

Comparison of Daly River fish samples with PFAS trigger levels

1. Background

The Northern Territory Department of Primary Industry and Resources (DPIR) has requested that Food Standards Australia New Zealand (FSANZ) review per- and poly-fluoroalkylated substances (PFAS) analytical data for 12 fish samples caught in the Daly River and compare these data to the trigger levels proposed by FSANZ.

In April 2017 the Department of Health published FSANZ's recommendations on appropriate tolerable daily intakes (TDIs) for PFOS and PFOA. In addition FSANZ proposed 'trigger levels' for a range of foods which indicate concentrations above which further consideration may be warranted by regulatory agencies. These reports were published on the Department of Health website¹.

2. Analytical data

PFAS analytical data were provided for 12 fish caught in the Daly River in November 2017. Three species of fish were analysed (barramundi, catfish and mullet). Fish flesh was analysed for all 12 samples as well as 5 barramundi liver samples.

Data provided indicated that PFOS was detected at levels greater than the level of reporting (LOR) of 0.3 µg/kg in all samples of flesh and liver except one fish flesh sample. PFAS concentrations in all fish flesh and liver samples were <LOR of 0.3 µg/kg for PFHxS, and <LOR of 0.5 µg/kg for all other PFAS congeners analysed, including PFOA.

Summary data for PFOS, PFOA, PFHxS and PFOS+PFHxS combined are provided in Table 1, with Table 2 providing summary PFOS + PFHxS combined summary data for each individual fish species analysed.

Table 1 Summary concentration data (µg/kg) for Daly River fish analysed for PFAS

Fish Matrix	Chemical	Count	Count of <LOR	Minimum	Maximum	Mean**	Median**
Flesh*	PFHxS	12	12	<LOR	<LOR	<LOR	<LOR
	PFOA	12	12	<LOR	<LOR	<LOR	<LOR
	PFOS	12	1	<LOR	62	10.1	3.8
	PFOS+PFHxS	12	1	<LOR	62	10.7	4.3
Liver	PFHxS	5	5	<LOR	<LOR	<LOR	<LOR
	PFOA	5	5	<LOR	<LOR	<LOR	<LOR
	PFOS	5	0	4.1	37	18.4	17
	PFOS+PFHxS	5	0	4.1	37	18.9	17.5

* All species combined.

** Upper bound mean and median derived where not detected results are assigned a concentration equal to LOR.

¹ See Department of Health: Health Based Guidance Values for Per- and Poly Fluoroalkyl Substances <http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-pfas-hbgv.htm>

Table 2 Summary PFOS + PFHxS concentration data ($\mu\text{g}/\text{kg}$) for different species of Daly River fish analysed

Fish matrix	Fish species	Count	Count of <LOR	Minimum	Maximum	Mean**	Median**
Flesh	Barramundi	5	1	<LOR	3.4	2.2	2
	Catfish	2	0	0.8	4.1	3	3
	Mullet	5	0	4.7	62	22.2	9.7
	All fish	12	1	<LOR	62	10.7	4.3
Liver	Barramundi	5	0	4.1	37	18.9	17.5

** Upper bound mean and median derived where not detected results are assigned a concentration equal to LOR.

3. Comparison with trigger levels proposed by FSANZ

3.1. Fish flesh

Trigger levels developed by FSANZ are provided at Attachment 1. Trigger levels of $5.2 \mu\text{g}/\text{kg}$ for PFOS+PFHxS combined and $41 \mu\text{g}/\text{kg}$ for PFOA were proposed for all finfish. This is a conservative value based on high (90th percentile) consumption of all diadromous, freshwater and marine fish by children aged 2-6 years.

All fish flesh analysed had concentrations of PFOA <LOR of $0.5 \mu\text{g}/\text{kg}$ and therefore were well below the PFOA trigger level of $41 \mu\text{g}/\text{kg}$.

