THE THIRD RAPID ASSESSMENT OF WATER QUALITY IN MARINE PROTECTED AREAS OF ORIENTAL MINDORO, PHILIPPINES:

MONITORING CONCENTRATION OF OIL AND GREASE IN POLA, PINAMALAYAN, CALAPAN, NAUJAN, AND MANSALAY

FEBRUARY 2024

CEED
CENTER FOR ENERGY, ECOLOGY, AND DEVELOPMENT

Published by: Center for Energy, Ecology, and Development

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February 2024

This report is available at https://ceedphilippines.com

EXECUTIVE SUMMARY

Following the MT Princess Oil Spill last year, rapid assessments of the concentration of oil and grease in marine protected areas (MPAs) in Calapan, Naujan, and Mansalay, and in Pinamalayan and Pola in Oriental Mindoro Province were conducted in November 2023 and January 2024, respectively. The samples were collected along the water surface and were delivered to a DENR-accredited laboratory for testing. It was found out that all MPAs did not comply with the water quality guidelines of DENR for the November 2023 assessment. On the other hand, only two MPAs in the January 2024 assessment were compliant with the water quality guidelines on oil and grease, specifically Ranzo Fish Sanctuary in Pinamalayan and St. Peter the Rock Fish Sanctuary in Pola. It was observed that there is a trend of decreased concentration of oil and grease in the MPAs of Pola and Pinamalayan through time compared to existing data from CEED's previous rapid water quality assessments conducted last July and September 2023. However, despite the decreasing trend, a trend of high oil and grease concentration that exceeds standards is observed all the same.

INTRODUCTION

On February 28, 2023, M/T Princess Empress, an oil tanker owned by RDC Reield Marine Services carrying 900,000 liters (Mongabay, 2023) or 237,754 gallons of industrial fuel, capsized in Tablas Strait, a strait separating the islands of Mindoro, Tablas, Panay, and Romblon. This resulted in one of the biggest oil spills recorded in Philippine history affecting over 200,000 individuals, 43,000 families, and nearly 28,000 of fisherfolk and farmers from four provinces including Oriental Mindoro, Batangas, Palawan, and Antique according to the latest 134th Situational Report of the National Disaster Risk Reduction Management Council (2024).

The Municipality of Pola, the ground zero of the oil spill, in the province of Oriental Mindoro declared a state of calamity on March 3, 2023 because the spill has caused the waters and shoreline to turn black. This environmental threat has severely affected food security upon contaminating exposed coastal waters, leading to fishing bans and making fisherfolk communities unable to obtain fish in municipal waters due to the oil spill. Overall, this has also affected the conditions of the Verde Island Passage (VIP) – known as the center of the center of marine shore fish biodiversity (Carpenter and Springer, 2005).

Figure 1. Avicennia mangrove saplings in the seaward zone smothered by the oil spill in Pola, Oriental Mindoro – the most hit town of the ecological threat (photo by Jilson Tiu for CEED).

The VIP is a marine area geographically situated between the islands of Luzon and Mindoro covering the coastal waters of the provinces of Batangas, Oriental Mindoro, Occidental Mindoro, Marinduque, and Romblon. The 1.14 million hectare marine corridor supports livelihood to over 2 million Filipinos sourced from food security, tourism, and transportation. Despite the rich waters of VIP, the oil spill is among its threats including the expansion of Liquefied Natural Gas (LNG) plants (CEED, 2023), unsustainable fishing, coastal developments, and even the effects of the climate crisis. The oil spill has exacerbated the existing issues faced by the Verde Island Passage in Oriental Mindoro.

CEED has since conducted two rapid assessments of the water quality last July 2023 and September 2023 in Pola and Pinamalayan, specifically focusing on the concentrations of oil and grease. Oil and grease is recognized as a water parameter that can be toxic to marine life in higher contents. This report presents the findings of the third rapid water quality assessment conducted by CEED, covering Calapan, Naujan, and Mansalay in November 2023 and in Pola and Pinamalay in January 2024.

