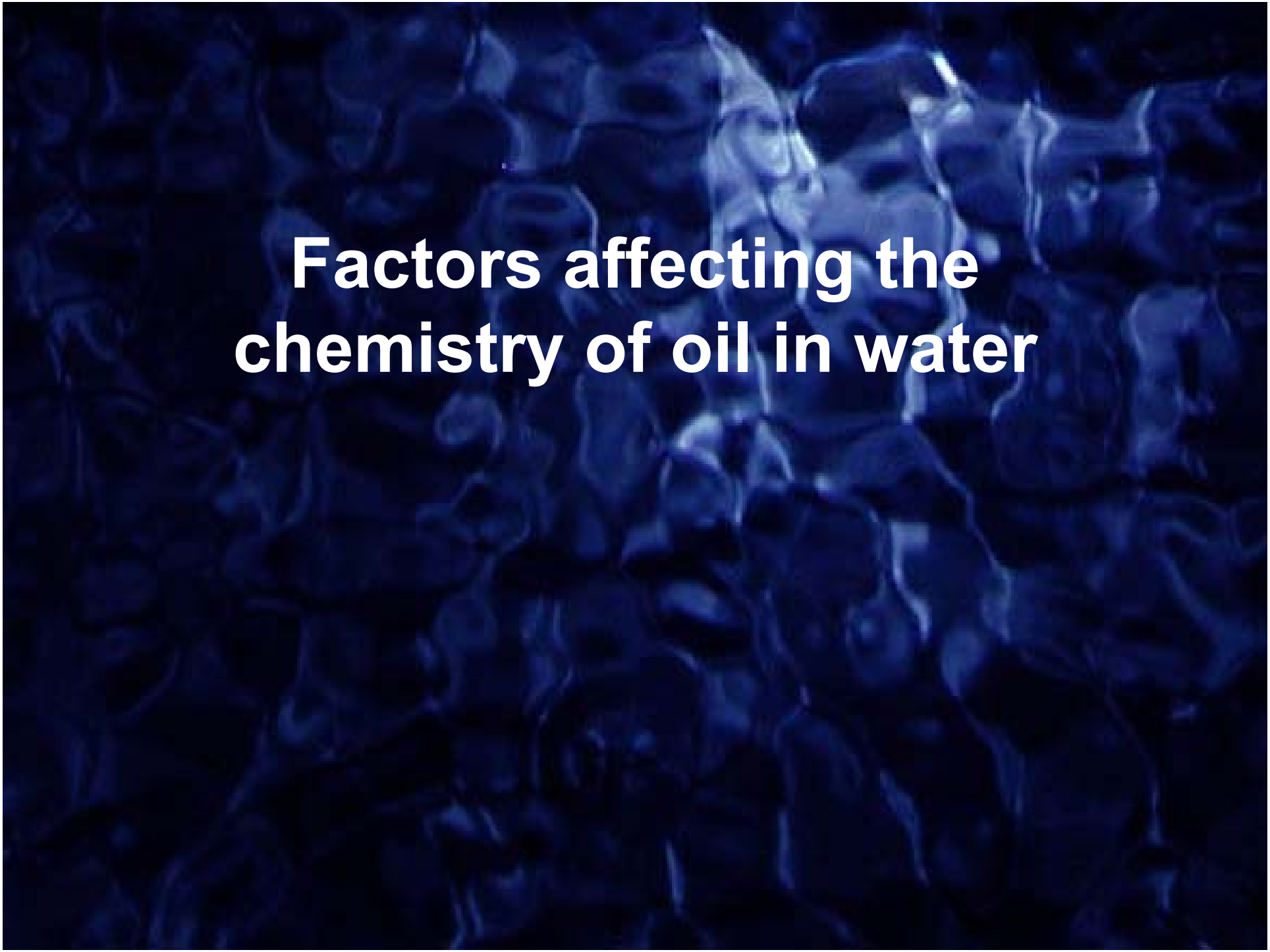

Factors affecting the
chemistry of oil in water

Factors affecting the chemistry of oil in water

Mark G. Carls, Larry Holland, Marie Larsen

NOAA, NMFS, Auke Bay Laboratory

Factors affecting the chemistry of oil in water ^ toxicity &

(water-accommodated fractions)

Mark G. Carls, Larry Holland, Marie Larsen

NOAA, NMFS, Auke Bay Laboratory

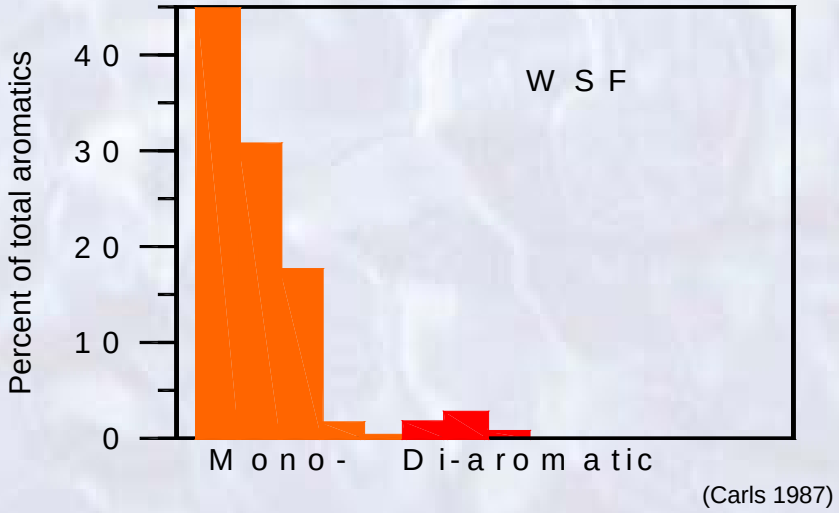
3 Parts:

1. Methods determine PAH composition
2. PAH composition influences toxicity
3. Match assay methods to toxicant

Part I:

Methods determine PAH composition

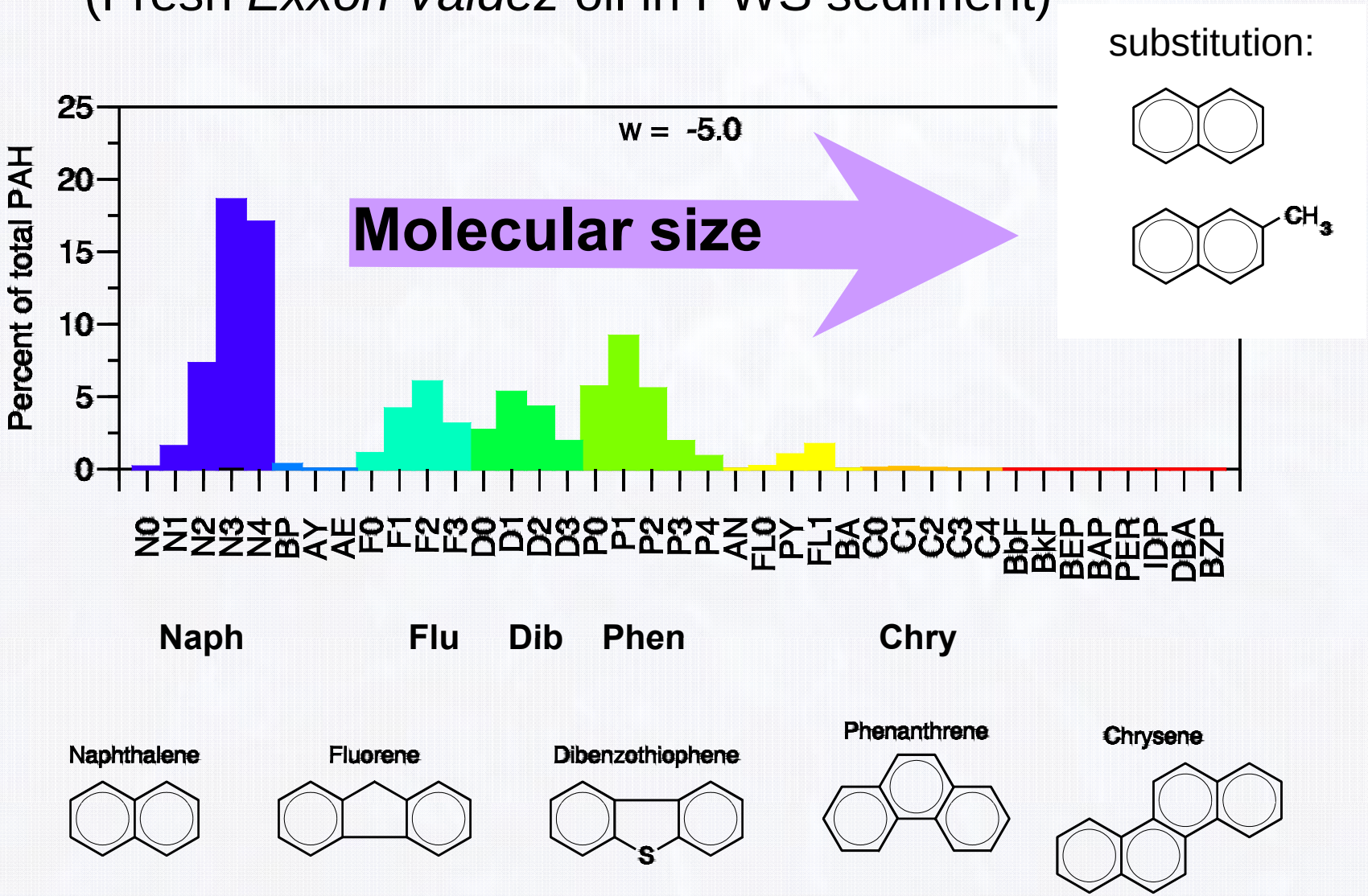
Example: low energy mixing



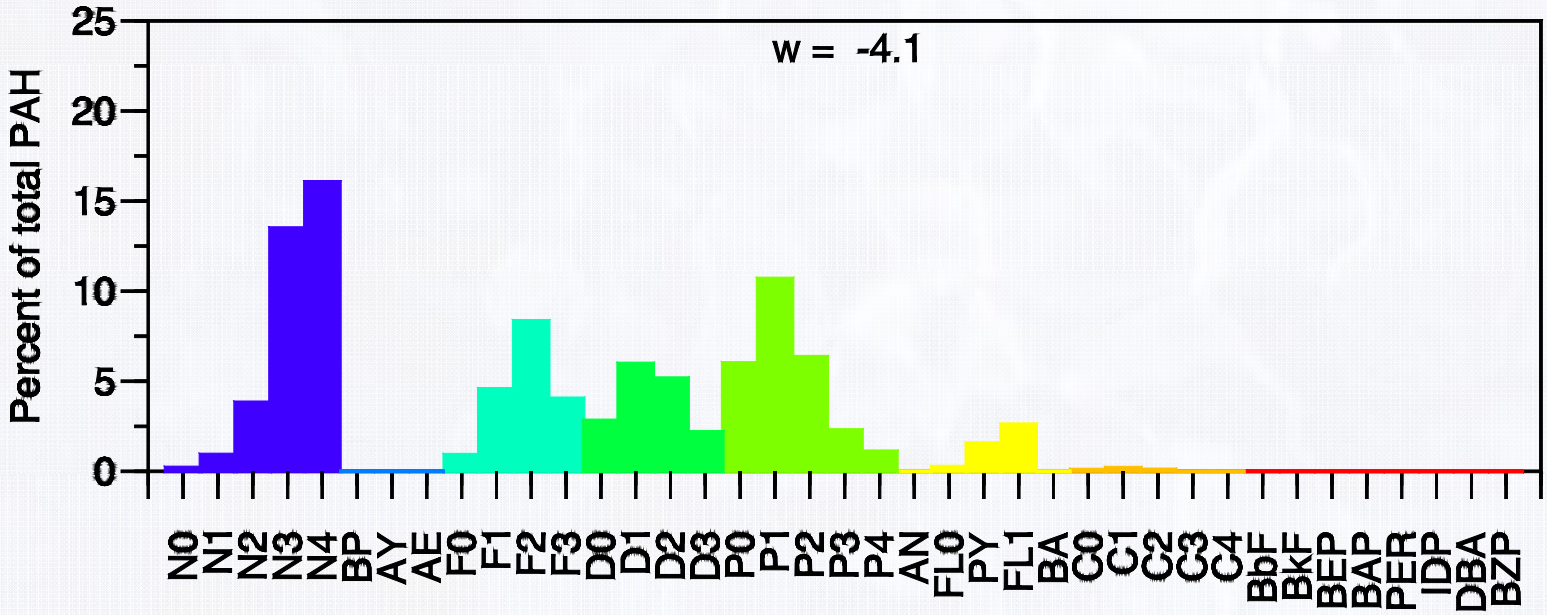
(Carls 1987)

PAH in crude oil:

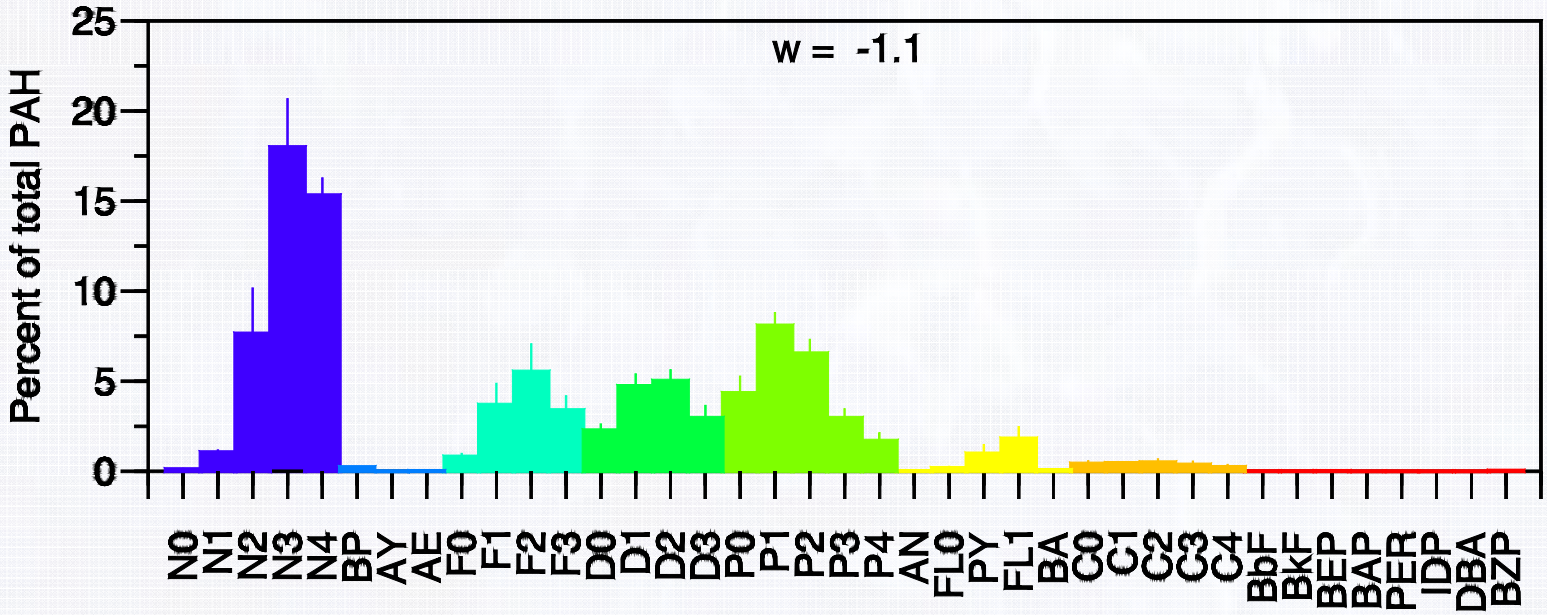
(Fresh *Exxon Valdez* oil in PWS sediment)



