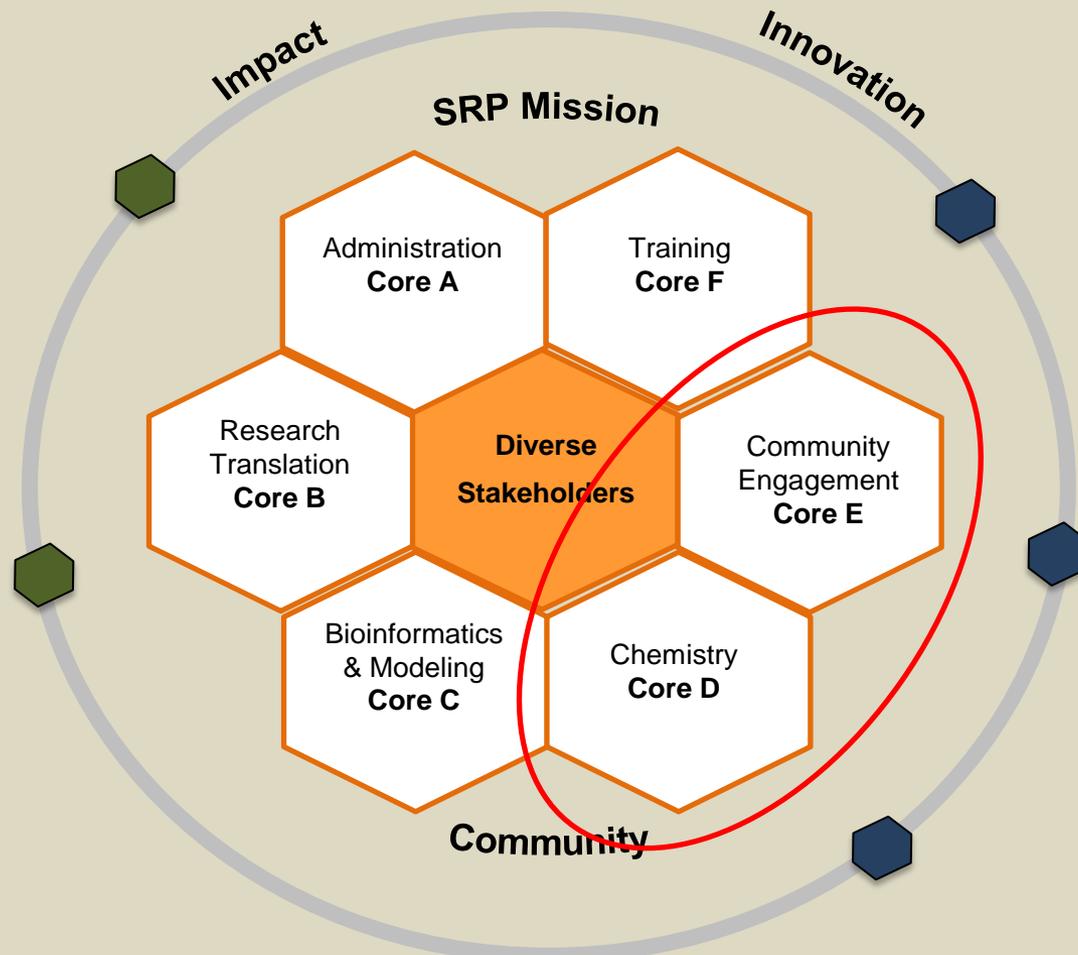


# Informing communities – a collaborative investigation of Native American PAH dietary exposure scenarios and possible risks to human health



Norman Forsberg, Dave Stone, Anna Harding, Barbara Harper, Stuart Harris, Melissa M. Matzke, Andres Cardenas, Katrina M. Waters, Kim A. Anderson

# Oregon State University Superfund Research Program: PAHs - New Technologies and Emerging Health Risks



# Engagement CORE project goals

Establish a collaborative project that includes the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) tribal agencies, tribal and university investigators, and tribal community members to better understand health risks associated with PAH exposure on the Reservation and assist in human capacity building with tribal partners.

## CTUIR specific requests:

- PAH exposure from traditional smoking practices
- PAH concentrations in traditionally smoked foods
- Tribal member engagement in research (CBPR)

# CTUIR geographic location

OF



IDAHO

This map is for informational purposes only. The data depicted is preliminary and has not been field verified. No warranty is made for the use of this map beyond the intended use by the G.I.S. staff.

# History of collaboration between OSU and CTUIR

- EPA-STAR-J1-R831046 (2003-2007)  
“Estimating Environmental Exposures for Tribes Practicing Traditional Subsistence Lifestyles”  
<https://www.box.com/shared/70r3579u5gh7ysdugfv7>
- Signed MOU in place
- Several pilot projects
- NIEHS-P42ES016465 (2009-2013)  
“Tribal-University Collaboration to Address Tribal Exposures to PAHs and Improve Community Health”

## Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual



Three Rivers, Idaho (Courtesy of Barbara Harper)

### Principal Investigator:

Barbara L. Harper, Oregon State University Department of Public Health and Confederated Tribes of the Umatilla Indian Reservation

### Co-investigators:

Anna K. Harding, Oregon State University Department of Public Health  
Therese Waterhous, Oregon State University Department of Nutrition and Exercise Sciences  
Stuart G. Harris, Confederated Tribes of the Umatilla Indian Reservation

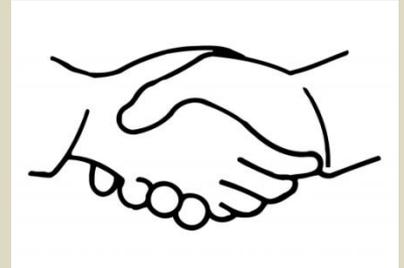
# Educating OSU community about Tribal research issues

