



Screening of PAHS Concentrations in Traditionally Smoked Freshwater Fish Products from Tonle Sap in Cambodia

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Introduction

- fish and fish products = major source of **protein income** for Cambodians
 - animal protein from fish meat is 18.3 kg per year and person, what is around 80% of total animal protein income (FAO, 2011; Hortle, 2007)
- lack of access to electricity
 - affecting 66 % of the population in Cambodia (The World Bank, 2014)
- very short peak period of fish being caught – necessity to process fish quickly and in a basic way (Eong & Hariono, 2003; FAO, 2011)
- smoking = one of the oldest preservation methods, still widely used (Stolyhwo & Sikorski, 2005)

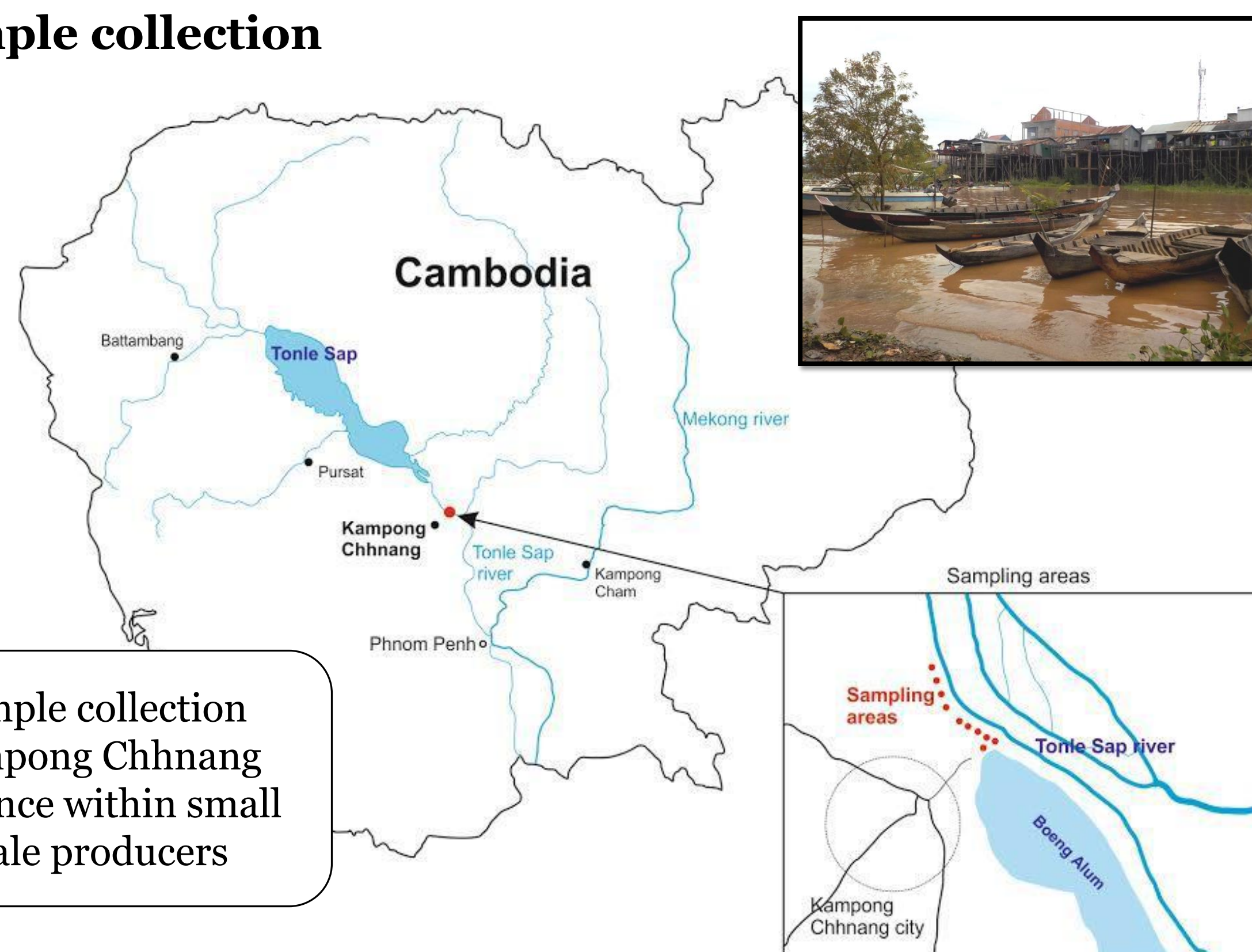
Objectives

Traditional techniques of smoked fish production in Cambodia had not been fully investigated, thus aim of the work were:

- to monitor traditional technique of smoking fish in Cambodian rural areas
- to evaluate amounts of carcinogenic compounds in the smoked fish products in Cambodia



Sample collection



Sample collection
Kampong Chhnang
province within small
scale producers

Visiting
smokehouses a rural
areas
August – October
2016

Collect 23 samples of
9 fish species from
10 producers

Approximately 100g
per sample placed in
plastic bags and
vacuum packed

Stored frozen -20°C
and transported to
CULS in Prague, CZ



Fish name

*Henicorhynchus
caudimaculatus*

*Phalacrotonotus
bleekeri*

*Kryptopterus
hexapterus*

*Belodontichthys
truncatus*

Thynnichthys

thynnoides

Osteochilus lini

Ompok bimaculatus

Paralaubuca typus

Number of samples per species

3

5

3

3

3

3

1

2

Sample evaluation



extraction of completely homogenized
samples by Soxtec apparatus

pre-cleaning (from lipids) by gel permeable
chromatography (GPC)

analytes were evaluated by high
performance liquid chromatography with
fluorescence detector (HPLC-FD)
Waters PAH C18 (250 x 2.1 mm)

- Identification of PAHs was based on comparison of retention times with standards
- quantification was performed by the method of external standards

- Results → in $\mu\text{g.kg}^{-1}$ of sample. Sum PAHs (PAHs4) was calculated as total of concentration of benzo[a]pyrene, chrysene, benzo[a]anthracene and benzo[b]fluoranthene according to the Appendix of Commission Regulation (EC) No 1881/2006

Conclusions

- Results showed that smoked fish represents important source of nutrients for Cambodian population but can lead to excessive intake of PAHs which can lead to higher risk of carcinogenic disease development as well as other PAHs related diseases.
- To decrease this risk, local population should be educated in use of better smoking techniques and improvement smoking kilns or at least change of smoking parameters which could lead to safer fish products.

References

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- Stolyhwo A, Sikorski ZE. 2005. Polycyclic aromatic hydrocarbons in smoked fish—a critical review. Food Chemistry 91(2): 303-311.
- The World Bank. 2014. Access to electricity (% of population). Available at <http://data.worldbank.org/>: Accessed 2016-11-16.

Results

- In general, the amount of the four priority PAHs in all samples highly exceeded maximum limits (ML) given by EC 1881/2006.
- Maximum limits for a $\Sigma 4$ PAHs and BaP were exceeded **2 times**
- Maximum limit for a $\Sigma 4$ PAHs was exceeded **50 times** and BaP was exceeded **60 times**

Determined values ($\mu\text{g.kg}^{-1}$) of four priority PAH.

Sample No.	Producer	Fish scientific name	benzo[a]anthracene*	chrysene	benzo[b]fluoranthene	benzo[a]pyrene	Σ PAH 4
1	3	Micronema bleekeri	13.65	23.85	3.84	6.13	47.47
13	2	Belodontichthys truncatus	5.22	21.57	6.64	8.66	42.09
14	3	Belodontichthys truncatus	17.29	27.36	3.98	8.01	56.64
23	5	Paralaubuca typus	204.06	242.62	31.62	119.45	597.75
		median	73.4	113.95	11.04	53.85	200.61
		average \pm SD	75.91 \pm 60.59	108.84 \pm 67.89	13.55 \pm 9.09	54.69 \pm 36.26	252.98 \pm 167.67

- Highest mean concentration was measured at sample of *Paralaubuca typus* from producer number 5 who reported longest time of smoking which is considerable higher than usually reported times (2-12 hours in DC).

- The type of the wood used for the smoking can also significantly influence PAH content in fish. In general soft wood is not recommended due to its high resin and lignin content.

- Other factors affecting PAHs content in final fish product are fish fat content, temperature of fire and smoke and distance of the product from fire. However it is necessary to mention that during this field research the fat content and temperature wasn't measured and the proximity was mentioned before.

Fish producer	Time of smoking	Fish rotation frequency	Fuel used for smoking
1	5 - 10 hours	N/A	Kreak (unspecified mixture of woods); fuelwood: Trosek (Peltophorum dasyrrhachis)
2	1 - 2 days	every 1 hour	Kreak (unspecified mixture of woods); fuelwood: Trosek (Peltophorum dasyrrhachis)
5	5 - 6 days	every 1.5 hour	Kreak (unspecified mixture of woods); fuelwood: Deam reang (Barringtonia acutangula)
6	2 - 3 days	every 1 hour	Kreak (unspecified mixture of woods); fuelwood: Deam reang (Barringtonia acutangula)

- This maximum mean concentration of 597.75 $\mu\text{g.kg}^{-1}$ for $\Sigma 4$ PAHs and 204.06 $\mu\text{g.kg}^{-1}$ for BaP was recorded for *Paralaubuca typus* sample smoked for 5 - 6 days on mixed fire wood and *Barringtonia acutangula*.