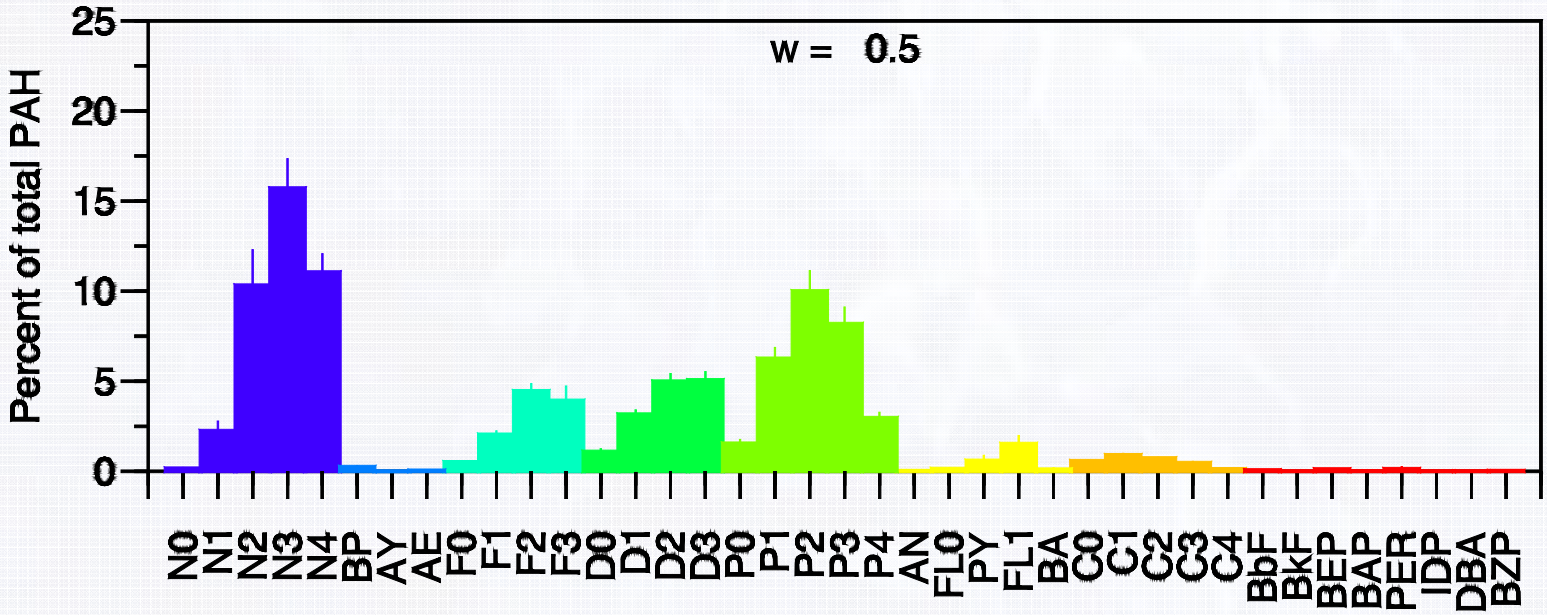
PAH in crude oil:



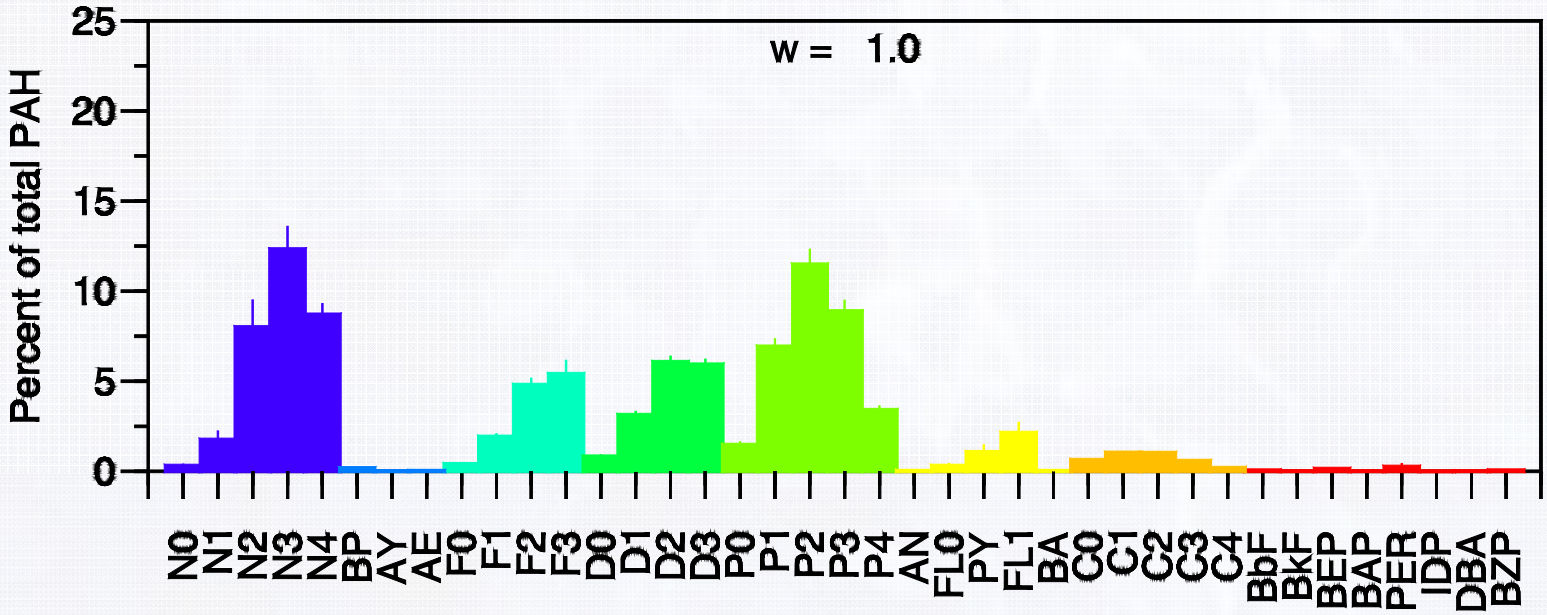
PAH in crude oil:



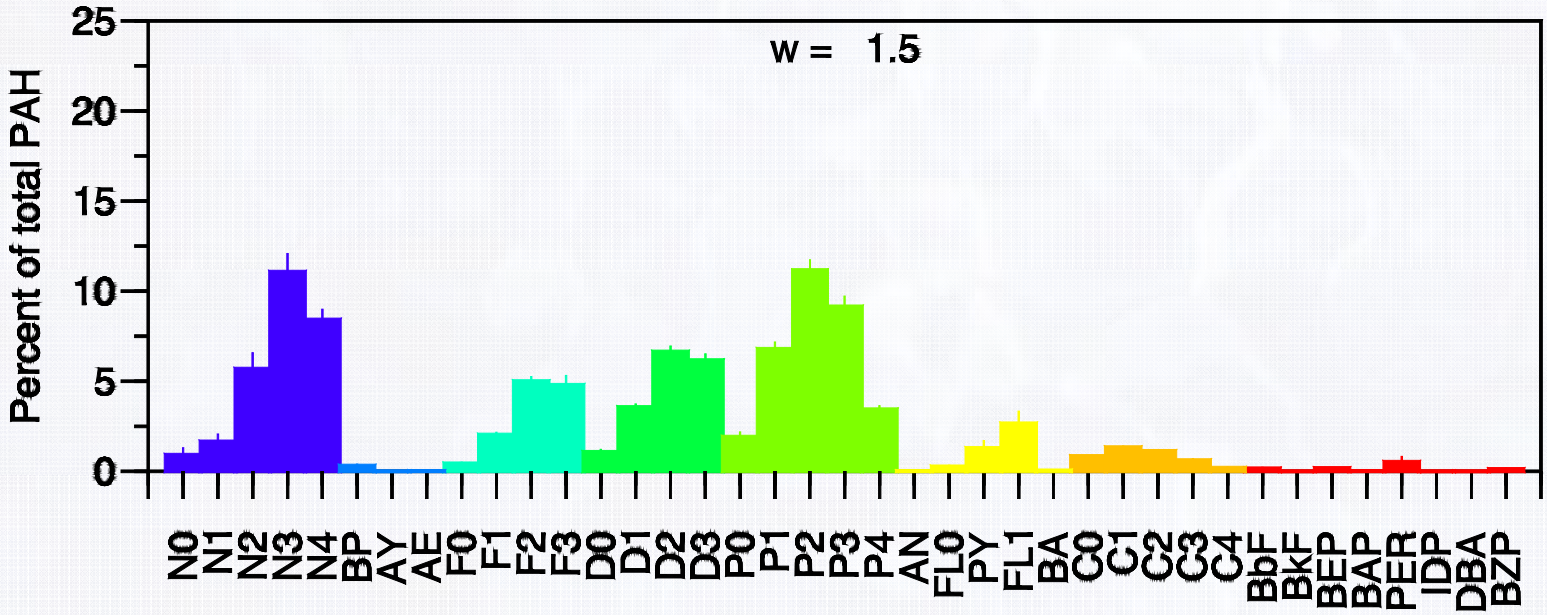
PAH in crude oil:



PAH in crude oil:



PAH in crude oil:



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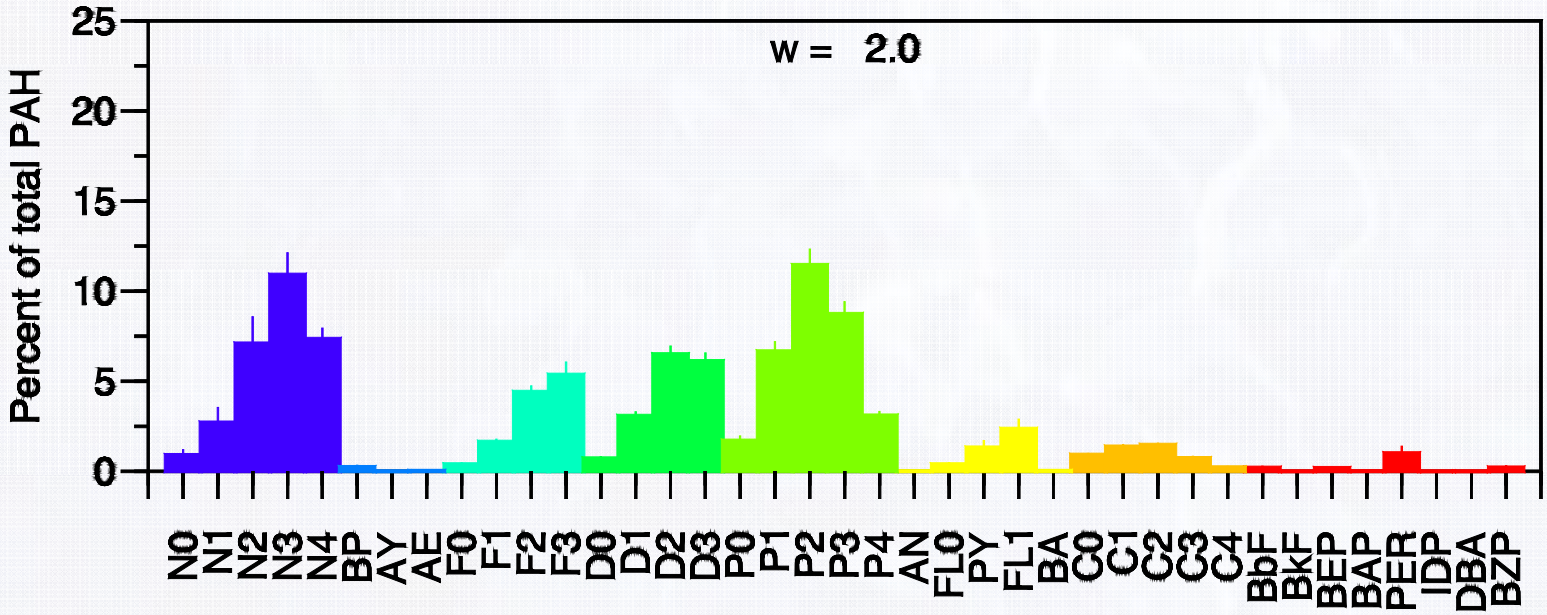
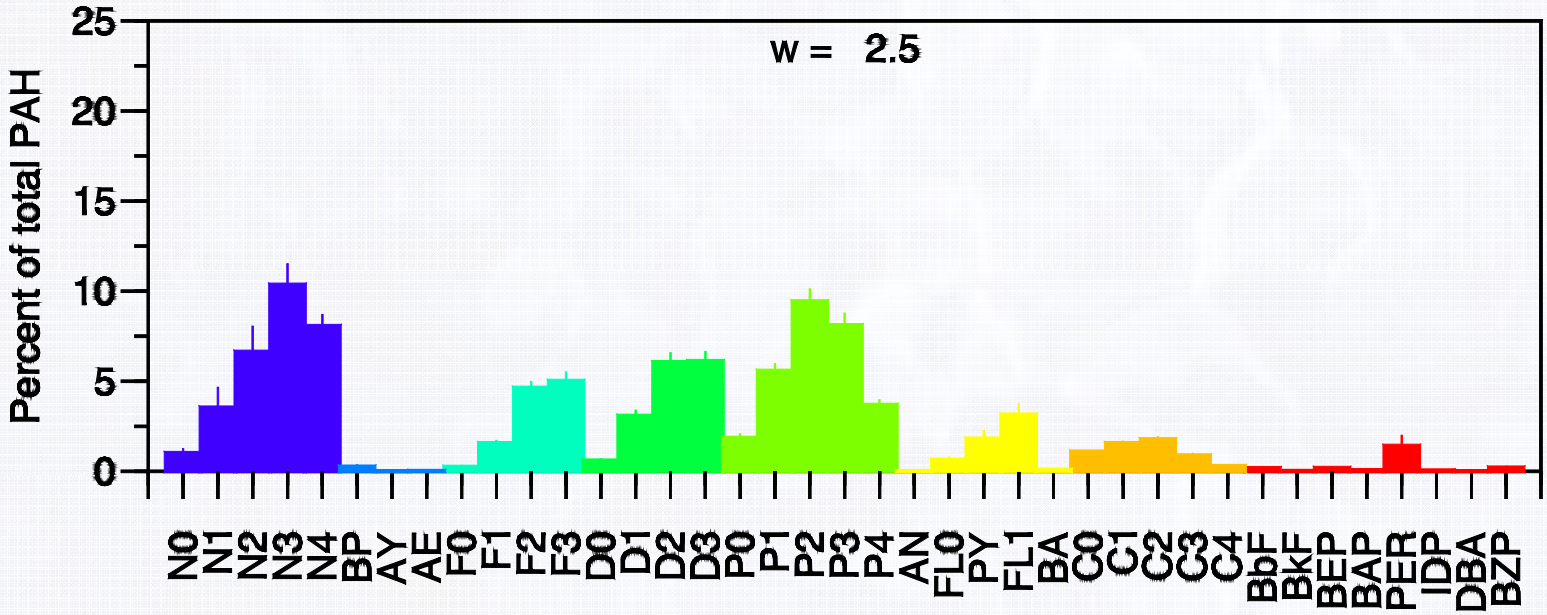
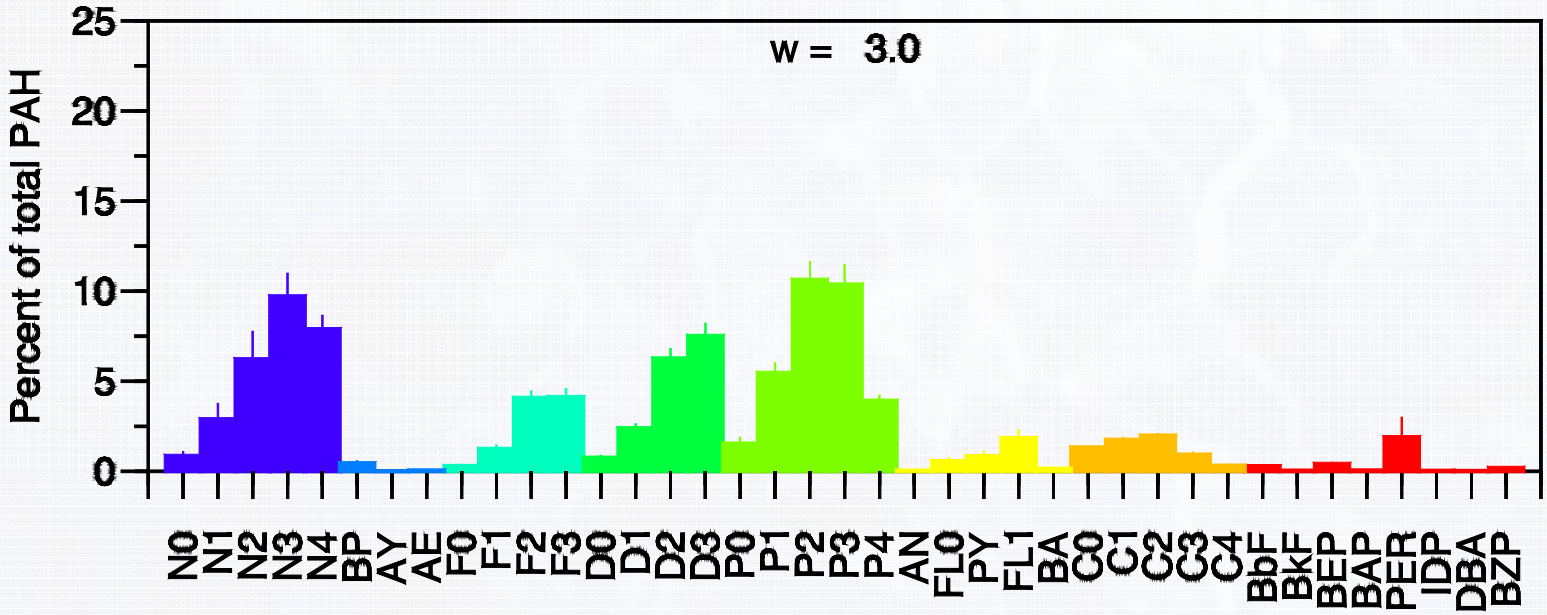


