

OPTIMIZING DETERMINATION METHODS FOR CHLORINATED PARAFFINS (CPs) TO EVALUATE THEIR LEVELS IN AUSTRALIA

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OBJECTIVE & AIMS

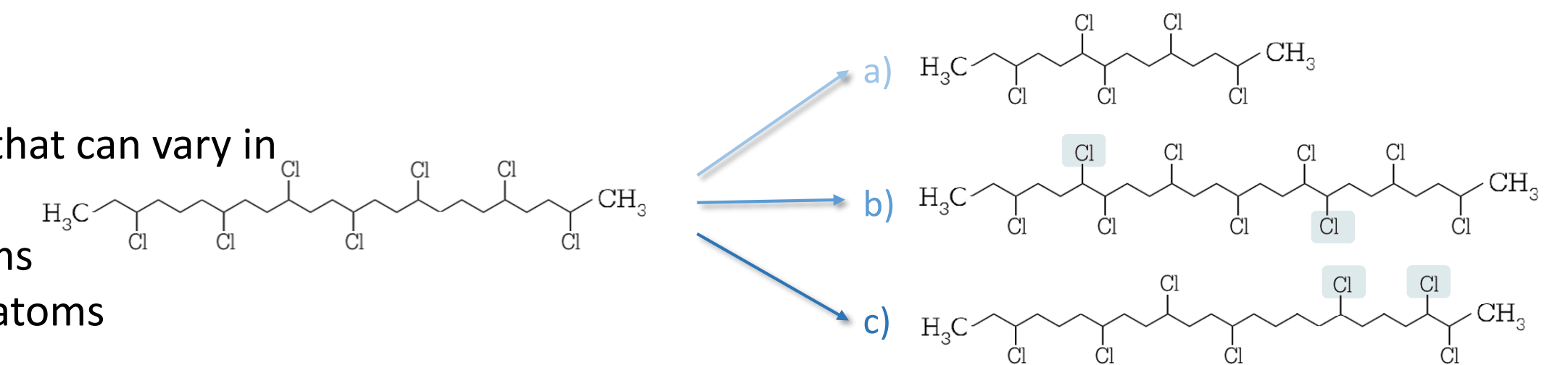
ADVANCE CAPABILITIES OF CP DETERMINATION IN ORDER TO ALLOW A FIRST EVALUATION OF THEIR LEVELS IN AUSTRALIA

- AIM 1:** Update on current knowledge on CPs & current state of CP analysis, by conducting literature reviews & organising interlaboratory studies
- AIM 2:** Optimising CP analysis, by developing/adapting and evaluating three different methods to identify the most suitable one
- AIM 3:** Provide information on their environmental occurrence (Australia), covering different matrices with potentially an increasing complexity: sewage sludge, ambient air and human serum samples

KEY RESULTS

WHAT ARE CPs?

Polychlorinated *n*-alkanes that can vary in
a) of carbon chain length
b) number of chlorine atoms
c) position of the chlorine atoms
Resulting >10,000 isomers



By convention categorized into three groups, based on their carbon chain length.

- Key properties
- Chemical stable
- Flame retardant & resistant to degradation
- Oily-waxy, water repellent & semi volatile

C10-13: Short-chain CPs (SCCPs)
C14-17: Medium-chain CPs (MCCPs)
C>18: Long-chain CPs (LCCPs)

KEY RESULTS (CONTINUED)

WHAT ARE CPs USED FOR?



