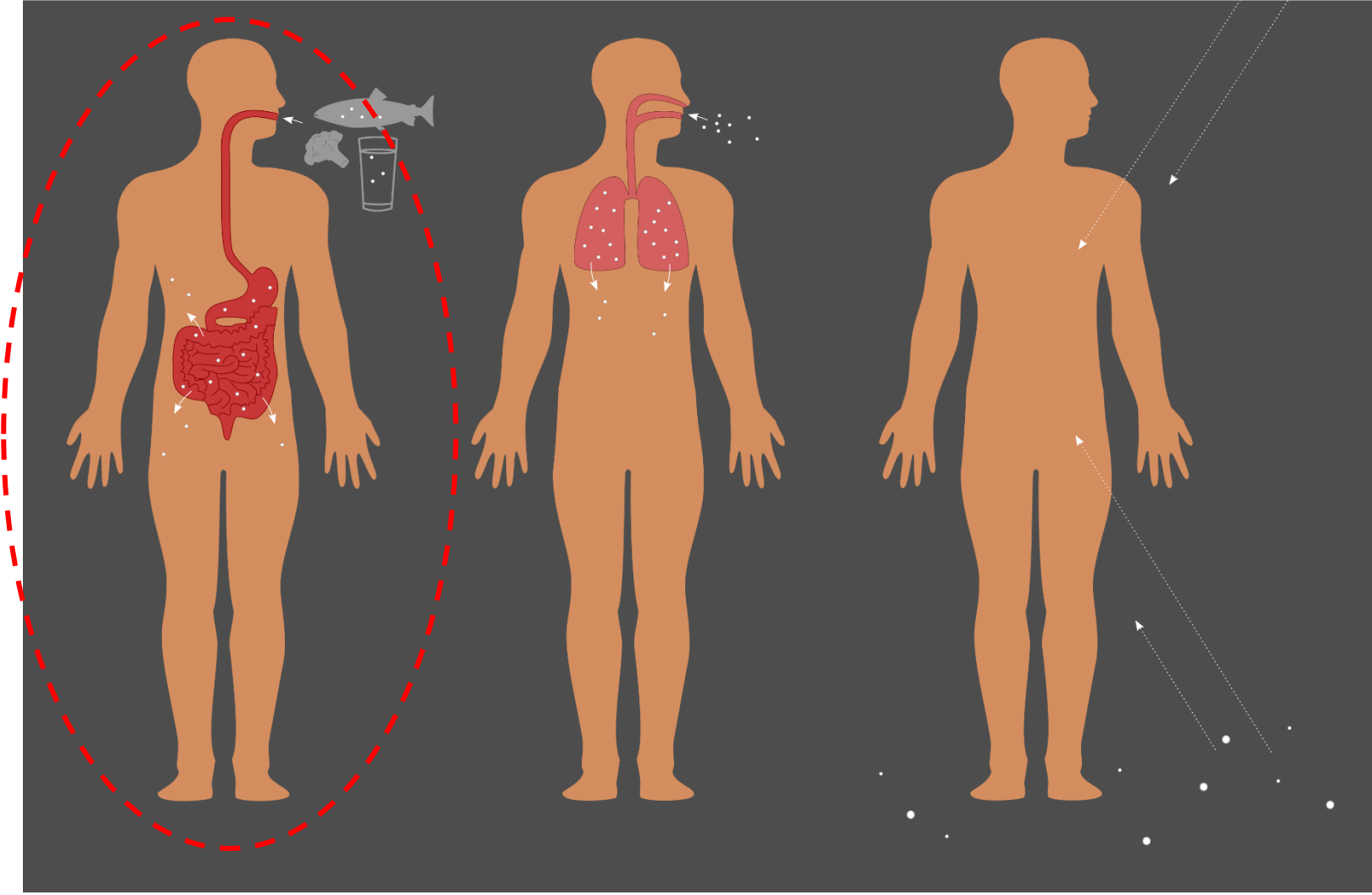


Risks from naturally occurring radionuclides in the Nordic diet

With focus on seafood and the NKS NANOD project

Mari Komperød (Stockholm, 16.01.2019)



Recent work in Norway:

- Report on radiation doses to the Norwegian public (all sources)
- Scientific paper on ingestion doses
- Risk assessment by Scientific Committee for Food Safety

Currently:

- NKS NANOD on natural radioactivity in fish and shellfish consumed in Nordic countries