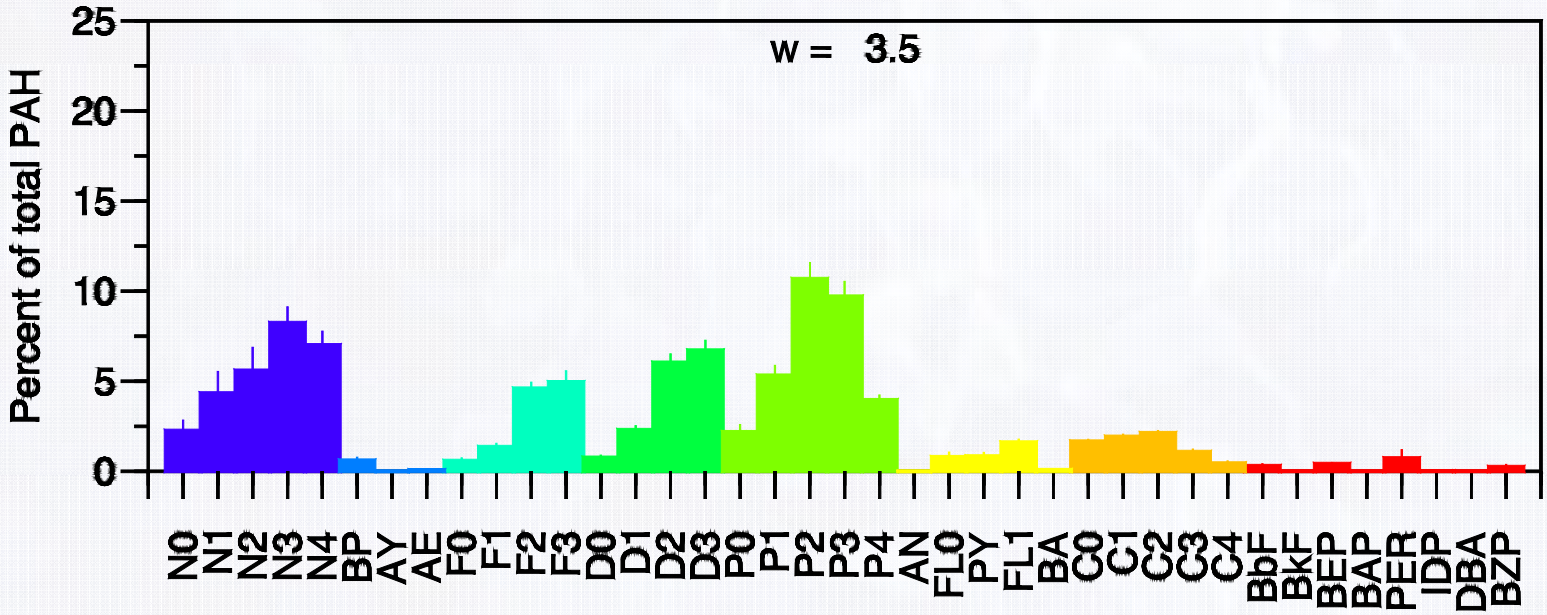
PAH in crude oil:



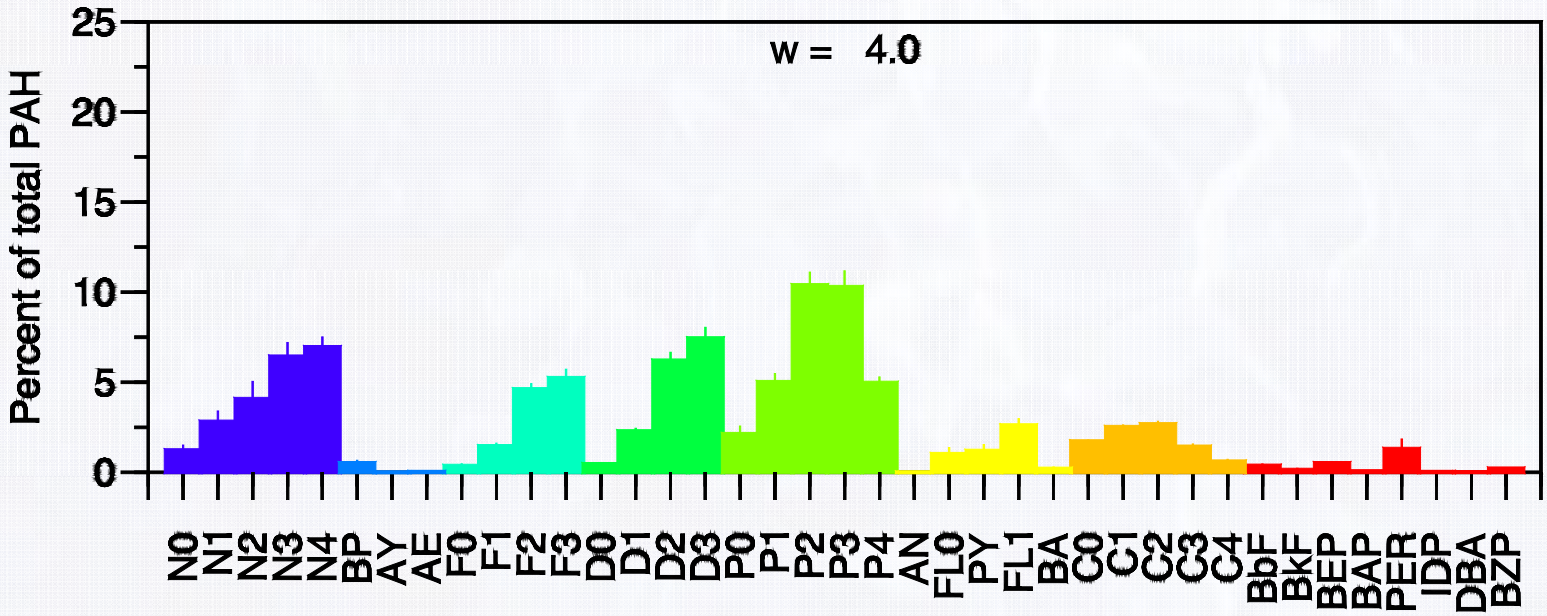
PAH in crude oil:



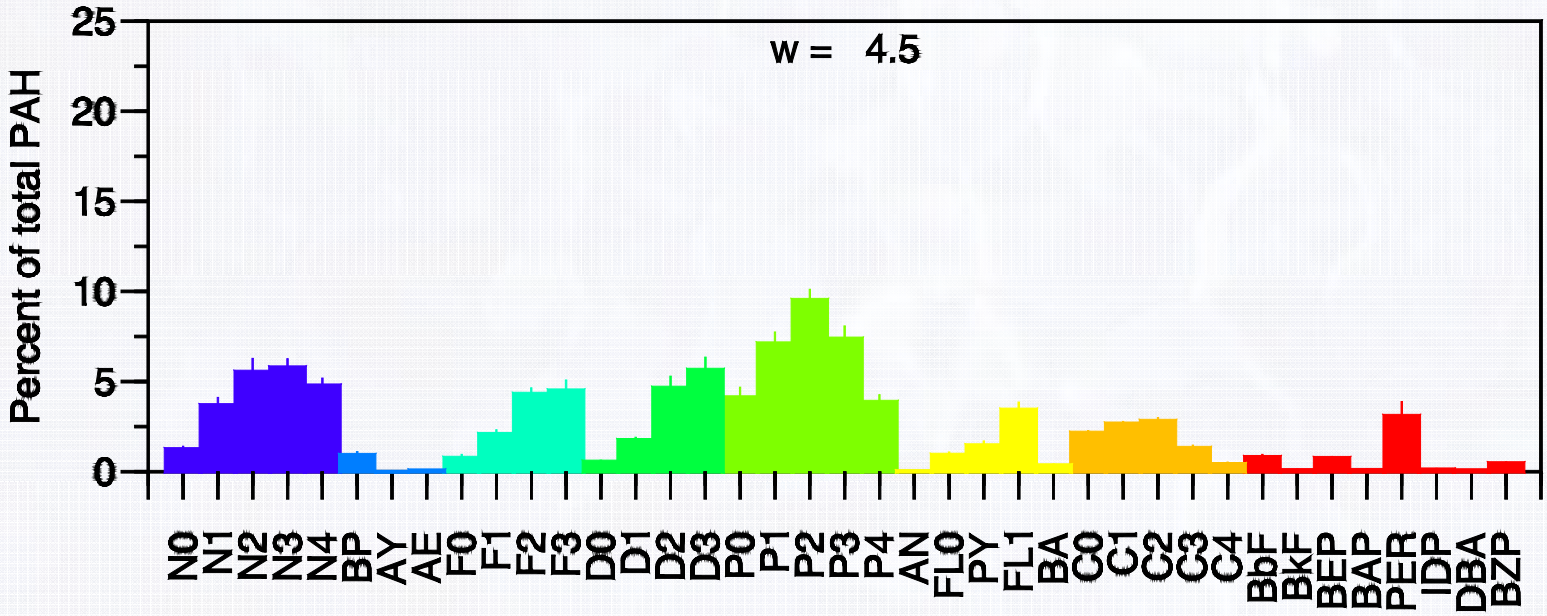
PAH in crude oil:



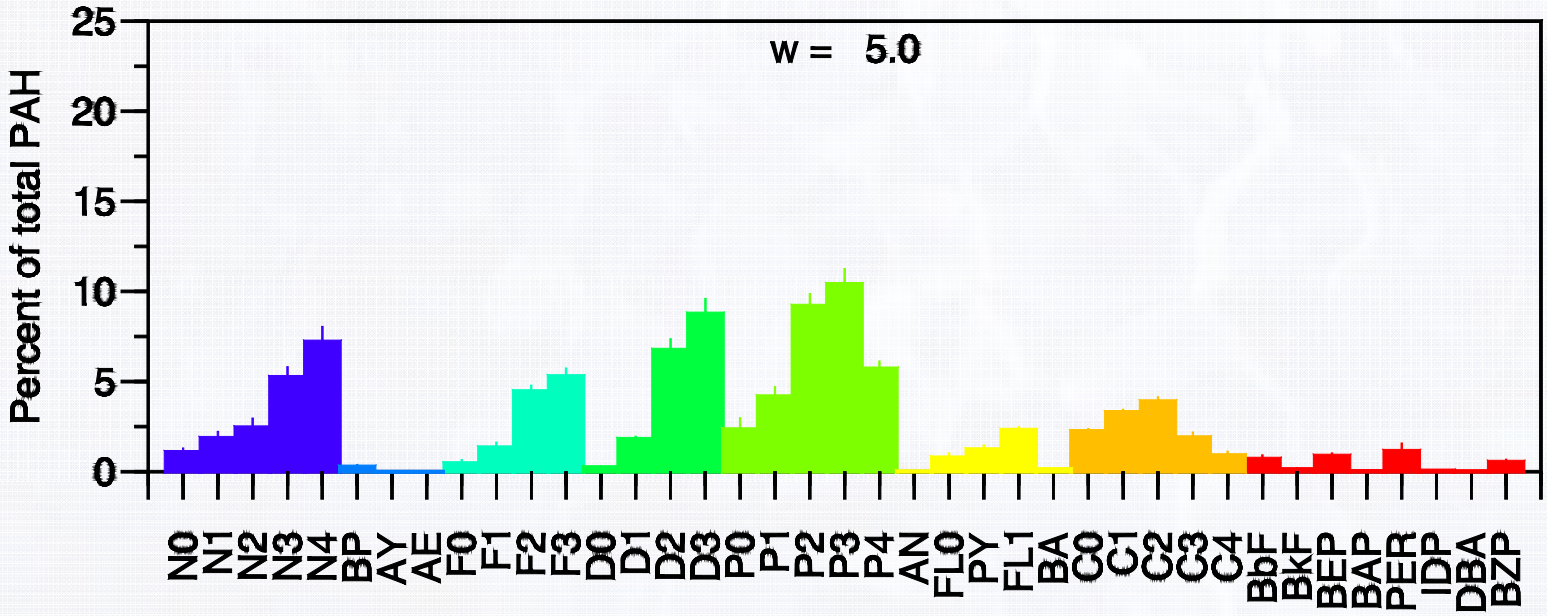
PAH in crude oil:



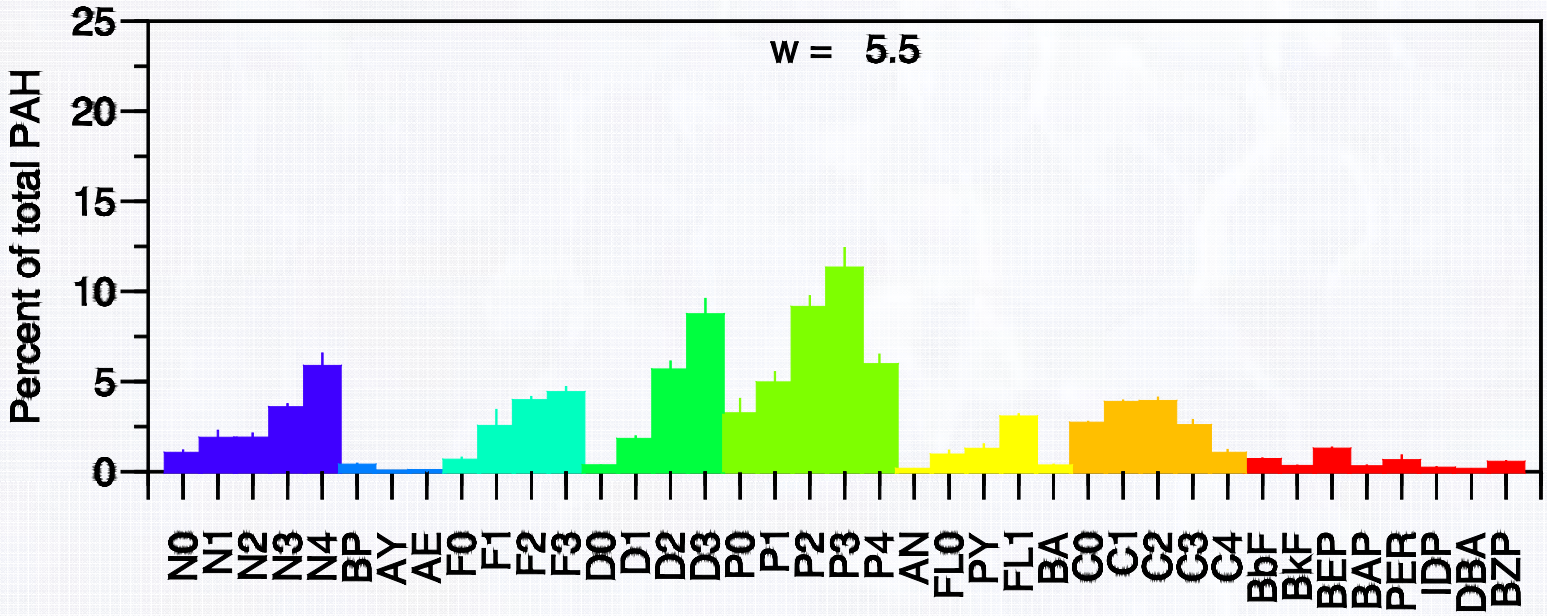
PAH in crude oil:



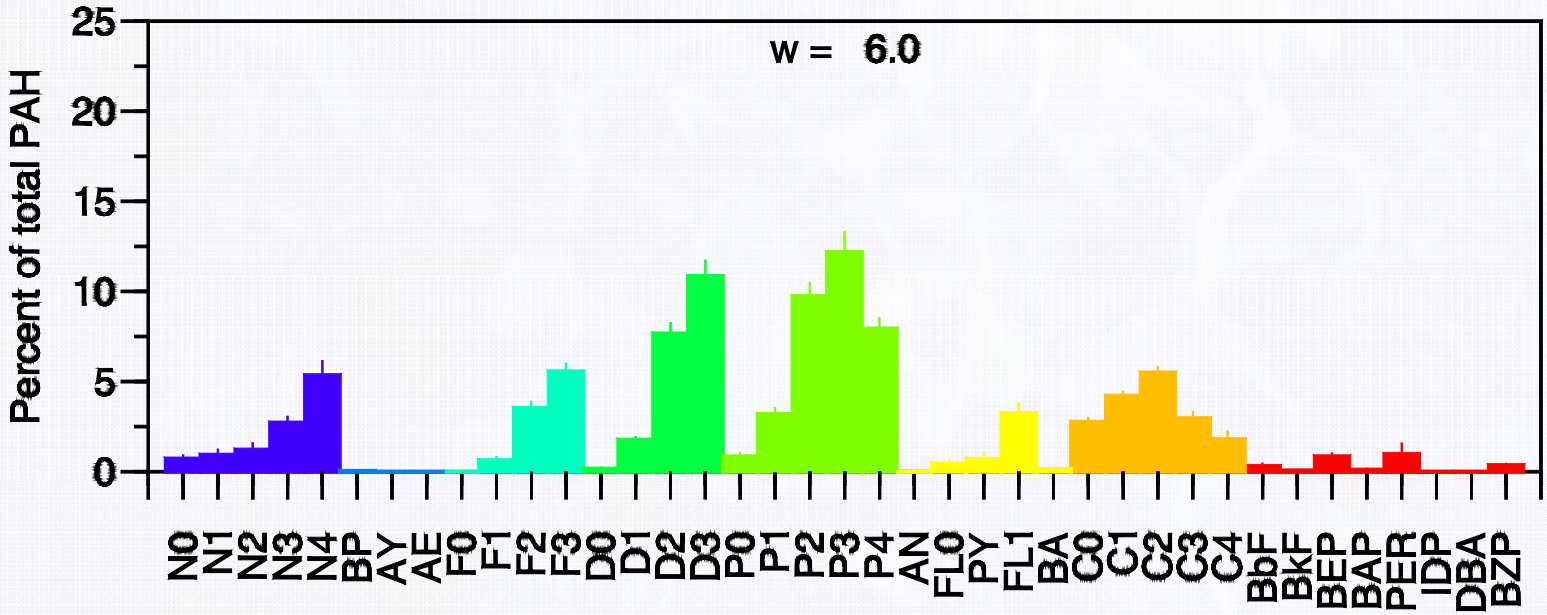
PAH in crude oil:



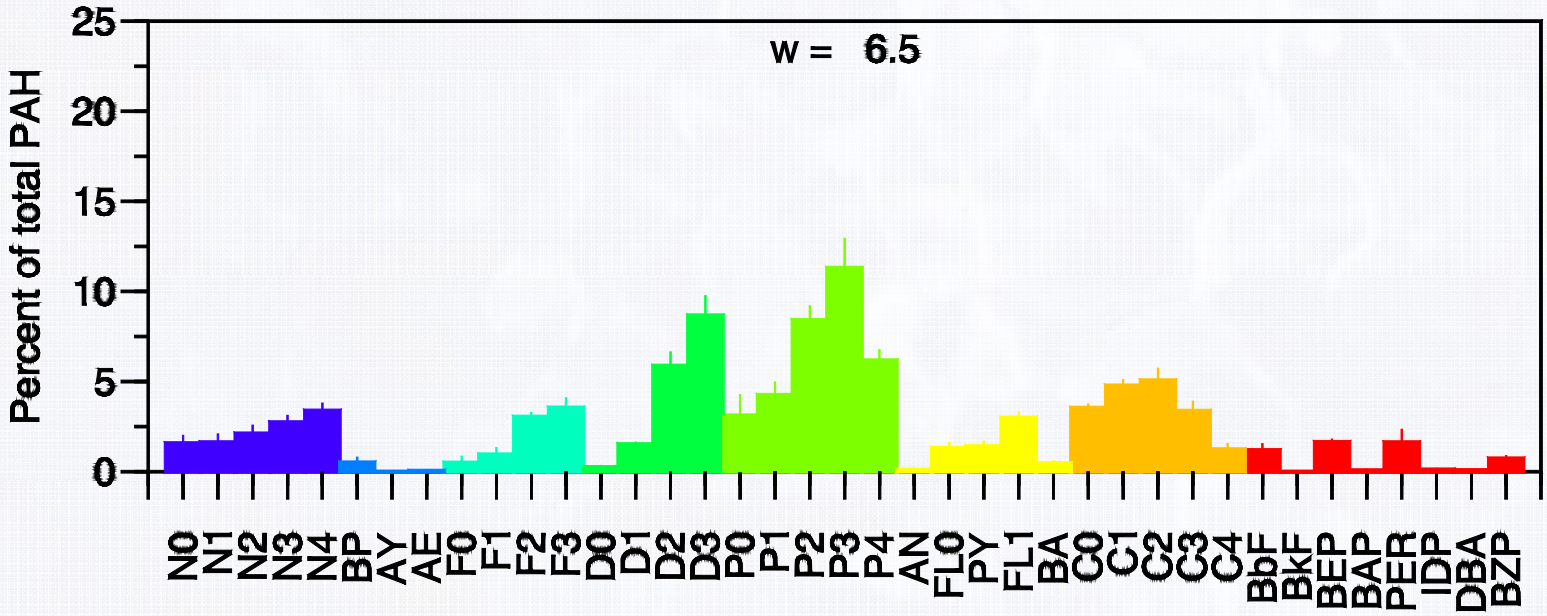
PAH in crude oil:



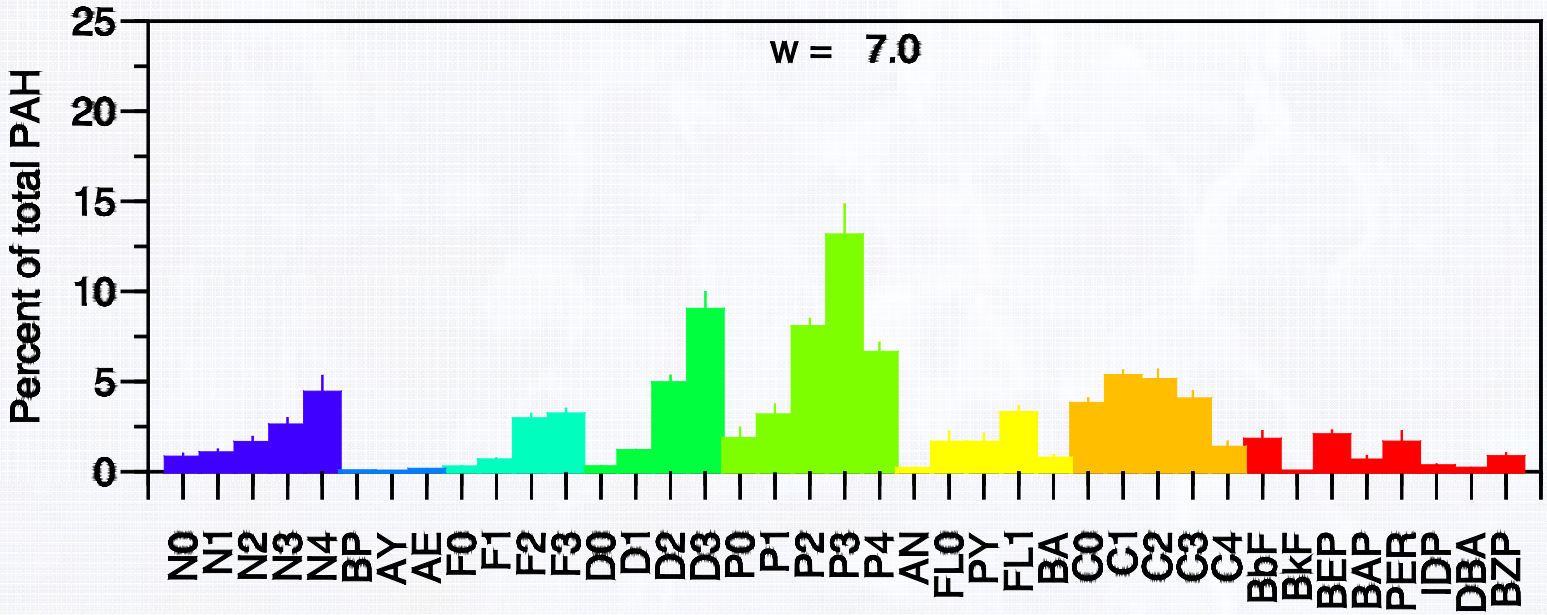
PAH in crude oil:



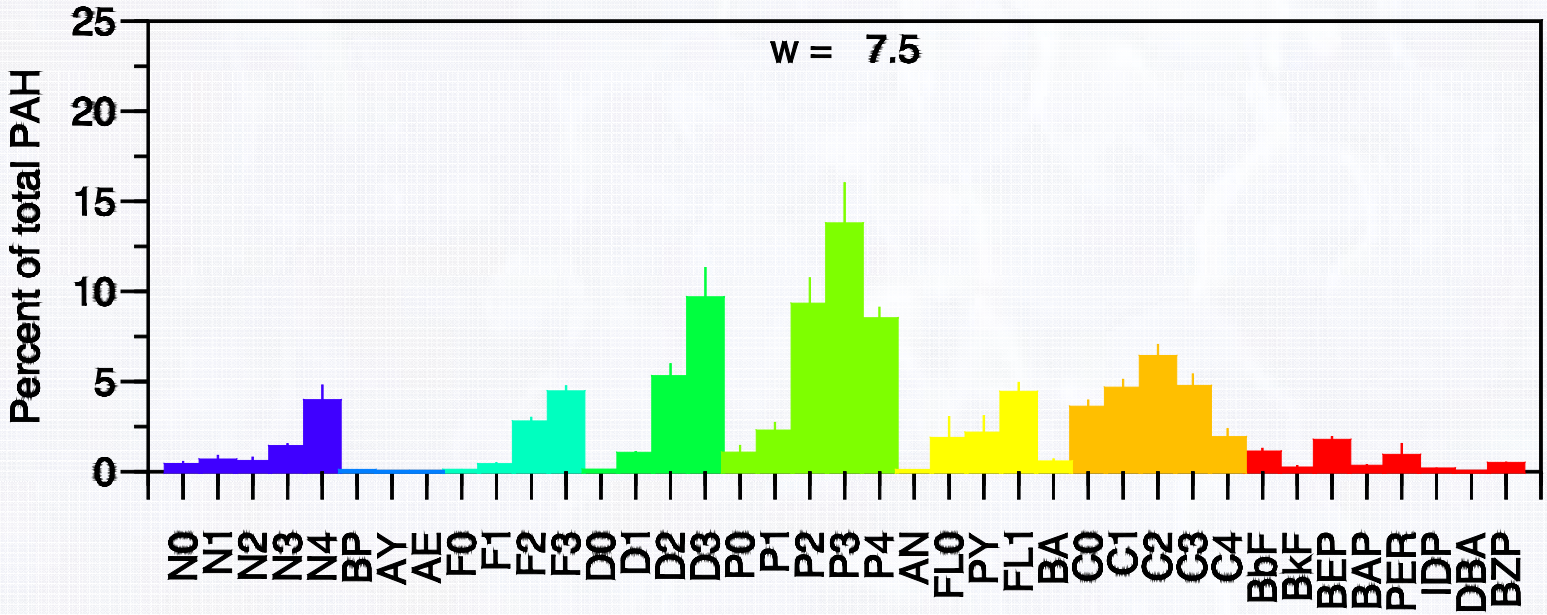
PAH in crude oil:



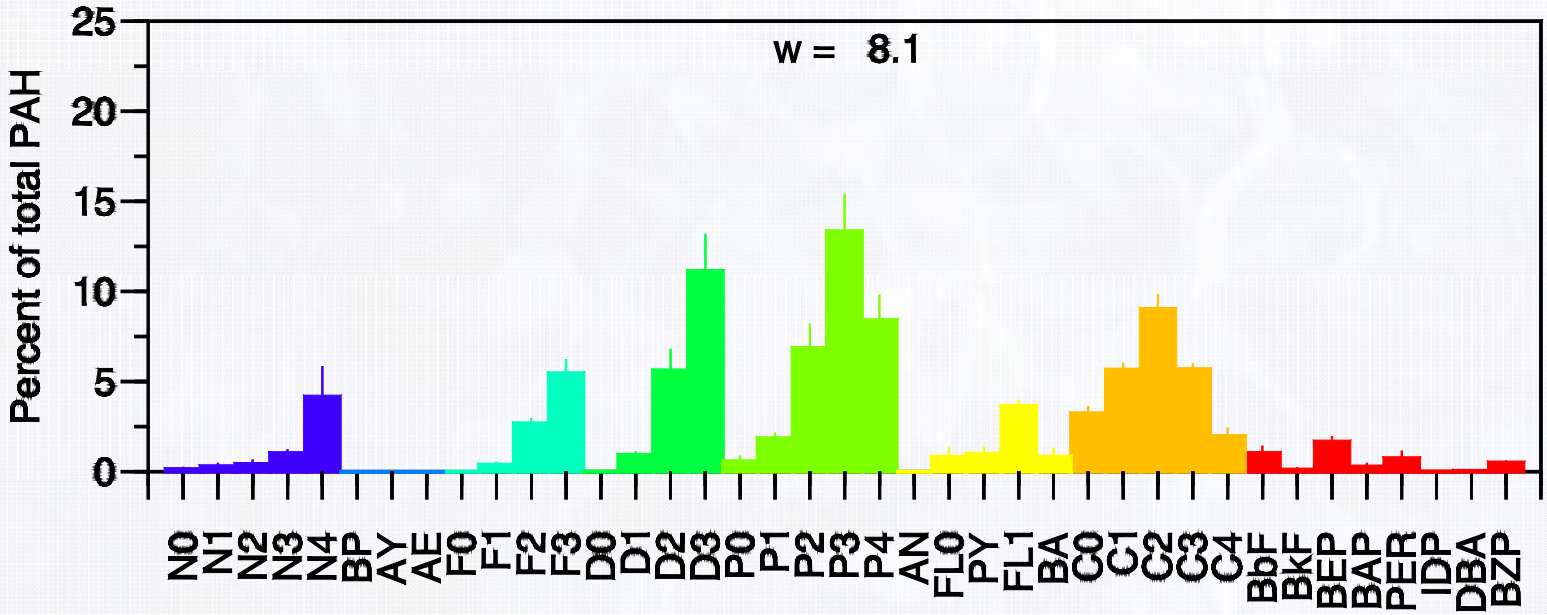
PAH in crude oil:



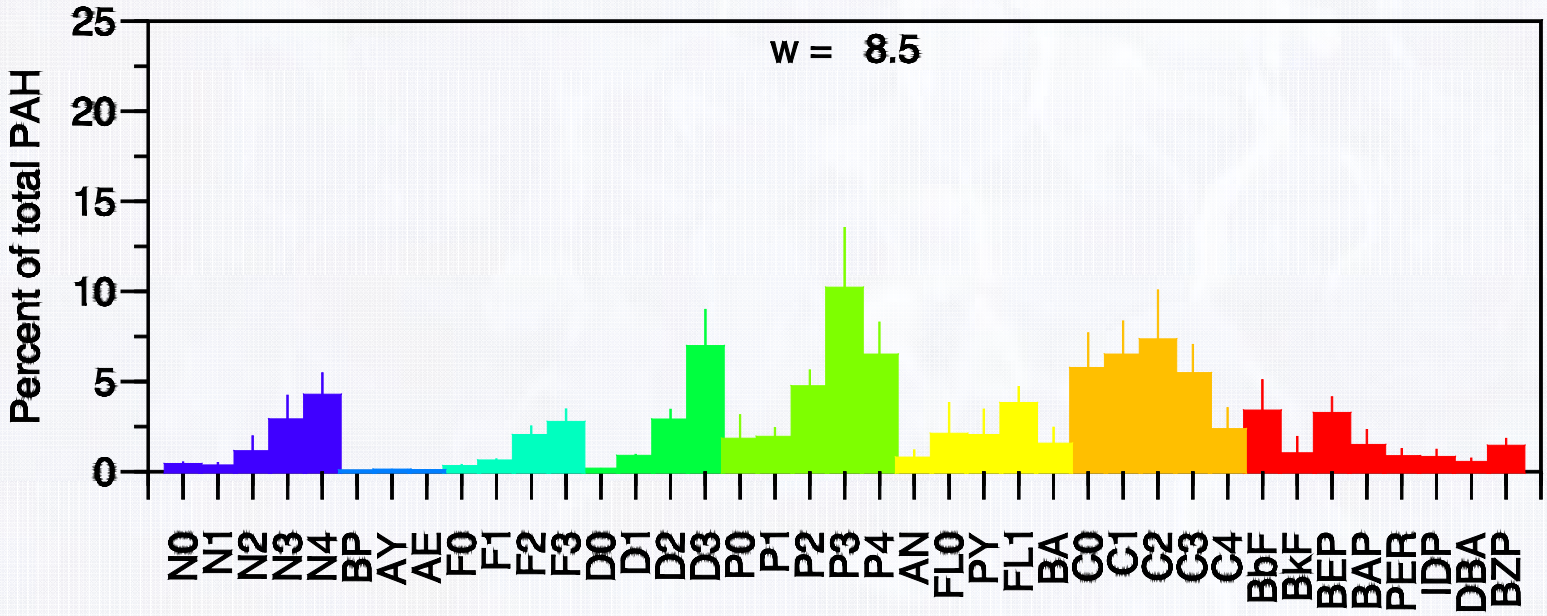
PAH in crude oil:



