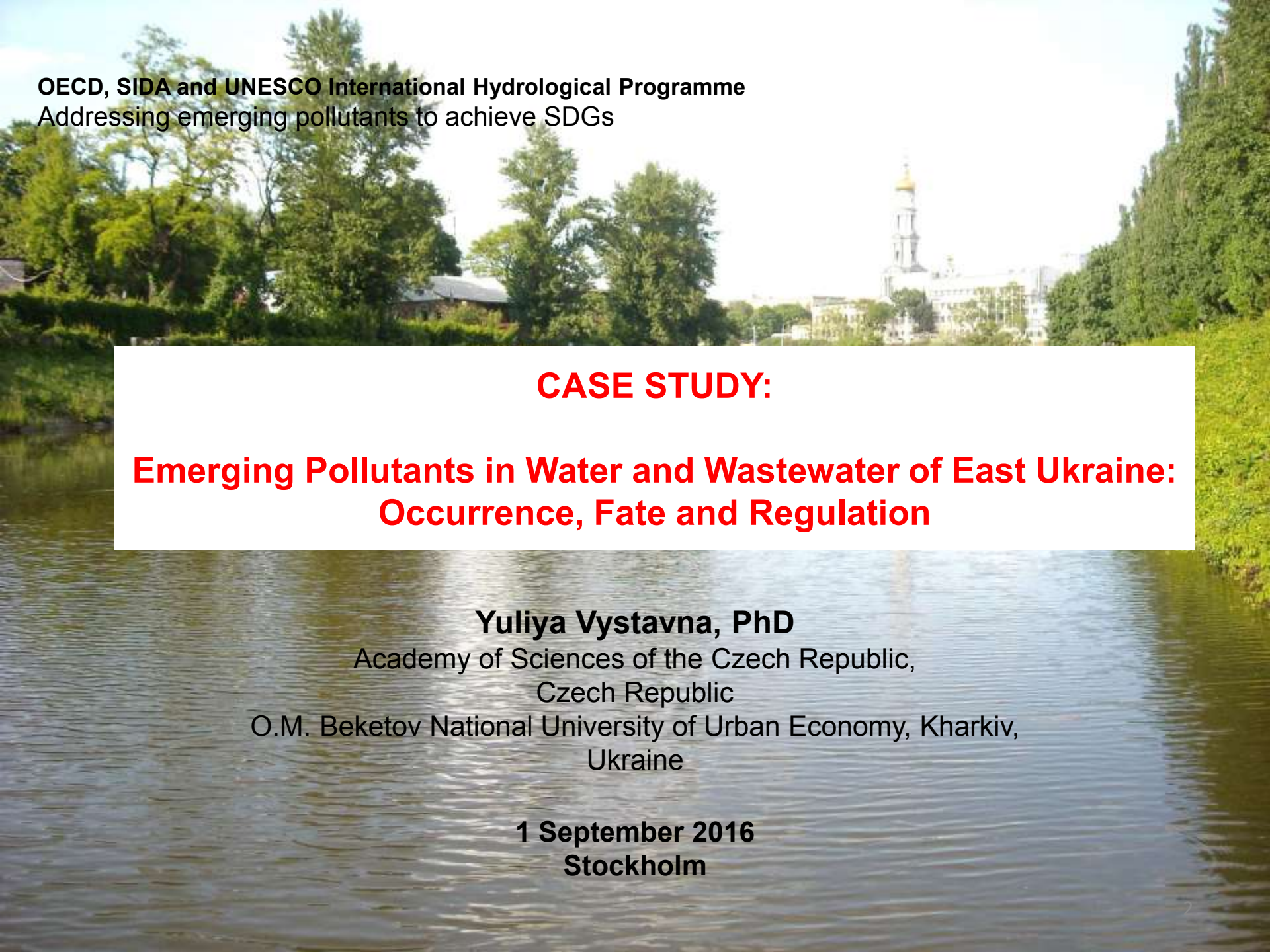
Presentation from

2016 World Water Week in Stockholm

www.worldwaterweek.org



OECD, SIDA and UNESCO International Hydrological Programme
Addressing emerging pollutants to achieve SDGs

