



Bioconcentration of cationic surfactants in fish

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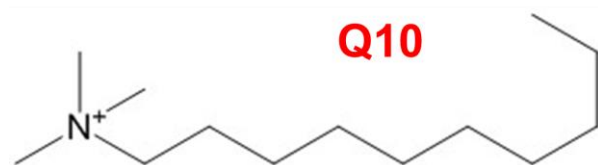
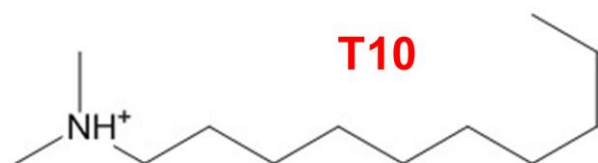
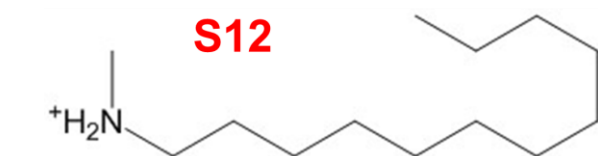
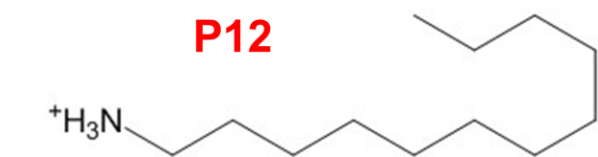
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Background

- Cationic surfactants are an important class of chemicals released to the environment
- Sorb strongly to membranes, increasing likelihood of strong bioaccumulation
- Sorb strongly to many other surfaces too, making BCF measurements difficult
- Dearth of BCF measurements
- Measured here for model evaluation

Test chemicals: alkyl amines and quaternary ammonium cations



MIX 1

P9	T10	P12	T13	Q14	P16
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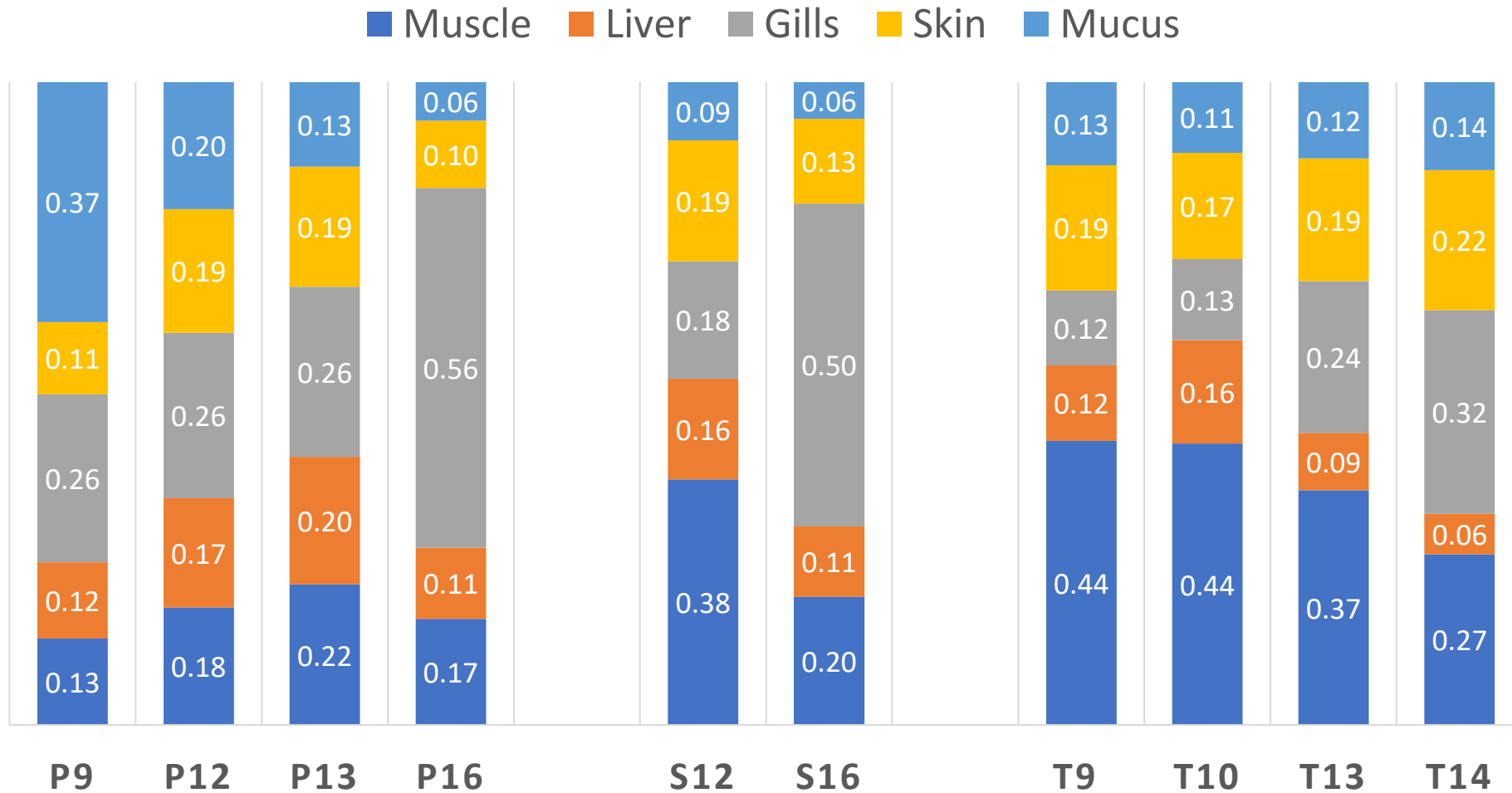
MIX 2