## OSU Tribal Research Symposium - April 2010

- Issues/perspectives related to research in Tribal communities
- Included Tribal legal issues, research ethics, concepts in indigenous and western science, integration of socio-cultural health indicators into Tribal risk research.
- Featured speakers from CTUIR and Swinomish Tribal Community and tribal legal scholar
- Bi-directional capacity building
- Presentation and speaker details:  
<http://oregonstate.edu/superfund/outreachevents>

# Community based participatory research (CBPR)

- Collaborative determination of:
  - Research aims beneficial to community
  - Data collection analysis validation



## Conducting Research with Tribal Communities: Sovereignty, Ethics, and Data-Sharing Issues

*Anna Harding,<sup>1</sup> Barbara Harper,<sup>1,2</sup> Dave Stone,<sup>3</sup> Catherine O'Neill,<sup>4</sup> Patricia Berger,<sup>5</sup> Stuart Harris,<sup>2</sup> and Jamie Donatuto<sup>6</sup>*

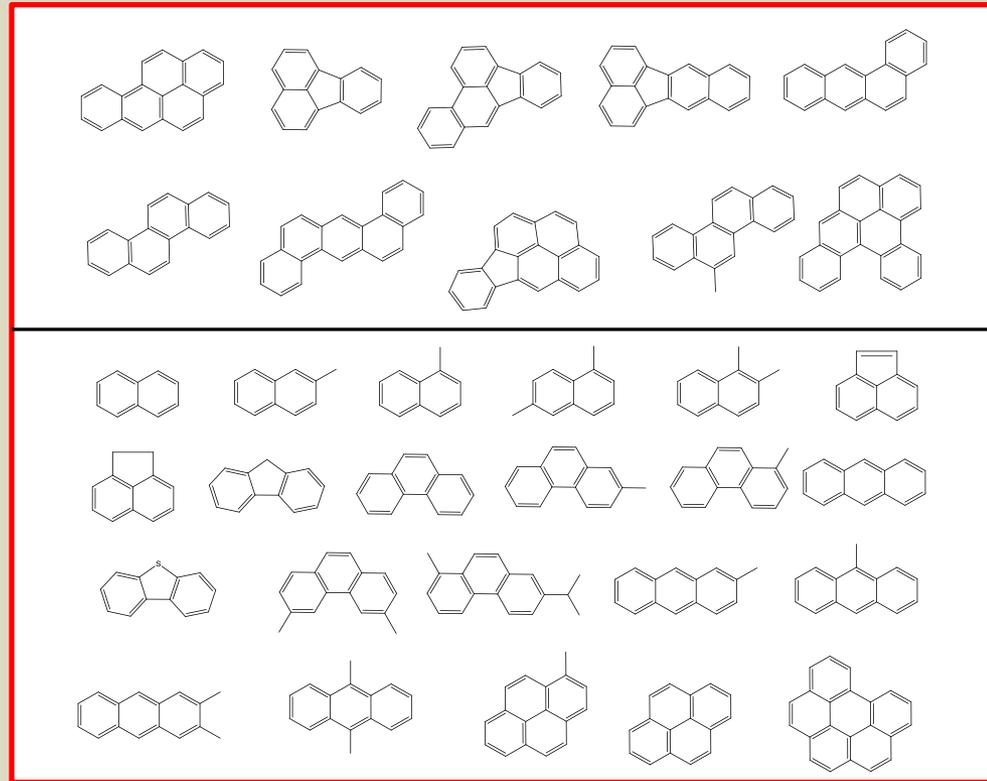
<sup>1</sup>School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, Oregon, USA; <sup>2</sup>Department of Science and Engineering, Confederated Tribes of the Umatilla Indian Reservation, Pendleton, Oregon, USA; <sup>3</sup>Department of Environmental and Molecular Toxicology, Oregon State University, Corvallis, Oregon, USA; <sup>4</sup>Seattle University School of Law, Seattle, Washington, USA; <sup>5</sup>Department of Information Technology, Marion County, Salem, Oregon, USA; <sup>6</sup>Swinomish Indian Tribal Community, Office of Planning and Community Development, La Conner, Washington, USA

"Harding, A.; et al. 2012. Conducting research with tribal communities: Sovereignty, ethics, and data-sharing issues. *EHP* 120(1): 6-10."

# Background

- Community based concerns
- PAHs occur in combustion emissions
- Traditional meat smoking techniques

## Carcinogenic PAHs



## Non-carcinogenic PAHs

# Study objectives

1. Characterize the effect of CTUIR smoking method on polycyclic aromatic hydrocarbon (PAH) content in smoked salmon
2. Compare traditionally smoked salmon PAH levels to PAHs in commercially smoked salmon.
3. Estimate potential risks from consumption of traditionally smoked salmon.