Levels of PFOS and PFOS+PFHxS combined were below the finfish trigger level of $5.2 \mu\text{g}/\text{kg}$ for all barramundi and catfish analysed. This indicates that consumption of these fish species caught in the Daly River are unlikely to present a public health and safety concern. However it should be noted that this conclusion is based on a limited number of analytical samples, especially for catfish.

Levels of PFOS and PFOS+PFHxS combined exceeded the finfish trigger level of $5.2 \mu\text{g}/\text{kg}$ for 4 of the 5 mullet samples analysed. Mean and median concentrations for mullet also exceeded the trigger value. This indicates that further investigation or risk management action may be required in relation to this fish species.

When all fish species analysed were considered together the median² PFOS+PFHxS combined concentration is $4.3 \mu\text{g}/\text{kg}$, less than the trigger level of $5.2 \mu\text{g}/\text{kg}$. This indicates that, overall, consumption of a range of these fish species over time is unlikely to present a public health and safety concern.

3.2. Fish liver

All barramundi liver analysed had concentrations of PFOA <LOR of $0.5 \mu\text{g}/\text{kg}$, and therefore were well below the PFOA trigger level for fish liver of $2240 \mu\text{g}/\text{kg}$.

Levels of PFOS and PFOS + PFHxS combined were well below the trigger level of $280 \mu\text{g}/\text{kg}$ for liver for all five barramundi samples, indicating that consumption of liver from barramundi caught in the Daly River is unlikely to present a public health and safety concern.

² The use of the median concentration level reflects that there will always be a distribution of the contaminant in the foods eaten over time. It is unrealistic to expect each food item consumed to be contaminated at the highest reported concentration on every eating occasion.

However, there is no data for concentrations of PFAS in the liver of other fish species. Given that higher concentrations of PFOS are found in liver compared to flesh, further analysis of mullet liver may be warranted, as analytical data for this species shows much higher concentrations of PFOS in the flesh compared to barramundi and catfish.

4. Serves of fish to reach the health based guidance value for PFOS

To provide additional context, tables 3 and 4 below provide an indication of the approximate number of serves of fish flesh and liver with median PFOS+PFHxS combined concentrations that can be consumed by the whole population and children aged 2-6 years before reaching the TDI for PFOS of 0.02 µg/kg bw/day.

5. Conclusion

On the basis of the very limited data provided, it is concluded that overall, exposure to PFAS from consumption of a range of Daly River barramundi, catfish and mullet over time is unlikely to present a public health and safety concern. Given the low number of fish sampled, further monitoring may be required. In particular, given the higher concentrations of PFOS in mullet, further investigation of this species may be warranted, particularly concentrations of PFOS in the liver.

While this report details that many serves of Daly River fish can be consumed before reaching the TDI for PFOS, FSANZ nonetheless recommends that due to health concerns regarding naturally occurring mercury levels in fish, that people limit their consumption of fish to a few serves a week for the adult population and less serves for children and pregnant women in accordance with national fish consumption advice produced by FSANZ in Attachment 1 and which can also be downloaded at:

<http://www.foodstandards.gov.au/consumer/chemicals/mercury/documents/mif%20brochure.pdf>

Table 3 Amount of food (grams/day, serves/day[^] and frequency of consumption) at median PFOS+PFHxS combined concentration that can be consumed every day over a lifetime before reaching the TDI* for the population aged 2+ years

Fish Matrix	Fish species	Amount of food that can be consumed before reaching PFOS+PFHxS TDI			Actual food consumption [~] (grams/day)	
		Grams/day	Serves of foods /day	Approximate frequency of consumption	P90 (consumers only)	Mean (consumers only)
Flesh	Barramundi	700	Approx 4½ fillet/cutlets (1 fillet/cutlet = 150 g)	About 32 serves of barramundi per week	143	56
	Catfish	475	Approx 3 fillet/cutlets (1 fillet/cutlet = 150 g)	About 22 serves of catfish per week		
	Mullet	144	Approx 1 fillet/cutlets (1 fillet/cutlet = 150 g)	About 7 serves of mullet a week		
	Fish - all	330	Approx 2 fillets/cutlets (1 fillet/cutlet = 150 g)	About 15 serves of fish per week		
Liver	Barramundi	80	16 livers (one liver = 5 grams)	About 110 livers		5 [#]