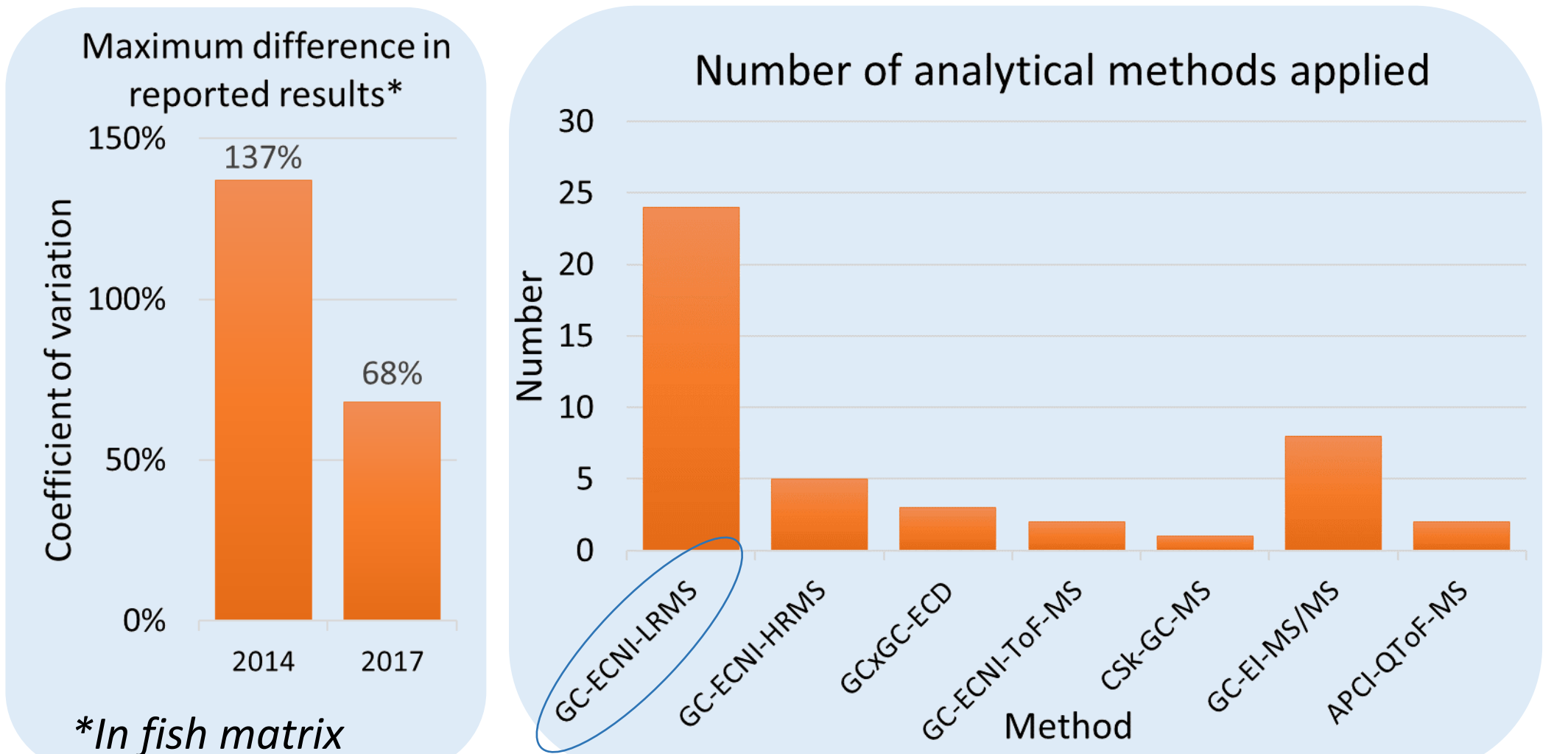
- Flame retardants and strengtheners in plastic such as PVC products and rubber
- Lubricants in sealants and industrial paints
- Fat liquoring of leather
- Coolants and lubricants in metal working fluids

WHAT DO WE KNOW ABOUT CPs?

	SCCPs	MCCPs	LCCPs
High production volumes	China 2013: > 1 million metric tonnes		
Widespread occurrence			
Potential hazard	P	P	P
Persistent (P)	B	B?	B?
Bioaccumulating (B)	T	T	T?
Toxic (T)			

