



A GERMAN - VIETNAMESE  
INITIATIVE

# Pesticide and antibiotic pollution in the Mekong Delta

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## Mekong Delta

- 55% of national rice production in 2011 [GSO, 2011]
  - 40% of fruits production [Vietnam's Fruit and Vegetables association, 2011]
  - 60% of fishery production [GSO, 2011]
- Increasingly use of pesticides and antibiotics



## ⦿ Risks of exposure to pesticides and antibiotics in water



[Photos : internet]

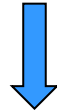
# Main objectives

1. To identify the main pollution sources for pesticides and antibiotics and assess their influence on water quality in the Mekong delta.
2. To link pesticide and antibiotic pollution with human exposure via different drinking water sources
3. To generate GIS based risk maps of drinking water quality by linking hazard (pollution) and exposure (water use for drinking).

◆ **First stage: (August 2011 – March 2012)**

Field survey, household interview, expert interview, secondary data collection

→ to select study sites, design sample size, sampling frequency and study compounds



◆ **Second stage: (Dec 2011 – May 2013)**

Analytical method development

Sampling, sample extraction and analysis

Data treatment and validation



**Third stage**

Development of GIS risk assessment maps



## Sampling locations

- **Can Tho city and An Giang province**



## *Selected sites for assessment of water pollution by pesticide use*

Province	Location	Land use	Soil type	Irrigation
<b>Can Tho</b>	O Mon (OM)	Triple paddy rice crop, fruit tree	Alluvial soil	None closed dyke system
	Co Do (CD)	Double paddy rice crop, veggies	Slight acid sulfate soil	None closed dyke system
	Thoi Lai (TL)	Triple paddy rice crop	Slight acid sulfate soil	None closed dyke system
<b>An Giang</b>	Thoai Son (TS)	Triple paddy rice crop	Slight acid sulfate soil	Closed dyke system

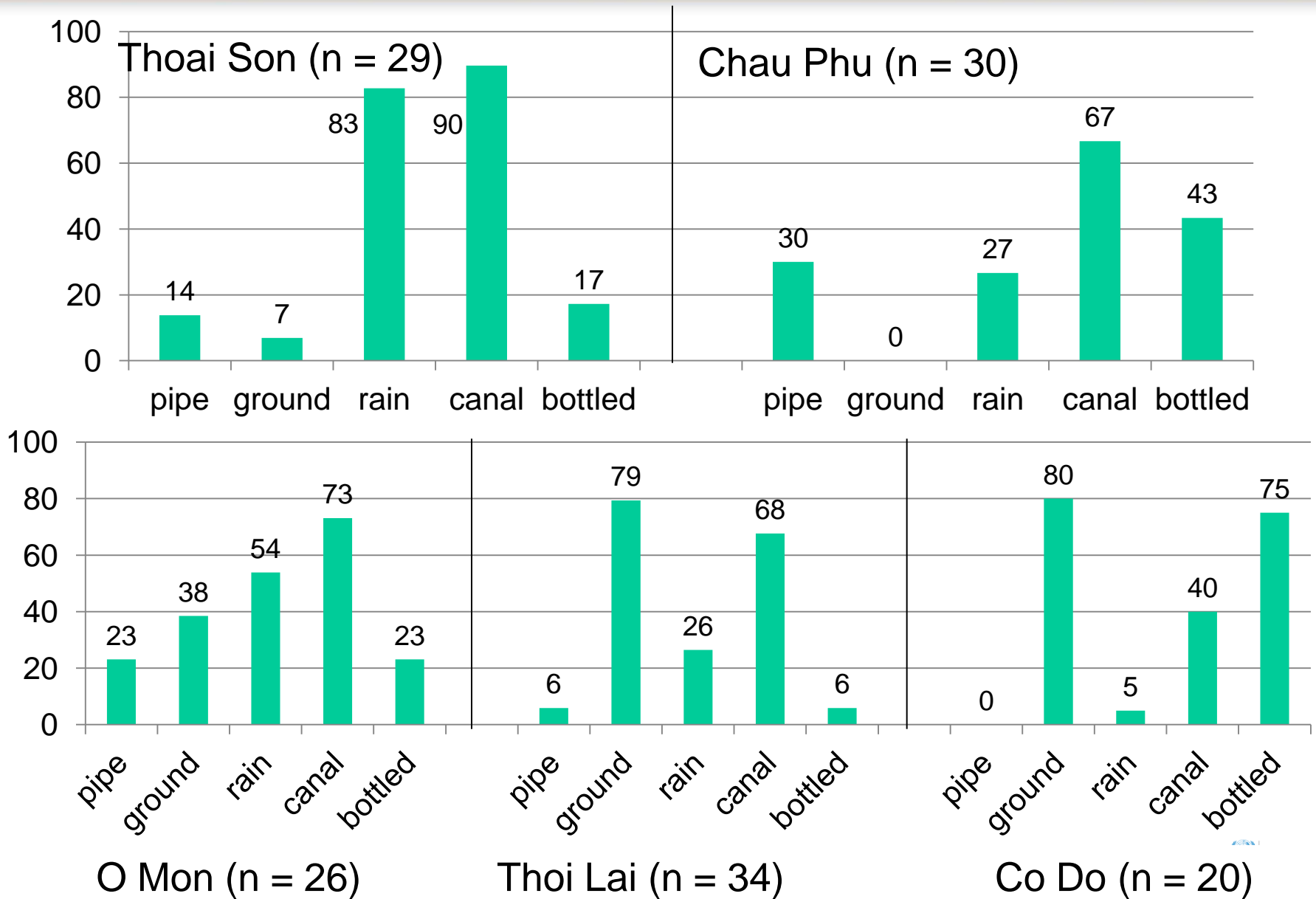
## *Selected sites for assessment of water pollution by antibiotic use*

