

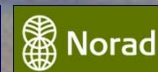
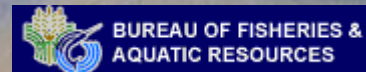


# AquaPark – Norad funded project

**Planning and management of  
aquaculture parks for sustainable  
development of cage farms in the  
Philippines**

**[www.aquapark.asia](http://www.aquapark.asia)**

AquaPark Panabo Stakeholders meeting interim results



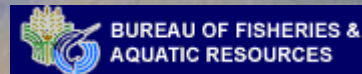
# Oil Spill Preparedness and Response Guidelines for Mariculture Parks in the Philippines

Out put from AquaPark

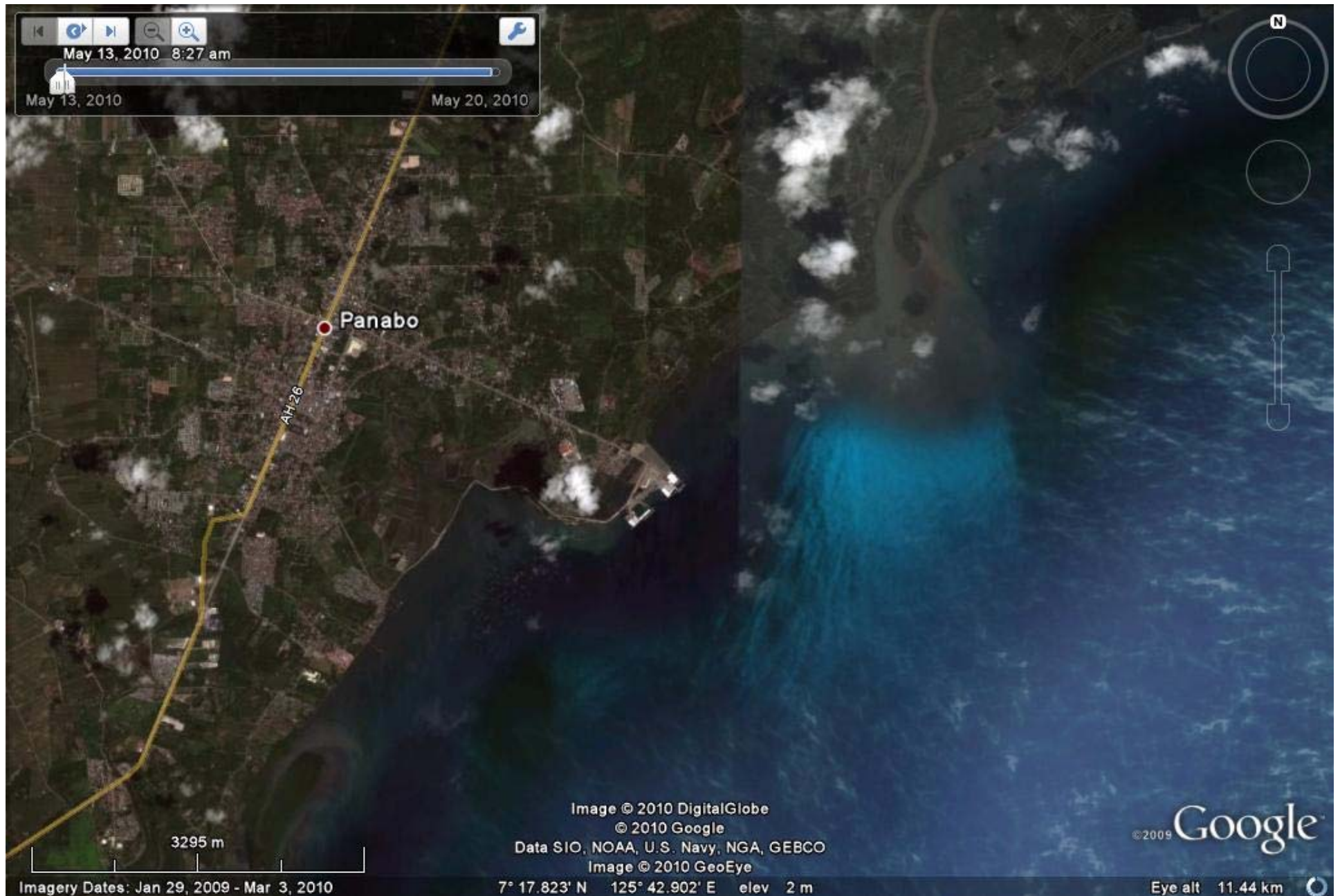
## Aquapark Project Partners

- Bureau of Fisheries and Aquatic Resources
- Akvaplan-niva AS
- Map and Marine Ltd

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# Risks





# Oil Spill Preparedness and Response

This working report attempts to summarise the measures that Mariculture parks can take to be prepared to deal with oil spills.