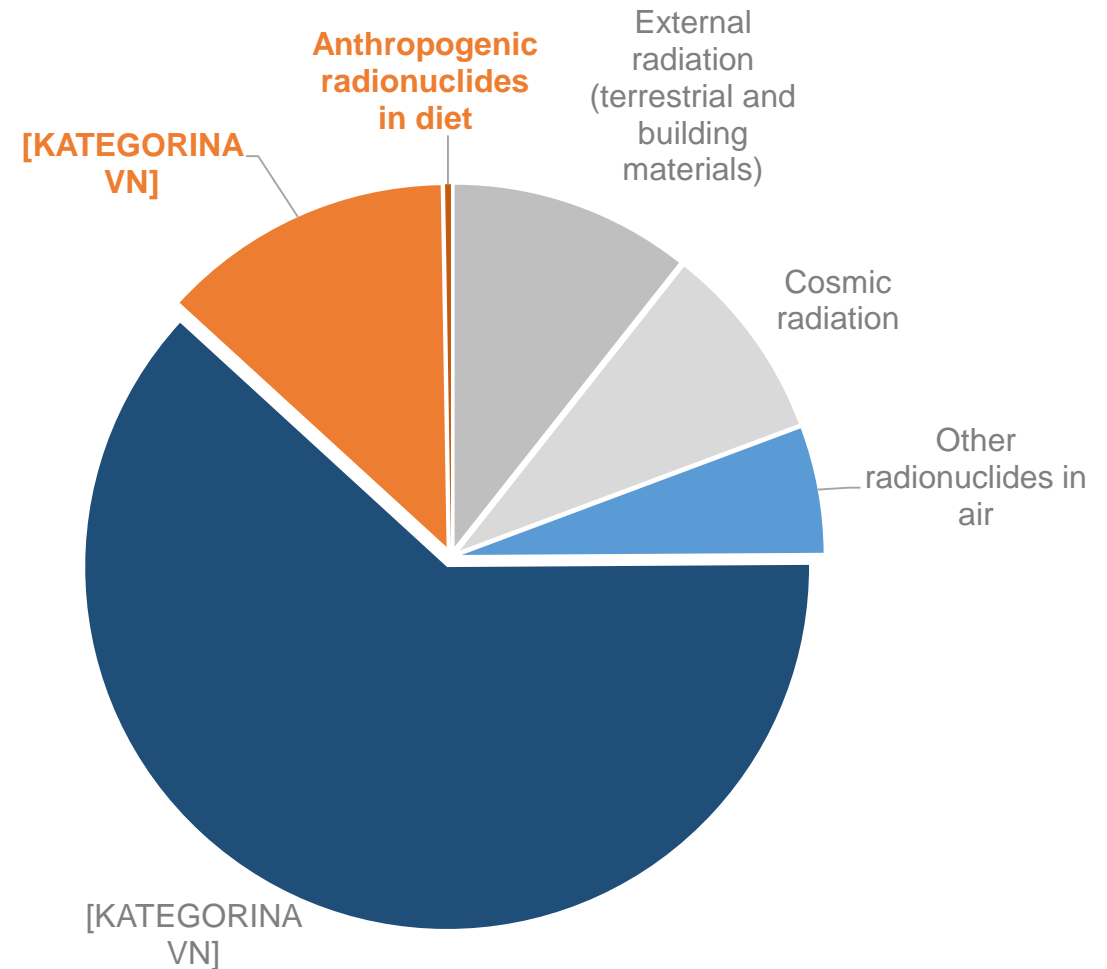


Average effective dose

Ingestion makes a significant contribution

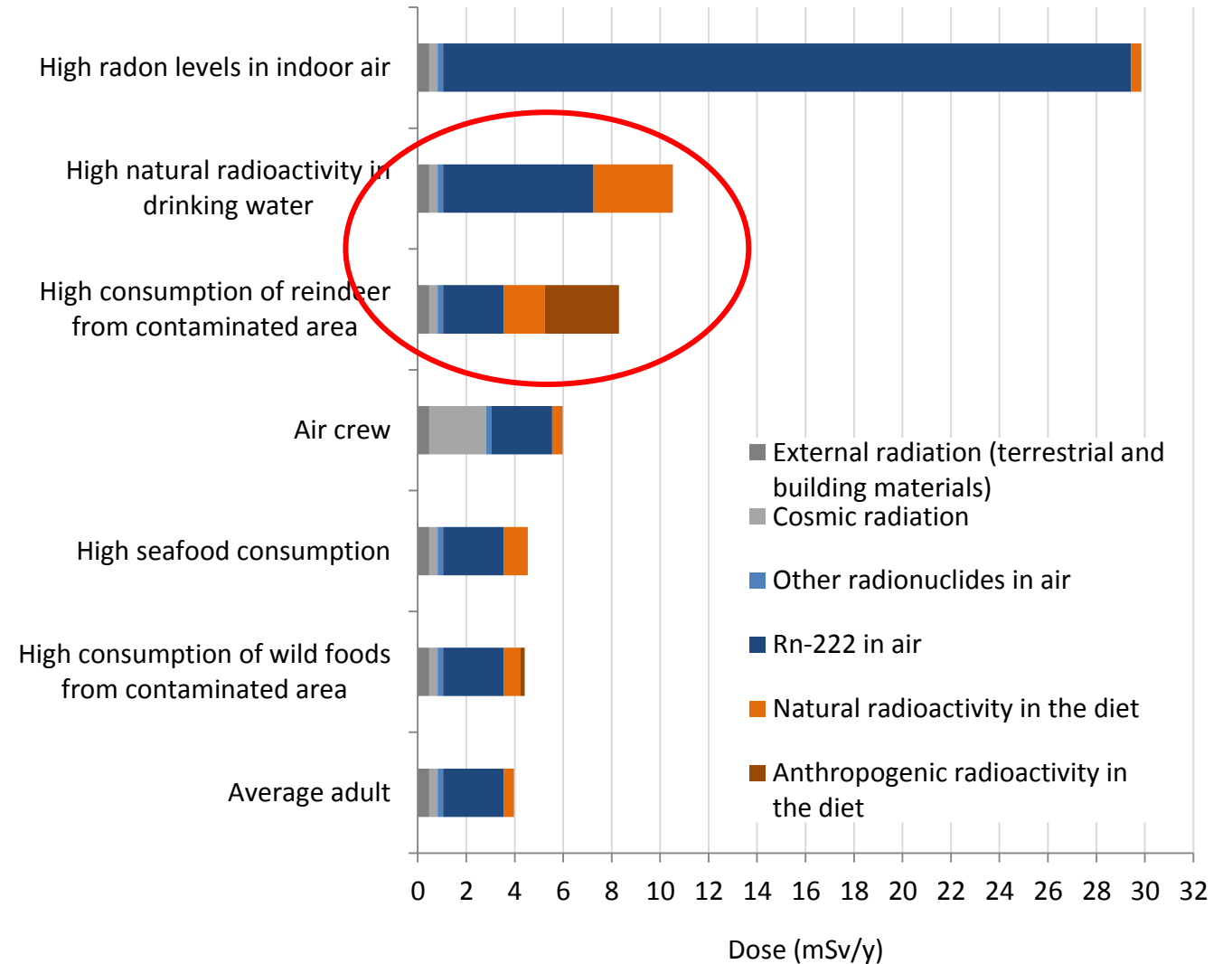
Naturally occurring radionuclides cause majority of ingestion exposure, but receive little attention