Province	Location	Land use	Soil type	Irrigation
<b>Can Tho</b>	Co Do (CD)	Hatchery fish	Slight acid sulfate soil	None closed dyke system
<b>An Giang</b>	Chau Phu (CP)	Mature catfish (Pangasius)	Alluvial soil	Closed dyke system

# Results



# Percentage of different water sources used by interviewed households



# Selected pesticides

(132 HH)	Types	WHO toxic classification	Use (%)
Fenoxaprop-P-ethyl	Herbicide	III	18
Butachlor		III	16
Pretilachlor		U	63
Azoxystrobin	Fungicide	III	34
Trifloxystrobin		III	14
Hexaconazole		U	27
Isoprothiolane		II	31
Difenoconazole		II	83
Propiconazole		II	64
Thiamethoxam		III	36
Tebuconazole		III	10
Quinalphos	Insecticide	III	17
Cypermethrin		II	14
Fenobucarb		II	19
Fipronil		II	38

# Selected antibiotics

(17 HH)	Use (%)	Chemical group
Amoxicillin	18	Penicillins
Ampiciline	12	Penicillins
Cephalexin Monohydrate	6	Penicillins
Chloramphenicol	6	Phenicol
Florfenicol	29	Phenicol
Kanamycin sulfate	6	Aminoglycosides
Spectinomycine	12	Aminoglycosides
Sulfadimethoxin	6	Sulfonamides
Doxycycline	29	Tetracyclines
Oxytetracycline	12	Tetracyclines
<b>Sulfamethoxazole</b>	<b>41</b>	<b>Sulfonamides</b>
<b>Trimethoprim</b>	<b>41</b>	<b>Bacteriostatic antibiotic</b>
<b>Enrofloxacin</b>	<b>47</b>	<b>Fluoroquinolones</b>

# Pesticide pollution

# Summary of the residues of pesticides in water for all samples (*n* = 270, March 2012 – January 2013)

Compounds	Quantification frequency (%)	Max. conc. (µg/L)	Median conc. (µg/L)
Butachlor	44.1	0.81	0.25
Pretilachlor	58.0	0.85	0.21
Fenox			0
Propic			.51
Tebuconazole	26.7	1.34	0.34
Hexaconazole	51.5	1.79	0.44
Trifloxystrobin	11.5	0.56	0.15
Isoprothiolane	77.4	8.49	0.47
Difenoconazole	5.2	3.18	1.30
Azoxystrobin	45.9	2.41	0.49
Fenobucarb	70.7	2.18	0.14
Quinalphos	57.4	1.33	0.17
Thiamethoxam	3.0	0.95	0.63
Fipronil	62.2	0.41	0.17
Cypermethrin	0.4	0.77	0.77

EC guideline of the threshold of individual pesticide in drinking water: 0.1 µg/L



## Pesticide residues in bottled water

### Randomly collected from 84 brands in Can Tho

500 mL bottle

19 L bottle

No. of analyzed samples/ brands

26/ 10

22/ 8

**No. of samples contaminated by pesticides**

**17/26**

**13/22**

Max total pesticide concentration ( $\mu\text{g/L}$ )

1.38

0.53

Average total pesticides ( $\mu\text{g/L}$ )