## The reports summarises

- Biological impacts of spills on fish, shellfish and sensitive environments
- Oil spill contingency planning and response
- Cleanup
- Compensation.

# Impacts

Oil spills can cause damage to fishing and aquaculture by

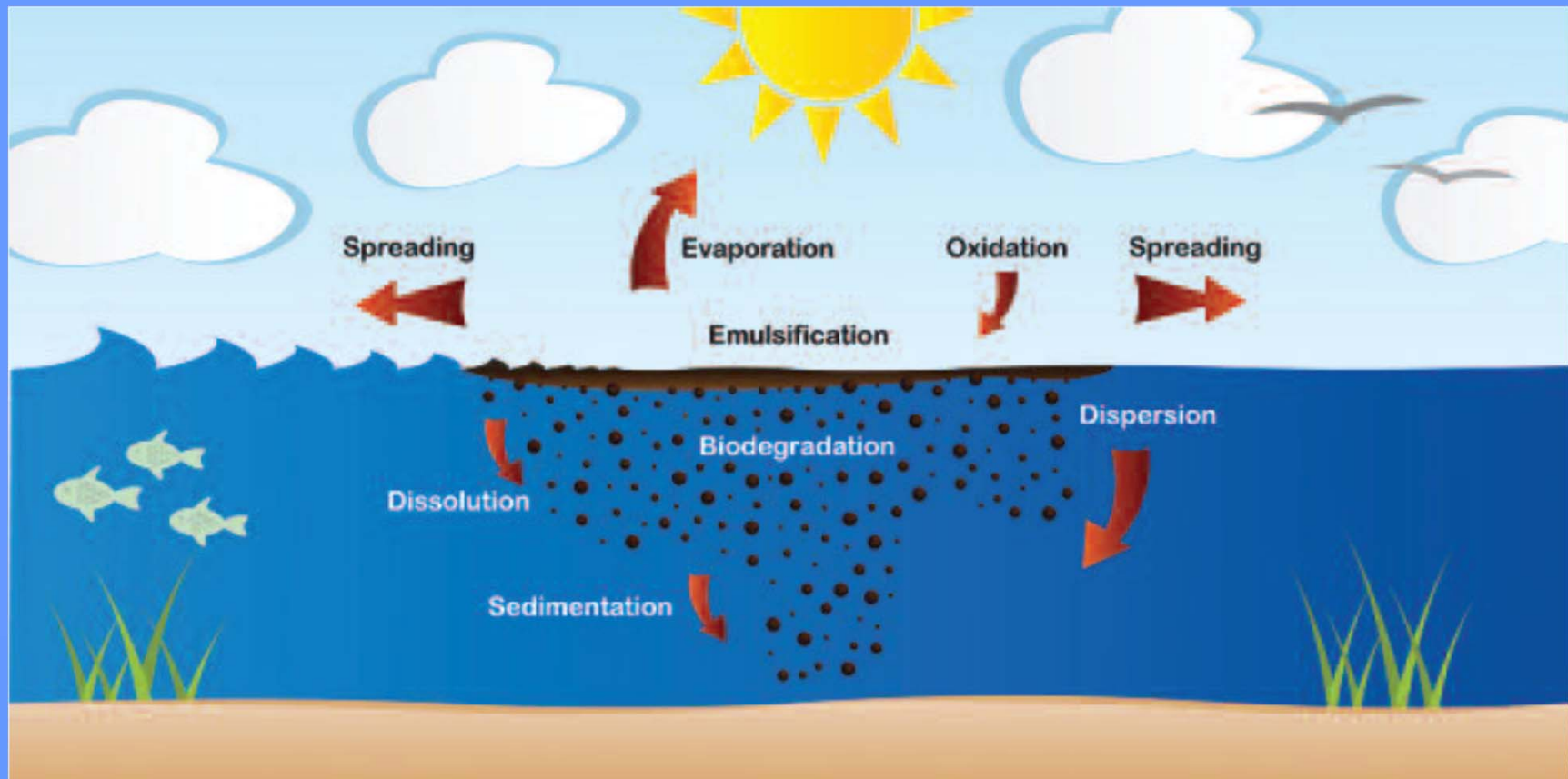
- physical contamination,
- toxic effects
- disrupting business activity.