METHODOLOGY

The coastal waters inside and outside the MPAs in Oriental Mindoro were assessed. The study was conducted in November 2023 and January 2024. The November collection included sites both inside and outside the MPAs of Calapan, Naujan, and Mansalay while the January collection sampled MPAs in Pola and Pinamalayan.

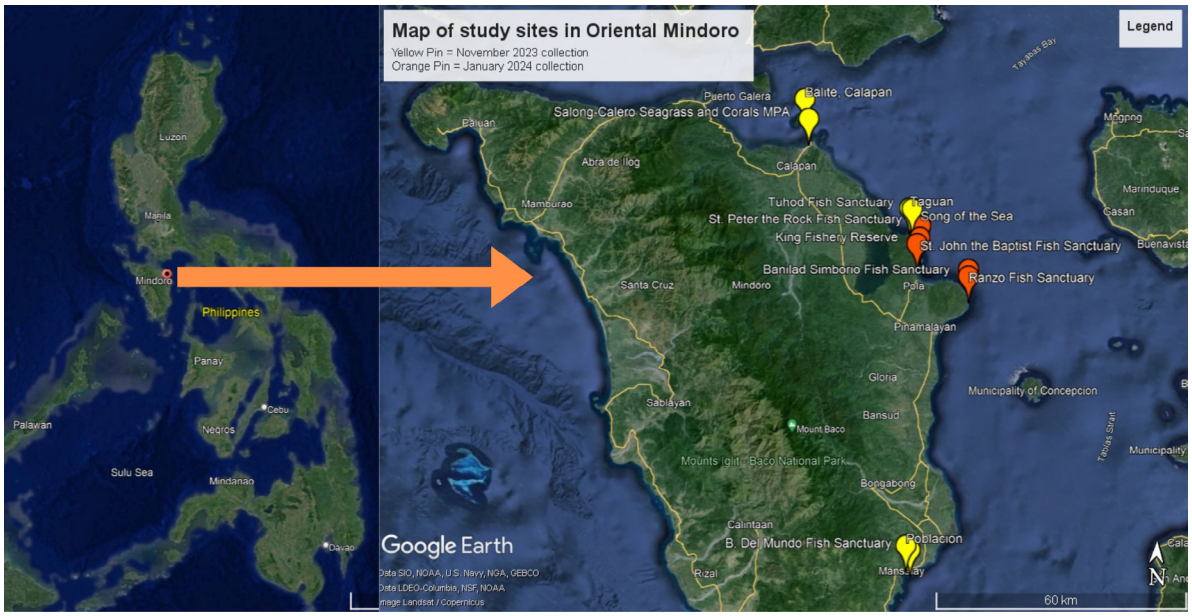

Figure 2. Map of study sites in Oriental Mindoro for the determination of concentration of oil and grease inside and outside MPAs with the use of Google Earth Pro.

A total of 24 water samples were collected in the November 2023 collection including four replicates each in three selected MPAs and three non-MPAs. On the other hand, 18 water samples for January 2024 were collected including three replicates for every MPA. In addition, there were water samples collected in January 2024 that were non-MPAs. The MPAs specifically included are B. Del Mundo-Fish Sanctuary in Mansalay, Tuhod Fish Sanctuary in Naujan, and Salong-Calero Seagrass and Corals MPA in Calapan City, while samples from two MPAs in Pinamalayan were collected including Ranzo Fish Sanctuary and Banilad-Simborio Fish Sanctuary and four MPAs were assessed in the town of Pola, namely the Song of the Sea, St. Peter the Rock Fish Sanctuary, King Fisher Marine Reserve, and St. John the Baptist Fish Sanctuary.