0.42

0.26

No. of samples with individual pesticide residues

Fenobucarb

2

6

Quinalphos

1

1

Butachlor

4

Isoprothiolane

8

6

Pretilachlor

13

3

Fipronil

4

Hexaconazole

3

6

Azoxystrobin

1

**No. of samples exceeding EC guideline 0.5  $\mu\text{g/L}$**

**5**

**2**

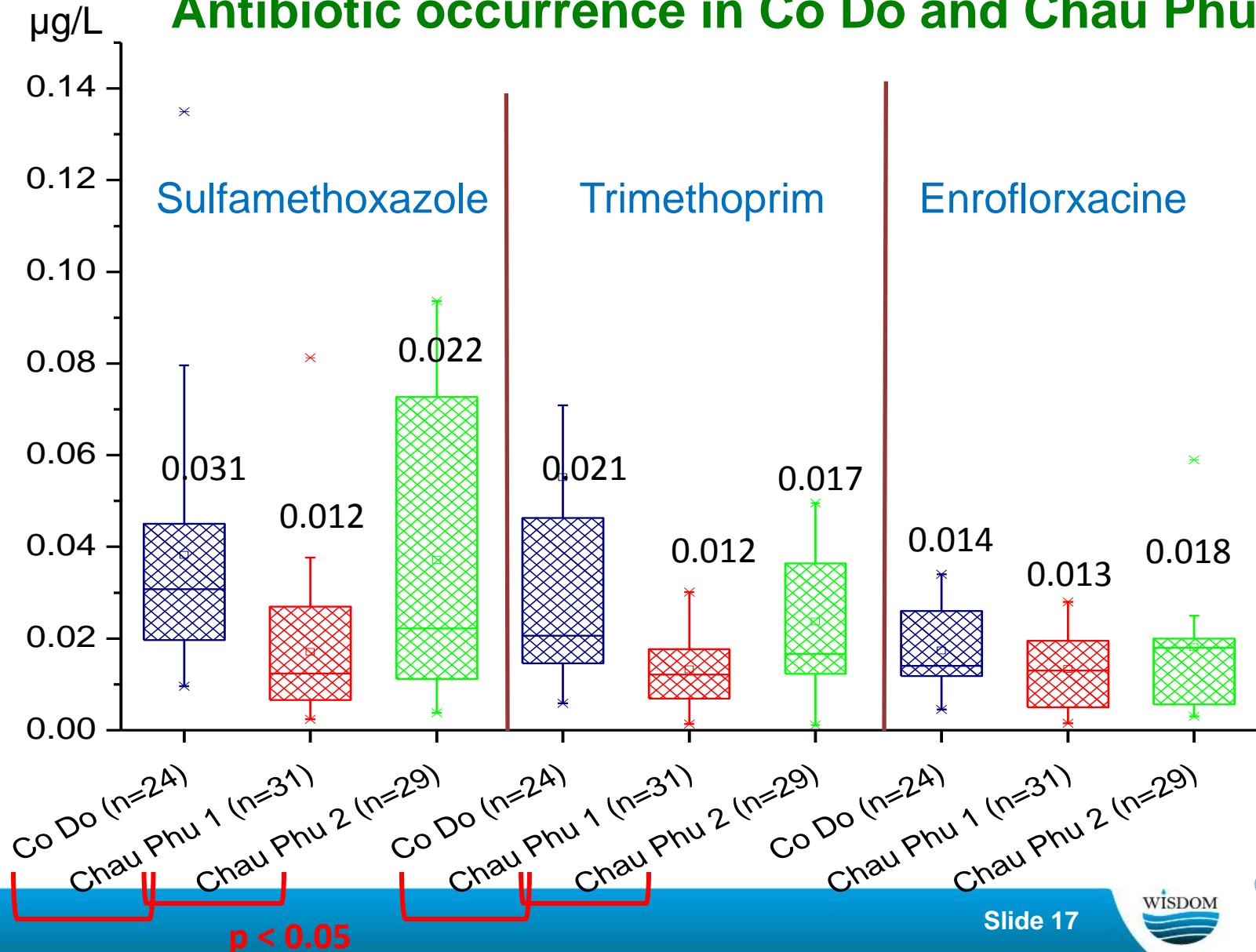
# Antibiotic pollution

## Summary of the residues of antibiotics in water

*(March 2012 to January 2013)*

	No. analyzed samples	Quantification frequency (%)	Median conc. (µg/L)	Range conc. (µg/L)
<b>Enroflorxacine</b>	169	38%	0.012	0.001 – 0.081
<b>Sulfamethoxazole</b>	169	78%	0.020	0.001 – 0.239
<b>Trimethoprim</b>	137	84%	0.016	0.001 – 0.330

# Antibiotic occurrence in Co Do and Chau Phu



$p < 0.05$

- ◆ Domestic water: surface water and groundwater are the main sources
- ◆ Drinking water: surface water is still used (up to 38% of households in Thoai Son)
- ◆ Most intensive pesticide use: Thoai Son
- ◆ **Isoprothiolane, fenobucarb and pretilachlor** were the 3 most frequently detected pesticides, median conc. 0.47, 0.14 and 0.17 µg/L, respectively
- ◆ Antibiotics: **low concentrations**, ranging from 0.001 to 0.330 µg/L
- ◆ **93% surface water** samples exceed EC guideline for total pesticides in drinking water (0.5 µg/L)
- ◆ So far, there are no guidelines for the thresholds of sulfamethoxazole, trimethoprim and enrofloxacin concentrations in drinking water.



- Develop GIS risk maps for drinking water quality
- Publications on (1) pesticide pollution, and (2) antibiotic pollution in the Mekong delta
- Finish the study on dissipation of some antibiotics under tropical climate

Thank you!

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