Contaminants in the invasive Chinese Mitten Crab: a risk for human consumption?

Stefan van Leeuwen[1], Michiel Kotterman[2], Martijn van der Lee[1] and Ron Hoogenboom[1]

[1] RIKILT Wageningen UR, [2] IMARES Wageningen UR

Background

Chinese mitten crab (*Eriocheir Sinensis*) is a brackish water crab that invaded north-west European waters since the late 1800s, and since then settled successfully. Since the 2000s, fishermen started commercial fishery on mitten crabs in The Netherlands. Clark *et al*. (2009) found high dioxin and PCB levels in crab from the UK and the Netherlands. Based on these and own findings, the main rivers Meuse and Rhine and their sedimentation areas were closed for mitten crab fisheries. Chinese consumers consider the crabs a delicacy and may consume several crabs per meal. However, the high pollutant levels found in these crabs raise the question: are they a risk for human consumption?

Objective

The aim of this study is to determine:
- the levels of PCBs and dioxins and heavy metals in crab;
- the distribution over the brown meat (body) and the white meat (legs and claws);
- the pollution level in relation to the area where they were caught;
- if consumption of these crabs may pose a risk to the consumer.

Methods

- Crabs from the closed areas being the main rivers (Meuse, Rhine) and river delta (Hollands Diep) were caught with fykes.
- In addition crabs from open areas (i.e. not closed for fisheries) such as IJsselmeer were caught.
- Pooled samples of 25 individuals were prepared, and in some cases individual crabs were analysed.
- Crabs were dissected and the (brown) meat from the body was collected. Similarly, white meat (muscle) from claws and legs was collected.
- Dioxins, PCBs, lipid content and heavy metals were determined in these samples.

Results
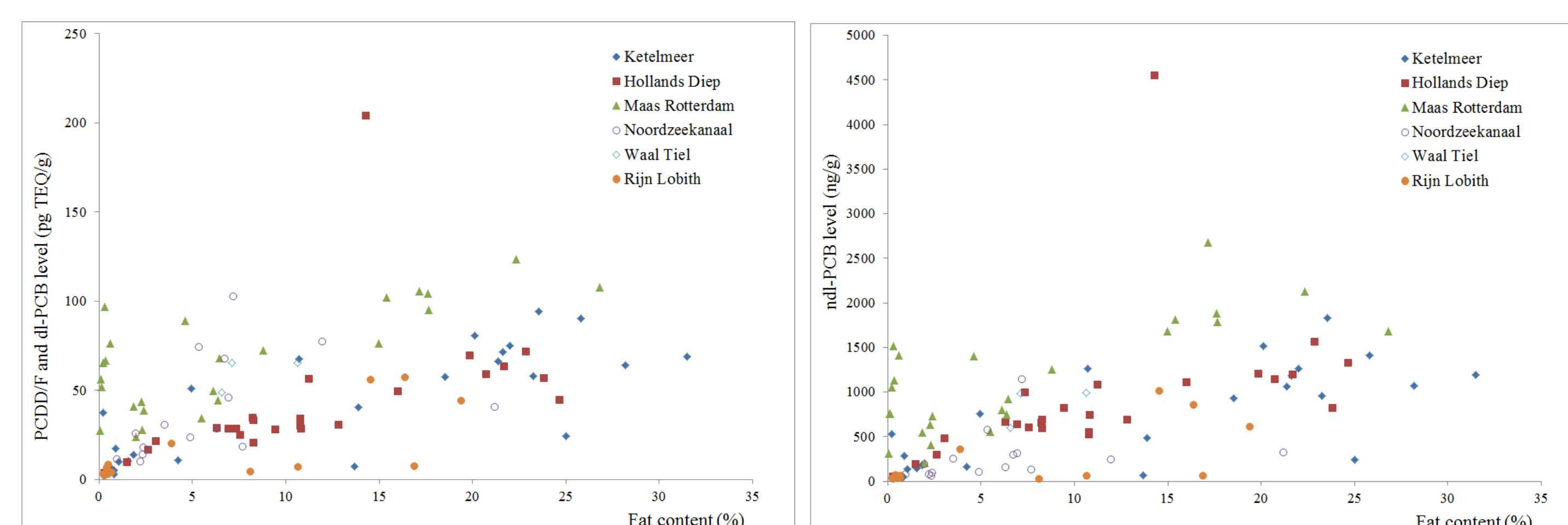
Figure 1. Levels of the sum of PCDD/Fs and dl-PCBs in pg TEQ/g brown meat (ww) (A) and ndl-PCBs in ng/g brown meat (ww) (B) in 107 individually analyzed mitten crabs from 6 locations in closed fishing areas, as compared to the fat content.

Results

Figure 2. Levels of PCDD/Fs and dl-PCBs in pg TEQ/g in pooled samples from Dutch locations. Lijf = levels in meat from the body (called 'brown meat") and Append* = levels in meat from the appendages (mucle meat from the legs and claws).

Figure 3. Steamed crab, ready for consumption, with the top of the carapace removed and turned upside down.

Figure 4. Weights of claws, legs (appendages) and the main body (carapace) of male crabs.
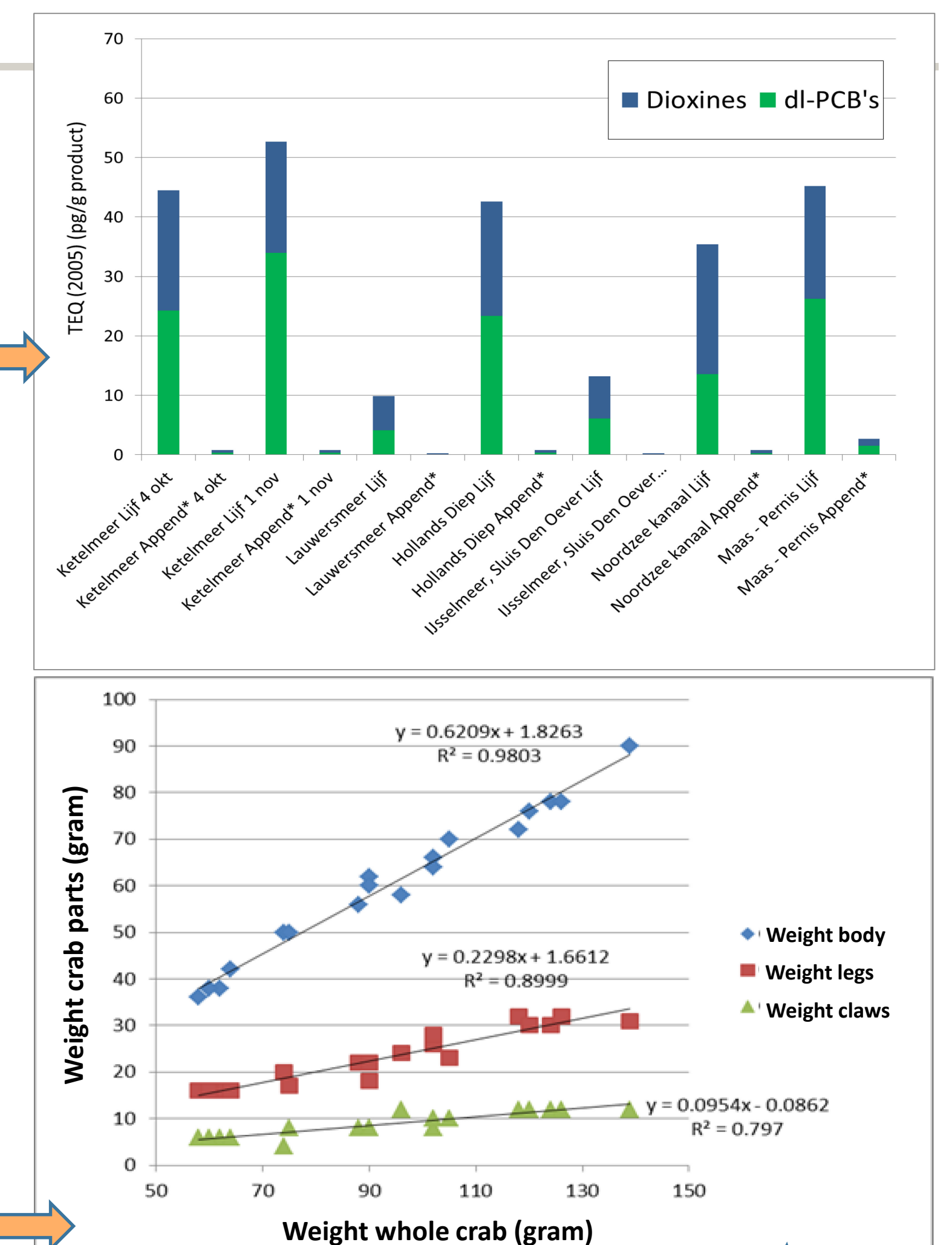
A risk for human consumption?

- The RIKILT-RIVM front office food safety has estimated the risk of consumption of Chinese mitten crabs, based of the following:
- ✓ Polluted crabs of the closed area are considered
- ✓ The average contamination level is 29 pg TEQ/g edible tissue
- ✓ Consumption of 50 gram crab tissue per month
- ✓ A crab of 100 gram provides approx. 16 gram edible brown meat and 8 gram white meat
- ✓ Exposure is compared to the provisional tolerable monthly intake (PTMI) of 70 pg TEQ/kg bw.
- Based on this, **the exposure of crabs from the closed areas results in exceedance of the PTMI, particularly for consumers that already have a high background exposure (fish consumers).**

There is!

Conclusions

- The brown meat of mitten crabs can be heavily polluted with dioxins and PCBs, particularly in the most polluted areas (main rivers and sedimentation areas)
- Consumption of crabs from polluted areas leads to elevated exposure to dioxins and PCBs
- Consumers with already a higher background exposure exceed the PTMI level

References

Clark *et al*. (2007) Dioxin and PCB Contamination in Chinese Mitten Crabs: Human Consumption as a Control Mechanism for an Invasive Species. Environ. Sci. Technol. 2009, 43, 1624–1629

Acknowledgements