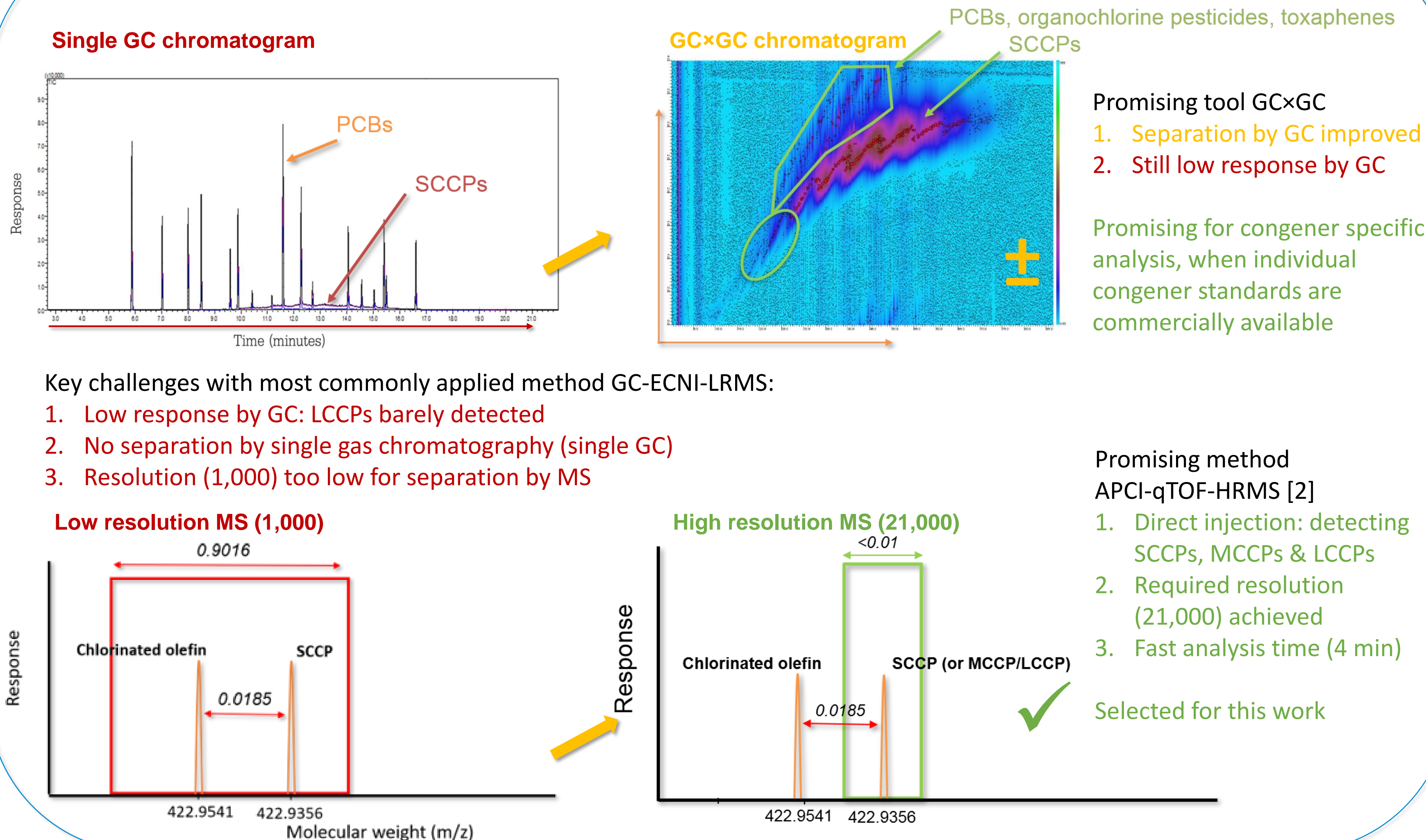
- China identified as world's largest CP producing country
- SCCPs thus far received the greatest attention
- MCCPs show similar characteristics as SCCPs although data still insufficient for classification
- Data on LCCPs particular scarce

CURRENT STATE OF ANALYSIS



- Analysis focused on SCCPs
- Reported concentration level for (SC)CPs
 - x Congener (2,5,6,9-Tetrachlorodecane) not yet possible
 - (✓) Congener group (C₁₀H₁₈Cl₄) possible for SCCPs [1]
 - ✓ CP group (ΣSCCPs) most commonly reported
- Interlaboratory study rounds (n = 4)
 - Only ca. 11 laboratories per round
 - In total >7 different methods applied
 - Reported results between laboratories vary greatly (although improving)
 - GC-ECNI-LRMS most commonly applied method

EVALUATION OF METHODS



Key challenges with most commonly applied method GC-ECNI-LRMS:

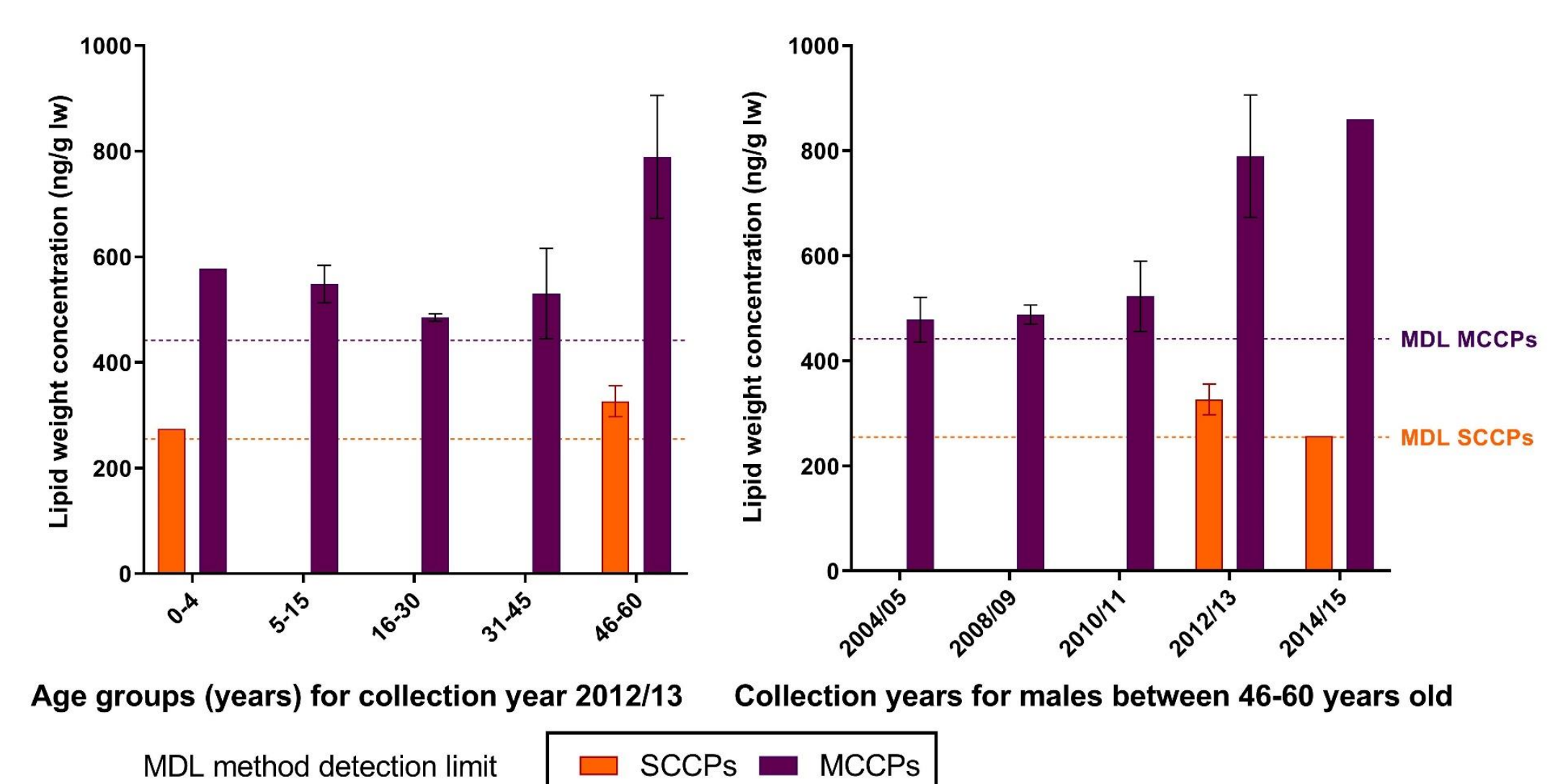
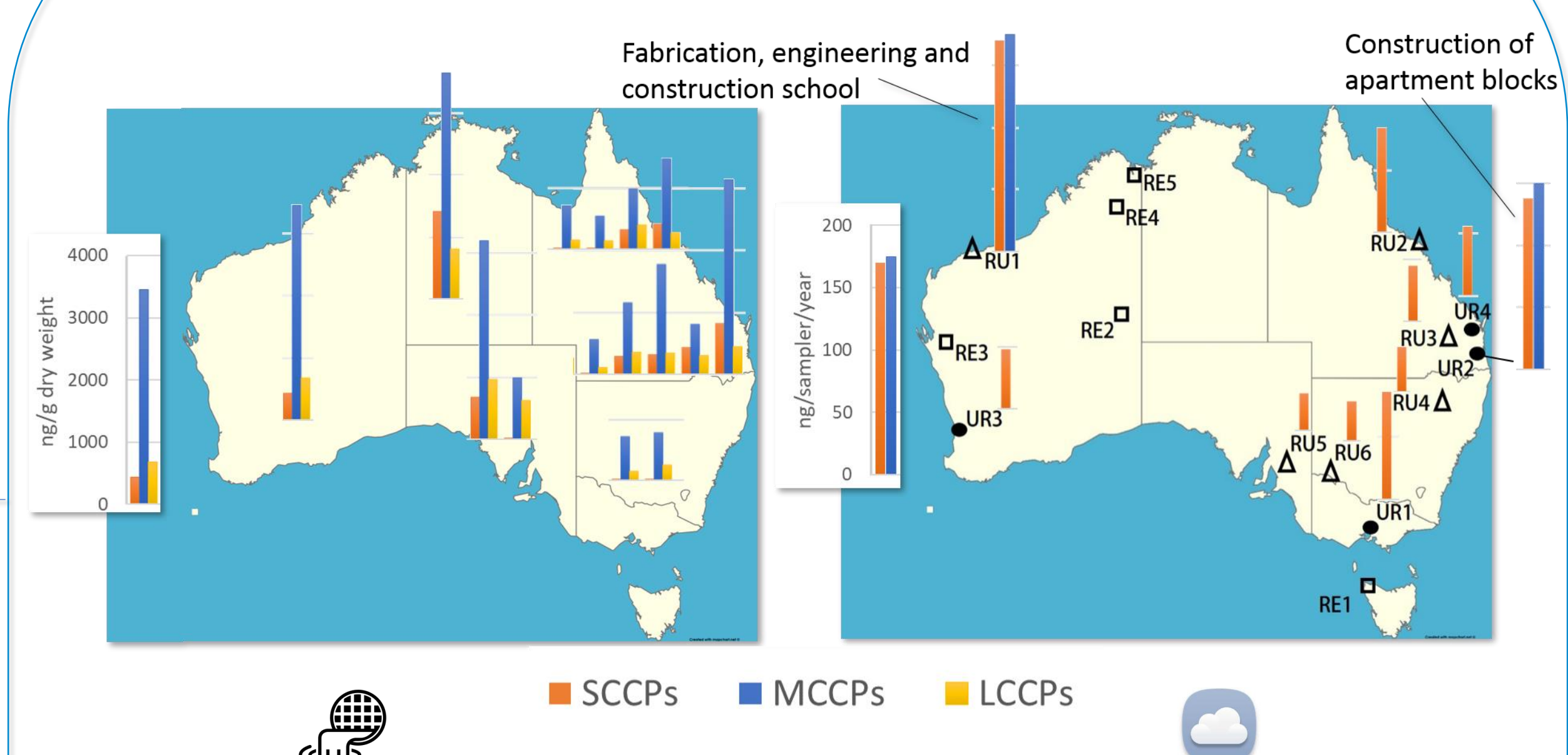
- Low response by GC: LCCPs barely detected
- No separation by single gas chromatography (single GC)
- Resolution (1,000) too low for separation by MS

Promising method APCI-qTOF-HRMS [2]

- Direct injection: detecting SCCPs, MCCPs & LCCPs
- Required resolution (21,000) achieved
- Fast analysis time (4 min)

Selected for this work

CP OCCURRENCE IN AUSTRALIA



MAIN CONCLUSIONS

- CPs high production volume chemicals & potential hazard
- Many indoor applications
- More assessments needed, especially for longer chain CPs
- Analysis is still challenging but tools out there to improve analysis
- APCI-qTOF-HRMS is a promising method
- GC-ECNI-LRMS not recommended
- CPs present in Australia
- MCCPs dominated
- More assessments needed whether actions are required