The nature and extent of the impact of an oil spill on seafood production depends on

- characteristics of the spilled oil,
- amount of oil,
- Location
- type of fishing activity or businesses affected.

# Fate of oil

When oil is spilled at sea it spreads and moves on the surface while undergoing a number of chemical and physical changes, collectively termed weathering



# Factors affecting oil spill impacts

## Persistence of Oil

- There are non-persistent oils, which tend to disappear rapidly from the sea surface, and persistent oils, which dissipate more slowly and usually require a clean-up response.

## Oil type

- Oil products differ widely in toxicity. The greatest toxic damage has been caused by spills of lighter oil. Spills of heavy oils can kill organisms through smothering rather than through toxic effects. Toxicity is reduced as oil weathers.



# Factors affecting oil spill impacts

## Geographic location and habitat type

- In the open sea, oil slicks may disperse naturally.
- Close to shore, most damage occurs in sheltered bays and inlets, where oil becomes concentrated. This is also true of inland lakes and some rivers.
- On the shore, the fate and effects of oil vary with exposure to wave energy and shore type. On exposed rocky shores, effects tend to be low and recovery rates rapid. The most sheltered shores have high biological productivity and are the worst oil traps.
- If oil penetrates into the shoreline or seabed, residence times are likely to be increased.



# Factors affecting oil spill impacts

## **Oceanographic and meteorological conditions**

- The physical exposure and weather conditions at a site will determine not only where oil may collect, but will also indicate how quickly oil will weather.
- Habitats in high wave and wind energy will likely experience much shorter residence time of oil than habitats in sheltered, low-energy environments

## **Season**

- Population concentrations of species that may be present in the impacted area may include spawning or nursery areas which are present seasonally

## **Climate and weather**

- High temperatures and wind speeds increase evaporation of the volatile part of the oil, which decreases the toxicity of the remaining oil. Temperature also influences the rate of microbial degradation - higher temperatures resulting in faster metabolism of the oil.

# Biological impacts

## ***Toxicity***

- Toxicity is level of harm that a chemical can cause. Concentration, duration of exposure, and sensitivity of the species will all determine the toxic effect.

## ***Sensitivity***

- Sensitivity to toxic compounds varies greatly by species, by life stage within a particular species, and by individual.
- In general, younger stages are more sensitive than adults (for example, eggs and larvae are often more sensitive than adult fish), but some exceptions exist.

# Biological impacts

## ***Acute effects***

- Acute toxicity refers to immediate impacts that result in death of the organism. Acute effect of oil on shoreline organisms is the physical process of smothering or the toxic properties of the oil and the concentration and dose that the organism receives. A single dose of a toxic substance at a high concentration can have the same effect as repeated doses at lower concentrations.

## ***Chronic effects***

- Some toxic effects may not be evident immediately, or may not cause the death of the organism. These are called chronic, or sublethal effects, and they can impact an organisms' physiology, behavior, or reproductive capability.



# Route of exposure

There are three principal ways in which hydrocarbons may interact with an animal to become contaminated:

- Ingestion of food contaminated with oil.
- Absorption of dissolved hydrocarbons through respiration, i.e., through gill tissues.
- Absorption of dissolved hydrocarbons from the water through the skin.

# Life stages

## Adult fish.

- Adult fish do not generally experience acute mortality at oil spills, and it is rare to find fish kills after a spill. Fish can take up hydrocarbons through the water column directly and through food, but there is no evidence of biomagnification of hydrocarbons in fish.