Average exposure from environmental sources in Norway

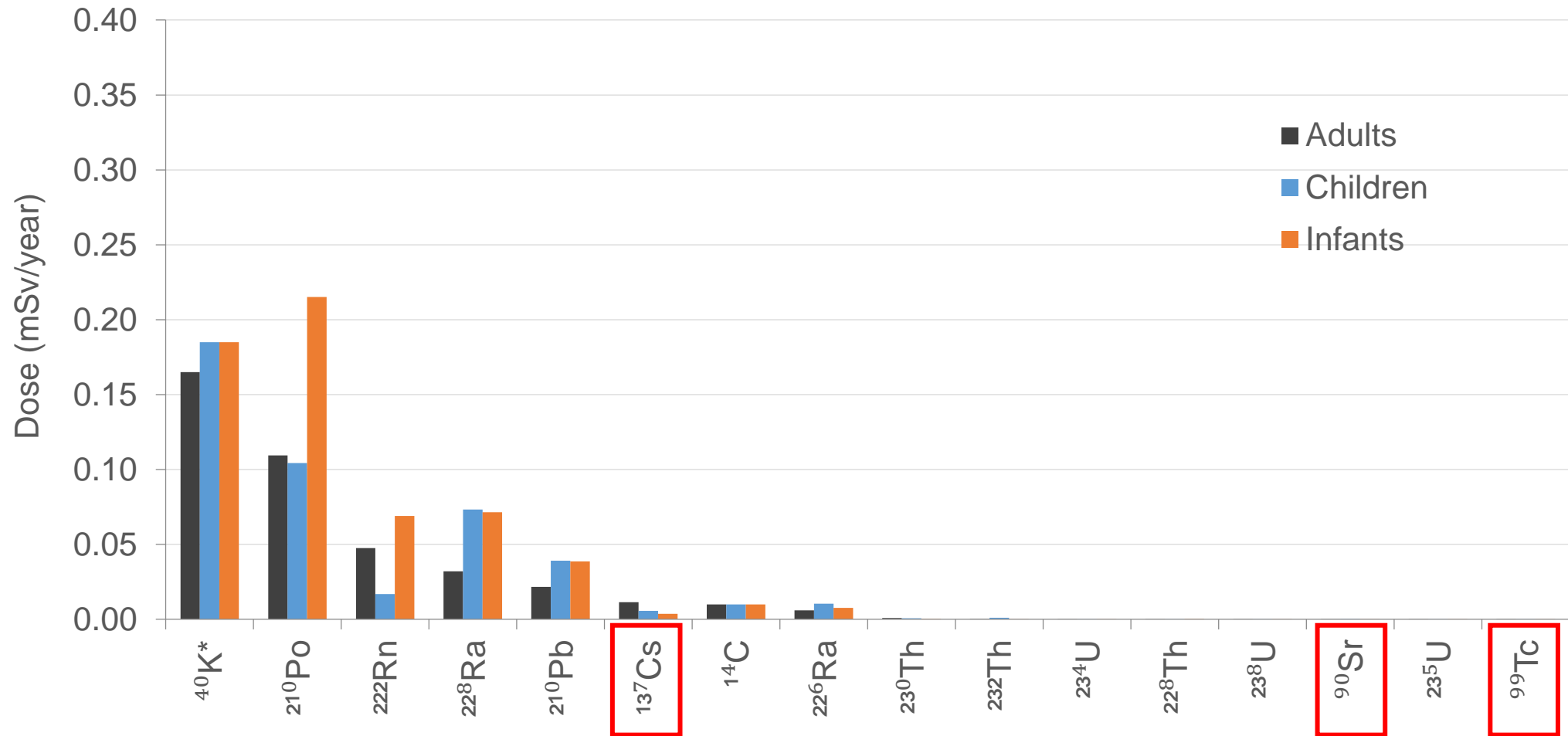


Groups with elevated exposure

Radioactivity in food and drinking water can cause substantially higher doses for some



Average ingestion dose per radionuclide



= Anthropogenic

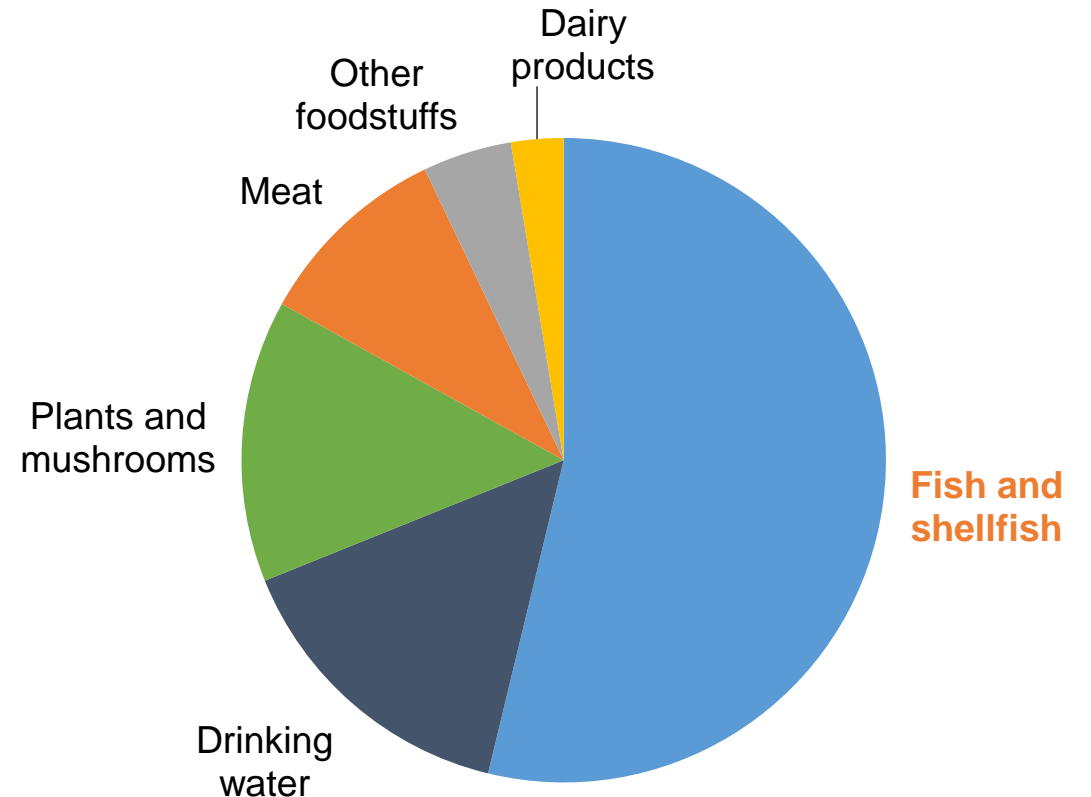
*Constant ^{40}K dose regardless of diet, due to homeostatic K regulation in the body (and constant $^{40}\text{K}:\text{K}$ ratio)