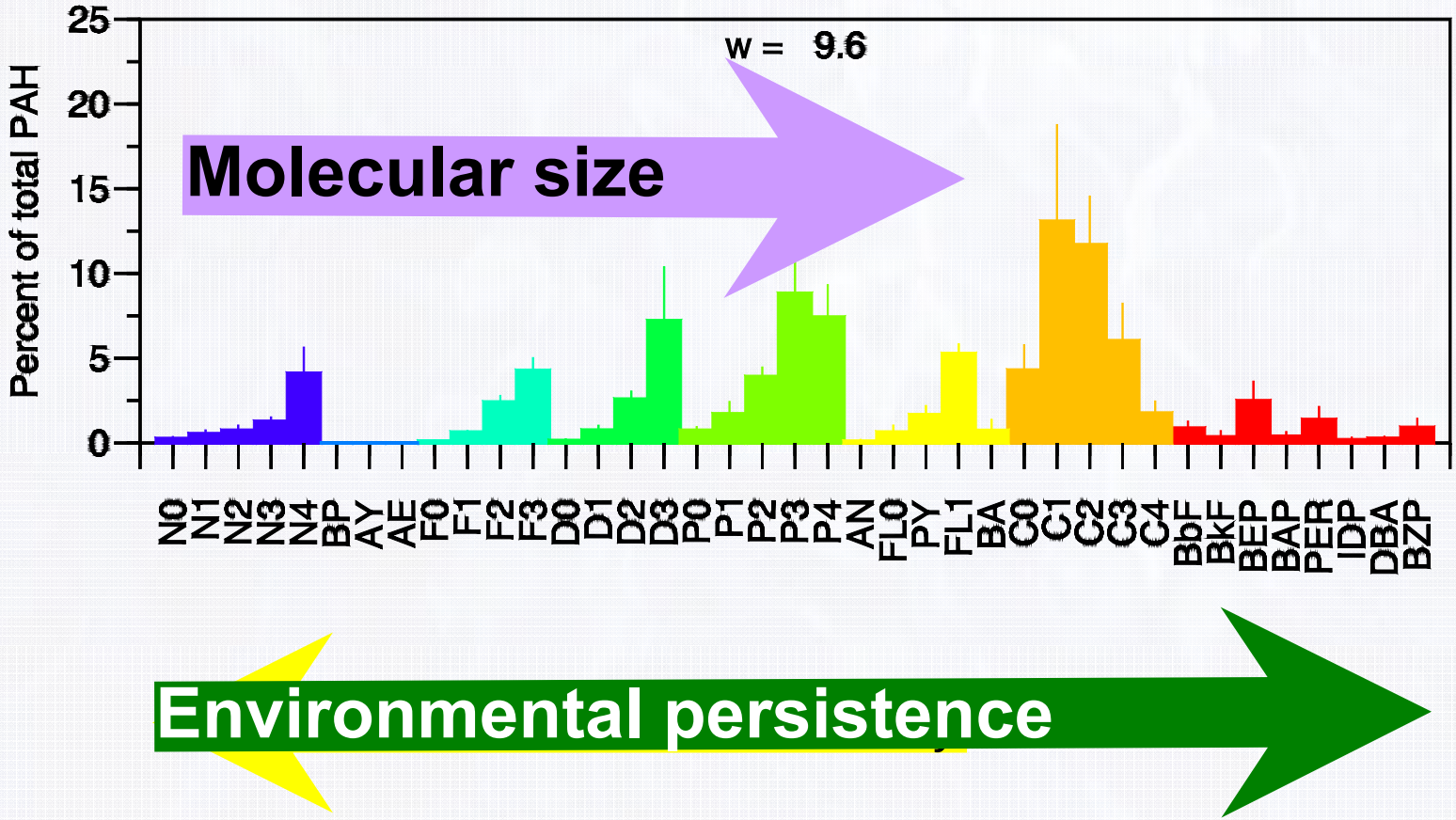
PAH in crude oil:



PAH in crude oil:



PAH in crude oil:

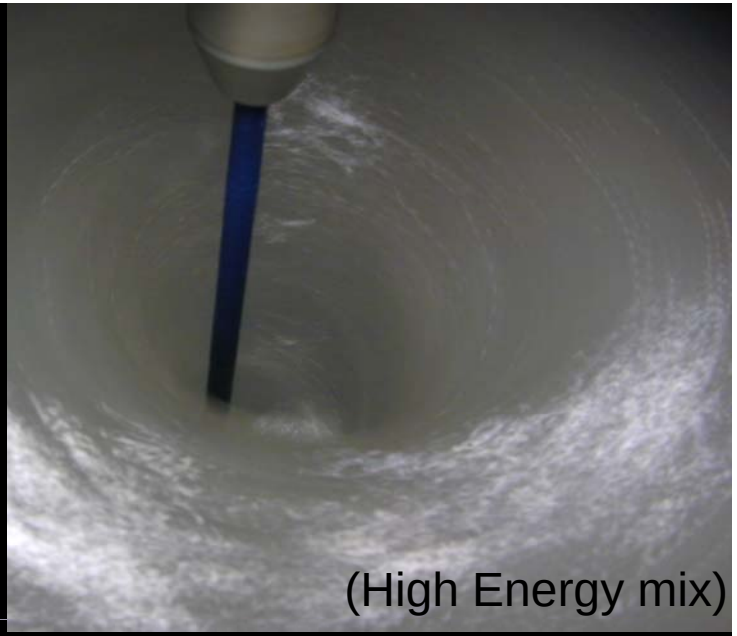


The point:

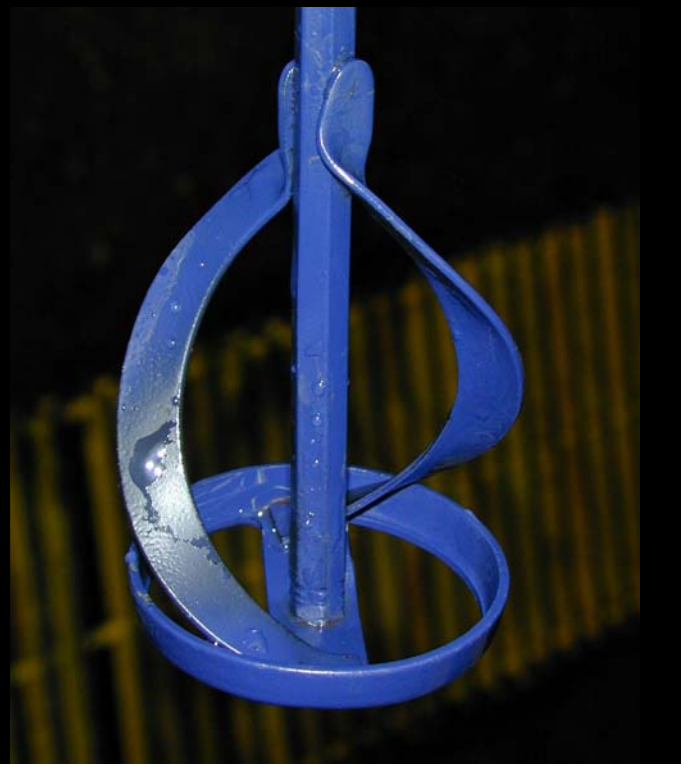
- **Know what you wish to emulate**

Methods

- Oiled rock columns
- Water-accommodated fractions of oil



(High Energy mix)

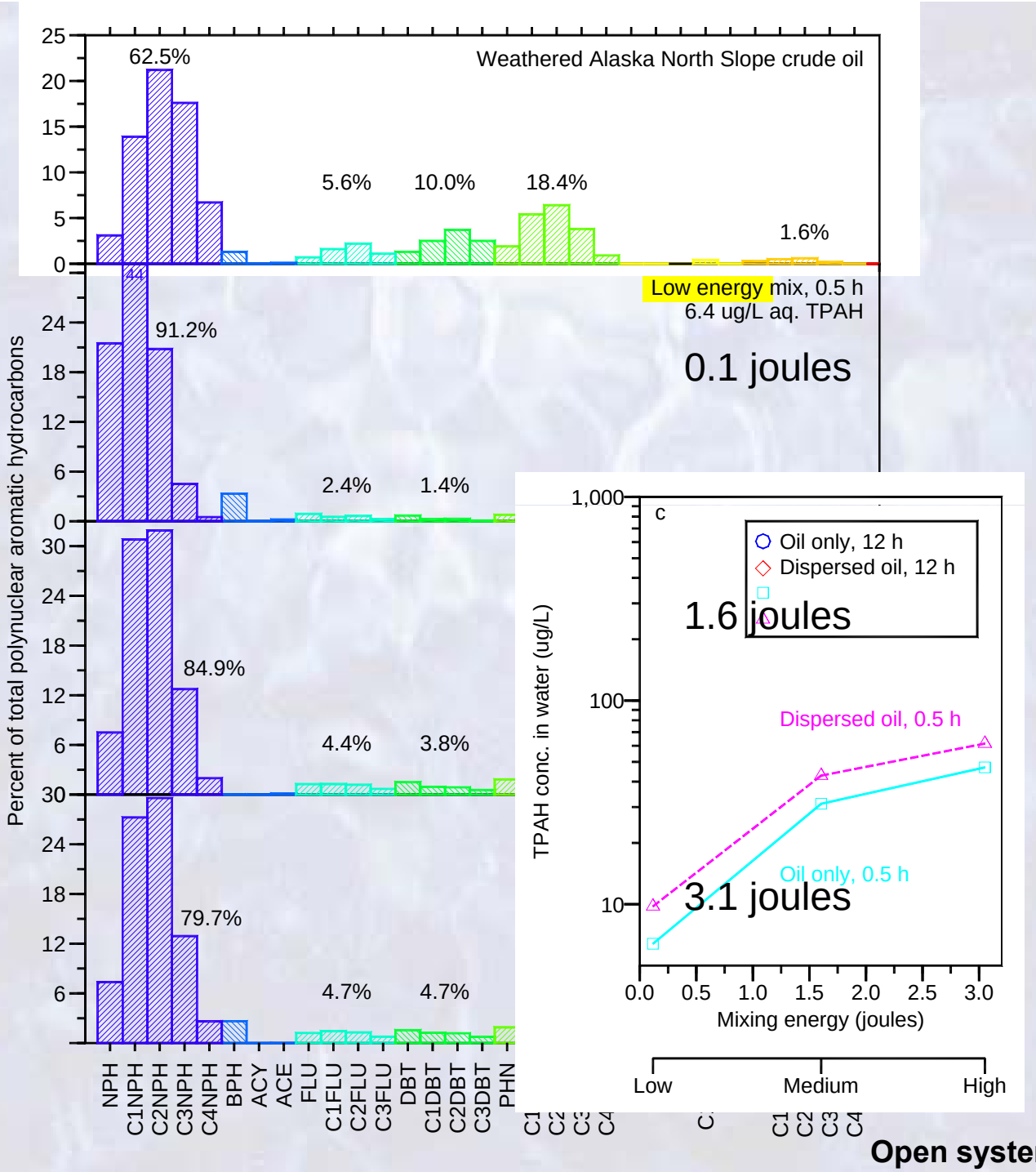


Results:

Oil Only

Energy

↑ **Energy:**
↑ **weathering**

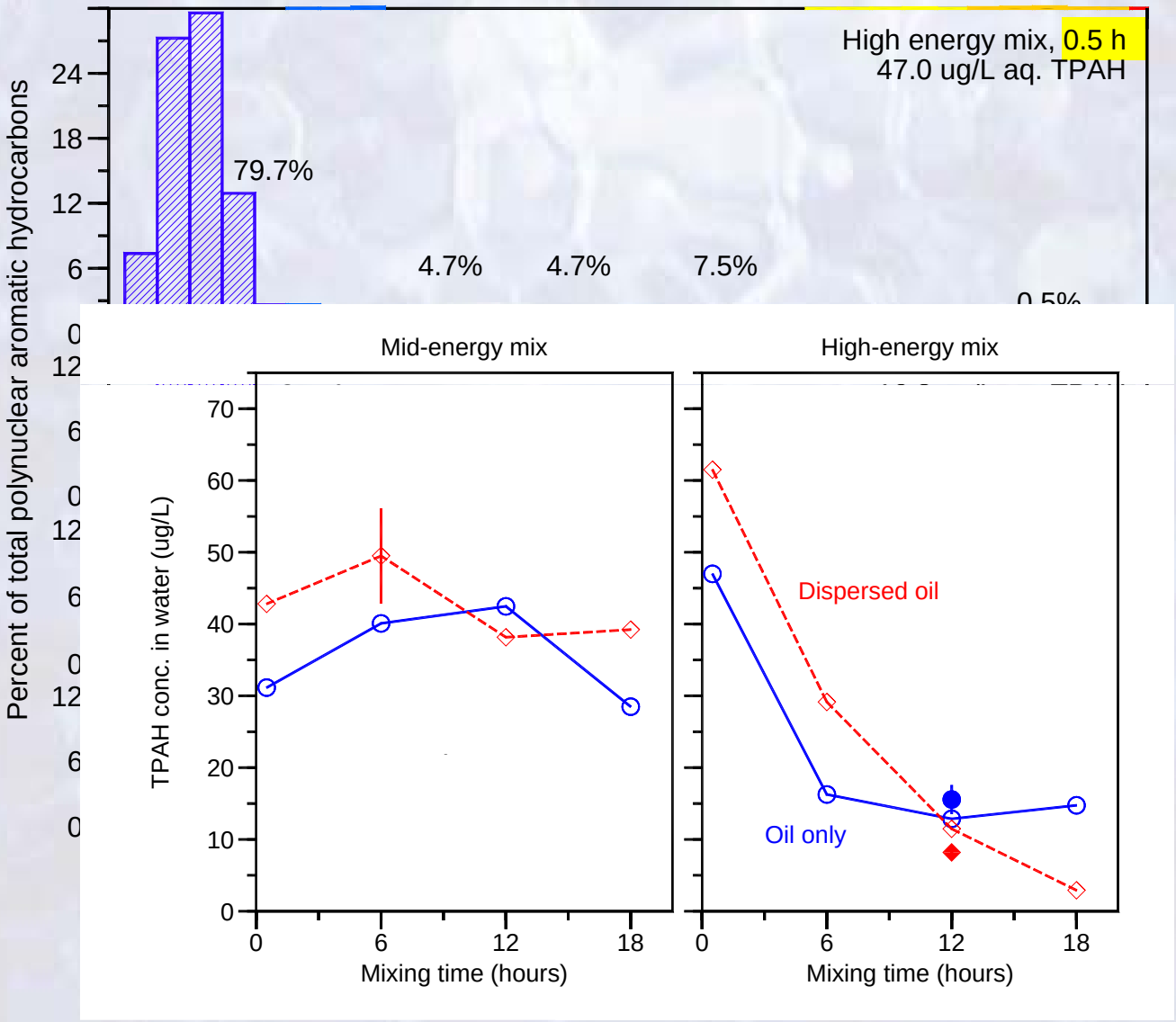


Open system

Oil Only

Time

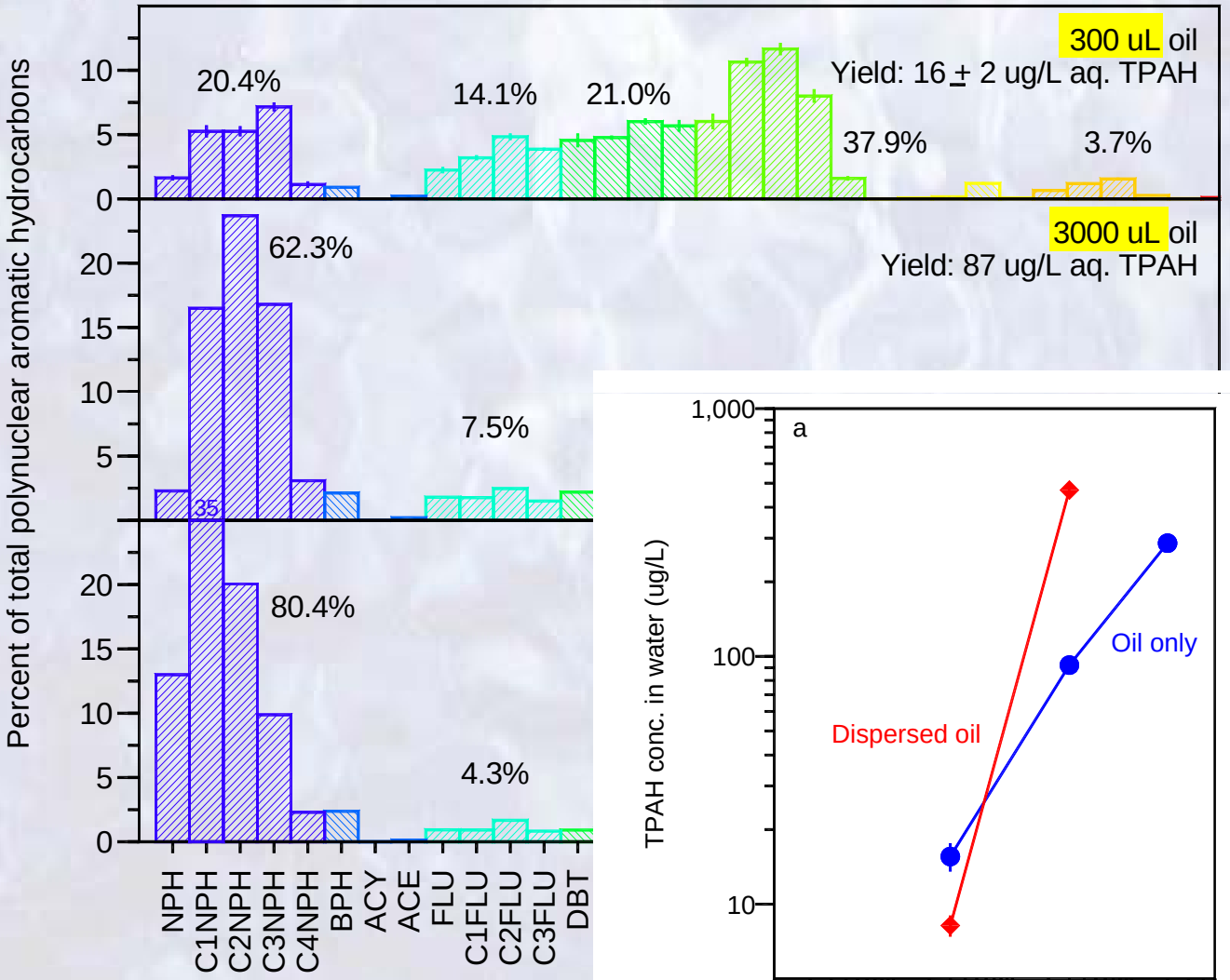
↑Time:
↑weathering

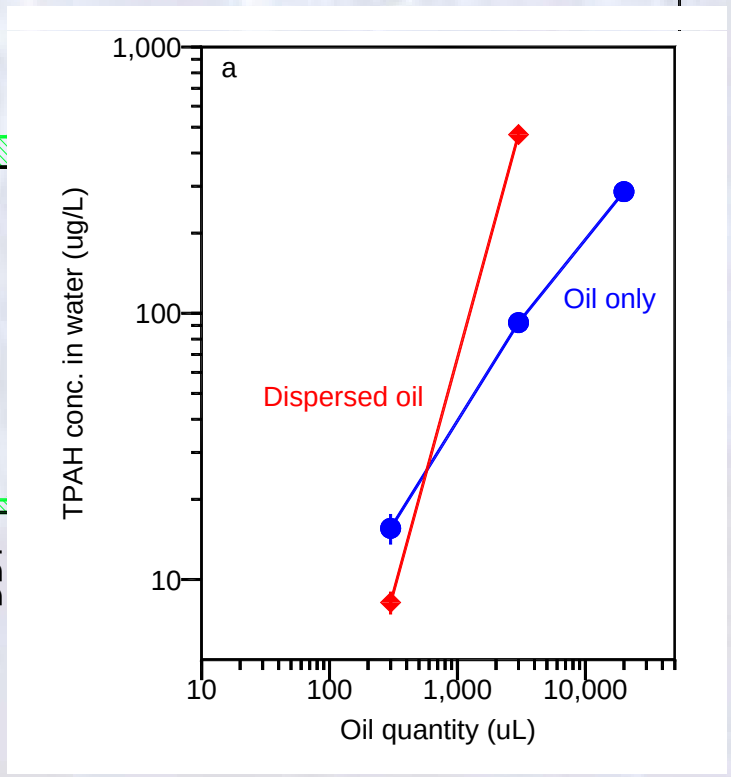


Open system, high energy

Oil Only

Volume

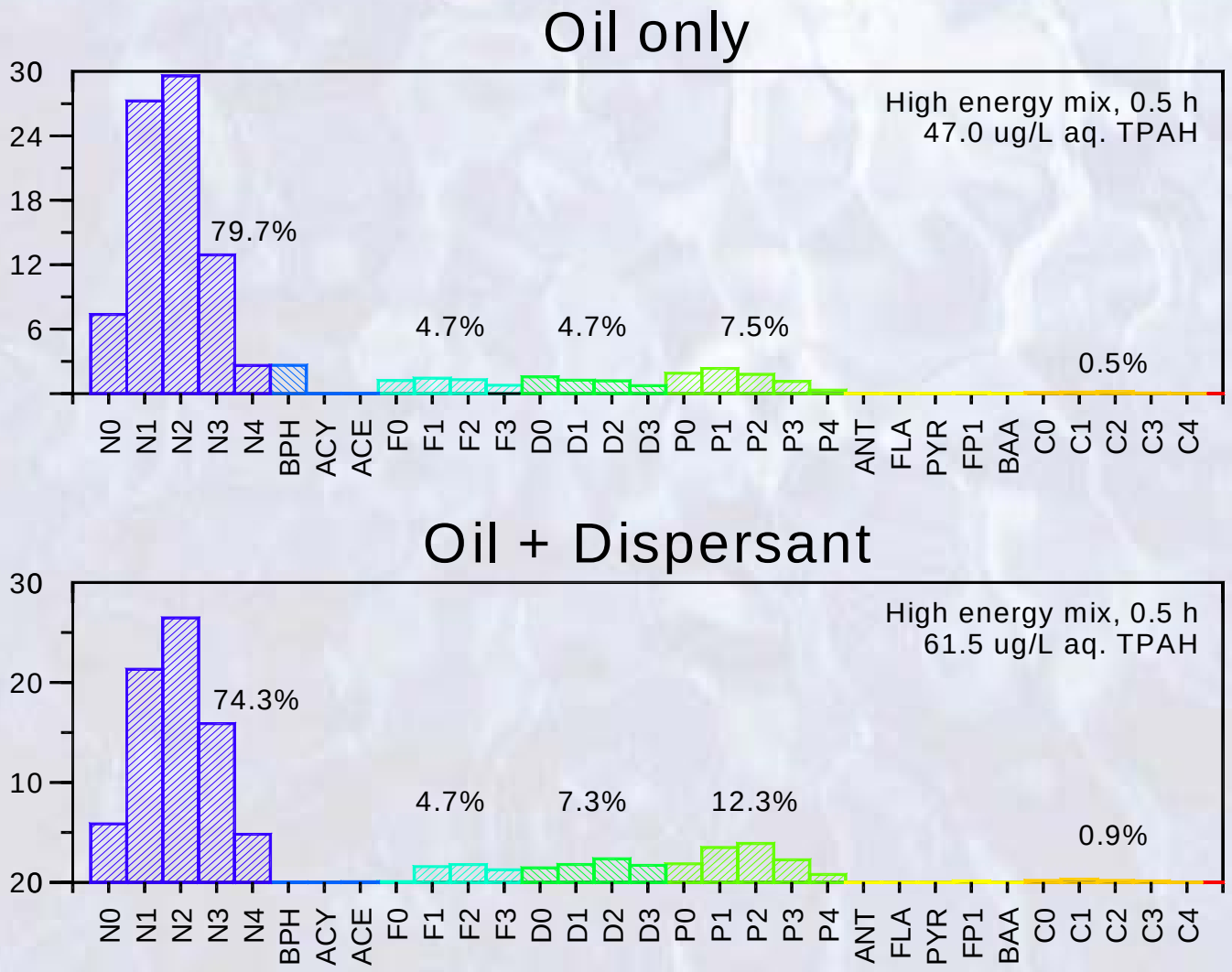




↑Volume:
↓ weathering

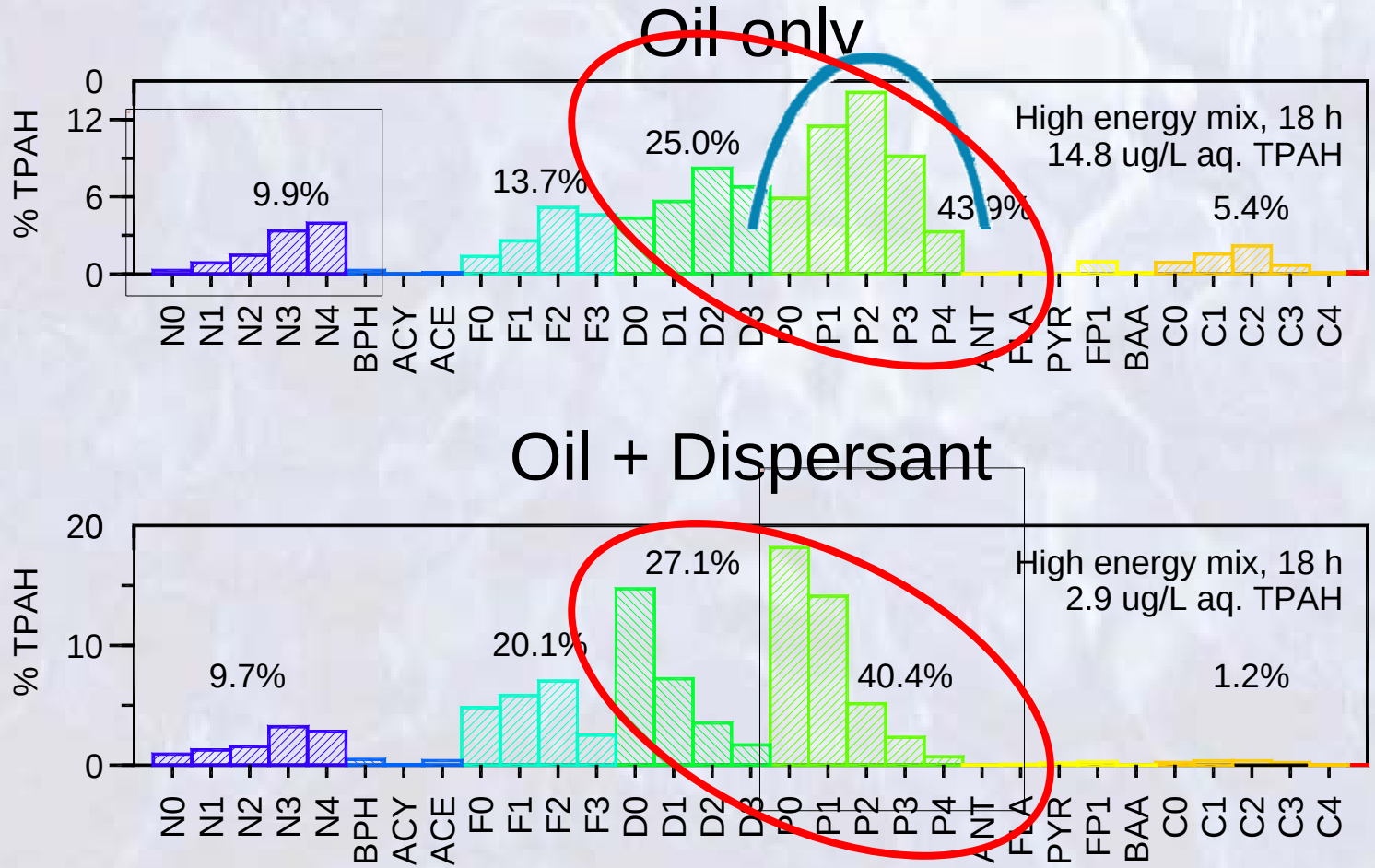
Open system, high energy

In the short term (0.5 h), dispersant increased weathering



Open system

In the longer term, dispersant decreased weathering



Composition changes

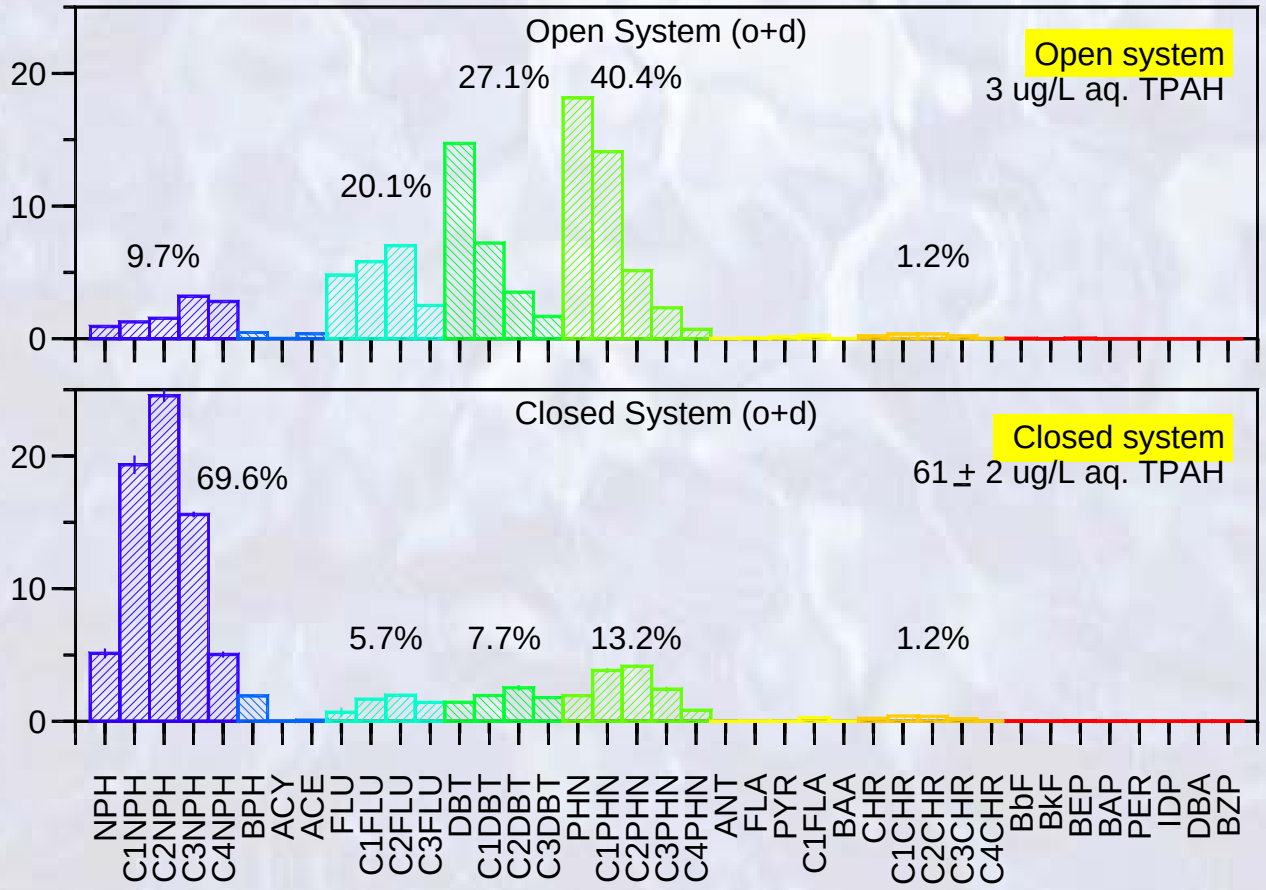
Open system

Open system

Closed system

