

# **Karst Water Vulnerability and Education of the Residents**

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# Water-borne Diseases in Croatia

## From 1992-2006:

- 26 outbreaks
- Microbiological contamination is the major problem
- Most drinking-water outbreaks were associated with non-community systems or individual ones (e.g. private wells) and a few unprotected springs in the countryside

(Dadić et al., 2007)

Real number of outbreaks probably is higher!

# Water-borne Diseases in Croatia


## (Cont'd)

### Problems:

- Data on water-borne diseases are often not collected systematically
- Non registration and inappropriate diagnostic
- Non registration in the place where disease occurred (e.g. during the trips)

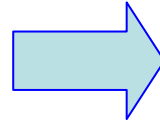
**However, 15 out 26 registered outbreaks occurred in karst part of Croatia!**

# Typical Challenges Associated with the Water Supply in Karst Regions

- High-risk water sources
  - Drinking water catchments are not adequately protected
  - Treatments are not adequate and appropriate
- 
- Availability of water e.g. on the islands, but also all over the region during the summer
  - Small population size, low density and inconvenient morphology
  - Vulnerable population (old people, tourists)

# Typical Challenges Associated with the Water Supply in Karst Regions

Large systems



Operating according to the standards (HACCP, ISO, ...)

Problems remain

Small systems

Household and non piped supply (more often by cisterns)

Inadequately equipped

The main source of water-borne diseases in Croatian coastal part were **inadequate water disinfection and water supply directly from the source.** (Smoljanović, 2007)

- **Secondary contamination**
- **Usually there is no filters and no disinfection**

# Karst Water Vulnerability and Residents

- Sinkholes have been used in rural areas to dump trash and household hazardous wastes

*And not only the sinkholes...*

- Unprotected and inadequately maintained sewage tanks
- Land use activities



Source of public health problems in karst regions in both developed and developing countries.

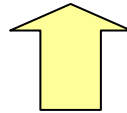
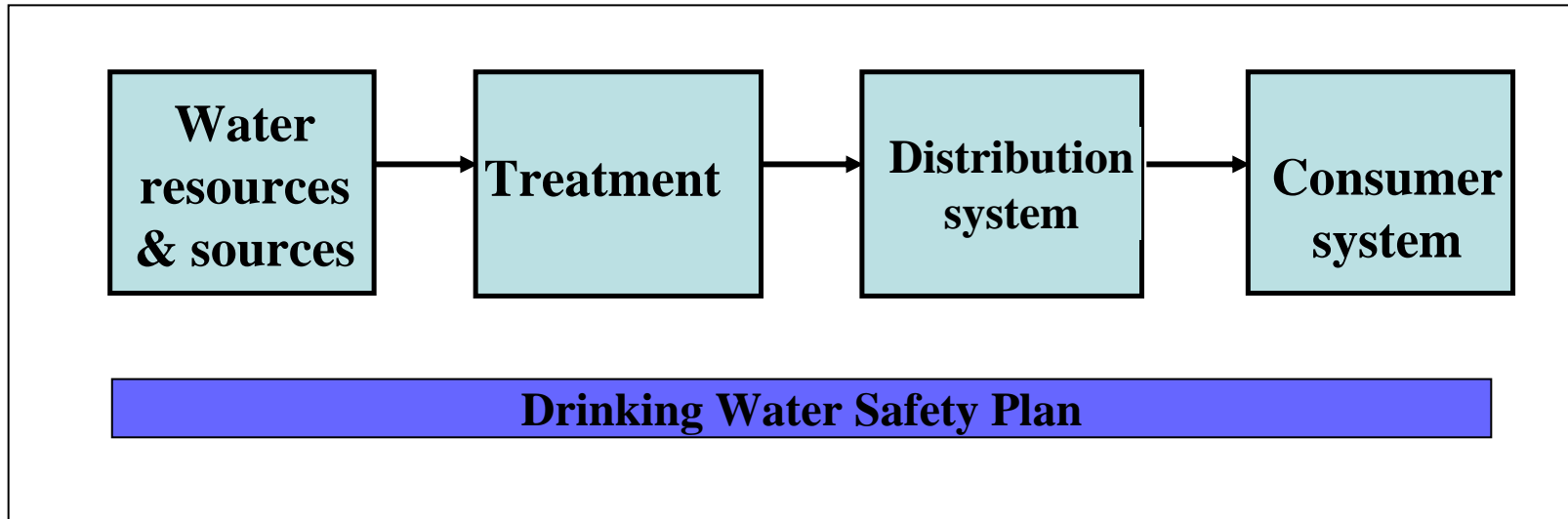
**The right to water places a clear responsibility on Governments to ensure access to safe and adequate water supplies in karst area too.**