Average dose per food group

Fish and shellfish is the food group causing largest ingestion dose in several countries*

Due to relatively high levels ^{210}Po and other natural radionuclides

Average dose by food category in Norway
(minus ^{40}K)



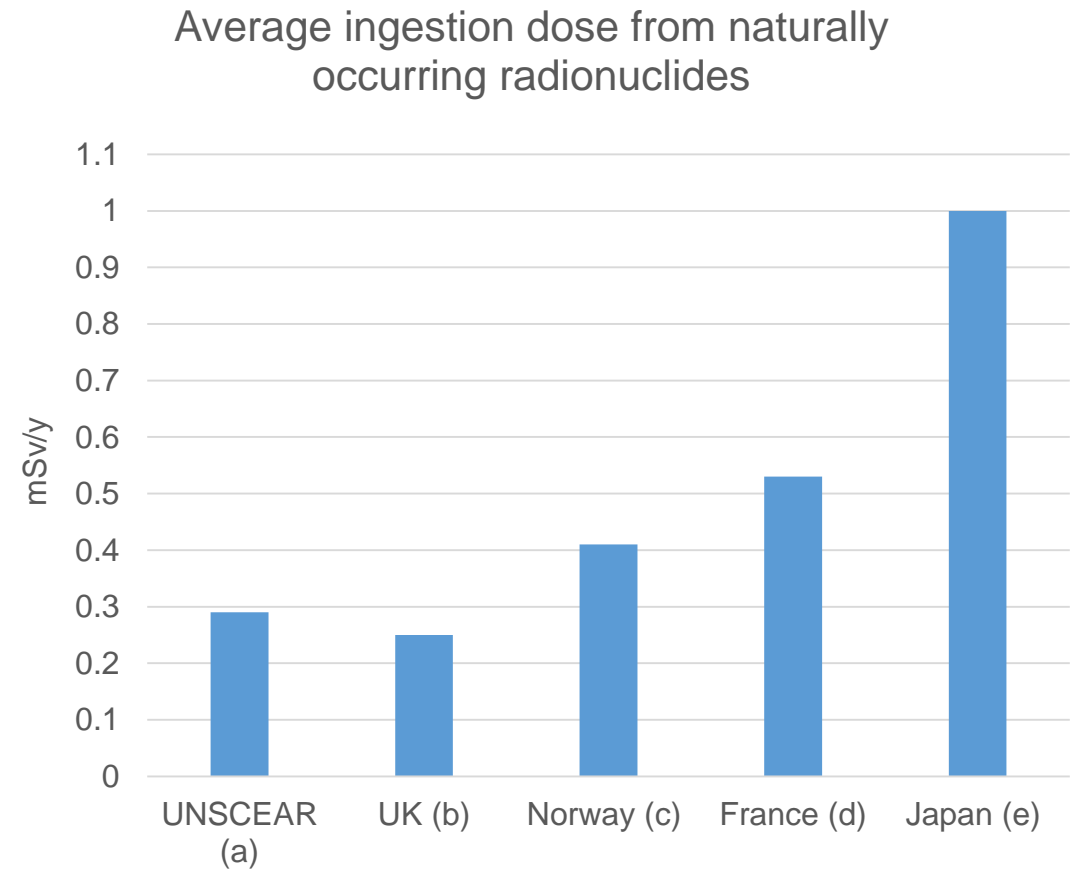
*Assessments from e.g. Norway, France, Japan, UK

Ingestion doses

National estimates vary

→ Partly due to differences in intake of fish/shellfish

Little data on naturally occurring radionuclides in Nordic food



a. UNSCEAR 2008; b. Watson et al. 2005; Komperød & Skuterud 2018; Renaud et al. 2015; Ota et al. 2009

^{210}Po in fish and shellfish

- ^{210}Po binds to surfaces of particles, including plankton
 - Primary route in fish/shellfish via diet
- Organisms with diet consisting of e.g. plankton, bottom substrates etc. generally have highest concentrations



Plankton photomontage by Kils at Wikipedia.com CC 3.0.
(https://commons.wikimedia.org/wiki/File:Plankton_collage.jpg)

^{210}Po in fish and shellfish

^{210}Po varies considerably between species

Important to use species actually consumed when performing dose assessments!!

Examples (muscle / edible parts)	Po-210 (Bq/kg fw)
Atlantic cod ^a	0.35
Atlantic mackerel ^b	3.5
European pilchard (sardine) ^b	66
Blue mussels ^a	37
Lobster ^c	62
Common periwinkle (snail) ^b	283

- a. Dahlgard 1995
- b. Carvalho 2011
- c. Rollo et al. 1992

NKS NANOD project

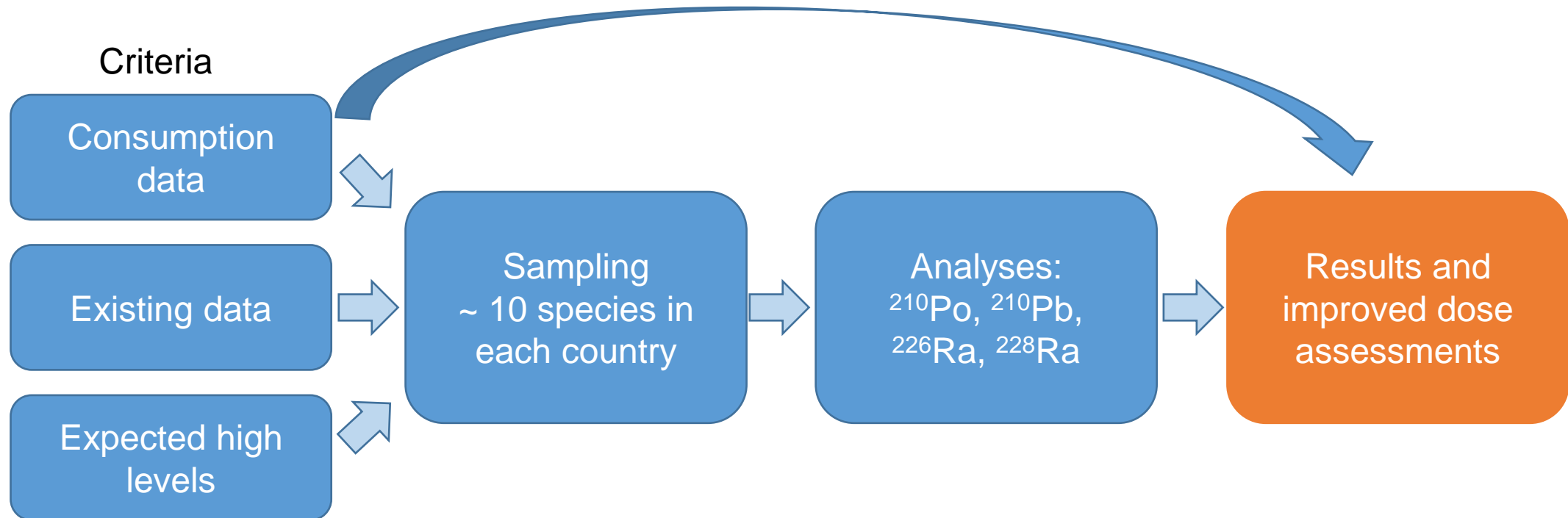
Natural Radioactivity in the Nordic Diet (NANOD)

