

# TAR ON BEACHES BONAIRE, NETHERLANDS ANTILLES

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## ABSTRACT

From October 1980 to October 1985, tar was collected, in one metre wide transects from waterline to backshore, several times a year at four windward and three leeward sites around the island of Bonaire. The difference between leeward and windward beaches is evident, with no tar found on leeward beaches at any collecting session and always tar on windward beaches with a mean of 278 g per metre for one transect. The form of the coastline and the angle of the wind direction to the coast probably have great influence on the amount of tar arriving and remaining on the beach.

## INTRODUCTION

Bonaire (Fig. 1) is an island about 90 km North of Venezuela and 45 km East of the island of Curacao (12°N/68°W). The island is boomerang shaped with the concave side towards the East, where a small uninhabited island (Klein Bonaire) is situated almost 1 km off the main island. The total land area is about 288 km<sup>2</sup>, with a human population of about 10,000. Eastern tradewinds are quite stable with changes only a few times per year. The general current pattern is from East to West, while on the leeward side eddies are created by the wake of the island.

On the North-East there is an oil transshipment facility for crude carriers up to 500,000 tons and a total storage capacity of 1,265,000 m<sup>3</sup> (9,300,000 barrels). In the flat South part there are solar salt works, while tourism on Bonaire is focussed on nature in general and the reef life in particular.

## METHODS

Within the CARIPOL oil pollution monitoring program me, tar was collected from Octo-

ber 1980 till October 1985 on seven sites around the island; four windward: Piedra Pretu, Playa Grandi, Playa Chikitu (2x); and three leeward: Wayaca (2x) and Punt Vierkant (Fig. 1). The methodology used was according to the CARIPOL Manual for Petroleum Pollution Monitoring (IOCARIBE, 1980). The choice for sites was limited as there are few gentle sloping beaches on Bonaire without a frequently emerging reef in front of them. The frequency of collection was rather random and erratic depending mostly on times when there were few other activities. As tides are not fully clear and easily predicted around Bonaire, no account was taken of low tides. In one metre wide transects from the backshore to the waterline, all tar balls were collected that were found on or near the surface. Up to 1982 the weight of the collected tar was calculated by means of its volume (multiplied by 0.85), afterwards when a balance was available, the tar was weighted directly. This report is a resume of twelve collecting sessions.

Usually the highest concentration of tar was found near the high water mark. Most tar will probably have been deposited by the largest waves during the last high tide. For this reason it is my opinion that it is more accurate to report the data in total weight per

unit beach length (g/m) instead of weight per surface unit ( $\text{g/m}^2$ ). For comparison some data are also presented as grams of tar per square metre.

#### RESULTS AND DISCUSSION

On the three leeward locations no tar has been found at all. The collecting did not coincide with the few days per year that the wind direction changes, but a check just after a wind direction change at two of the leeward sites, showed no tar either.

The four windward sites had tar all the times (Tables 1, 2), although varying between 0.7 g tar per one metre wide transect ( $0.004 \text{ g/m}^2$ ) to 1959 g per transect ( $391.8 \text{ g/m}^2$ ). The highest amount being due to a single large clump. The average amount of tar per collecting session varied between 3.08 g/m ( $0.2 \text{ g/m}^2$ ) and 560.38 g/m ( $107.8 \text{ g/m}^2$ ) for the four windward sites combined (Fig. 3). Because of the constant wind and the relatively few data it is difficult to correlate the amount of tar stranded to meteorological differences, although there is a tendency to less tar around the end and the beginning of the year, a period just after the usual time of change in wind direction. This may be due to slow horizontal movement of tar in open waters.

The location of the transect, with reference both to the wind direction and to the coastal morphology is pertinent to the amount of tar found. The least amount of tar was found at Piedra Pretu in the Southern part of the island, a more or less straight stretch about perpendicular to the wind direction. Probably the washing back of the flotsam is quite high there. Most tar was usually found at Playa Grandi, a spot just West of a small outcrop in a wide cove, in an area where the general coastline is about 45 degrees to the wind direction. The length of the transect at Playa Grandi was also much shorter than elsewhere. At Playa Chikitu, a deeper cove with a sandy beach just West of Playa Grandi in the same general coastline, two transects were sampled (Fig. 2). At the Eastern part of the cove (Playa Chikitu I), more tar was found than at the Western part of the cove (Playa Chikitu II).

TABLE 1.—Average amount of tar found at each site (g/m).

Transect	Number of Observations	Sample Mean (g/m)	Standard Deviation of Sample
Playa Chikitu I	12	95.12	100.60
Playa Chikitu II	11	56.76	58.03
Playa Grandi	12	277.94	552.74
Piedra Pretu	12	55.63	79.46

TABLE 2.—Average amount of tar found at each site ( $\text{g/m}^2$ ).

Transect	Number of Observations	Sample Mean ( $\text{g/m}^2$ )	Standard Deviation of Sample
Playa Chikitu I	12	4.77	4.55
Playa Chikitu II	11	3.05	3.01
Playa Grandi	12	55.28	109.71
Piedra Pretu	12	5.16	10.88

As the amount of tar available in the waters around Bonaire is probably equally distributed, the island being relatively small, the coastal morphology and angle towards the wind direction would be relevant to the amount of tar deposited. In the Southern part of the island (Piedra Pretu), the wind direction is perpendicular to the coast and the general coastline is also much lower so the possible locations for tar to be deposited are plenty. The coast of the Northern part of Bonaire consists generally of cliff, where flotsam can only be deposited by very high waves washing far over the cliff. Most of the tar will probably be transported along the coast and will concentrate on the few lower areas available (Playa Grandi and Playa Chikitu).