## Fish eggs and larvae.

- Fish eggs and larvae experience toxic effects at low concentrations of hydrocarbons, ranging from 1-10 ppm.
- In most cases, eggs and larvae are more sensitive than adults, though some exceptions exist.
- Fish larvae were found to be more sensitive than eggs.

## Effects on plankton

- Eggs and young stages are more vulnerable to oil pollution than adults. Even though many commercial species spawn over large areas, direct effects on plankton have been recorded. Their importance in primary productivity of the oceans and as a temporary home for the eggs and larvae of fish, shellfish, sea bed and shoreline organisms is well known, but there is little evidence of widespread harm to these functions from spills which subsequently translates into long-term damage.

## Plants

- The main plants in the intertidal zone are the attached macroalgae. Though macroalgae may be subject to smothering by oil, they can be quite resilient and survive even heavy oiling

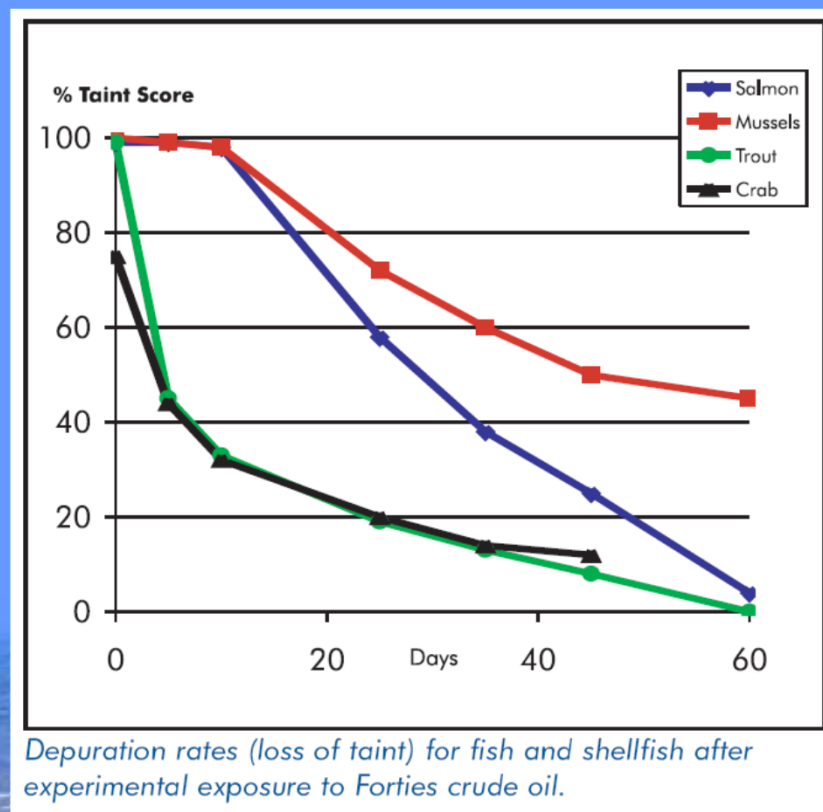


- **Shellfish**

- Mussels (*Mytilus edulis*) have been observed to survive heavy oiling without apparent acute effects.
- They are frequently used as indicators of bioaccumulation for various contaminants
- Mussels subjected to chronic, repeated exposures of hydrocarbon fractions of diesel oil were found to have reduced feeding rates and food absorption efficiency.

# Tainting

Tainting is considered to be the development of flavours or odours in seafood that are not typical of the seafood itself.



# Aquaculture Management during the spill

- There are management strategies which may help to minimise contamination and financial losses to producers.
- Options include
  - moving floating facilities out of the path of slicks,
  - temporary sinking of the nets (tied at the top) below the surface to allow oil to pass over,
  - transfer of stock to areas unlikely to be affected.
- There is a risk that if feeding is continued while there is oil on the surface, the food will absorb the oil as it passes through the surface oil layer and be ingested by the fish causing additional tainting.
- It is better to temporarily suspend feeding until there is no surface layer of oil remaining. If the oil layer persists, then feed can be fed to the fish through a pipe that releases the feed below the water surface.