Objective: More data to improve dose assessments for fish/shellfish and total diet in the Nordic countries

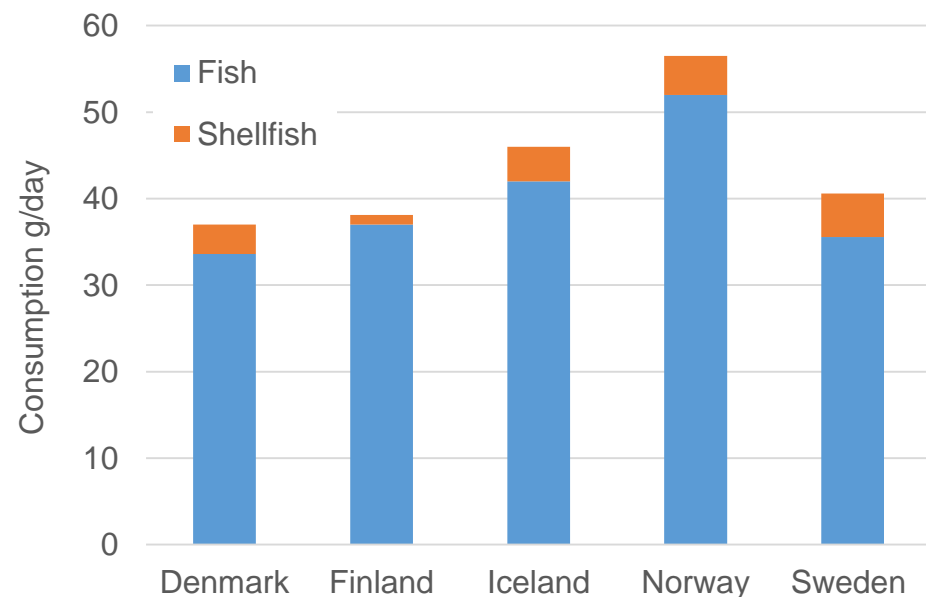
Partners

- Denmark: Technical University of Denmark (DTU)
- Sweden: University of Gothenburg (GU)
- Iceland: Icelandic Radiation Safety Authority (IRSA)
- Finland: Radiation and Nuclear Safety Authority (STUK)
- Norway: Norwegian Radiation and Nuclear Safety Authority (DSA)

NKS NANOD project



NKS NANOD - consumption



Total and species-specific consumption varies

Preferred fish species (> 5 g/d):

Denmark: Herring, tuna, mackerel

Finland: Salmon, trout

Iceland: Haddock, cod

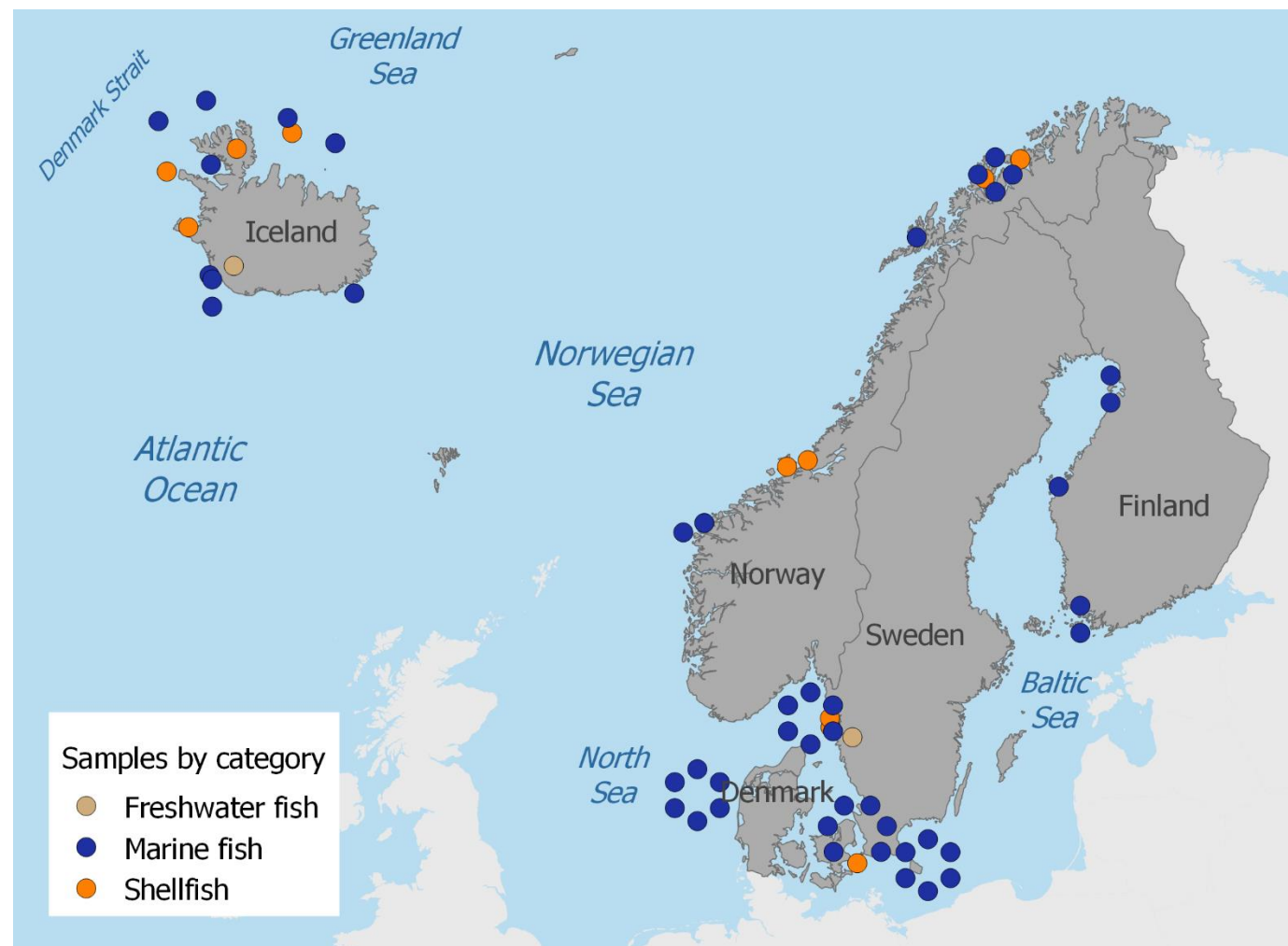
Norway: Cod, salmon

Sweden: Cod, mackerel

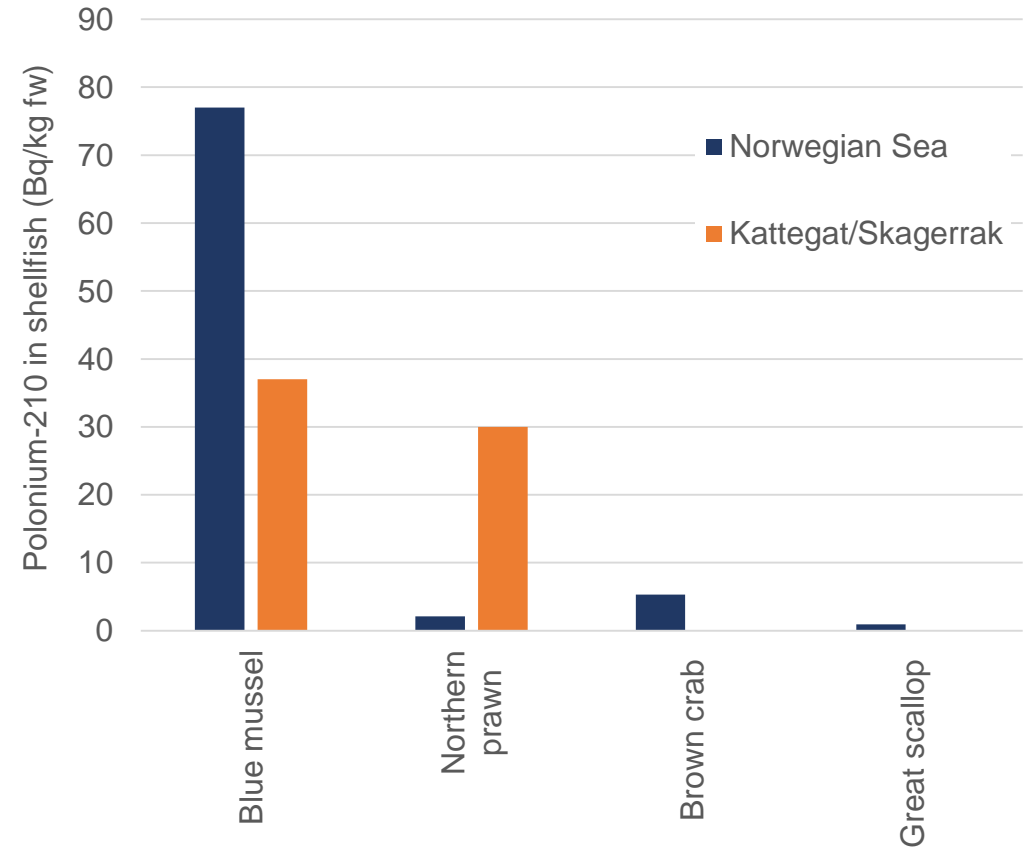
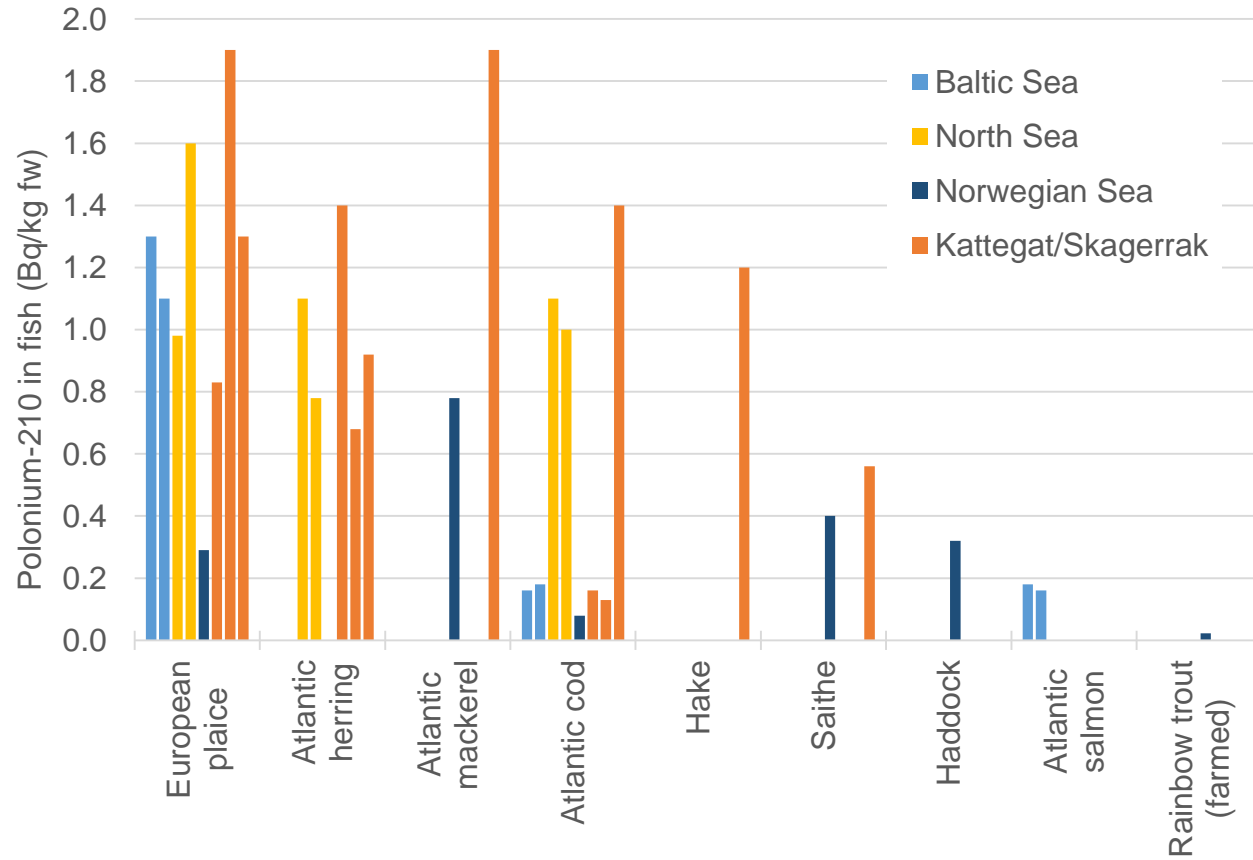
Note: Large individual variation!