Table 1. List of Marine Protected Areas in Oriental Mindoro covered for the determination of oil and grease

Data Collection	City or Town	Barangay	Name of MPA
First Collection (November 2023)	Calapan	Calero	Salong-Calero Seagrass and Corals MPA
	Naujan	Herrera	Tuhod Fish Sanctuary
	Mansalay	Palaypay	B. Del Mundo-Fish Sanctuary
Second Collection (January 2024)	Pinamalayan	Banilad	Banilad-Simborio Fish Sanctuary
		Ranzo	Ranzo Fish Sanctuary
	Pola	Misong	Song of the Sea
		Tagumpay	St. Peter the Rock Fish Sanctuary
		Tiguihan	KingFisher Marine Reserve
		Puting-Cacao	St. John the Baptist Fish Sanctuary

The water samples were obtained utilizing Manual Grab Sampling under the guidance of the Environmental Management Bureau's (EMB) Manual on Ambient Water Quality Monitoring. All samples were collected along the water column using glass bottles with a volume of one

liter and these bottles were stored in a cooler filled with ice to keep the temperature cool at <6°C. The samples were then transported within 24 hours to a DENR-Accredited Laboratory, Alpha Laboratory in Calamba, Laguna, for testing and determination of the concentration of oil and grease in the study sites. The analytical method used by the laboratory was Liquid-liquid, Gravimetric Partition (SMEWW 5520B) for all samples. To locate the specific area of water collection, coordinates were tracked using GPS.

Oil and grease as a water parameter is included in DENR's Administrative Order 2016-08: Water Quality Guidelines and General Effluent Standards of 2016. The water quality standard for oil and grease was based on DENR's guidelines to determine if the coastal waters inside and outside of the MPAs were compliant.

Table 2. Water Body Classification and Usage of Marine Waters (page 4 of DENR AO 2016-08)

Classification	Intended Beneficial Use
Class SA	1. Protected Waters - Waters designated as national or local marine parks, reserves, sanctuaries, and other areas established by law (Presidential Proclamation 1801 and other existing laws), and/or declared as such by appropriate government agency, LGUs, etc. 2. Fishery Water Class I - Suitable for shellfish harvesting for direct human consumption.
Class SB	1. Fishery Water Class II - Waters suitable for commercial propagation of shellfish and intended as spawning areas for milkfish (Chanos chanos) and similar species 2. Tourist Zones - For ecotourism and recreational activities 3. Recreational Water Class I - Intended for primary contact recreation (bathing, swimming, skin diving, etc.)

Table 3. Water quality guidelines for Secondary Parameters-Organics, specifically oil and grease[1]

Parameter	Unit	Water Body Classification and Usage of Freshwater					Water Body Classification and Usage of Marine Waters			
		AA	A	B	C	D	SA	SB	SC	SD
Oil and Grease	mg/L	<1	1	1	2	5	1	2	3	5

To compare temporal data on the MPAs in Pinamalayan and Pola, CEED (2023) published a study on the rapid assessment of water quality for oil and grease in the MPAs of the mentioned towns in Oriental Mindoro last July and September 2023. These data were used to determine the trend of oil and grease concentration in the MPAs as time passes by (Figure 3).

RESULTS AND DISCUSSION

During the November 2023 collection, the MPA with the highest mean concentration of oil and grease was Tuhod Fish Sanctuary in Naujan followed by B. Del Mundo-Fish Sanctuary in Mansalay and Salong-Calero Seagrass and Corals MPA with oil and grease levels of 6.65 mg/L, 4.28 mg/L, and 2.05 mg/L, respectively. On the other hand, coastal waters that were

[1] DAO No. 2016-08, p. 8.

outside the protected areas with the highest value of oil and grease was in Taguan in Naujan with a concentration of 4.7 mg/L followed by Poblacion in Mansalay (3.53 mg/L), and lastly Balite in Calapan (1.2 mg/L). Study sites for both inside and outside the MPA in Calapan had the lowest mean concentration of oil and grease compared to the sites in Naujan and Mansalay.