CASE STUDY:

Emerging Pollutants in Water and Wastewater of East Ukraine: Occurrence, Fate and Regulation

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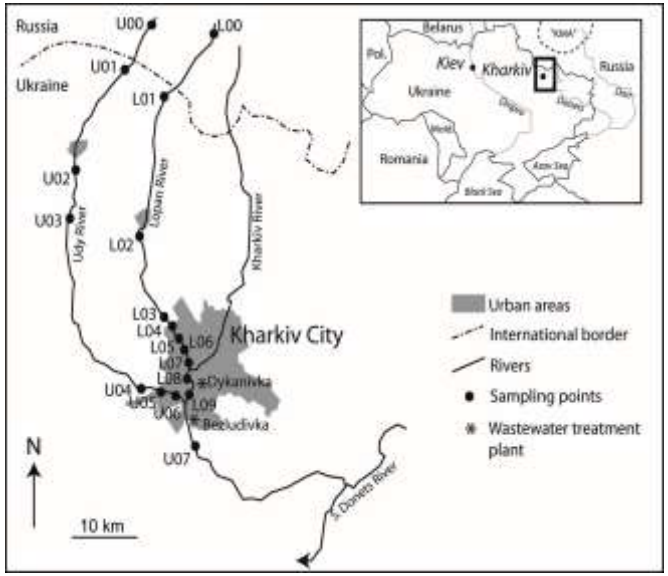
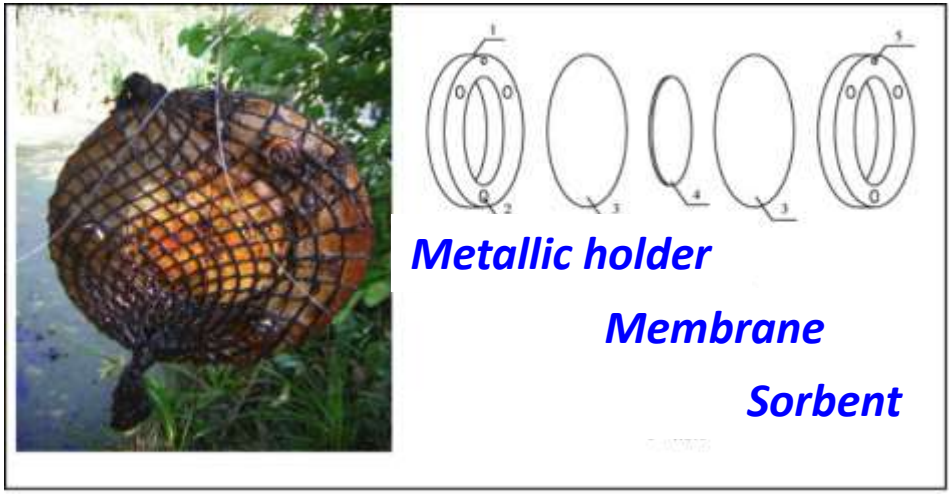
Stockholm

Study area and method



(a) Installation (duplex)



Climate: continental
Population: c.a. 3,000,000 inh
Precipitation: c.a.500mm/year
2 WWTP (c.a. 1,000,000 m^3/d)
Mean annual temperature: 6.9 ^{0}C