NKS NANOD - samples

Collected samples
2018



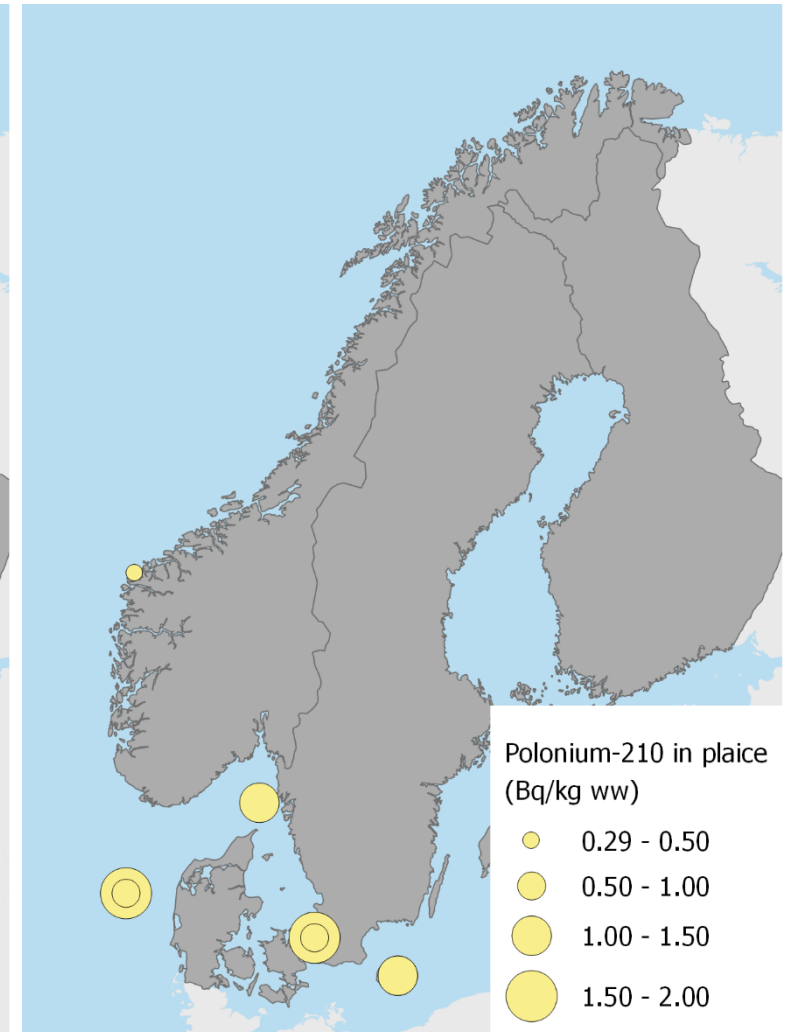
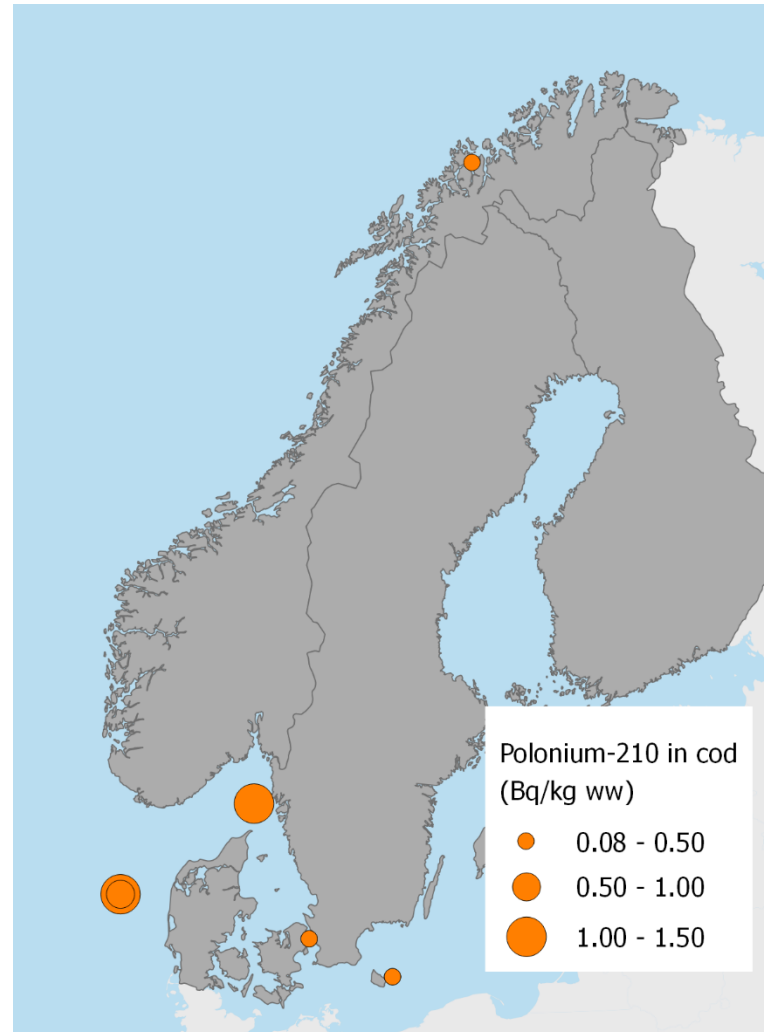
NKS NANOD – preliminary results ^{210}Po