## **WHO Water Safety Plans (WSP) approach**

- Preventive management system that provides measurable assurance that safe drinking water is provided 24 hrs/day
- Designed for drinking water supplies irrespective of their size
- WSP approach will be added to the new EU Drinking Water Directive (draft is expected in June 2008)

**Prepare WSP for typical water supply in karst areas.**

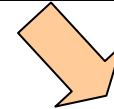
# Water Safety Plans (WSP)



**Knowledge and education are essential for the implementation**



**education of operators**  
(small systems operators will probably need additional support)



**public education**  
important tool for protection and management of karst areas



# Public Education and Risk Communication

Fontain of Ston water supply dating from the year 1581

Not in use as public water supply  
There is no disinfection



**Perception of risks is not clear at the community level.**

# Examples of Public Education

## 1) Outdoor school

Project in collaboration of the Zadar Private High School and the Croatian National Public Health Institute

- 2000 - 2004 NP Paklenica, Zrmanja
- 2004 - Region of Imotski

Topic:

“Karst Water Vulnerability: Case Study Region of Imotski”

# Outdoor School Objectives

To teach students about:

- water supply problems all over the World and Croatia especial in their karstic part
- karst water vulnerability
- types and sources of pollution

Field work:

- visiting different karst features
- sampling different karst waters (sources, lakes, rivers)
- dealing with basic physical-chemical analyses of water

# BOSNA I HERCEGOVINA



Ričice  
**Jezero Ričice**

Ričice

Vrbica

**Galipovac**

**Knezovića jezero**

Krenica

**Prološko blato**

Lokvičići

**Mamića jezero**

Ričina

Gornji Proložac

Donji Proložac

**Jezero Dva oka**

**Crveno jezero**

**Modro jezero**

Opačac

Suvaja

Sija

Imotsko polje

Glavina Donja

**IMOTSKI**

Grubine

Kamenmost

Donji Vinjani

Mati





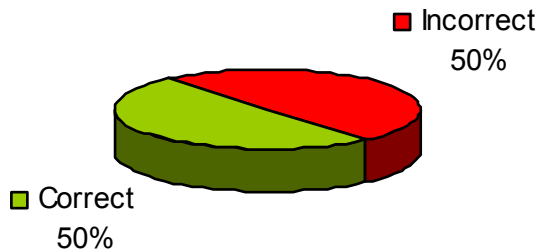


# Questionnaire - evaluation

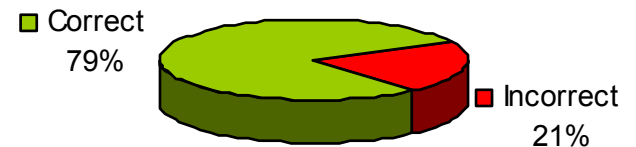
22 questions on:

- water and health in general (World, Croatia)
- karst features
- pollution in karst