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## LITERATURE CITED

IOCARIBE, 1980. CARIPOL Manual for Petroleum Pollution Monitoring, San Jose, 24 p.

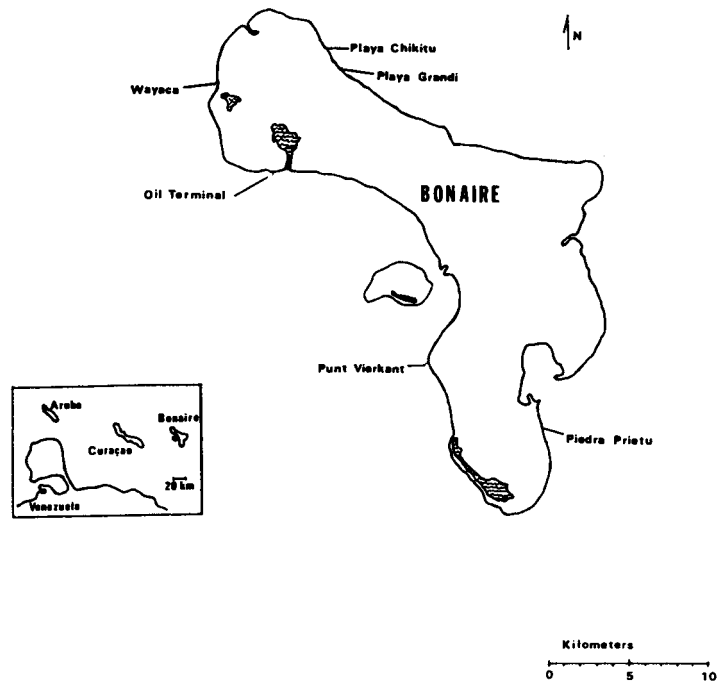


FIGURE 1. Map of Bonaire with collection sites. Inset: Bonaire situated off Venezuela.

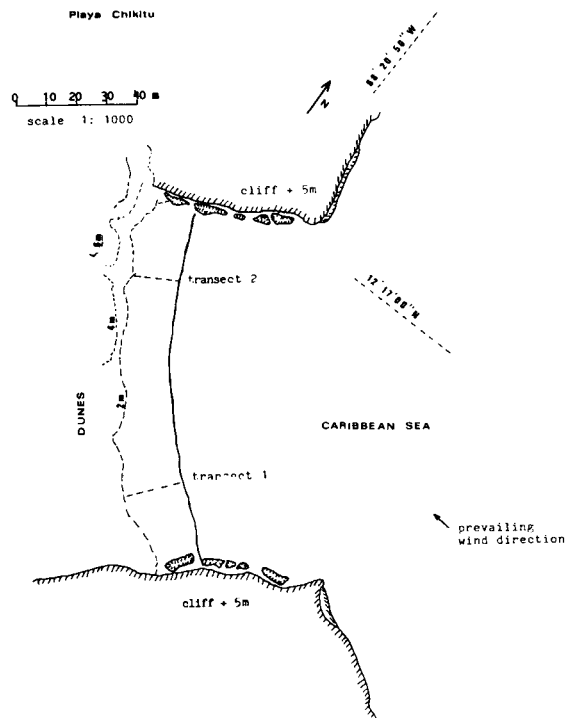


FIGURE 2. Playa Chikitu with collection transects.

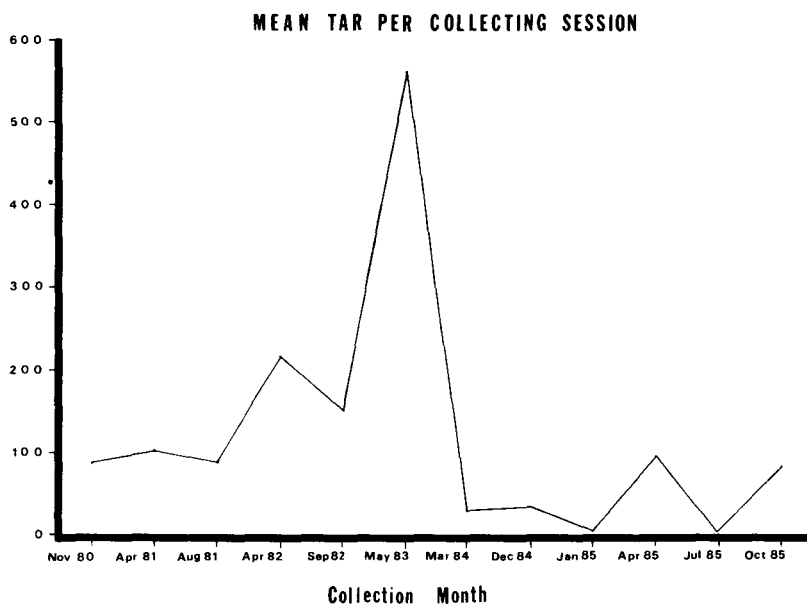


FIGURE 3. Mean tar per collecting session.