[^] Measures taken from AUSNUT 2011-12 Measures File [AUSNUT Food Measures File](#)

* Tolerable daily intake for PFOS and PFOS+PFHxS combined is 0.02 µg/kg body weight/day

[~] Actual food consumption for all fish as reported in the 2011-12 Australian National Nutrition and Physical Activity Survey

[#] no food consumption data available, Population 2+ years, median consumption assumed to be 5 g (weight of one liver). Source: FSANZ report on Edith River, Northern Territory 2013, https://dpir.nt.gov.au/_data/assets/pdf_file/0006/260187/TraceElementsNTFish.pdf

Table 4 Amount of food (grams/day, serves/day[^] and frequency of consumption) at median PFOS+PFHxS combined concentration that can be consumed every day over a lifetime before reaching the TDI* for the population aged 2-6 years

Fish Matrix	Fish species	Amount of food that can be consumed before reaching PFOS+PFHxS TDI			Actual food consumption [~] (grams/day)	
		Grams/day	Serves of foods /day	Approximate frequency of consumption	P90 (consumers only)	Mean (consumers only)
Flesh	Barramundi	190	Approx 2½ fillet/cutlets (1 fillet/cutlet = 75 g)	About 18 serves of barramundi per week	73	24
	Catfish	129	Approx 1½ fillet/cutlets (1 fillet/cutlet = 75 g)	About 12 serves of catfish per week		
	Mullet	39	Approx ½ fillet/cutlet (1 fillet/cutlet = 75 g)	About 4 serves of mullet a week		
	Fish - all	89	Approx 1 fillets/cutlets (1 fillet/cutlet = 75 g)	About 7½ serves of fish per week		
Liver	Barramundi	22	Approx 4½ livers (one liver = 5 grams)	About 30 livers per week		5 [#]

[^] Measures taken from AUSNUT 2011-12 Measures File [AUSNUT Food Measures File](#)

* Tolerable daily intake for PFOS and PFOS+PFHxS combined is 0.02 µg/kg body weight/day

[~] Actual food consumption for all fish as reported in the 2011-12 Australian National Nutrition and Physical Activity Survey

[#] no food consumption data available, Population 2+ years, median consumption assumed to be 5 g (weight of one liver). Source: FSANZ report on Edith River, Northern Territory 2013, https://dpir.nt.gov.au/_data/assets/pdf_file/0006/260187/TraceElementsNTFish.pdf

Attachment 1

Table 1. Proposed trigger points for investigation

Food	Food classification	Proposed trigger points for investigation (µg/kg)		Derivation
		PFOS, PFOS+ PFHxS combined	PFOA	
Fish and Seafood	Crustaceans and Molluscs [#]	65	520	Children 2-6 years, median consumption
	Finfish (all)	5.2	41	Children 2-6 years, P90 consumption
	Fish liver [#]	280	2240	Population 2+ years, median consumption assumed to be 5 g (weight of one liver)*
Animal Products	Meat mammalian	3.5	28	Children 2-6 years, P90 consumption
	Milk	0.4 or LOD if higher	2.8	Children 2-6 years, P90 consumption
	Honey	33	264	Children 2-6 years, P90 consumption
	Offal mammalian [#]	96	765	Population 2+ years, median consumption
	Poultry eggs	11	85	Children 2-6 years, P90 consumption
Fruits and vegetables	Fruit (all)	0.6 or LOD if higher	5.1	Children 2-6 years, P90 consumption
	Vegetables (all)	1.1 or LOD if higher	8.8	Children 2-6 years, P90 consumption

[#]occasionally consumed food, trigger points for investigation for crustaceans applied to molluscs due to small number of consumers of molluscs.

* no food consumption data available, source: FSANZ report on Edith River, Northern Territory 2013, https://dpir.nt.gov.au/_data/assets/pdf_file/0006/260187/TraceElementsNTFish.pdf