# Clean-up methodology

## ***Booms and Skimmers***

- The use of booms to contain and concentrate floating oil prior to its recovery by specialised skimmers is often seen as the ideal solution since, if effective, it would remove the oil from the marine environment.



# Oil Sorbents

- Sorbents are essentially inert and insoluble materials that are used to remove oil from water or solid surfaces through adsorption, in which the oil is attracted to the sorbent surface and then adheres to it; absorption, in which the oil penetrates the pores of the sorbent material
- Remove oil with absorbent sponges made from diaper-like substances. Some sorbents are made from natural materials -- straw, grasses, coconut husks, or wood chips and even human hair.



# Dispersants

- Dispersant chemicals work braking the oil into tiny droplets which are dispersed into the water column, where they are diluted by currents and eventually break down naturally.
- Dispersants can be sprayed from boats and planes.
- However dispersants can be strongly toxic to plankton and fish





# Cleaning mariculture facilities

When mariculture facilities and nets become contaminated, they can sometimes be cleaned *in situ*. When contamination is more severe, they may have to be dismantled for cleaning, and when impossible to clean they may have to be replaced.

- **Manual Removal** using rags or sorbents and manual labour and placing in containers for removal from the shoreline. Most appropriate for light to moderate oiling conditions.
- **Passive Collection Sorbents** placed on the water surface allowing it to absorb oil as it is released by tidal or wave action. Oil removal is dependent on the capacity of the particular sorbent and degree of weathering. Often used as a secondary treatment method after gross oil removal.
- **Cold Water/Low Pressure Washing** using a low pressure pump to remove liquid oil that is still fresh that has adhered to the cages, ropes, buoys or nets
- **Cold Water/High Pressure Washing** with water pressure up to 100 psi to remove oil that has adhered to hard substrates or impregnated nets and ropes.
- **Warm or hot water/High Pressure Washing** when washing with cold water is not effective. Warmed seawater is sprayed at moderate to high pressure to the ropes and nets onshore that have been deeply impregnated.

# Contingency plans

- Contingency plans should clearly define the responsibilities of all the different people likely to be involved in a spill and the organisational structure for effective command and control.
- There should be an up-to-date list of key contact points.
- Plans should have agreed response strategies for different culture systems at different times of the year, stocks of clean-up equipment and materials, temporary storage sites and final disposal options.
- Contingency plans should be regularly tested and updated. Any problems need to be identified in an objective manner so that they can be addressed through amendments to the plan.

# Risk assessment

The first task that should be undertaken when preparing to conduct oil spill response operations is a comprehensive risk assessment and hazard analysis.

The initial approach should be to answer such questions as:

- Where are the most likely sources for an oil spill
- What are the mostly types of oil that could be spilt
- Which culture facilities or locations are the most likely to be affected
- Which species or culture systems are the most vulnerable

# Responding to a spill

- **Notification.** Make a list of people who should be notified in the case of a spill.
- **Functional responsibilities.** Identify the different tasks and responsibilities for the oil spill contingency
- **Spill management responsibilities.** Identify suitable people to undertake those responsibilities
- **Equipment and supplies.** Identify the equipment requirements.
- **Recovered oil and debris management.** Processing and final disposal of oil and oily debris in an acceptable manner requires planning. Care must be taken not to create another environmental problem.
- **Information flow.** In major oil spill incidents, handling the media and managing the crisis consumes much time. Planners should take care to choose public affairs objectives that create realistic situations and provide public affairs personnel with practice of managing oil spill issues.



# Insurance claims

There is a two-tier system of compensation established by the international Conventions, with the owner of the tanker that caused the spill being legally liable for the payment of compensation under the first tier, and with oil receivers contributing once the tanker owner's limit of liability has been exceeded.

## ***First layer of compensation—the tanker owner and his P&I Club***

- The text describes the scope of application of the 1992 CLC; The Protection and Indemnity Clubs (P&I Clubs) are mutual, non-profit making associations which insure their shipowner members against various third-party liabilities, including oil pollution).