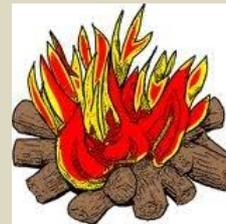
# Study design

- Two-factors considered
  - Smoking structure - tipi or shed
  - Wood type - apple or alder
- Smoked salmon prepared as if to be eaten!
- Non-smoked salmon control
- 3 different commercial smoked salmon



# Study execution – salmon smoking

- 10 non-smoked salmon sub-samples/event → -10°C
- 10 fillets/ smoking method
- Apple wood followed by alder wood



# Study execution – post smoking

JOURNAL OF  
**AGRICULTURAL AND  
FOOD CHEMISTRY**

ARTICLE

[pubs.acs.org/JAFC](http://pubs.acs.org/JAFC)

## Determination of Parent and Substituted Polycyclic Aromatic Hydrocarbons in High-Fat Salmon Using a Modified QuEChERS Extraction, Dispersive SPE and GC–MS

Norman D. Forsberg, Glenn R. Wilson, and Kim A. Anderson\*

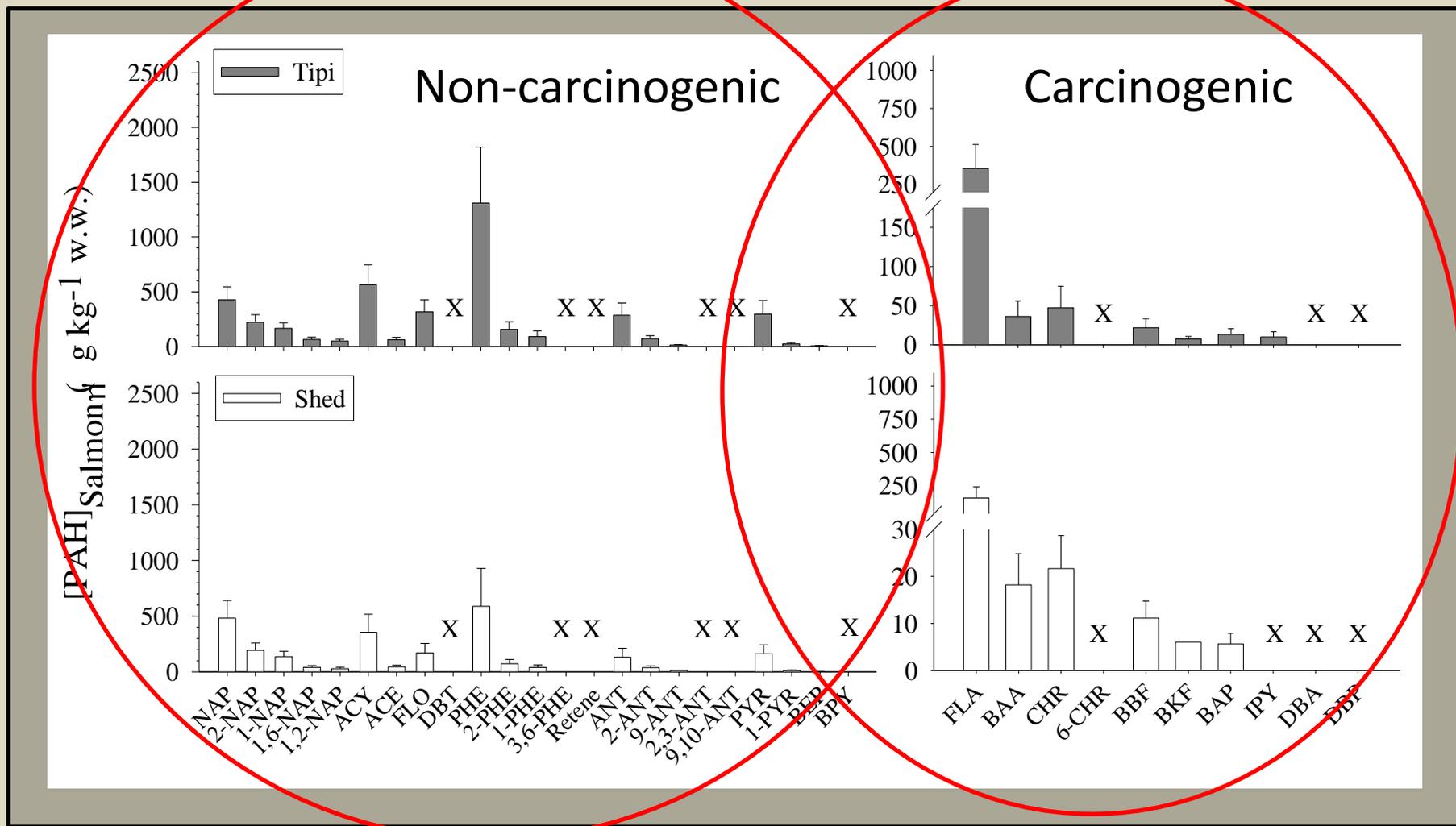
Department of Environmental and Molecular Toxicology, Oregon State University, Corvallis, Oregon 97331, United States

Stewardship  
Laboratory (-20°C)