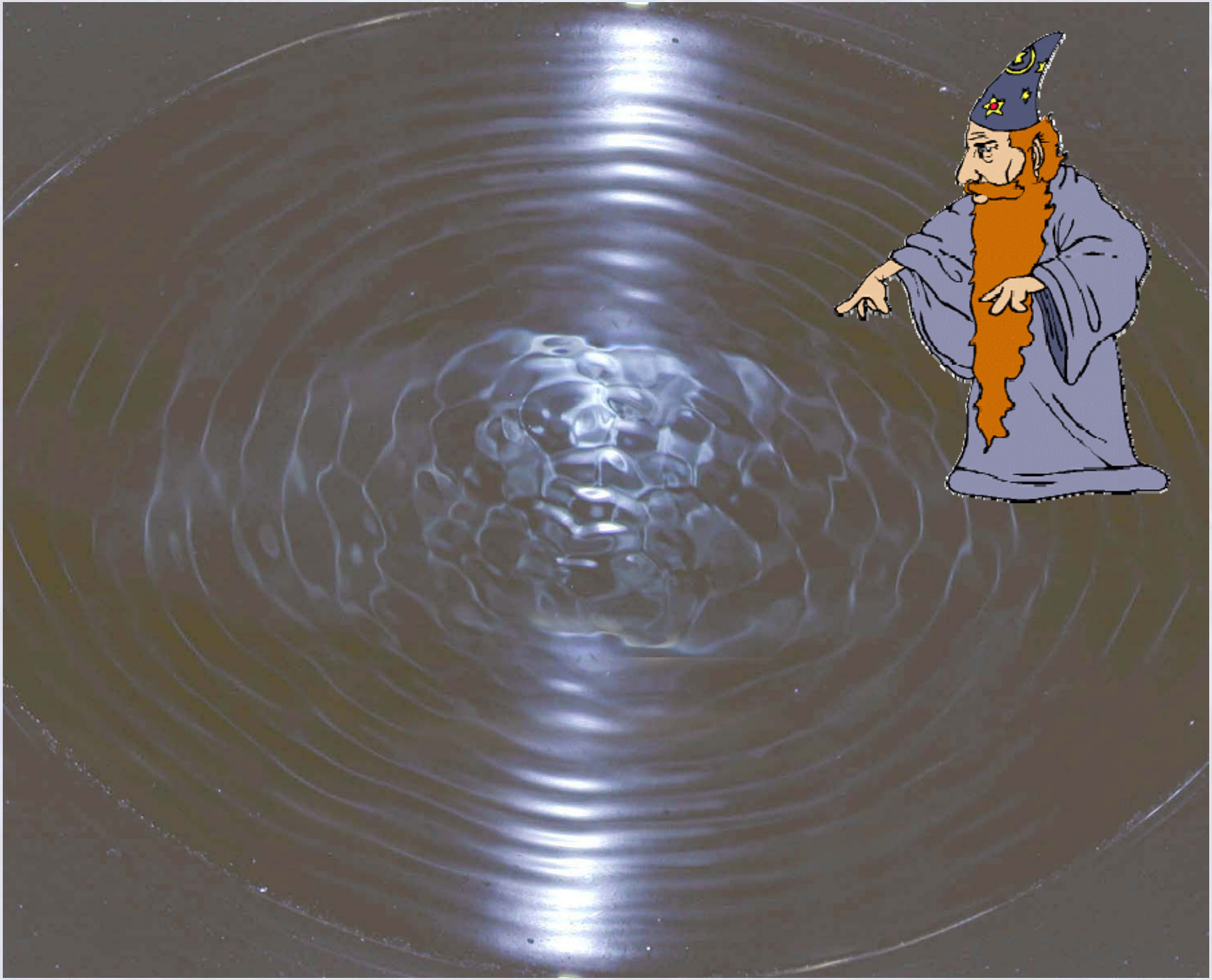
Oil Only

Open/closed



Closed:

No weathering



Conclusion (Part I)

Methods are important!

Weathering can be controlled by:

Energy

Time

Volume

Dispersants

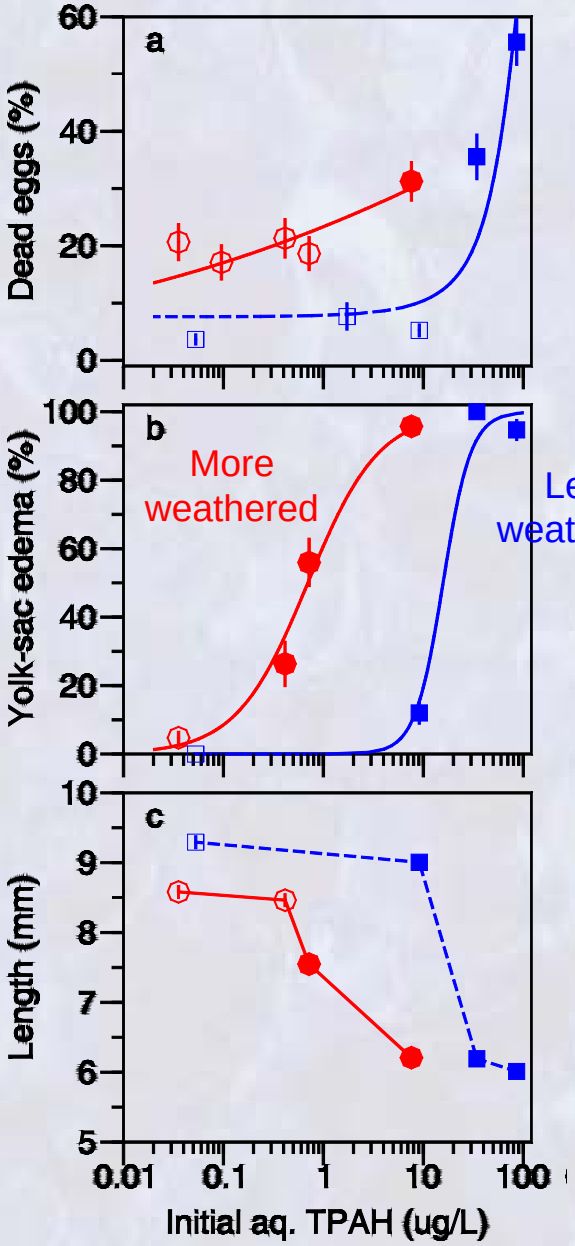
Other system/environmental attributes

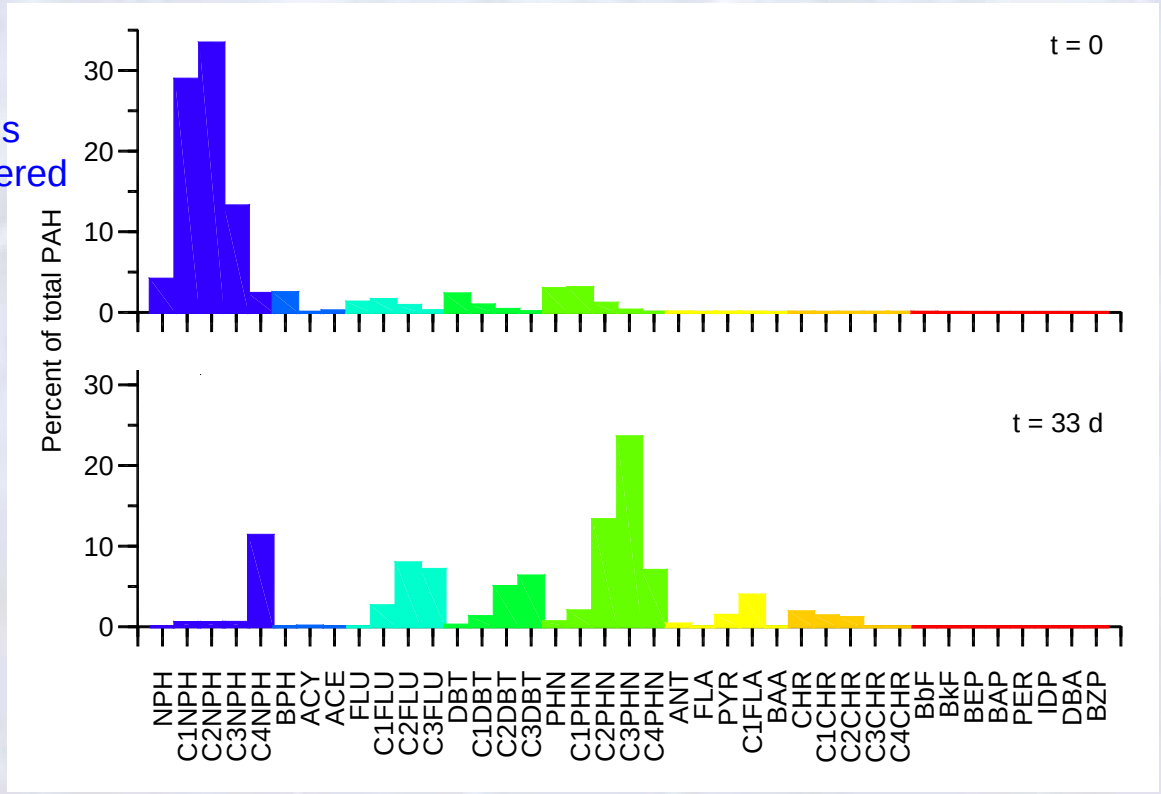
Part II:

PAH composition influences toxicity

2 examples

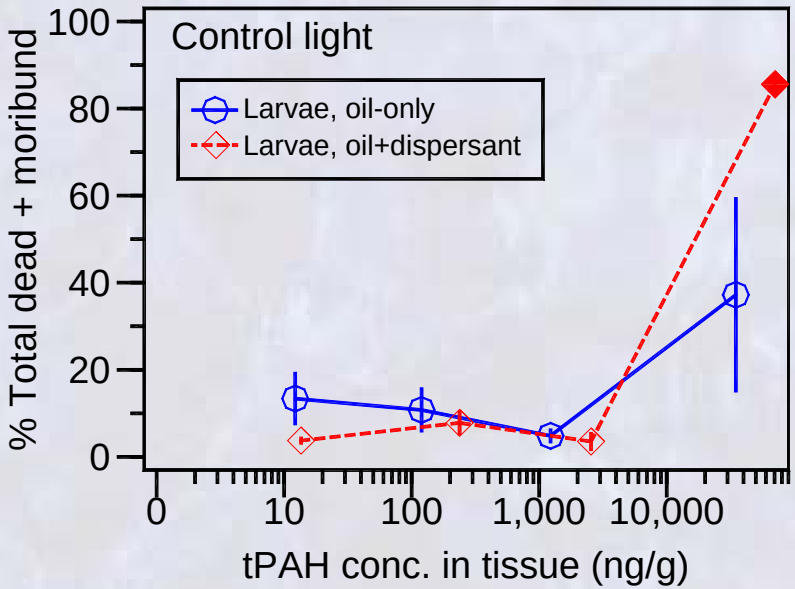
PAH influences toxicity





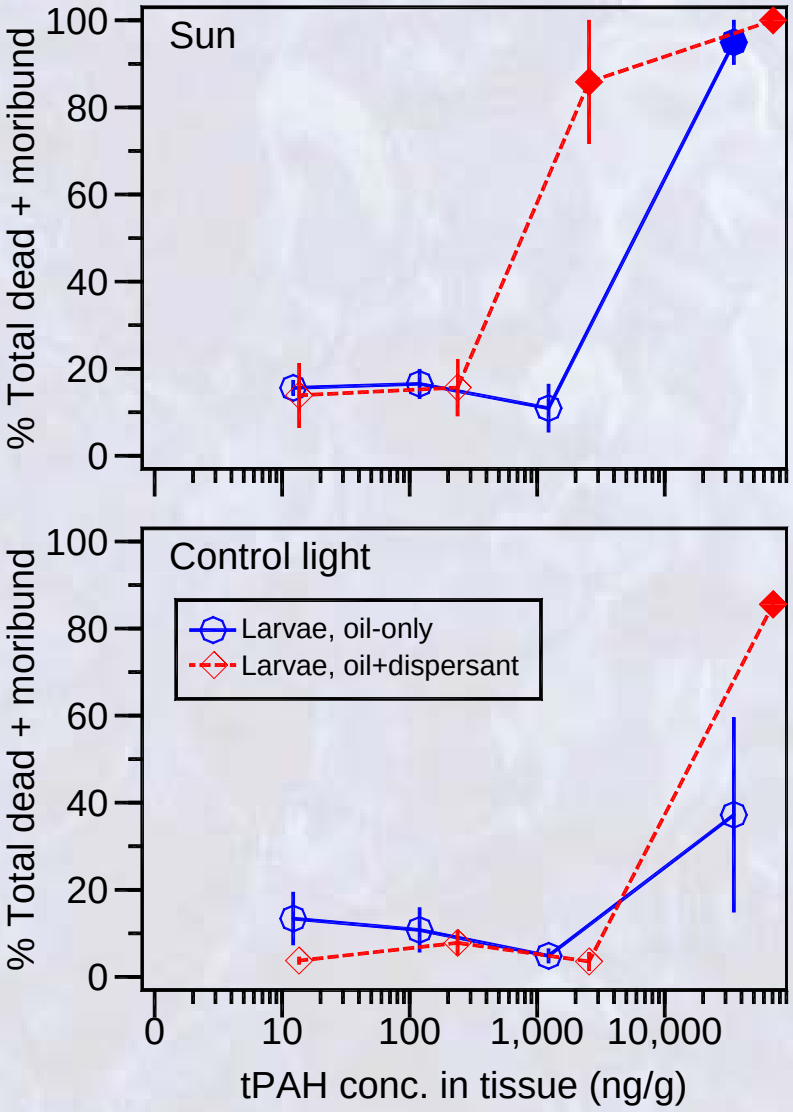
Pacific herring
Oil only

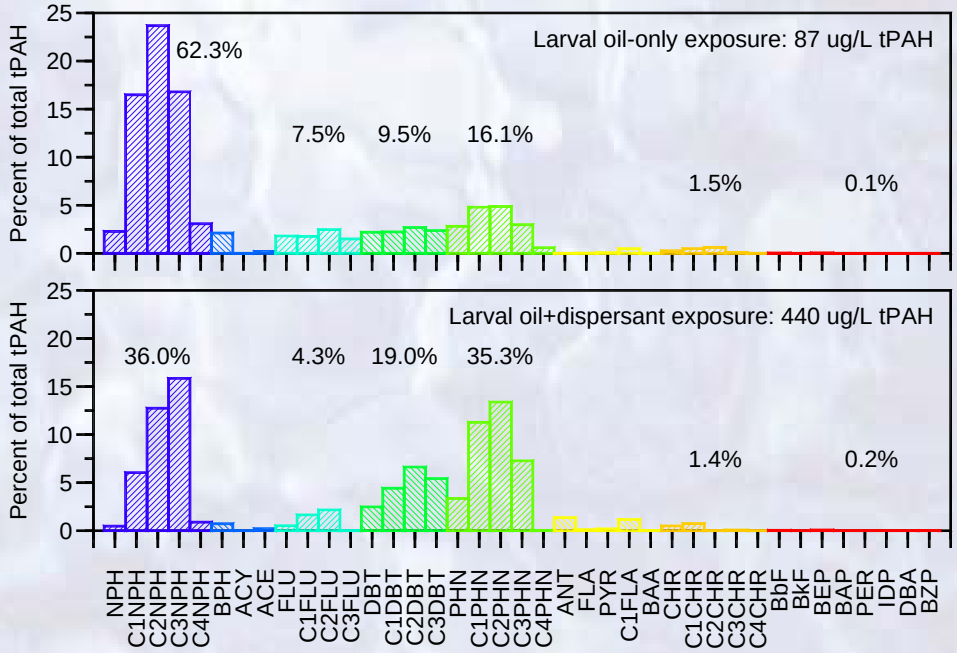
PAH influences toxicity



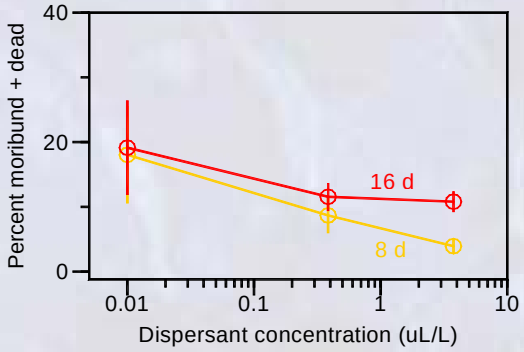
(Barron et al. 2003)