All questions-first day

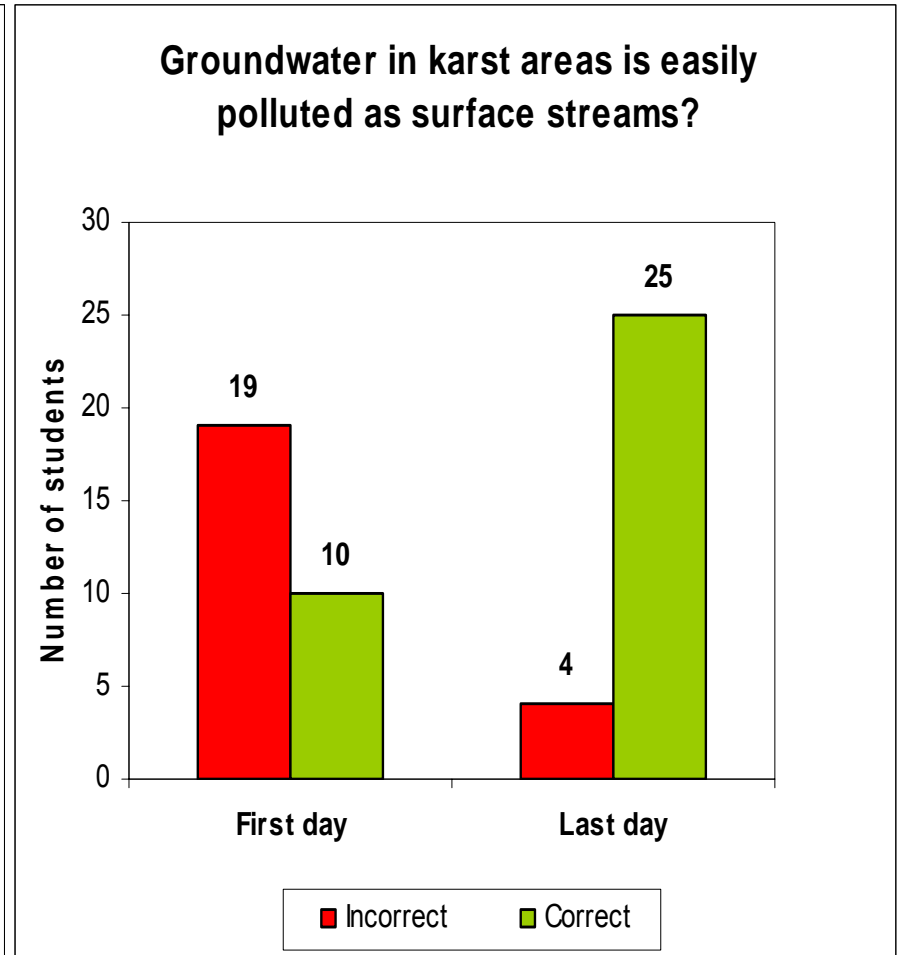
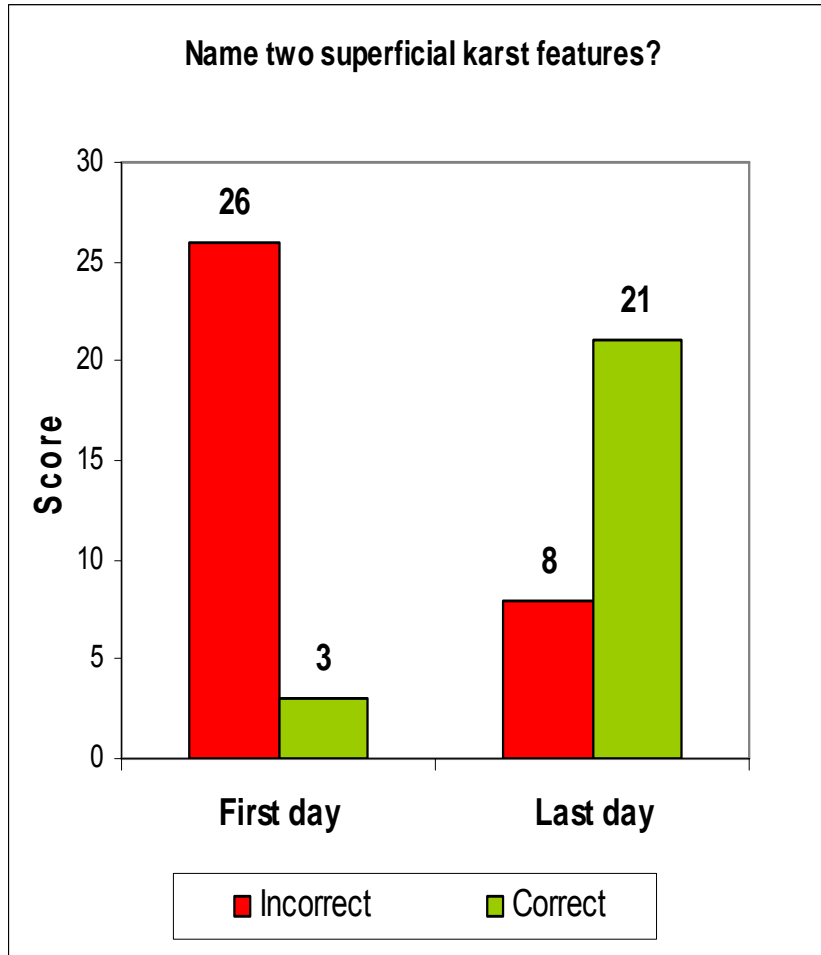


All questions-last day





# Questionnaire - evaluation (Cont'd)



# Examples of Public Education (Cont'd)

## 2) Synchronization into Croatian of the DVD

*“DON'T BUG ME – Pathogens & Pathways in Drinking Water Supplies”*

- DVD made by Ministry of Health, New Zealand
- “discovered” thanks to ***International Network for the Management of Small Community Water Supplies (SCWSM Network)***
- To be distributed into schools at the end of April 2008

# Conclusion

**Perception of risks is not clear at the community level.**

Residents must understand that:

dumping

certain land use activities

unprotected and inadequately maintained sewage tanks

can have significant consequences in nearby and seemingly distant locations.

**Public education all over karst region is critical for the management and protection of karst water resources.**

# Conclusion

Education and more clear risk communication announcements are necessary for protection of public health.

WHO's Water, Sanitation and Health Activities can help

- **International Network for the Management of Small Community Water Supplies**

- **International Network to Promote Household Water Treatment and Safe Storage**

*Example of risk communication from Morocco*



# Conclusion

For a better water management in karst areas - remind residents on necessity of rain water harvesting even when if there is water supply system.



# Rainwater

Catch it While You Can!



## CONSERVE THE WATER