

# **The ‘Tyne Fish Project’ – Concentrations of BFRs, Congener and Enantiomer Profiles in Different Fish Species and Sample Types from The Tyne River Estuary, UK, and Dietary Intake Estimates for Anglers.**

Lindsay Bramwell<sup>1,2</sup>, David Mortimer<sup>2</sup>, Alwyn Fernandes<sup>3</sup>, Martin Rose<sup>3</sup>, Phil Hartley<sup>4</sup>, Tanja Pless-Mulloli<sup>1</sup>

<sup>1</sup>Newcastle University, Institute of Health and Society, Newcastle, UK, NE2 4HH

<sup>2</sup>Food Standards Agency, Aviation House, 125 Kingsway London, UK, WC2B 6NH

<sup>3</sup>Food and Environment Research Agency, York, North Yorkshire, UK, YO41 1LZ

<sup>4</sup>Newcastle City Council, Civic Centre, Newcastle, UK, NE1 8PB

## **Introduction**

The River Tyne estuary is located in a densely populated conurbation of around a million people on both sides of the river banks. The area has a long industrial heritage and significantly contaminated areas on both shores have been the subject of specific investigations and remediation. For some of these sites the Food Standards Agency (FSA) has provided advice about the potential for contamination in the food chain. Industrial discharges also exist from present industry in addition to some contemporary raw sewerage discharge during storm events. In some cases the quality of water and sediment in the river has been impacted. In addition upstream discharges from numerous towns and villages in the catchment have the potential for input. Nevertheless, a substantial amount of angling takes place on the Tyne estuary, in the vicinity and downstream of these sites, and it is known that catch is often consumed. Some areas around the lower sections of the river have populations that are of low socio-economic status, and it may be that, for some consumers, locally caught fish represents a regular part of the diet. Newcastle City Council is concerned about possible health impacts of entry into the food pathway of contamination of the river.

The Food Standards Agency has already reported on brominated chemicals in wild fish, farmed fish and shell fish (FSA 2006) and is currently investigating contamination of freshwater fish in unmanaged UK waterways and possible exposure for anglers who consume their catch. In 2009 Fernandes (Fernandes et al. 2009) reported concentrations of brominated chemicals in shellfish from around the UK. However, no work has been carried out with regard to estuarine fish in England. With good quality background information already existing for the Tyne environment and the situation clearly representing a potential risk to consumers, the Food Standards Agency provided the Local Authority, Newcastle City Council, with a grant towards the sampling and testing of fish caught in the Tyne estuary.

The objectives of this research were twofold. Firstly, to determine the concentrations of a range of contaminants in different fish species, sample types and mussels from the Tyne Estuary. Secondly, to develop daily intake estimates associated with consumption of the fish to assess any health risk for anglers and local residents consuming those fish. Analysis of BFR congener and enantiomer profiling took place as part of this wider study.

## **Materials and Methods**

A steering group for the Project was brought together to ensure all stakeholders’ needs were met, and to maximise of value for money regarding integration with and benefit for other Tyne projects. The steering group also provides interpretation and effective dissemination of the results. Steering group members include experts and researchers from Newcastle University, local administrative authorities Newcastle City Council (NCC) and Gateshead Metropolitan Borough Council (GMBC), UK Government Health Protection Agency, Food Standards Agency, Environment Agency, Marine Fisheries Agency, Natural England and the Tyne Rivers Trust, a charitable body set up to manage and improve the Tyne Catchment through practical enhancements and educational activities.

Newcastle City Council and Newcastle University collected the fish samples and information on local angling activities and consumption patterns.

Over two kg each of Codling (*Gadus morhua*), Whiting (*Merlangius merlangus*), Flounder (*Platichthys flesus*) and Eel (*Anguilla anguilla*) were collected from the Tyne by three methods;

- Approaching individual recreational fishermen on the Walker Riverside area (Jan to June 09) (codling and flounder),
- Fishing competitions on the Copthorne area (June to August 2009) (whiting, eel and flounder) thanks to competitors and Rutherford's Angling Ltd,
- Open fishing competition (November 09) (codling, flounder, whiting, eel and pouting collected from Hebburn and Jarrow sites) thanks to South Shields Angling Club.

Mussels (*Mytilus edulis*) from a bed situated within the sampling area were also collected for analysis as a useful biomarker for comparison with other studies (FSA 2006; Moon 2007; Fernandes, Mortimer et al. 2009). However, to our knowledge mussels from this bed are not harvested for human consumption.

Laboratory analysis is being carried out by the UK Government's Food and Environment Research Agency (Fera) (formerly CSL), Sand Hutton, York. Species sample types are pooled and homogenised to make composite samples.

Muscle for each fish species was analysed. Cod liver was also analysed. Cod liver is traditionally consumed as part of Eastern European and Scandinavian diets and immigrants residing in the Tyneside area can be expected to consume liver from cod caught in the Tyne. For white or non-oily fish, organic contaminants tend to accumulate to a much greater extent in the liver than in muscle.

The following BFRs were measured:

- Polybrominated diphenylethers (PBDEs) - IUPAC numbers 17, 28, 47, 49, 66, 71, 77, 85, 99, 100, 119, 126, 138, 153, 154, 183 and 209.
- HBCD:  $\alpha$ ,  $\beta$ , and  $\gamma$  enantiomers.

### **Data Analysis**

Cod muscle data from the study is compared with previous cod muscle studies in the UK (FSA 2006) and Belgium (Voorspoels et al. 2007). Cod liver data is compared with cod liver data from Denmark (DVFA 2003). Whiting muscle data is compared with previously collected whiting muscle data from the UK (FSA 2006). Flounder muscle is compared with previous UK data (Allchin et al. 1999). Eel data is compared with other eel data from the UK (FSA 2006), Denmark (DVFA 2003) and Belgium (Covaci et al. 2005). Mussel data from the study is compared with mussel data from the UK (Allchin et al. 1999; FSA 2006; Fernandes et al. 2009) and Korea (Moon et al. 2007).

### **Results and discussion**

The Tyne Fish Project data is unique as it is the first study that investigates the range of brominated contaminants in a range of fish species and sample types from an estuarine river, and it compliments the previous FSA studies. The wider Project also provides valuable information regarding local anglers and their families' exposures to contaminants via consumption of their catch.

The Food Standards Agency has reported on the UKs dietary intake of brominated chemicals (FSA 2006). Harrad (Harrad et al. 2004) and Fernandes (Fernandes et al. 2009) also developed estimates for dietary intake of PBDEs in the UK. Using these studies as the basis for dietary intake in the UK and considering Dorne's risk assessment guidance (Dorne et al.

2009) we determine PBDE and HBCD dietary exposure for anglers consuming fish caught in the Tyne. This estimate is compared with dietary intake estimates for Japan (Ohta et al. 2002; Ashizuka et al. 2007) Hong Kong (Cheung et al. 2008), Australia (FSANZ 2006), Spain (Bocio et al. 2003), Belgium (Voorspoels et al. 2007), Sweden (Darnerud et al. 2006) and USA (Schecter et al. 2006; Johnson-Restrepo and Kannan 2009) . The dietary intake estimates are compared with intake guidance from RIVM (Winter-Sorkina et al. 2006).

Discussion of data presented at BFR2010 includes comparison of sample type data with PBDE congener and HBCD enantiomer patterns. The advice given to Tyne anglers and regulatory implications are also reported.

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