## ***Second layer of compensation—the 1992 Fund and Supplementary Fund***

- The International Oil Pollution Compensation Fund 1992 ('1992 Fund') pays when the insurance of the P&I clubs is exceeded;

# Insurance claims

Admissible claims can fall under a number of general headings:

- Preventive measures (including clean-up)
- Damage to property
- Economic losses
- Reinstatement/restoration of impaired environments

Claims must be back up with documentary evidence

- Linking oil to a spill
- Damage to stocks
- Damage to equipment
- Clean-up costs
- Income loss

# Watersheds

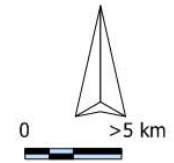
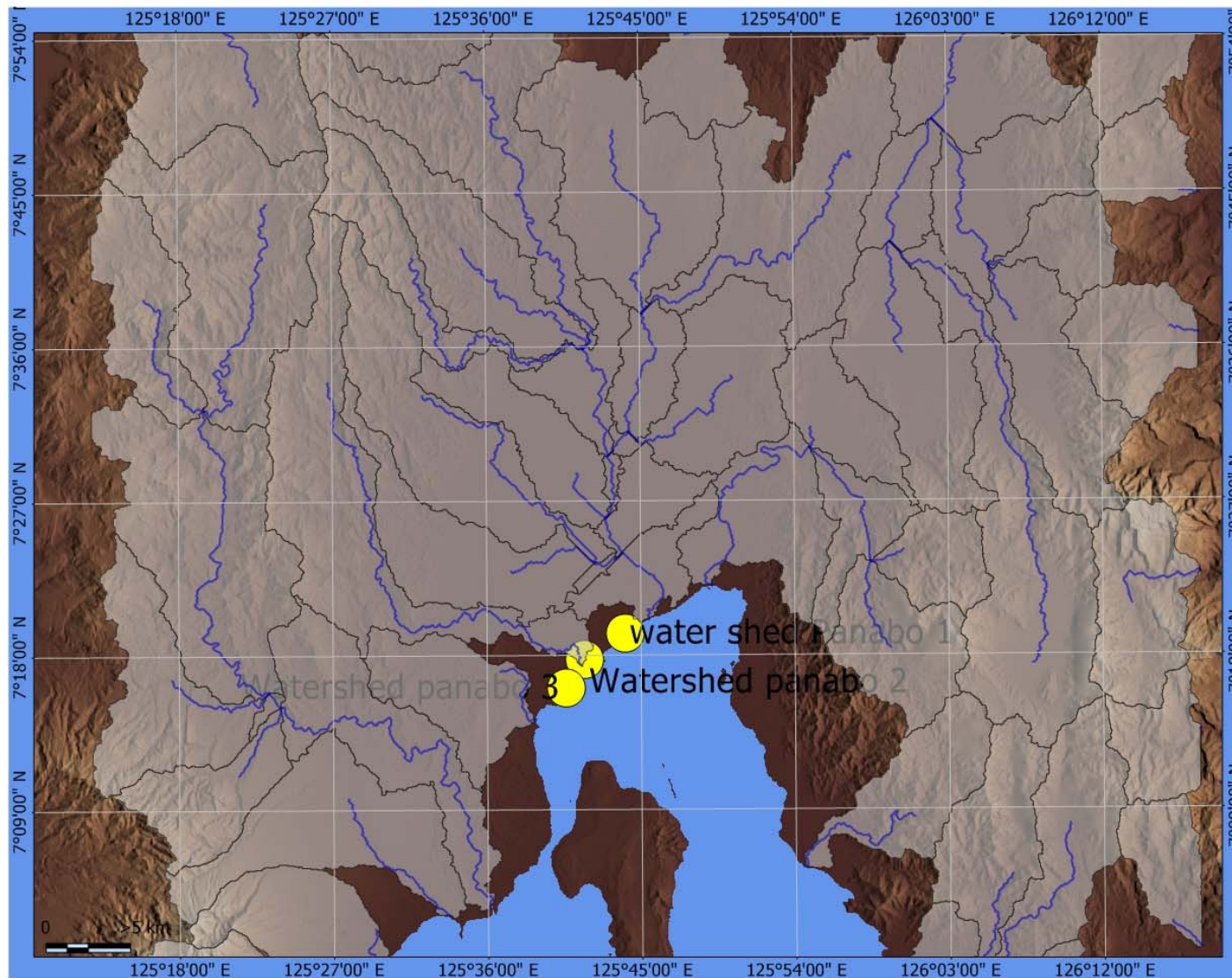