T9	Q10	S12	P13	T14	S16
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Tissue distribution experiment

- To explore the extent of analyte sorption to the outer surfaces of the fish
- 6 rainbow trout (~130 g) were exposed to MIX1 and MIX2
- Sacrificed after 1 week of exposure
- Muscle, liver, gills, skin, and mucous (methanol rinse of skin) analysed

Tissue distribution of test chemicals in rainbow trout



BCF experiment, environmental conditions

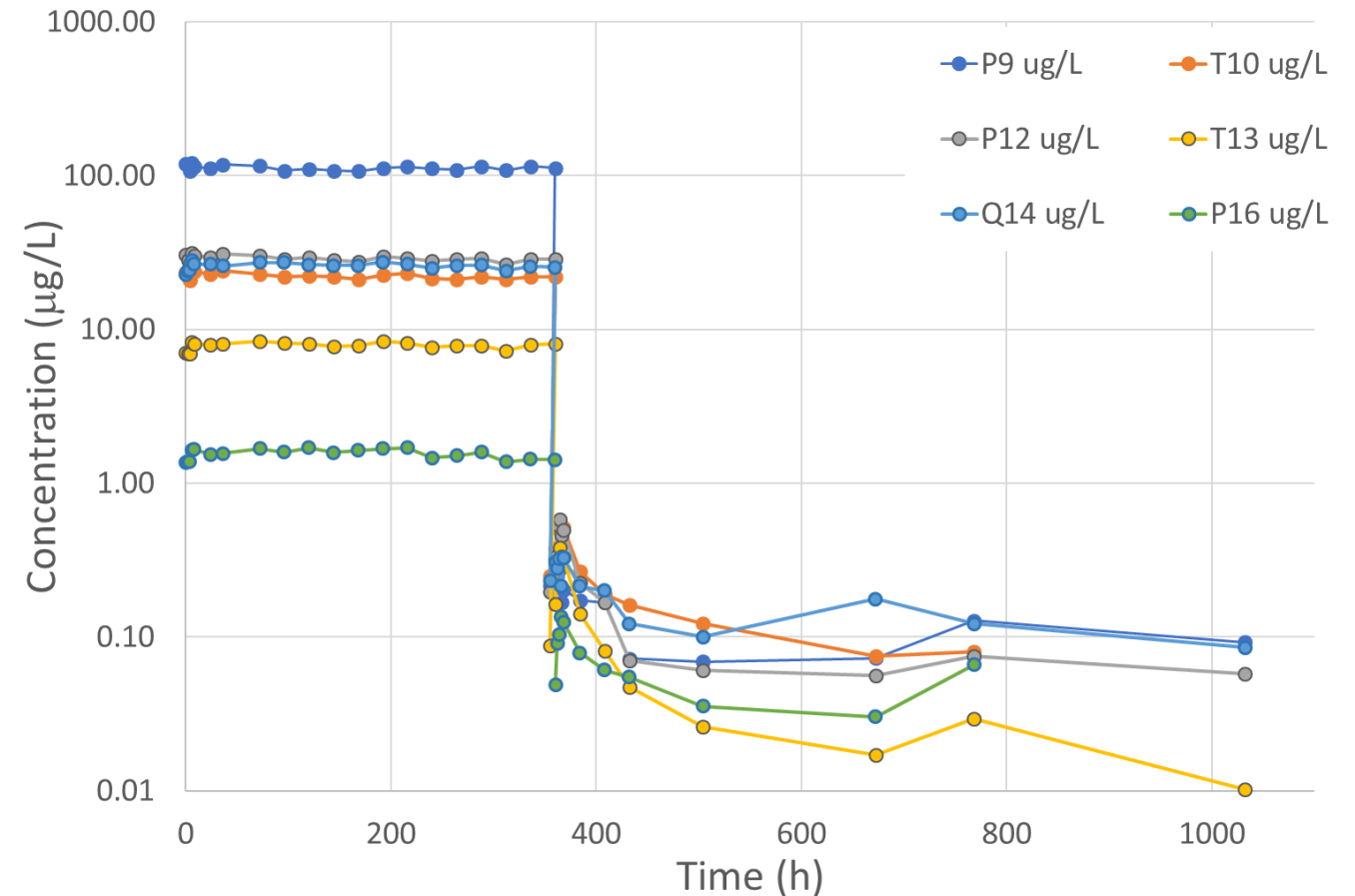


- Flow-through fiberglass aquaria
- Water residence time 4 h
- Water filters changed daily
- Feces siphoned off daily (kept TOC to $\sim 5 \text{ mg C L}^{-1}$)
- Test chemicals delivered in methanol with syringe pump