NKS NANOD – preliminary results ^{210}Po

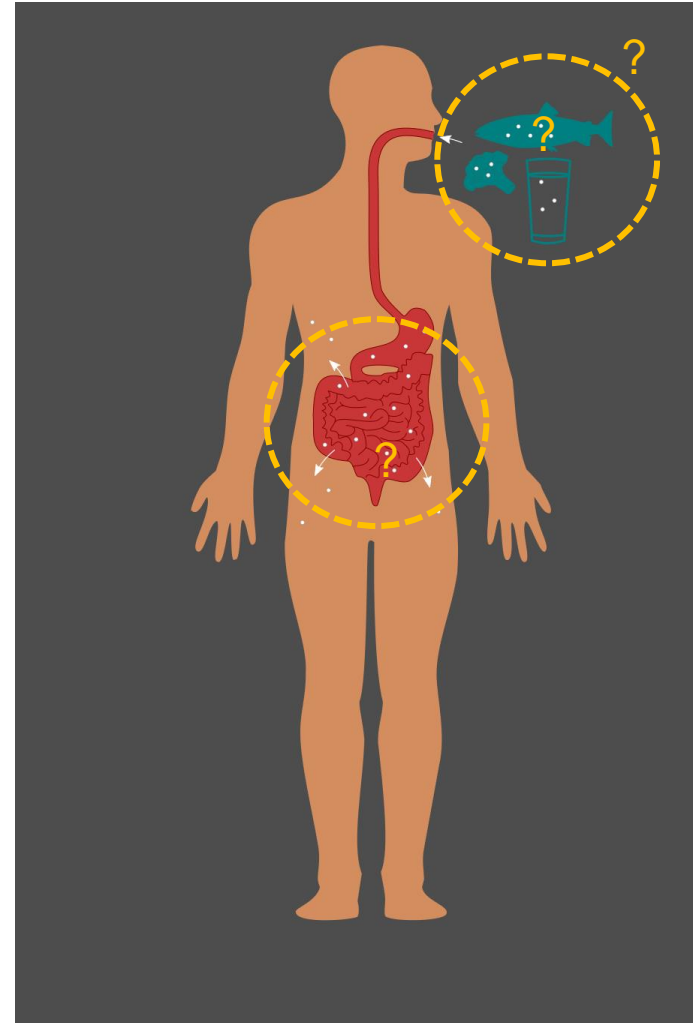
Possible factors for variations within the same species:

- Location?
- Size?
- Season?



Uncertainties in assessing ingestion doses

- Representative values for activity concentration
- Reliable consumption data
- Dose coefficients (ICRP)



Uncertainties in assessing ingestion doses

Effect of food preparation?



By Superbass - Own work, CC BY-SA 4.0,
<https://commons.wikimedia.org/w/index.php?curid=37744930>



By Archangel12 - Normandy '10: Saint-Vaast-la-Hougue, CC BY 2.0,
<https://commons.wikimedia.org/w/index.php?curid=31868904>

Uncertainties in assessing ingestion doses

Delay from harvest until consumption

(^{210}Po half-life = 138 days)



Lotus Head [GFDL (<http://www.gnu.org/copyleft/fdl.html>), CC-BY-SA-3.0 via Wikimedia Commons



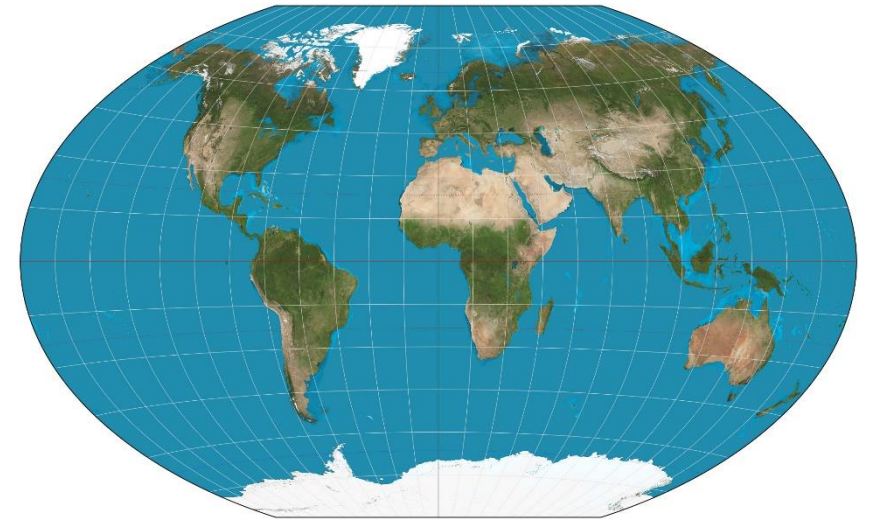
By Daniel Case, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=5839392>

Nordic seafood in global market

> 10 % of fish export in world market

IAEA, FAO, WHO: joint project on guidelines for natural radioactivity

Already frequent requests for documentation of anthropogenic radionuclides – increased need for documentation of natural radionuclides in future?



By Strebe CC BY-SA 3.0 via Wikimedia Commons)

Summary

- Ingestion contributes a significant share of average dose, primarily through naturally occurring radionuclides
- For some, the ingestion dose is substantially higher
- Fish and shellfish is a major contributor to ingestion dose
- It is important to use species actually consumed

Way forward

NANOD: Remaining analyses, dose assessments and Final Report 2019

For improved dose assessments:

- More data on naturally occurring radionuclides in food
- Obtaining reliable consumption data (incl. percentiles)
- Further examining effects of delay and food preparation on radionuclide levels