Table 4. Concentration of oil and grease (mg/L) in the November 2023 collection

Town	Barangay	Classification	Study Site	Mean Value of Oil and Grease (mg/L)	Status for Water Quality Guidelines
Mansalay	Palaypay	MPA	B. Del Mundo-Fish Sanctuary	**4.28**	Fail
	Pantalan	Non-MPA	Poblacion	**3.53**	Fail
Naujan	Herrera	MPA	Tuhod Fish Sanctuary	**6.65**	Fail
	Herrera	Non-MPA	Taguan	**4.7**	Fail
Calapan	Salong Calero	MPA	Salong-Calero Seagrass and Corals MPA	**2.05**	Fail
	Balite	Non-MPA	Balite	**1.2**	Pass

~ Highlighted in RED exceeded Water Quality Guidelines for Class SA as these MPAs are classified under protected waters
~ Highlighted in ORANGE exceeded Water Quality Guidelines for Class SC as these non-MPA sites are classified as such

As for the January 2024 collection, the highest mean concentration of oil and grease was found in the Song of the Sea (3 mg/L) followed by Kingfisher Marine Reserve (1.55 mg/L), Banilad-Simborio Fish Sanctuary (1.47 mg/L), and Ranzo Fish Sanctuary and St. Peter the Rock Fish Sanctuary with a concentration of <1.0 mg/L, respectively.

Table 5. Concentration (mg/L) of oil and grease in the January 2024 collection

Town	Name of MPA	Mean Value of Oil and Grease (mg/L)	Status for Water Quality Guidelines
Pinamalayan	Ranzo Fish Sanctuary	**<1.0**	Pass
	Banilad-Simborio Fish Sanctuary	**1.33**	Fail
Pola	Song of the Sea	**3**	Fail
	St. Peter the Rock Fish Sanctuary	**<1.0**	Pass
	KingFisher Marine Reserve	**1.55**	Fail
	St. John the Baptist Fish Sanctuary	**1.47**	Fail

~ Highlighted in RED exceeded Water Quality Guidelines for Class SA as these MPAs are classified under protected waters

In the November 2023 collection, it was reported that all MPA sites were not compliant with the water quality guidelines of DENR. Meanwhile, in the January 2024 collection, only two out of six MPAs were compliant with the water quality standards and these were Ranzo Fish Sanctuary in Pinamalayan and St. Peter the Rock Fish Sanctuary in Pola. All other study sites not mentioned were not able to comply with the guidelines since the concentration for oil and grease were exceeded.

Comparing the data between the data in July and September (CEED, 2023), there is a trend of decreasing oil and grease through time, but high concentrations of oil and grease that exceeds standards all the same. Oil and grease concentrations in the MPAs in January 2024 were relatively lower compared to the first rapid assessment of CEED (2023) in July 2023. It must be noted however that there was no available data yet for the Song of the Sea MPA in CEED's previous assessments.

