

Introduction

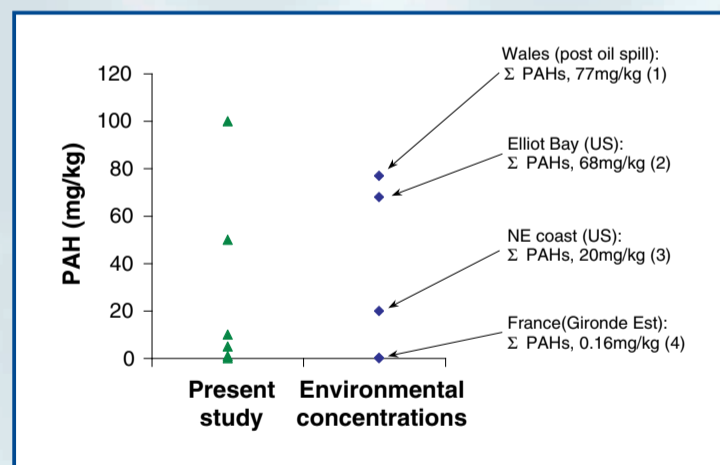
The Polycyclic aromatic hydrocarbons (PAHs) are a major group of contaminants present in the estuarine and coastal environment. The main aim of this project is to establish firmer links between biochemical and histological biomarkers of PAH exposure and/or effects and deleterious changes in fish health.



Flounder (*Platichthys flesus*).

Materials and Methods

Tank reared flounder (*Platichthys flesus*) were fed pelleted feed, for 28 days, dosed with equal concentrations of benzo(a)pyrene (BaP), benzanthracene (BaA), pyrene and phenanthrene. The concentrations in the feed reflect the range of contaminant burdens in prey items from areas of low to high contamination.



Experimental vs Environmental levels of prey item contamination

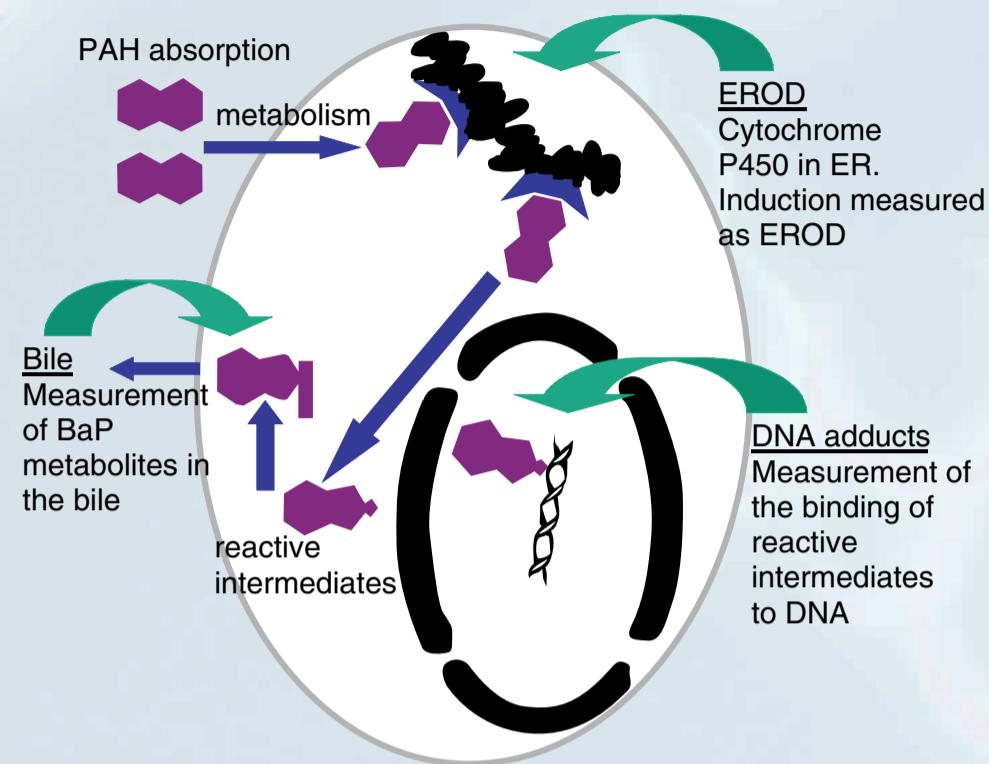
Biomarkers

Biomarkers can be measured as molecular, cellular or whole animal changes. However, all initial contaminant interactions occur at the molecular level.