PAH influences toxicity





Dispersant (alone) was not toxic



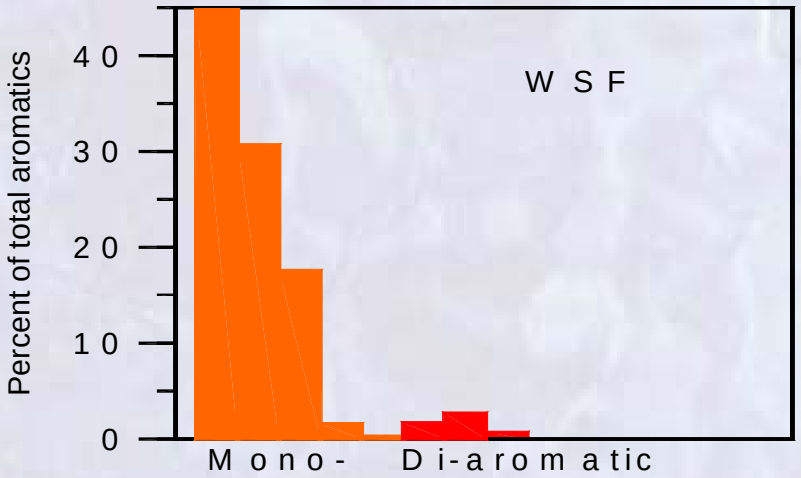
Part III:

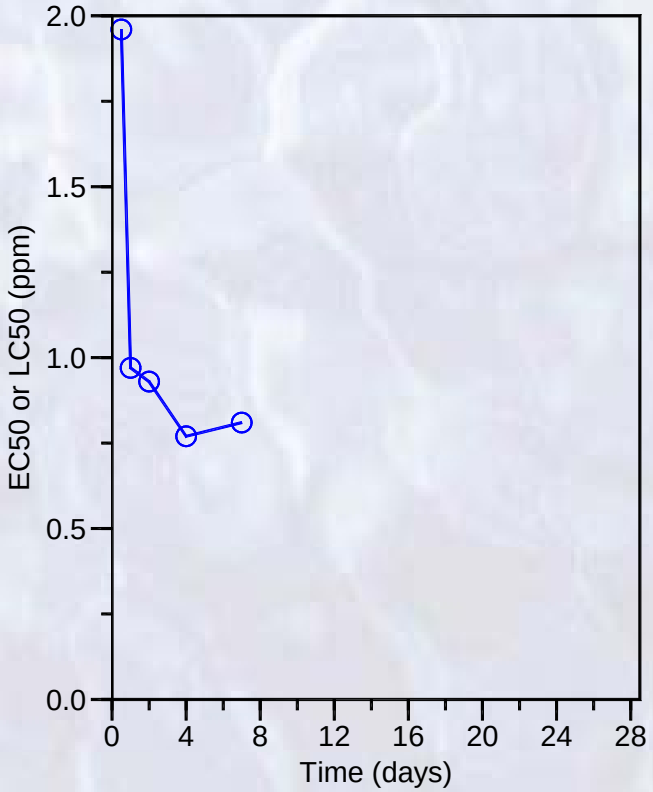
Match assay methods to toxicant

Short assays for rapid toxins

Long assays for slow toxins & longer observation times

Short assays for rapid toxins (or high conc.)

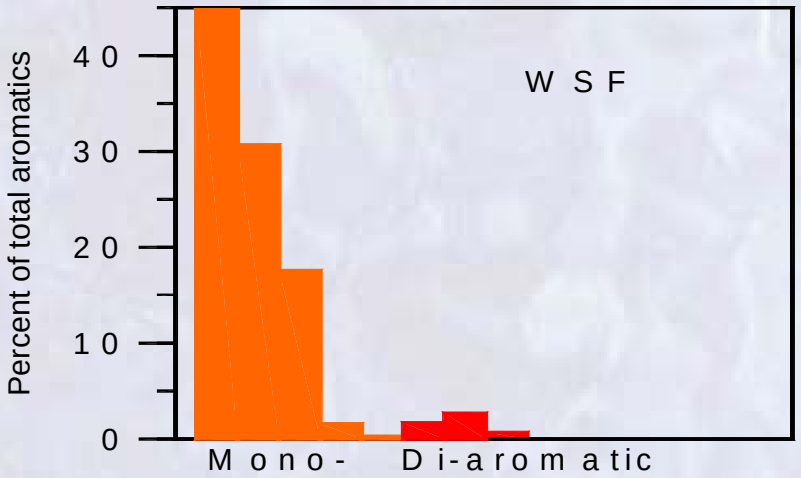


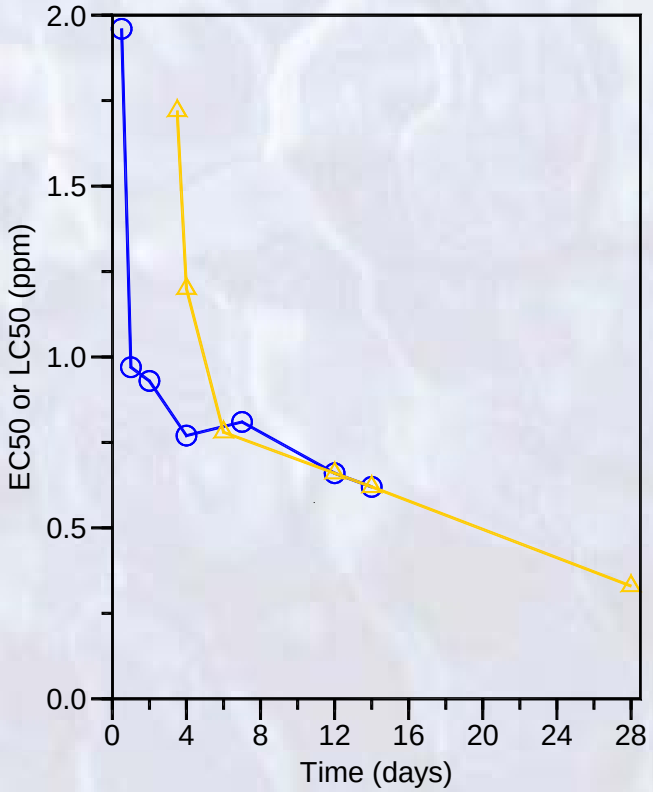


Feeding rate (herring larvae)

(Carls 1987)

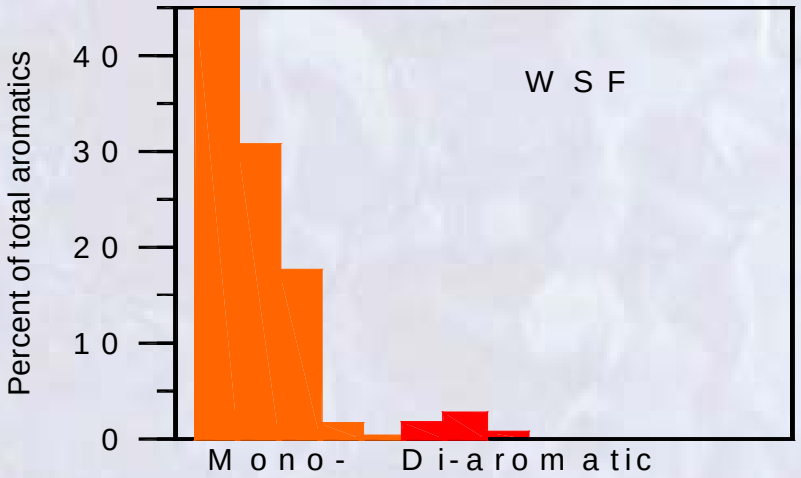
Short assays for rapid toxins (or high conc.)

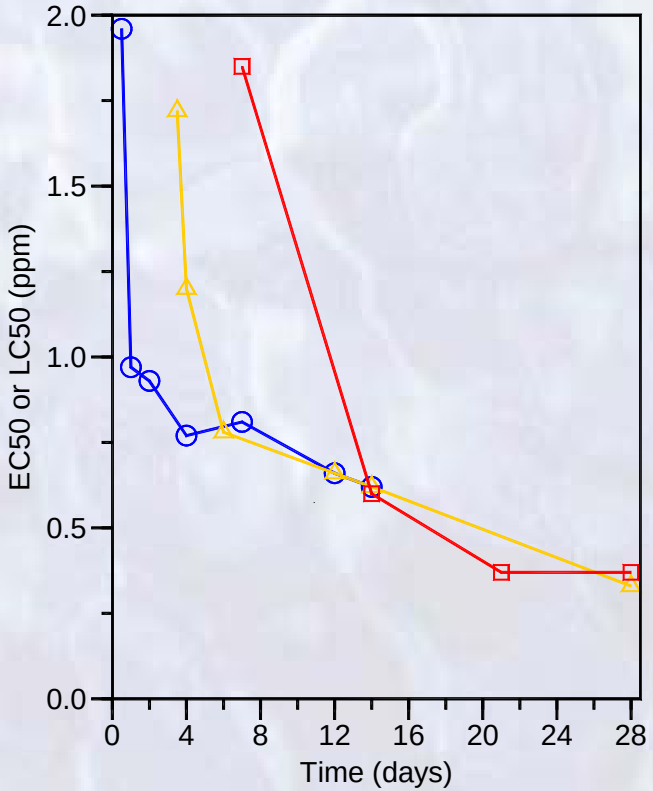




Swimming inhibition

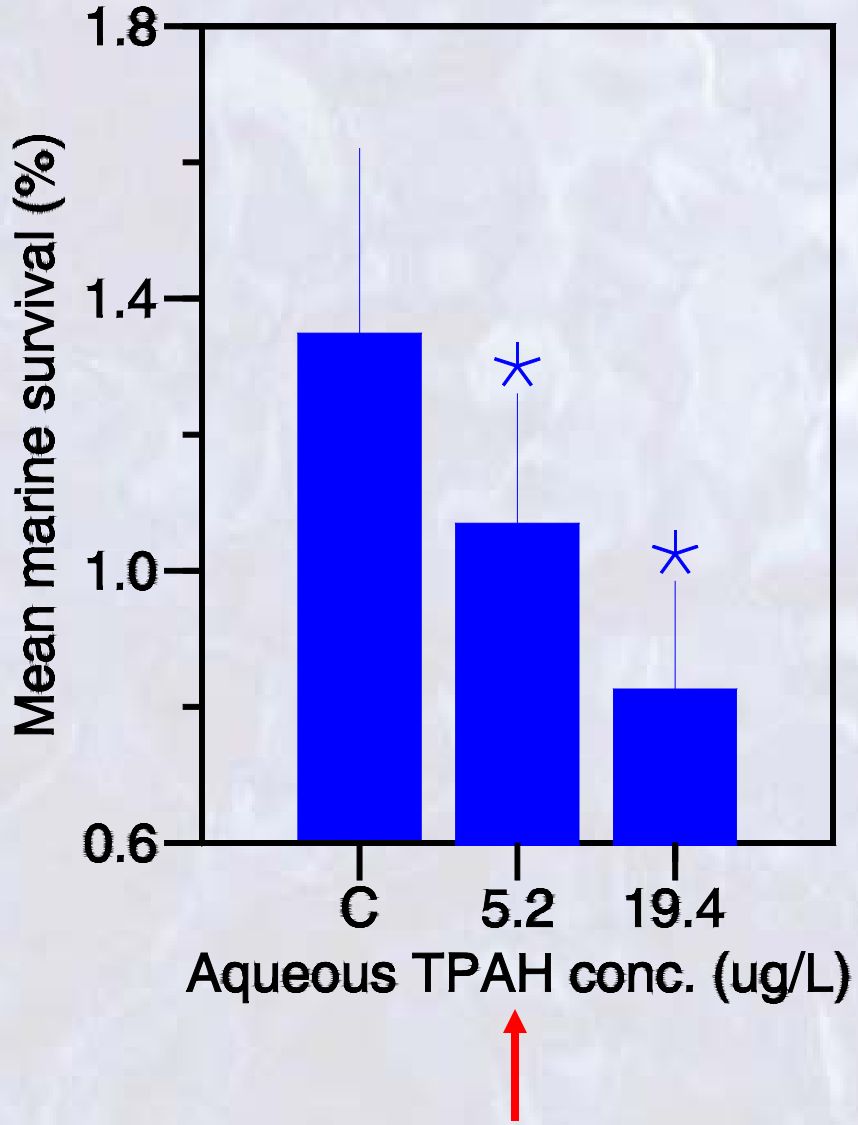
Short assays for rapid toxins (or high conc.)





Death

Long-term consequences:



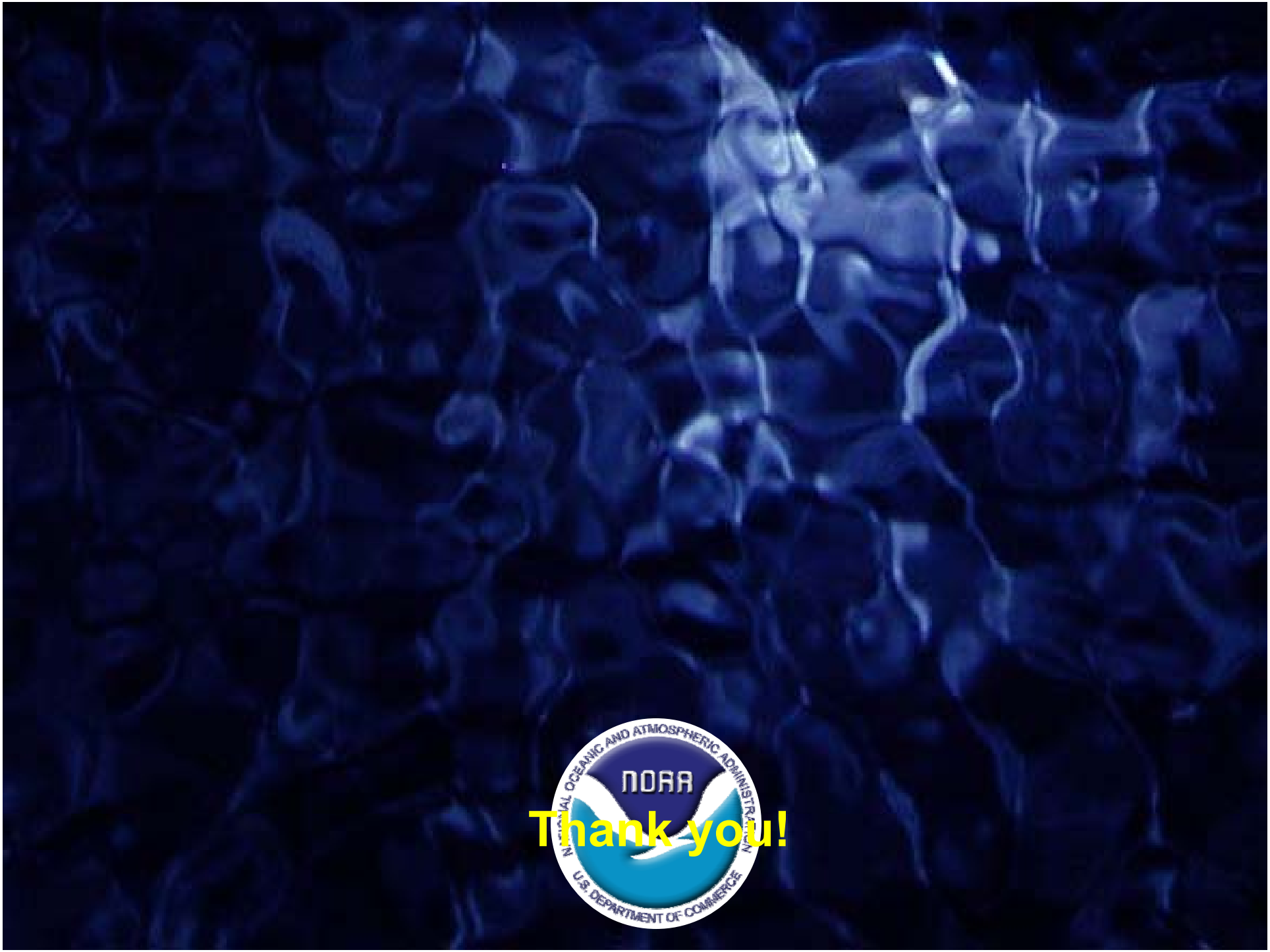
Pink salmon:

Marine survival decreased with dose

LOEC = 5.2 µg/L aq. TPAH

Conclusions:

1. Methods determine PAH composition
2. PAH composition influences toxicity
3. Match assay methods to toxicant


Thank you!
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE