

Pathogenic Fungi: an unacknowledged risk at coastal resorts? New insights on microbiological sand quality in Portugal

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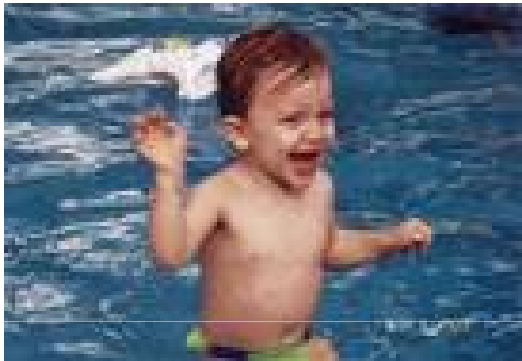
An actual beach on the south coast of Lisbon during a misty day in the Summer



Examples of fungal infections “easily” passed on to non-immunocompromised individuals by sand



Population with increased risk without specific disorders



Children



Pregnant women



Elderly

Past

- ◆ **1989** - Mycology group looking into fungi in sand (joint study with Portuguese National Directorate of Health).
- ◆ For **10 years**, several beach sands were screened for fungi, following different approaches.

World Health Organization, 2003, in “Guidelines for safe recreational water environments”, p118.

- “From a recreational viewpoint, sand beaches are sought after. Especially in higher latitudes, a significant percentage of time is spent on the beach itself rather than in the water.”
- “A number of genera and species that may be encountered through contact with sand are potential pathogens. Accordingly concerns has been expressed that beach sand may act as reservoir of vectors of infection.”

Project # 1

Structure/Methods/Parameters/Standards

2000 – 2002: a project involving several national institutions took place, aiming to structure beach sand quality parameters and associated methods:

“Microbiologic Quality of Coastal Beach Sands”

Participants:

 Portuguese Blue Flag Association,  The National Institute of Health Dr. Ricardo Jorge (INSA),  The General Directorate of Health (DGS),  The Environmental Institute (IA),  The Water Institute (INAG),  The City Hall of Cascais,  The City Hall of Viana do Castelo



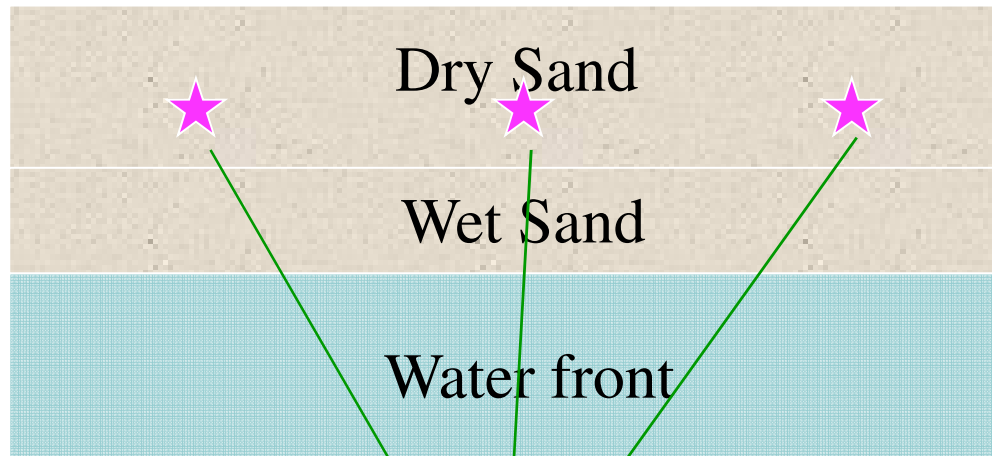
5 Regions – Bimonthly sampling during 13 months

3 beaches per region:

- 1 Beach awarded with the Blue Flag
- 1 Beach with no direct human interference
- 1 Beach with documented poor water quality