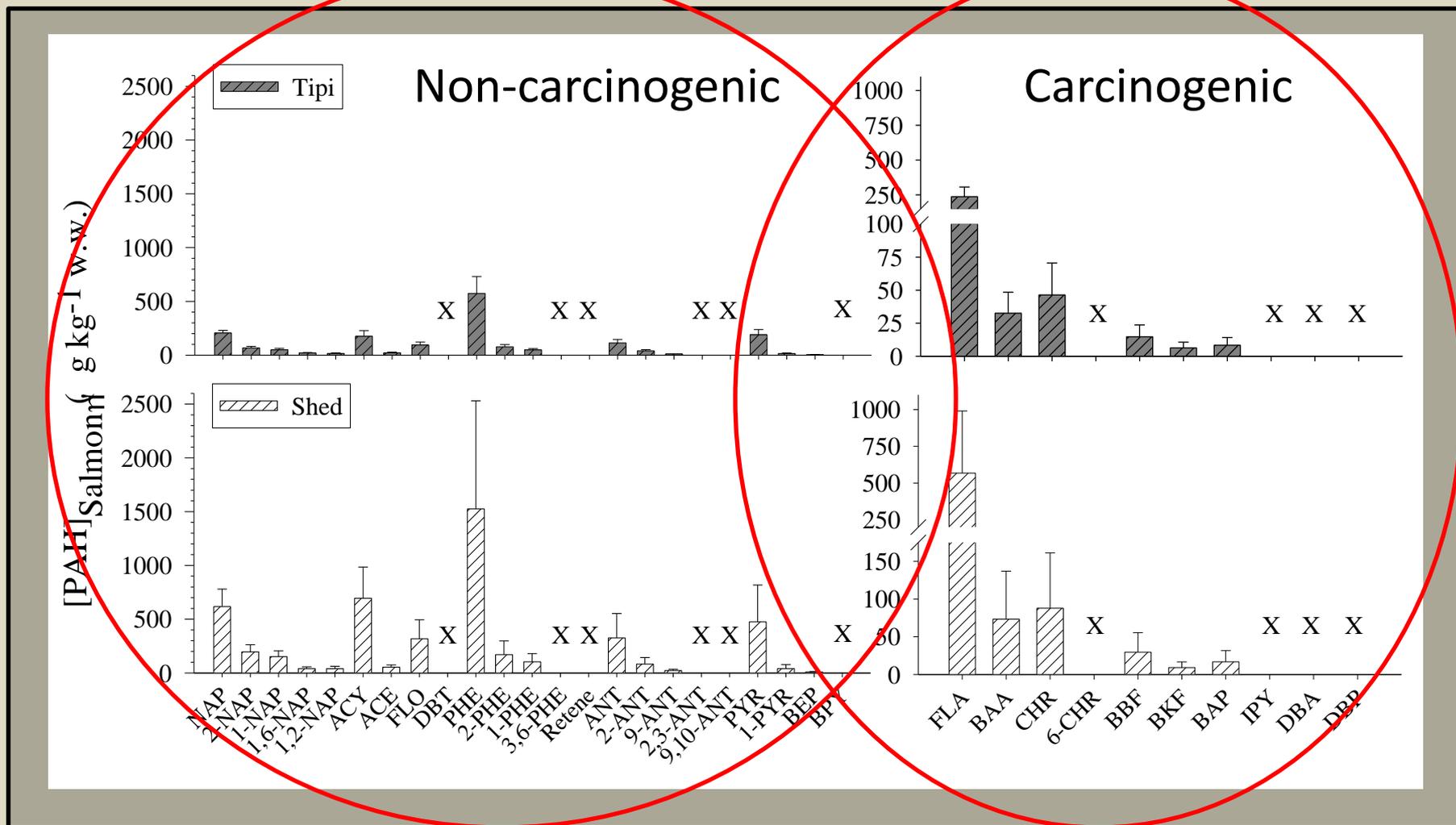
- Salmon analyzed for 33 PAHs by GC-MS



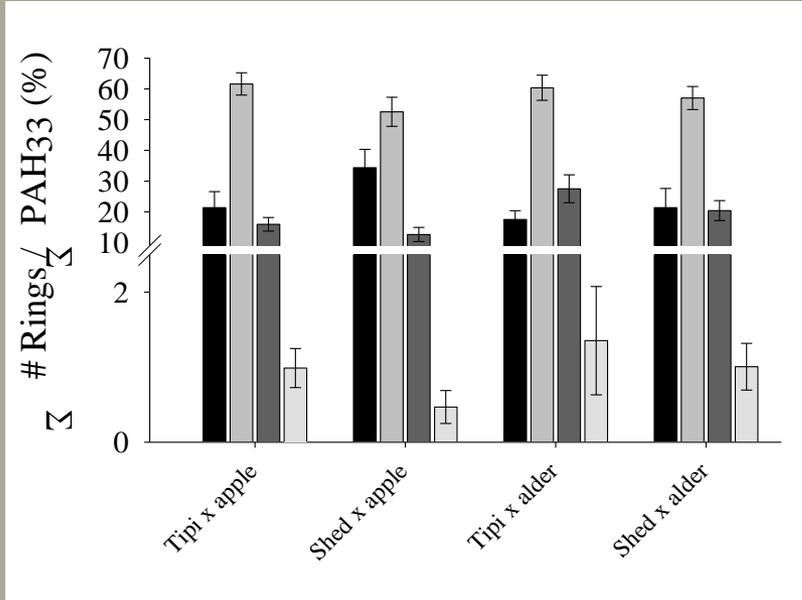
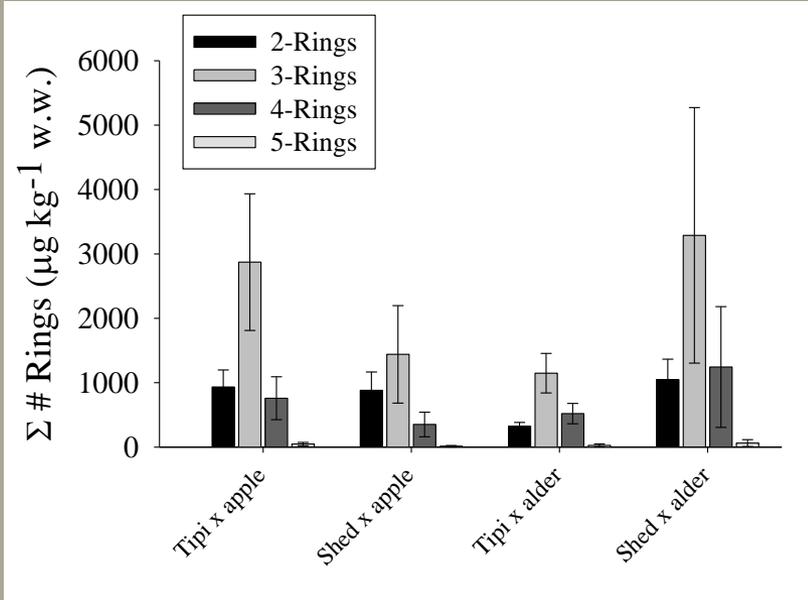
# PAH content in apple wood smoked salmon