References

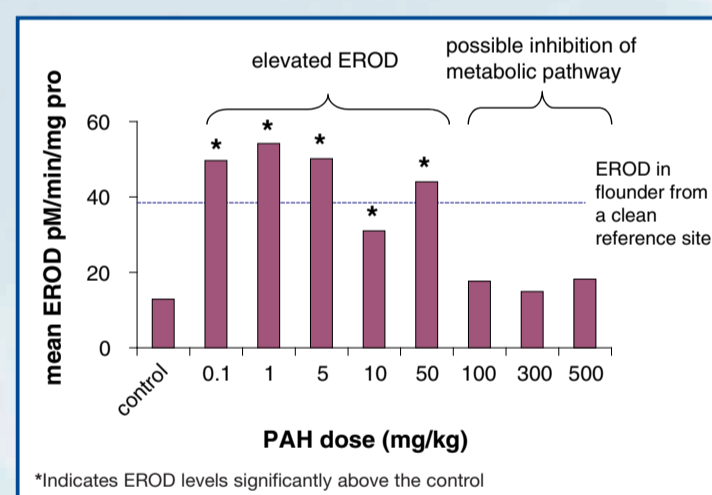
- 1) CEFAS data
- 2) Varanasi, U., Chan, S., McCain, B. B., Brown, D. W., Myers, M. S., et al. (1984-86) NOAA Technical Memorandum.
- 3) Johnson, L. L., Stehr, C. M., Olson, O. P., Myers, M. S., Pierce, S. M., Wigren, C. A., McCain, B. B., Varanasi, U. (1993). *Env Sci Tech.* 27: 2759-2771
- 4) Baumard, P., Budzinski, H., Garrigues, P., Sorbe, J. C., Burgeot, T., Bellocq, J. (1998). *Mar Poll Bull.* 36: 951-960

Biomarkers of contaminant exposure



EROD

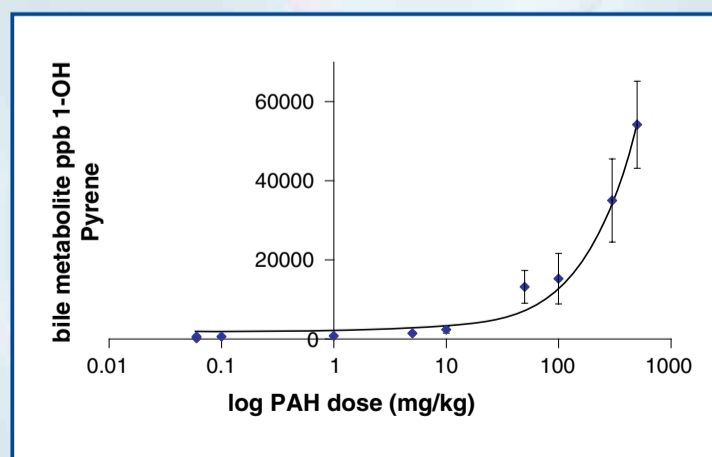
Levels of induction of P450, following exposure to some contaminants, can be measured by the EROD assay.



Mean EROD activities: 28 day feeding study

Bile metabolites

A fluorescent metabolite of BaP excreted in the bile was measured.



Mean concentration of BaP metabolite in bile: 28 day feeding study

Other Techniques

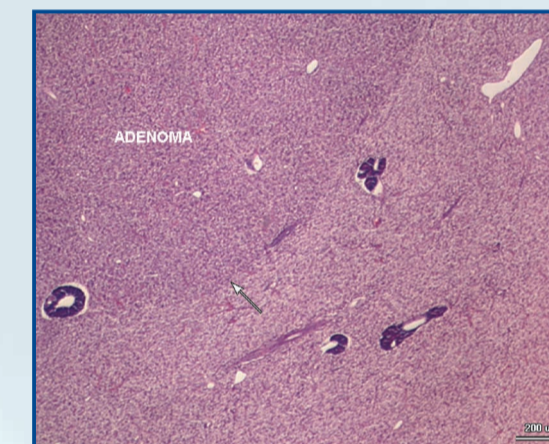
In the current study a suite of biomarkers of both response to and effect of PAHs are being measured.

Chemical analysis of muscle tissue by HPLC

| Dose (mg/kg) | Phenanthrene | Pyrene | BaA | Bap |
|--------------|--------------|---------|---------|---------|
| Control | <0.0015 | <0.0015 | <0.0015 | <0.0015 |
| 0.1 | <0.0015 | <0.0015 | <0.0015 | <0.0015 |
| 1 | 0.0023 | <0.0015 | <0.0015 | <0.0015 |
| 5 | 0.0060 | <0.0015 | <0.0015 | <0.0015 |
| 10 | 0.0078 | 0.0028 | <0.0015 | <0.0015 |
| 50 | 0.0521 | 0.0087 | <0.0015 | <0.0015 |
| 100 | 0.0370 | 0.0036 | <0.0015 | <0.0015 |
| 300 | 0.0787 | 0.0101 | 0.0044 | 0.005 |
| 500 | 0.1525 | 0.0198 | 0.0201 | 0.0065 |

Histopathology

- Dose related increase in storage products in hepatocytes
- One case of adenoma



Histology of targeted tissues



Pathogen challenge with the bacterium *Vibrio anguillarum*

Bacterial challenge study

- A successful methodology for a bacterial challenge has been developed

Conclusions

- EROD induction is significantly increased by the ingestion of PAHs. However, at high PAH concentrations induction may be inhibited.
- Bile metabolite data indicate that ingested PAHs are bioavailable.
- Chemical analysis of muscle tissue has shown the presence of all parent compounds at higher doses.
- Initial analysis of liver tissues has shown dose related histological changes.
- A direct relationship between exposure to contaminants and increased disease susceptibility has been observed.