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**Digital Elevation Model  
Panabo Area**



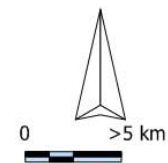
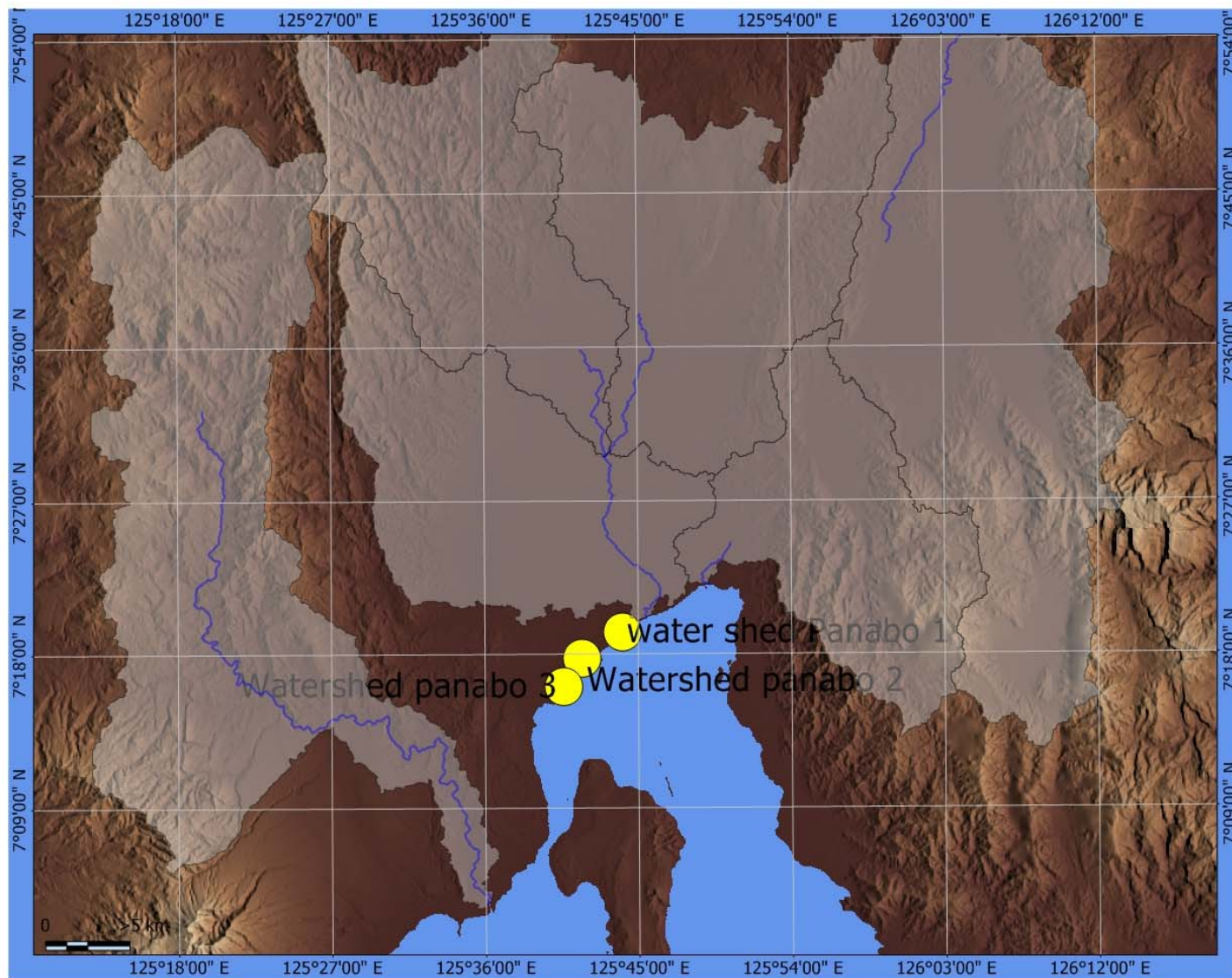


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## Panabo, Davao del Norte Watersheds

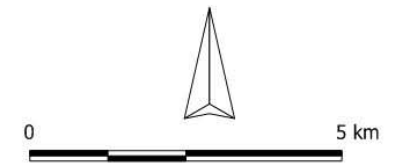
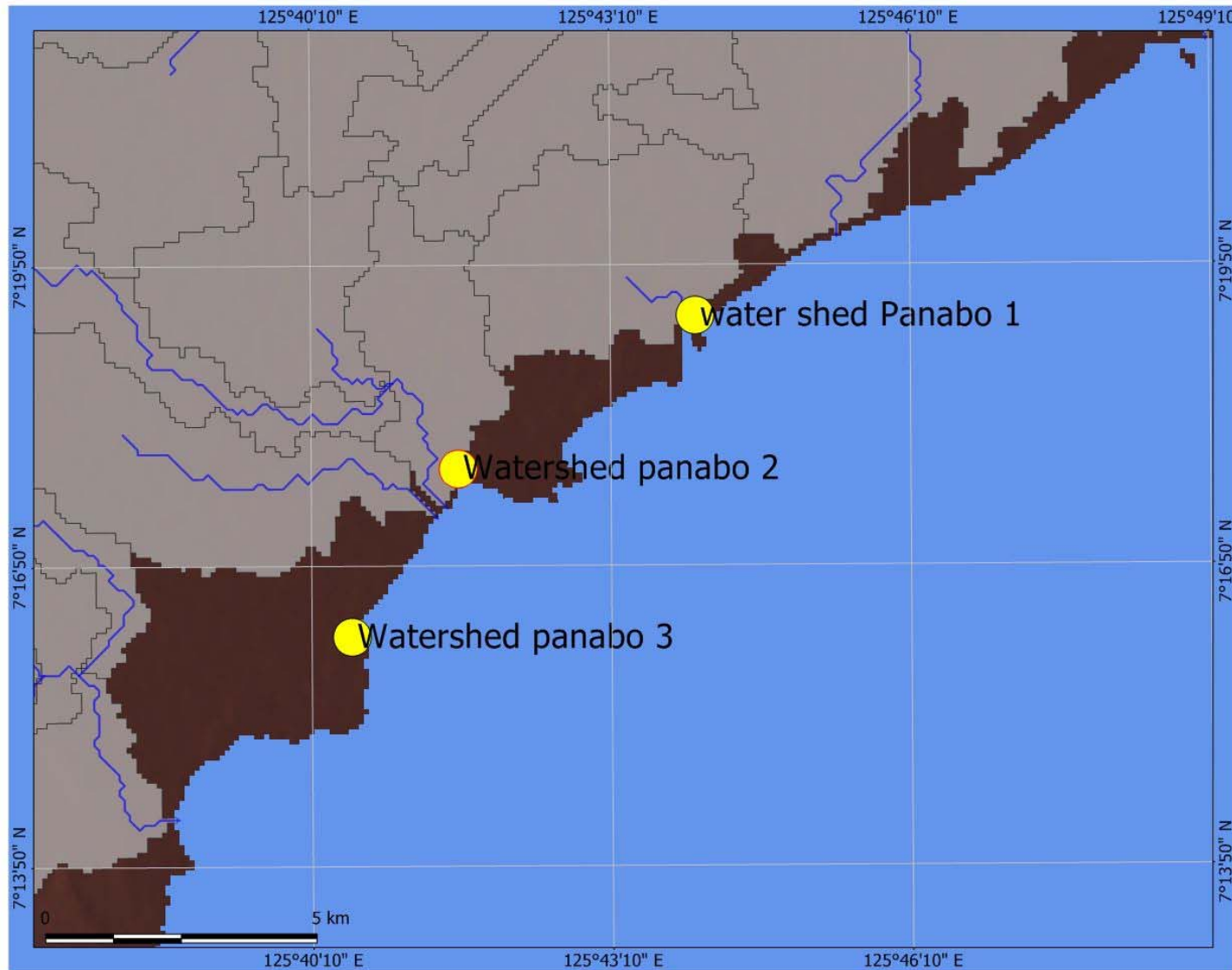




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## **Panabo, Davao del Norte Watersheds**



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## Panabo, Davao del Norte Watersheds