# PAH content in alder wood smoked salmon



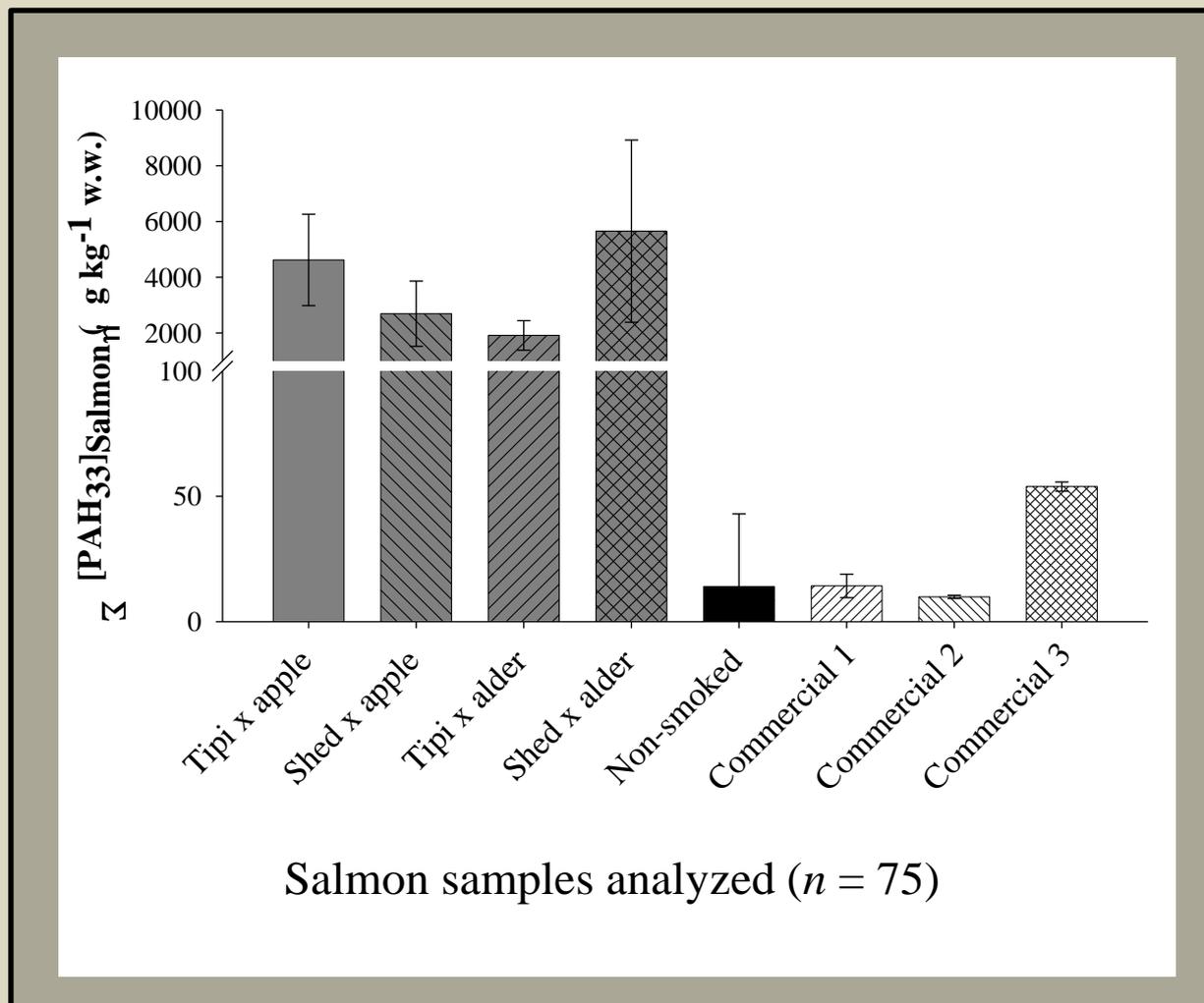
# Categorized PAH abundances



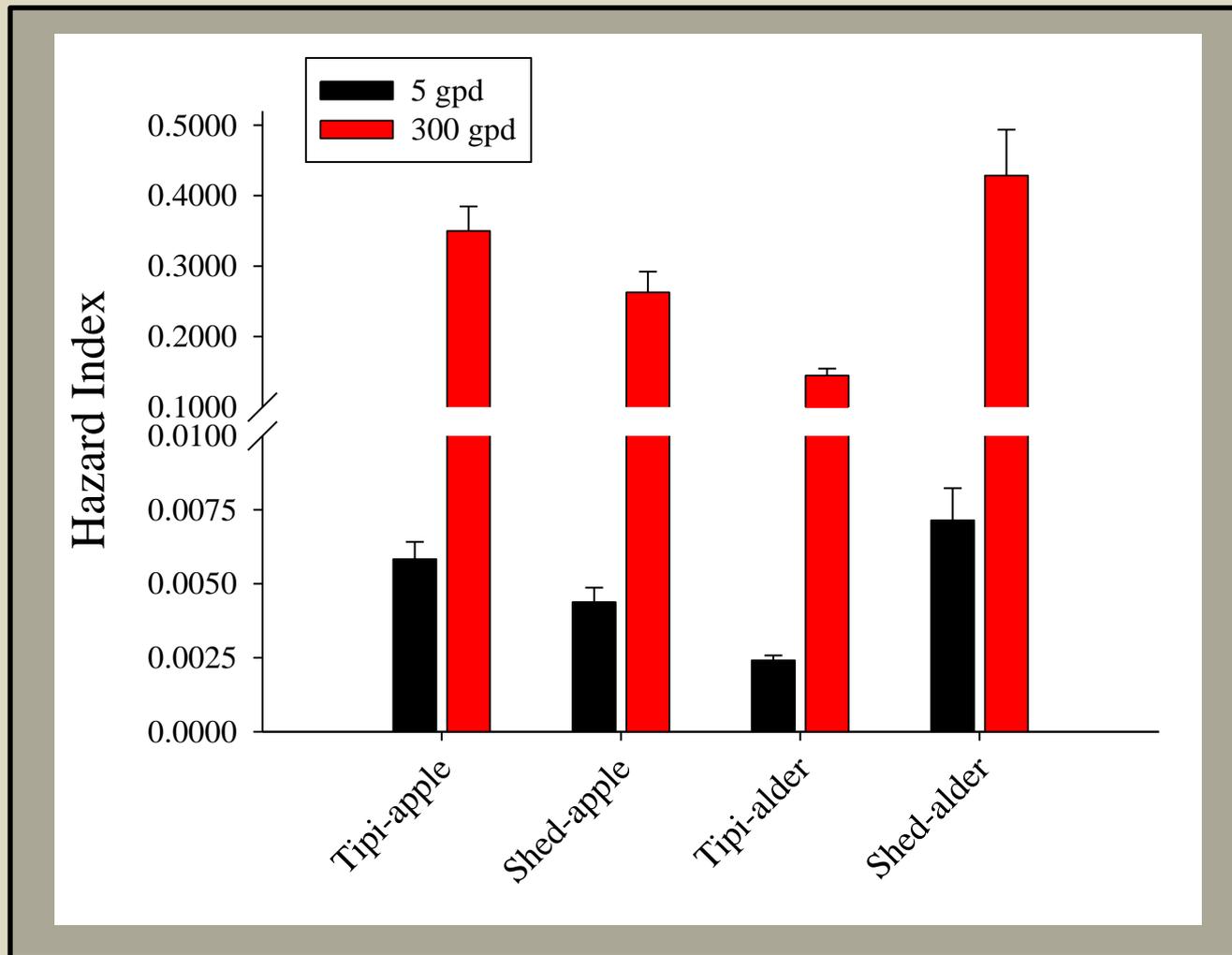
- PAHs by number of rings:  $3 > 2 \approx 4 > 5$
- Non-carcinogenic  $\sim 90\%$ , carcinogenic  $\sim 10\%$