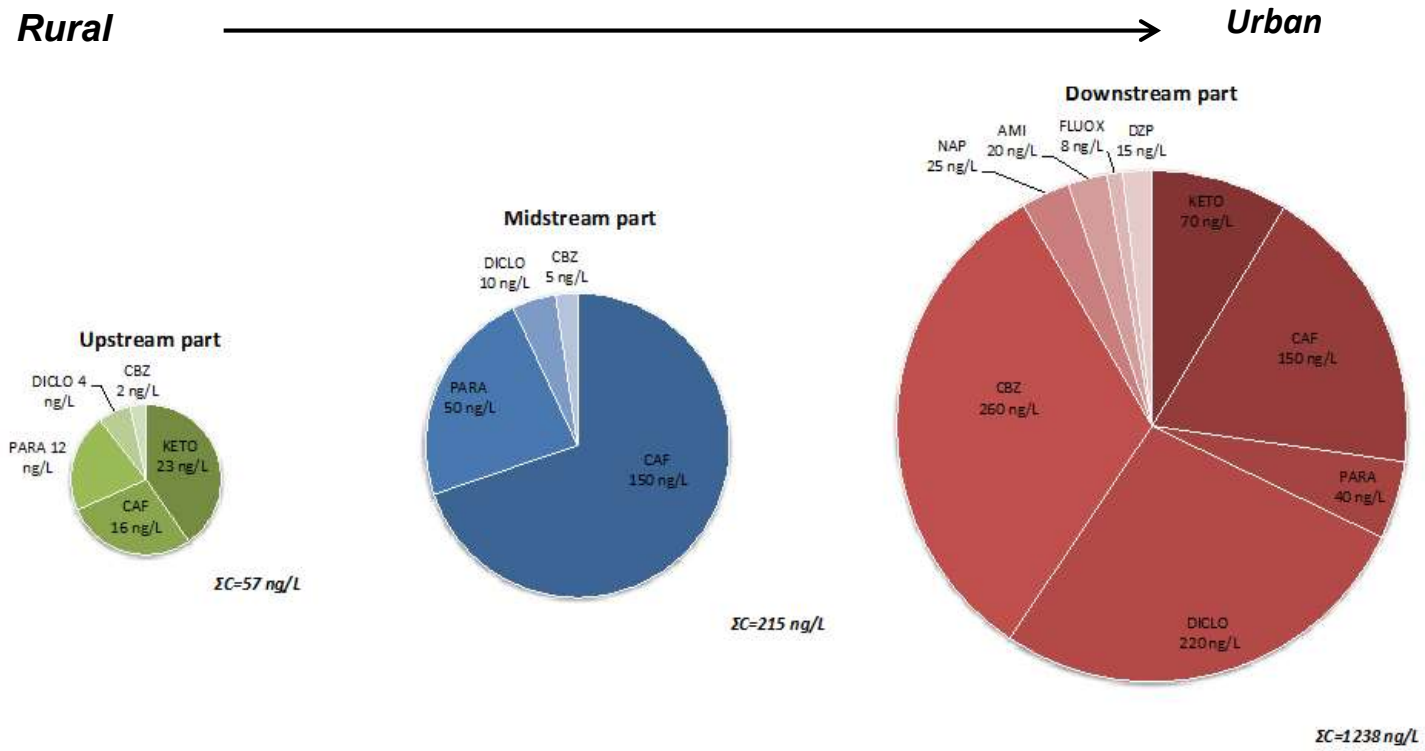
(b) Retrieval and extraction

(c) LC-MS-MS ESI+/-

(d) Data quality control

Field and laboratorial blanks
Spike and recovery rates
Gravimetric control
Detection limits

Distribution of pharmaceuticals

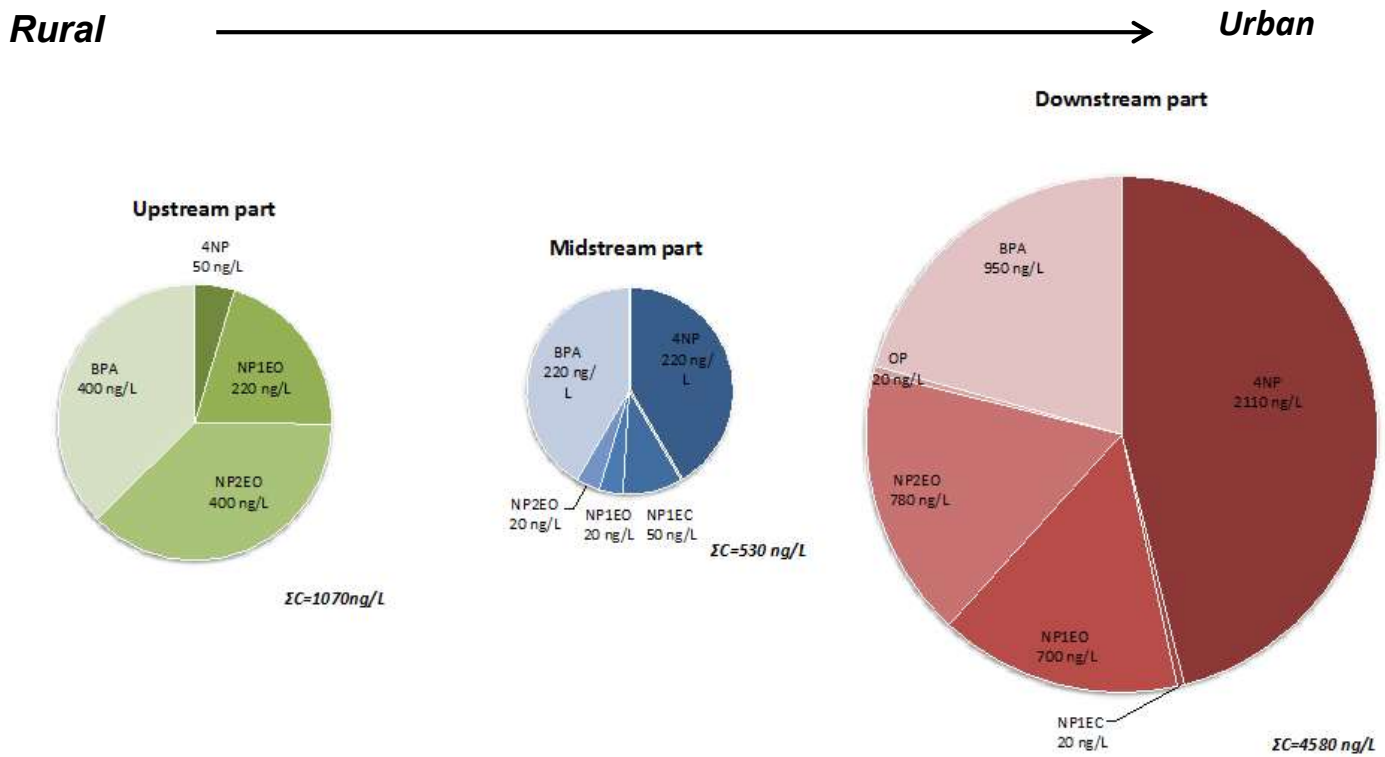


CBZ – carbamazepine, DICLO – diclofenac, KETO – ketoprofen, PARA – paracetamol, CAF – caffeine, NAP – naproxen, FLUOX – fluoxetine, AMI – amitriptyline, DZP – diazepam

Rural area: not prescribed pharmaceuticals (caffeine and paracetamol) dominate, where wastewaters are discharged without any treatment and where these compounds can enter with run off from septic tanks and farms.

Urban area: prescribed pharmaceuticals (carbamazepine, diclofenac, fluoxetine) dominate and fewer amounts of not prescribed compounds (caffeine, paracetamol) are find downstream of wastewater treatment facilities; significant amount of emerging pollutants is found in the city centre, what indicates that urban run-off does not undergo appropriate treatment and becomes a water contamination source