210 sand samples
105 water samples





Sterile sampling bag and gloves

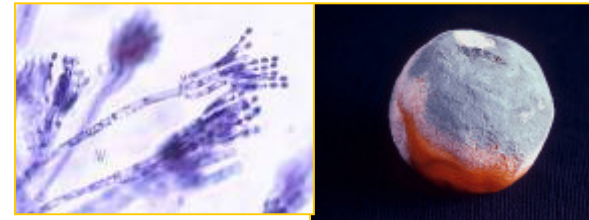
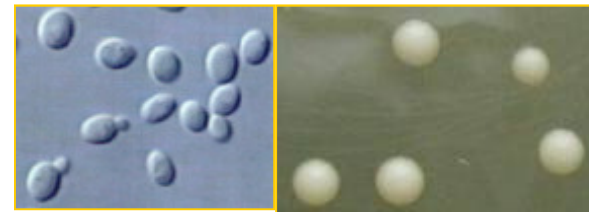


Transport in cold and analysis within 24 hours of sampling



Mycological parameters for sand quality assessment

- Yeasts (a):
Faecal contamination indicators
- Potentially pathogenic and allergenic moulds (b):
- Dermatophytes (c):
Indicators of animal presence, including humans





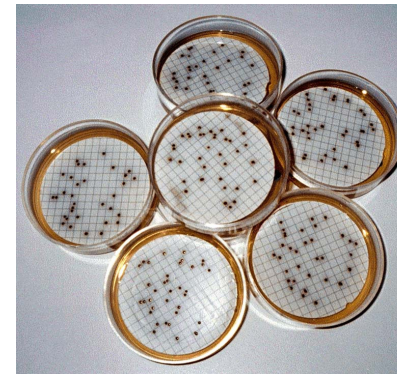
- **Yeasts** (genuses *Candida*, *Cryptococcus* and *Rhodotorula*),
- **Alergogenic and (potential) pathogens** (genuses *Aspergillus*, *Fusarium*, *Scopulariopsis*, *Scedosporium*, *Chrysosporium*, *Scytalidium*, *Histoplasma*, *Coccidioides*, *Exophiala*, *Fonsecae*, *Phialophora*, and other moulds of clinical significance (the later when present as dominating species in significant counts (> 500 cfu/g)).
- **Dermatophytes** (genuses *Microsporum*, *Epidermophyton* and *Trichophyton*)

Bacterial parameters for sand quality assessment

- Coliform bacteria



- *Escherichia coli*



- Intestinal enterococci



Reference values for sand quality assessment based on national means

Mycologic Parameters:

1. Yeasts	60 cfu/g
2. Potential pathogenic moulds (filamentous fungi)	85 cfu/g
3. Dermatophytes	15 cfu/g

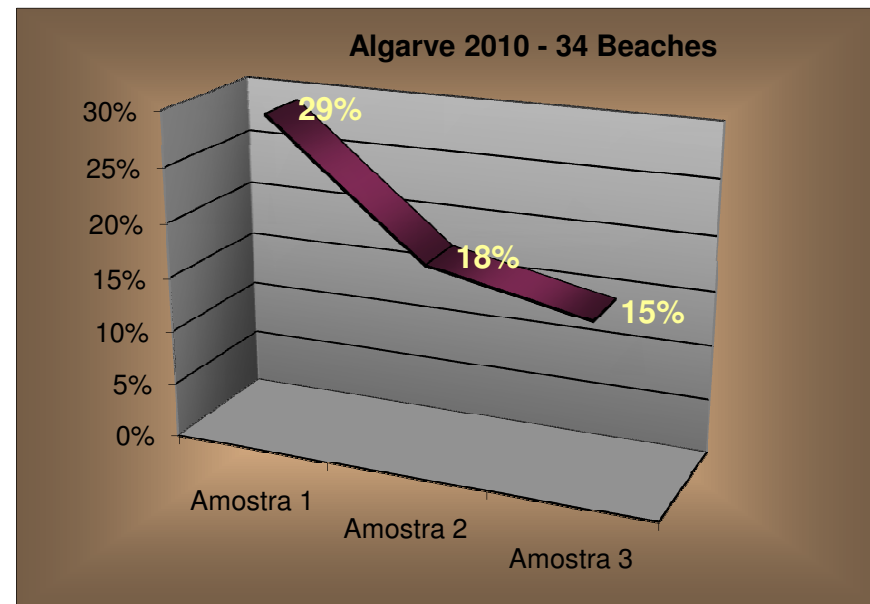
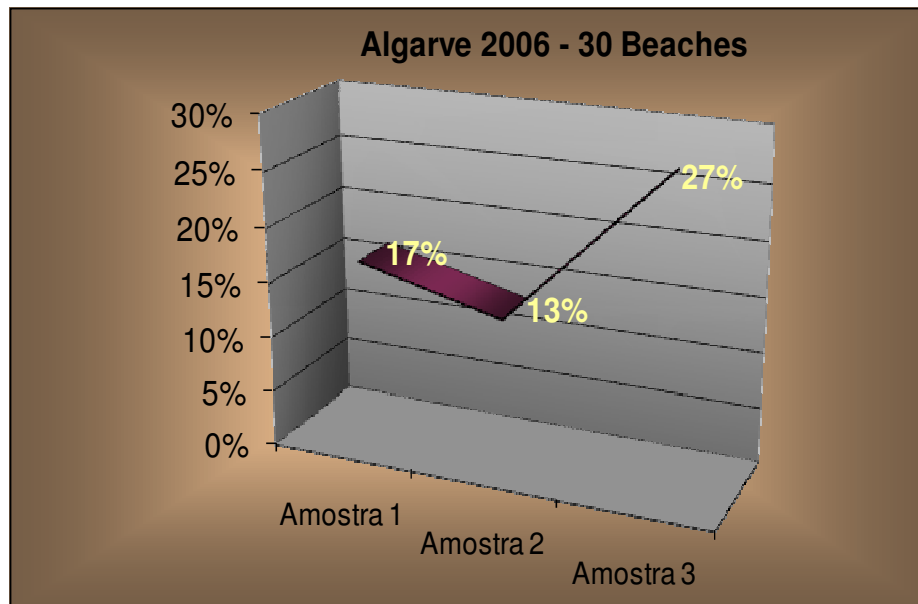
Bacteriologic Parameters:

1. Total coliforms	100 cfu/g
2. <i>E. coli</i>	20 cfu/g
3. <i>Enterococci</i>	20 cfu/g



Algarve 2006 x 2010

Samples that exceeded at least one of the Reference Values



Beach managers were instructed on how to control contaminant levels. Result: Dramatic reduction of contaminant levels from the first sampling (pre-bathing season) to the following two (within bathing season)

Factors that positively influence the quality of beach sand

- **Garbage removal** - Frequent removal of litter and garbage from sand and neighbouring areas;
- **Garbage recipients** - Number of garbage recipients appropriate for the length of the beach;
- **Sand treatment** - based on experience of one region with weekly iodine spraying;
- **Surroundings** - Identification and treatment of neighbouring contaminated areas



Factors that negatively influence the quality of beach sand

- Over-use of beach
- Admission of pets
- Accumulation of garbage
- Abandonment of remains from fishing
- Rodents and prowling animals

Project # 2

Parameter consistency/Reference Values

2006 through 2010 data of 33 beaches statistically revisited

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ABSTRACT

Whilst the potential impact on beach users from microorganisms in water has received considerable attention, there has been relatively little investigation into microbial contaminants in sand. Thirty three

Some results

- 60.4% of the samples were positive for the reference fungal species
- 25.2% were positive for the three bacterial groups
- 33.3% were negative for all the parameters
- 20.2% were positive for both fungal and bacterial parameters
- Yeasts and dermatophytes tend to increase along the sampling periods
- Interesting relationships were found (i.e. *Scopulariopsis spp* and Dermatophytes, between yeasts and coliforms)

Proposed values for sand quality assessment based on the high 95 percentile

Mycologic Parameters:

1. Yeasts	15 cfu/g
2. Potential pathogenic moulds (filamentous fungi)	17 cfu/g
3. Dermatophytes	8 cfu/g

Bacteriologic Parameters:

1. Total coliforms	84 cfu/g
2. <i>E. coli</i>	250 cfu/g
3. <i>Enterococci</i>	100 cfu/g



Currently

- We currently provide this service to the community upon direct request from municipalities
- We're doing research in order to move on to molecular analysis and be able to provide faster results (with classic microbiology techniques partial results within a week and final within 4 weeks at least)
- We're working on the extension of the analysis to specific pathogens, viruses (wet sand) and parasites (both wet and dry sand)
- We're available to do concerted work in order to tackle this issue at a non-local scale (Reference values and even parameters differ according to climate – as described in our paper)