- No treatment related effect (two-way ANOVA, interaction  $p$ -value  $< 0.001$ )

# PAHs in CTUIR smoked salmon vs commercial smoked salmon

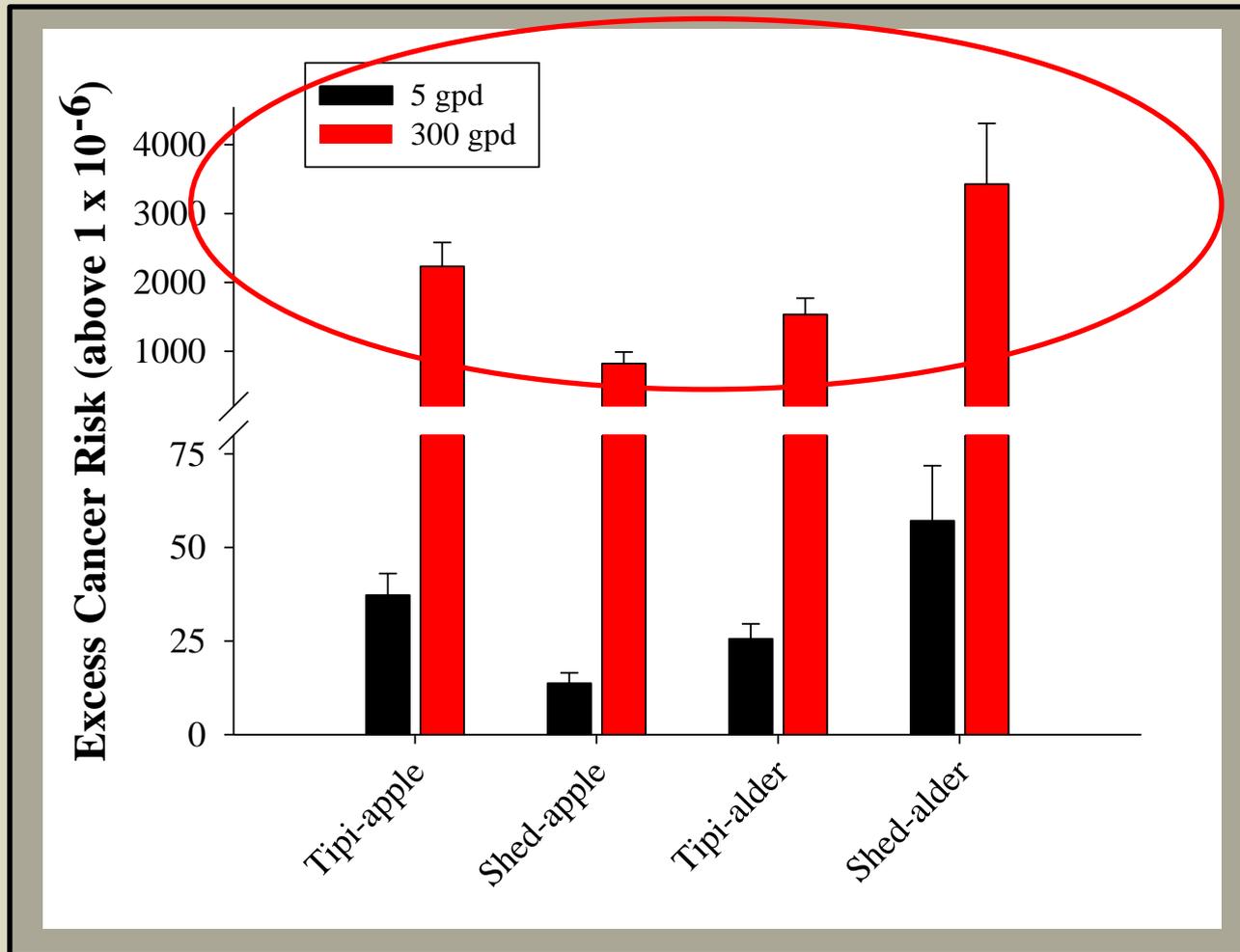
- PAH levels were x 140 – 430 in CTUIR smoked salmon
- $\Sigma$ PAH levels in commercial smoked salmon similar to non-smoked CTUIR salmon