MIX1 pH: Concentrations in Water

- Water sampled directly into autosampler vial
- Analysis by direct injection



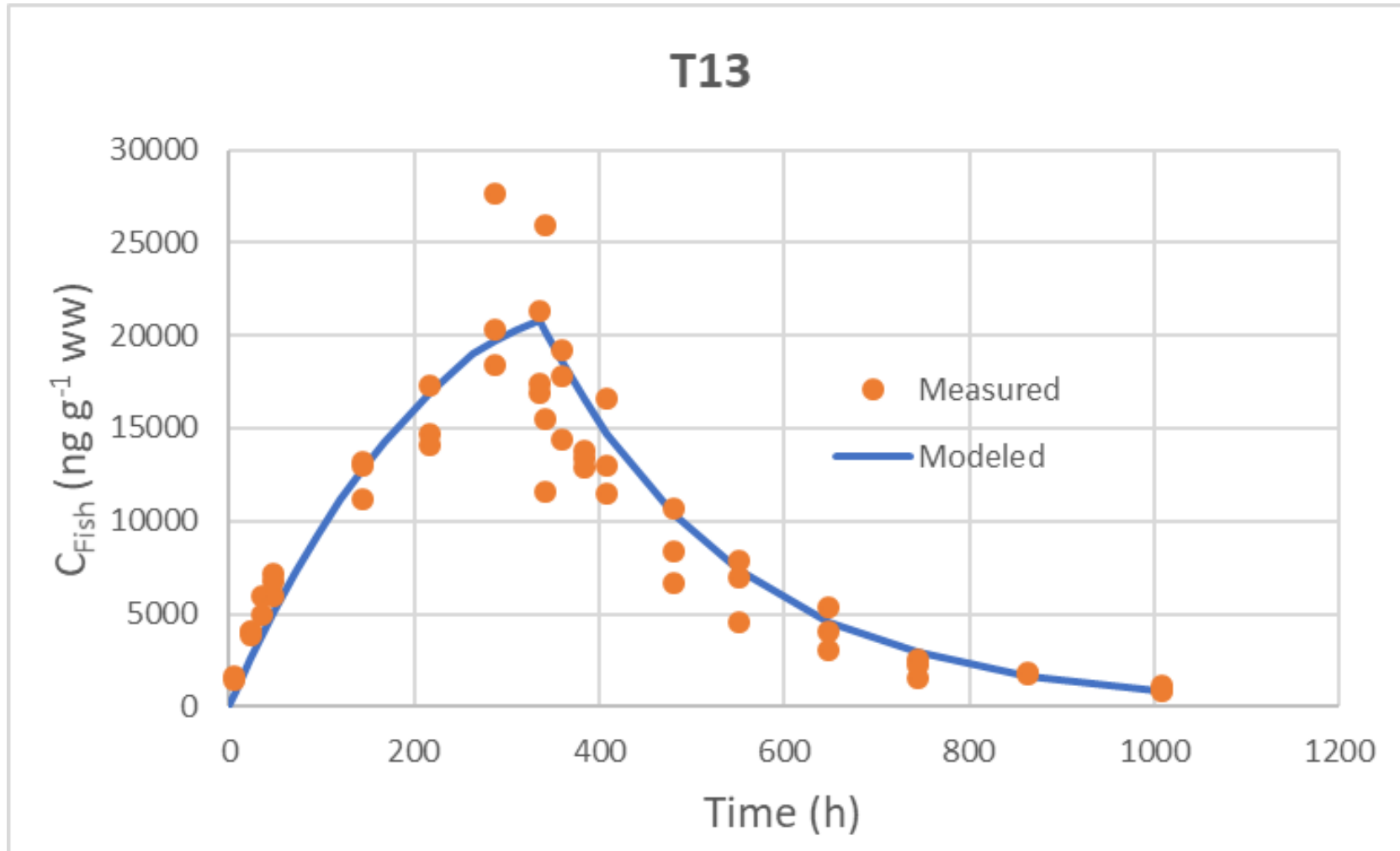
Fish exposure



- 3 experiments:
 - a) MIX 1, pH 7.8
 - b) MIX 2, pH 7.8
 - c) MIX 1, pH 6.3
