
Polo								
Sta. Maria				80				

Table 5. **Analysis of manure produced by 1,000 lb live weight of livestock in confinement**

	Hens	Pigs	Dairy Cattle	Sheep
Raw Manure, lb/day	59	50	88	37
Total Solids, lb/day	17.4	7.2	9	8.4
Volatile Solids per day	15.9	6.9	80	6.9
BOD 5, lb/day	4.4	2.1	1.7	0.7

Source: Zain and Abedin 1979.

Table 6. **Average concentration in mg/kg pub of pesticides in marine fishes**

Source	Alpha BHC	Gamma BHC	Heptachlor	Aldrin
Manila Bay	4.11	-	3.25	1.20
Bulacan	trace	-	1.12	6.32

Table 7. **Average pesticides concentration on various waterways, 1980**

Area/River	Alpha BHC	Gamma BHC	Heptachlor	Aldrin
Manila Bay	.008	.014	.005	trace
Bulacan	-	-	-	-

Source: National Pollution Control Commission, 1980.