# Estimated hazard indexes for smoked salmon ingestion (mean $\pm$ SEM, $n = 10$ )

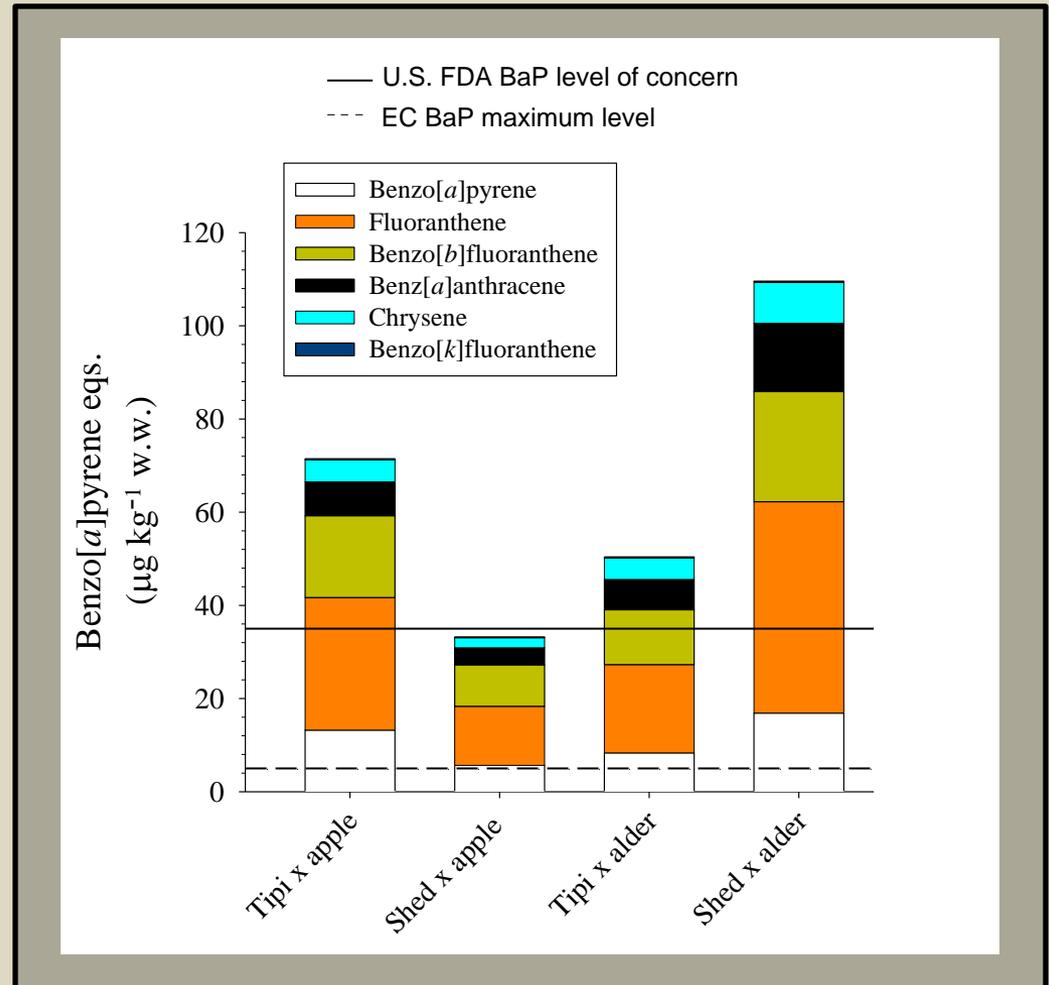


# Estimated cancer risks for smoked salmon ingestion (mean $\pm$ SEM, $n = 10$ )



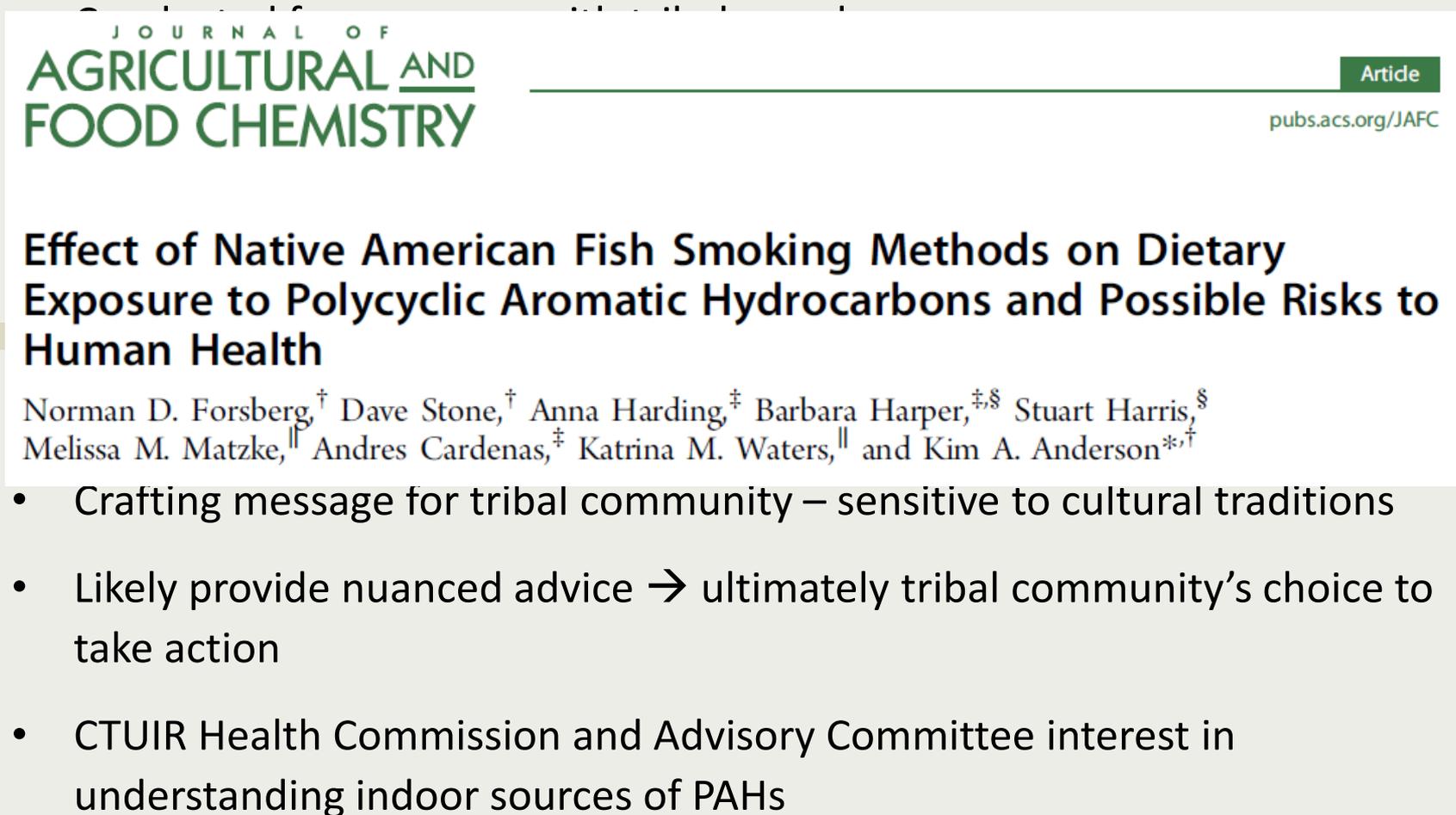
# Contribution of carcinogenic PAHs to BAPEqs.

- Benzo[*a*]pyrene, fluoranthene and benzo[*b*]fluor. greatest contributors
- Levels were in excess of criteria



# Communicating results

## Completed:



The image shows a screenshot of a journal article page. At the top left is the journal title "JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY" in green. At the top right is a green box with the word "Article" and the URL "pubs.acs.org/JAFC". The main title of the article is "Effect of Native American Fish Smoking Methods on Dietary Exposure to Polycyclic Aromatic Hydrocarbons and Possible Risks to Human Health". Below the title are the authors: Norman D. Forsberg,† Dave Stone,† Anna Harding,‡ Barbara Harper,‡,§ Stuart Harris,§ Melissa M. Matzke,|| Andres Cardenas,‡ Katrina M. Waters,|| and Kim A. Anderson\*,†. Below the authors is a list of three bullet points.

**JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY**

Article  
pubs.acs.org/JAFC

### Effect of Native American Fish Smoking Methods on Dietary Exposure to Polycyclic Aromatic Hydrocarbons and Possible Risks to Human Health

Norman D. Forsberg,<sup>†</sup> Dave Stone,<sup>†</sup> Anna Harding,<sup>‡</sup> Barbara Harper,<sup>‡,§</sup> Stuart Harris,<sup>§</sup> Melissa M. Matzke,<sup>||</sup> Andres Cardenas,<sup>‡</sup> Katrina M. Waters,<sup>||</sup> and Kim A. Anderson<sup>\*,†</sup>

- Crafting message for tribal community – sensitive to cultural traditions
- Likely provide nuanced advice → ultimately tribal community's choice to take action
- CTUIR Health Commission and Advisory Committee interest in understanding indoor sources of PAHs

# Key Points

- Trusting relationship between university and tribal researchers necessary for successful collaborative research.
- University researchers /trainees should become familiar with tribal research issues and CBPR principles if engaging in research with tribes.
- Material and data sharing agreements explicitly state agreed-on processes and benefits to community and university partners.
- Collaborative research has opened doors for other tribal exposure/health issues to be explored

# Acknowledgments

Other Engagement Core key personnel: Barbara Harper (CTUIR), Stuart Harris (CTUIR), Dave Stone (OSU RTC), Sandra Uesugi (OSU), Jack Butler (CTUIR), Andres Cardenas (OSU)

Other OSU SRP investigators: Kim Anderson, Yuling Jia, Staci Simonich, Dan Sudakin, Katrina Waters

CTUIR Participants and Fisherman

Tribal Advisory Committee members: Michelle Burke (CTUIR)

OSU staff: Kristin Pierre, Ricky Scott, Jorge Padilla, Kevin Hobbie, Oleksii Motorykin, Lane Tidwell

NIEHS funding – Award No. P42ES016465