- Exposure phase 14 d, 8 sampling points
- Depuration phase 28 d, 10-12 sampling points
- 3 fish per sampling point
- Juvenile rainbow trout
- Feeding 1% of body weight per day

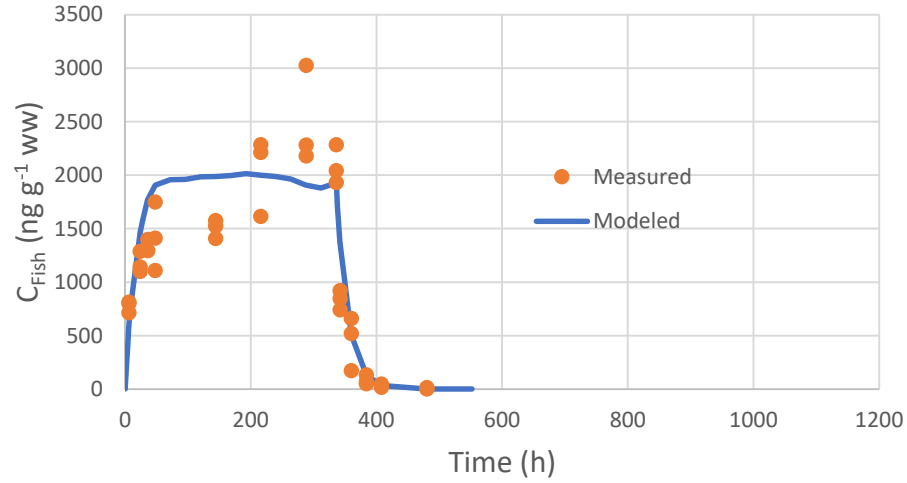
Kinetics in fish

(1 compartment model)