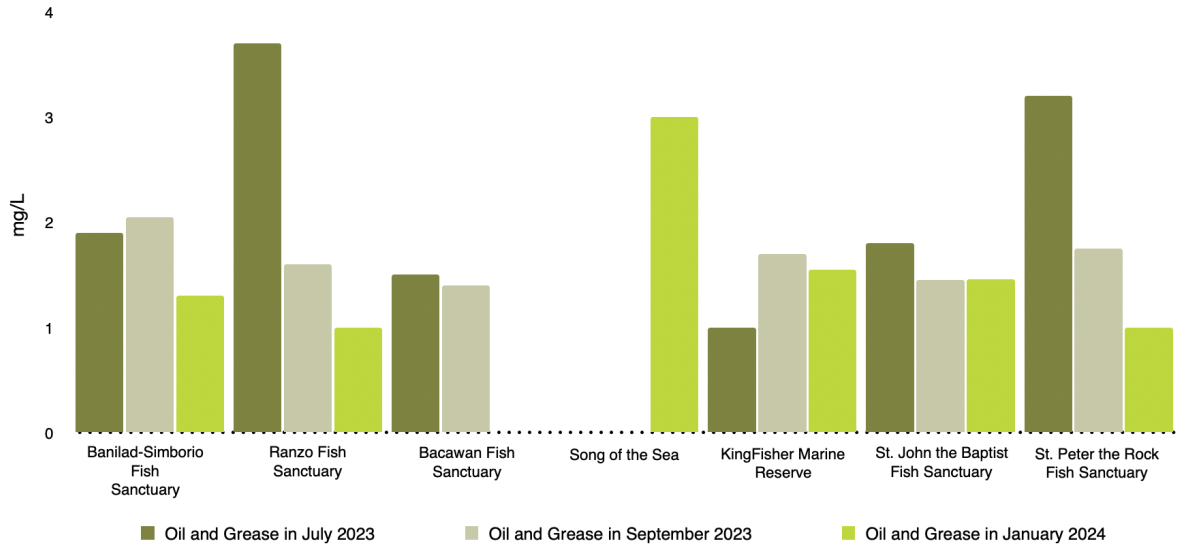

Figure 3. Concentration of oil and grease in the MPAs of Pola and Pinamalayan in July and September (CEED, 2023) and in January 2024.

Potential sources for oil and grease attributing to the high concentrations are numerous. Aside from the oil spill from the sunken MT Princess Empress, domestic pollution (Khozanah, 2021) can be a variable leading to the contents of oil and grease in the coastal waters in Oriental Mindoro. Other sources can be from leakages of tanker ships carried out by the hydrodynamics of water as the open waters in the province are routes to different types of ships.

Through time, the contents of oil spill in the coastal waters is influenced by varying factors. Evaporation is among the important processes in mass balance. A publication by the National Research Council (2003) reported that within a few days after the spill, light crude oil can be reduced to 75% of their initial volume but heavy and residual oils can only lose not more than 10% of their volume. In the case of the Mindoro Oil Spill, industrial and residual oil were released from the tanker and these are heavier compared to light crude oil. Another process that can influence oil during an oil spill is emulsification — a process of formation of various states of water in the exposed oil and these changes can lead to the creation of "tarballs". This process can change the properties and characteristics of the oil contents that were spilled and exposed. In the town of Pola, tarballs were found along the coastlines and oil spill workers were responsible for removing the emulsified oil.

Figure 4. Emulsified oil or tarballs held by one of the oil spill workers in Pola, Oriental Mindoro (Photo from CEED).

High contents of oil and grease in the marine environment are detrimental. Presence of oil and grease, even in thin layers, can affect photosynthetic organisms because light attenuation is reduced and light cannot be fully penetrated in the water surface for the organisms to get in light to make their own food (Urzola et al., 2019). Corals and seagrasses depend on light for them to develop and make their own food and these coastal habitats are ultimately valuable because these are shelters for commercially-important fishes and crustaceans that contribute largely to food security and small-scale fisherfolk. Fish as a main source of protein to humans can be lethal if these fish are exposed to the oil spill with high contents of oil fractions such as PAHs or Polycyclic Aromatic Hydrocarbons (PAHs).

CONCLUSION

The study demonstrates that oil and grease contents persist in oil spill-affected waters in Oriental Mindoro and highly vulnerable sites such as MPAs should be monitored. The impacts of oil spill can be long-term and oil and grease concentrations in the majority of MPAs covered by the study were not compliant with the water quality guidelines of DENR. The temporal data showed that there was a decline of oil and grease contents through time in the MPAs of Pola and Pinamalayan but there are various factors influencing the concentration. Furthermore, high concentrations of oil and grease across the municipalities exceed standards all the same. It is highly recommended to pursue regular testing of water quality in the study sites to determine the safety of coastal waters to become the basis for clean-up and restoration efforts in oil spill-affected waters in the province.

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