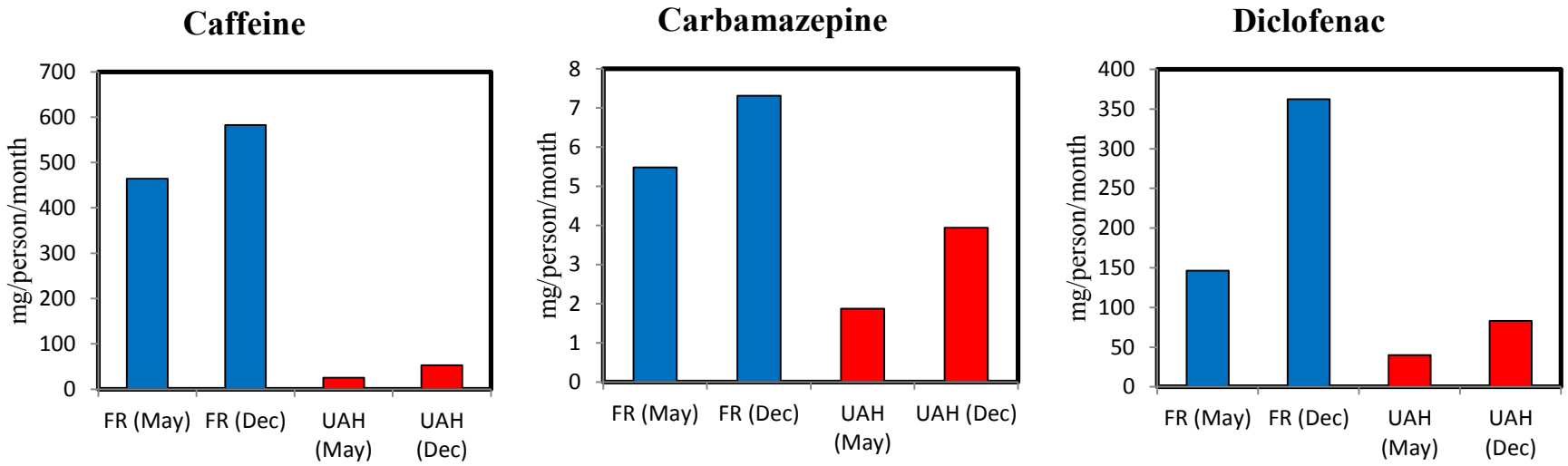
Distribution of phenolic endocrine disruptors



4OP - 4-tert-octylphenol, 4NP - 4-n-nonylphenol, NP1EC - nonylphenol-ethoxy acetic acid, NP1EO and NP2EO - nonylphenol monoethoxylate and diethoxylate respectively, BPA - bisphenol A.

Phenolic endocrine disruptors were detected mainly downstream of wastewater effluents.
Presence of these endocrine disruptors indicate that the municipal wastewater treatment plant is not efficient to eliminate it
4NP was at 7 times higher than the value recommended by EC

Consumption patterns: pharmaceuticals



$$M_c = (Q_w \times C_w - Q_u \times C_w) / (K_1 (1-K_2))$$

Pharmaceuticals	Fact (France, 2006) g/person/year	Calculated (France, 2009) g/person/year
Carbamazepine	0.3	0.1
Diclofenac	4.3	0.3

Vystavna et al. 2012 WASP,
Vystavna et al. 2013 EMAS

Constructed wetlands for emerging pollutants treatment

Treatment efficiency on constructed wetlands

20 – 50%	50 – 70%	More than 70%
Carbamazepine Ibuprofen Sucralose Gemfibrozil Diclofenac	Androstenedione Paracetamol Estrone	Caffeine Naproxen Triclosan

Some pharmaceuticals are more efficiently removed than on conventional WWTP
Lower construction and treatment costs than compared to WWTP
Removal can exhibit seasonal patterns

Conclusions and acknowledgements

- Passive sampling technique is a convenient tool for screening of emerging contaminants in ungauged streams
- Emerging pollutants can be indicators of diverse wastewater sources
- Presence of pharmaceuticals and phenolic endocrine disruptors in urban streams reflects its regional consumption patterns
- Constructed wetlands can be an efficient technique for the elimination of emerging pollutants from rural wastewaters

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