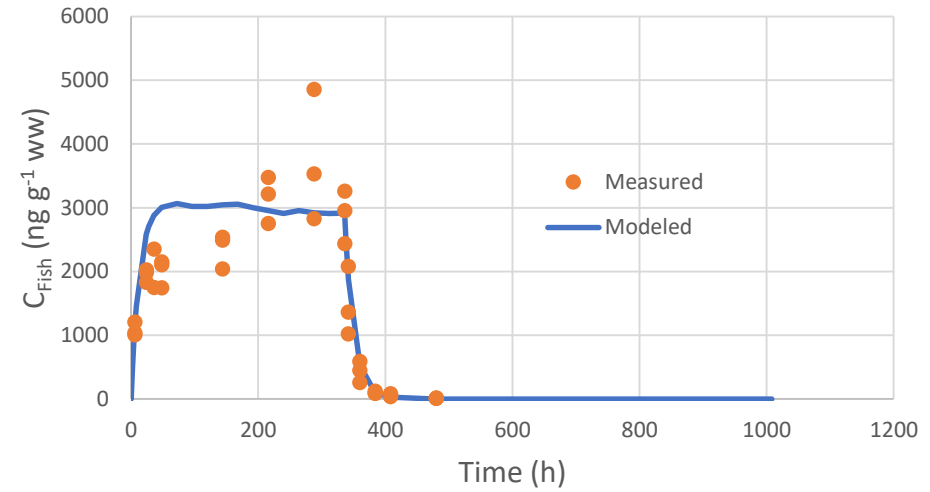


Tertiary amines, pH 7.8

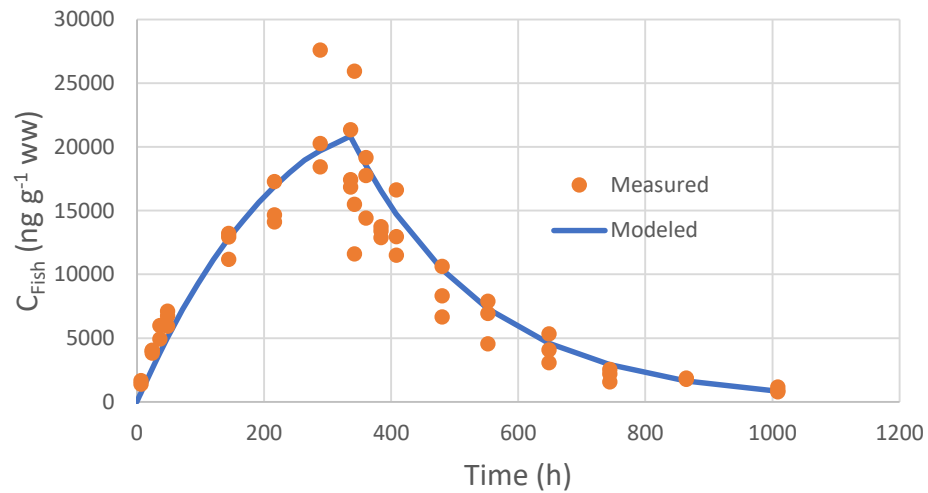
T9



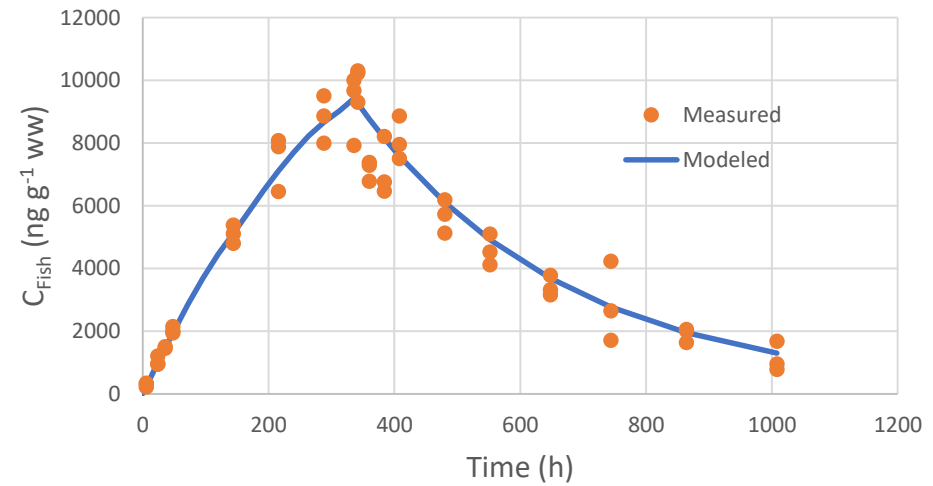
T10



T13

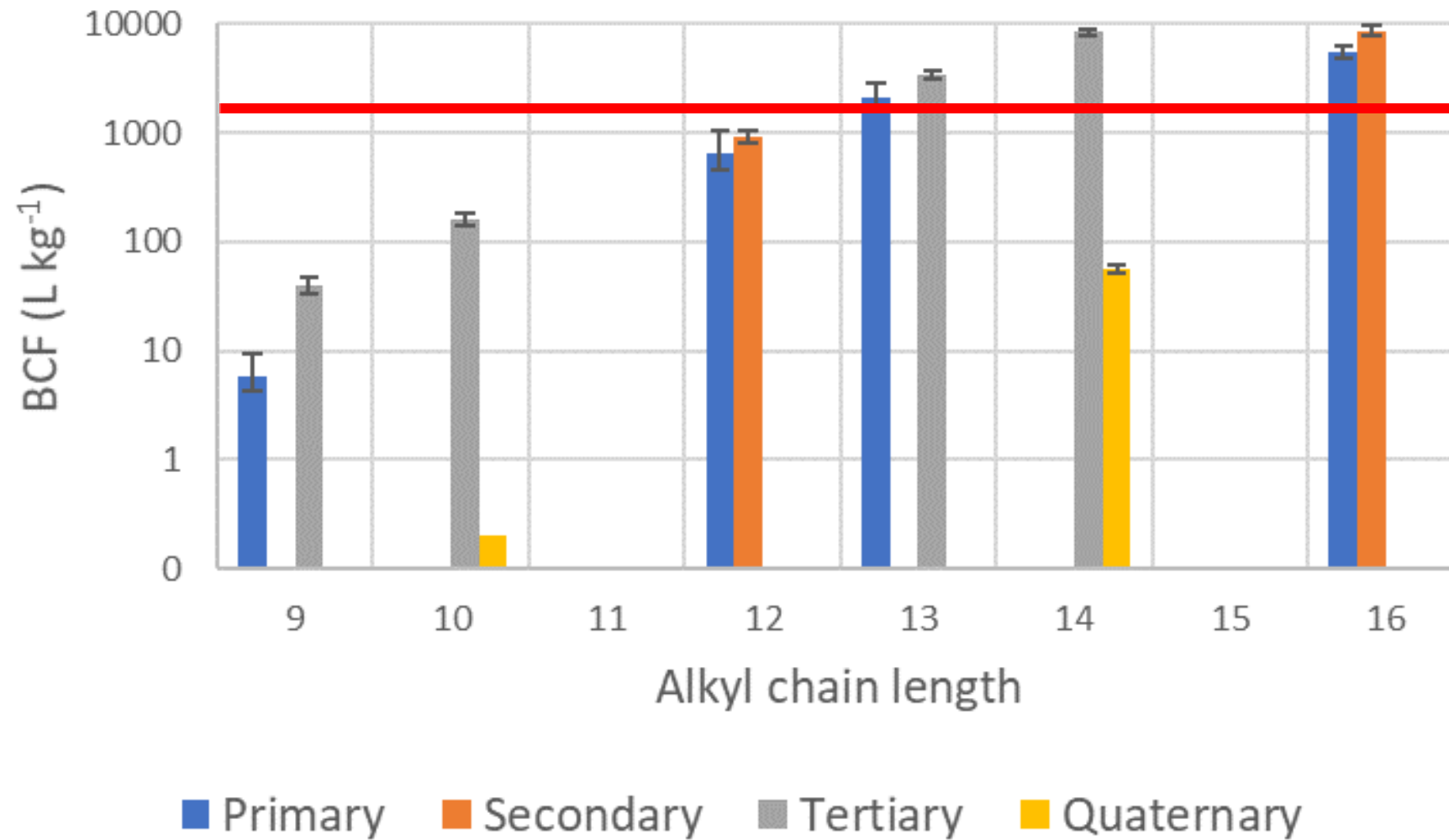


T14

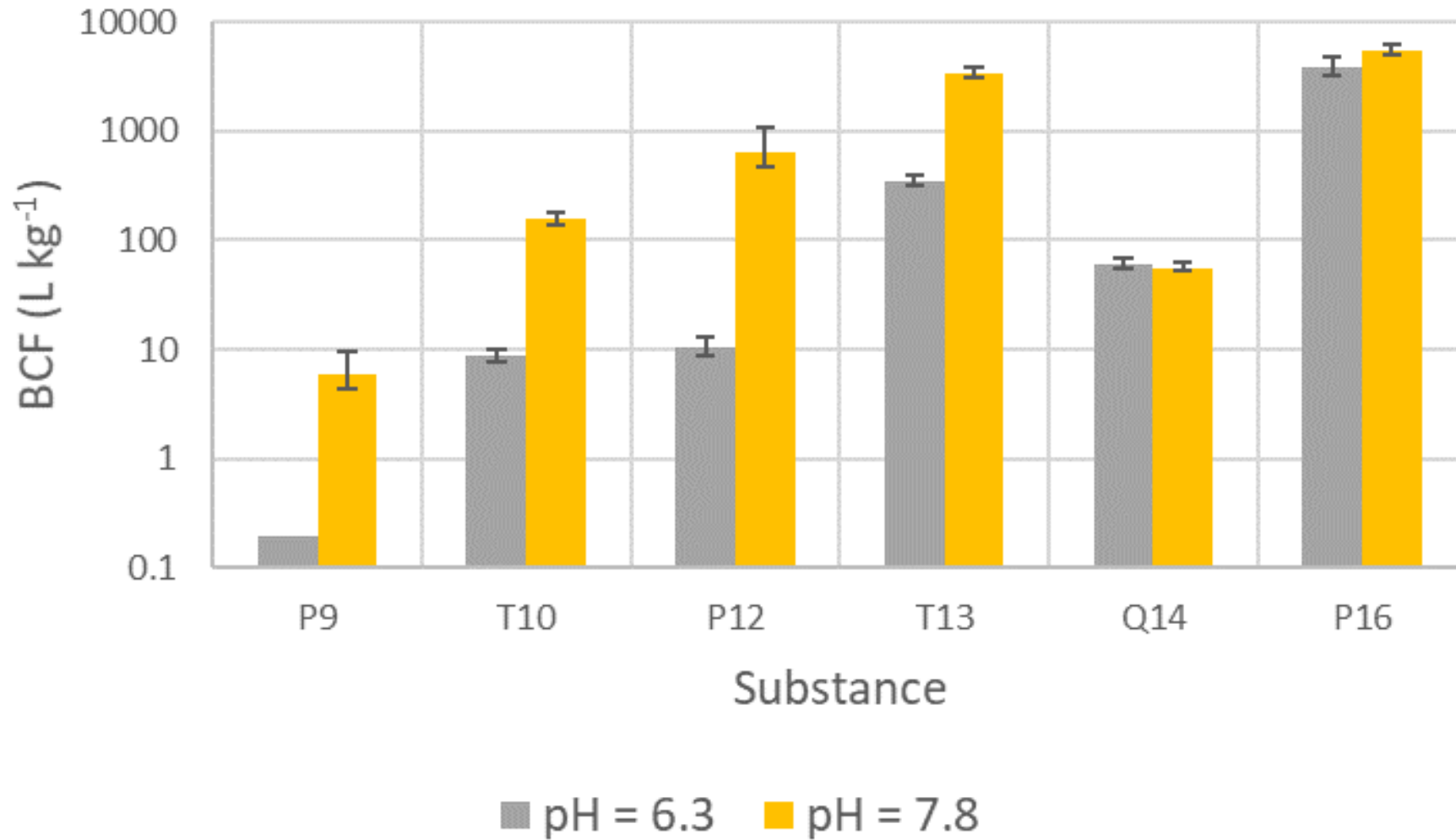


BCF

(pH = 7.8)



BCF as a function of pH



Further interpretation

- Mechanistic understanding, as a function of e.g.
 - pKa (acid dissociation constant)
 - K_{MW} (membrane water partition coefficient)
 - k_B (biotransformation rate constant)
- Data will be used to evaluate the mechanistic model
BIONIC

Conclusions

- BCF of alkylamines increases with chain length and with pH
- BCF of quaternary ammonium compounds low, independent of pH
- Both k_1 and k_2 contribute to variability in BCF for alkylamines
- Sorption to rapidly cleared tissues plays a small role in bioconcentration of the alkylamines

Acknowledgements

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