Model Se in food web

Selenium in water

↓ ← K_d

Selenium in food (**Step 1 of the food chain**)

↓ ← **Bioavailability**

Selenium in zooplankton (**Step 2 of food chain**)

↓

Selenium in fish (**Step 3 of food chain**)

Derive Se standard for water column

Selenium in water

↑ ← K_d

Selenium in food (**Step 1 of the food chain**)

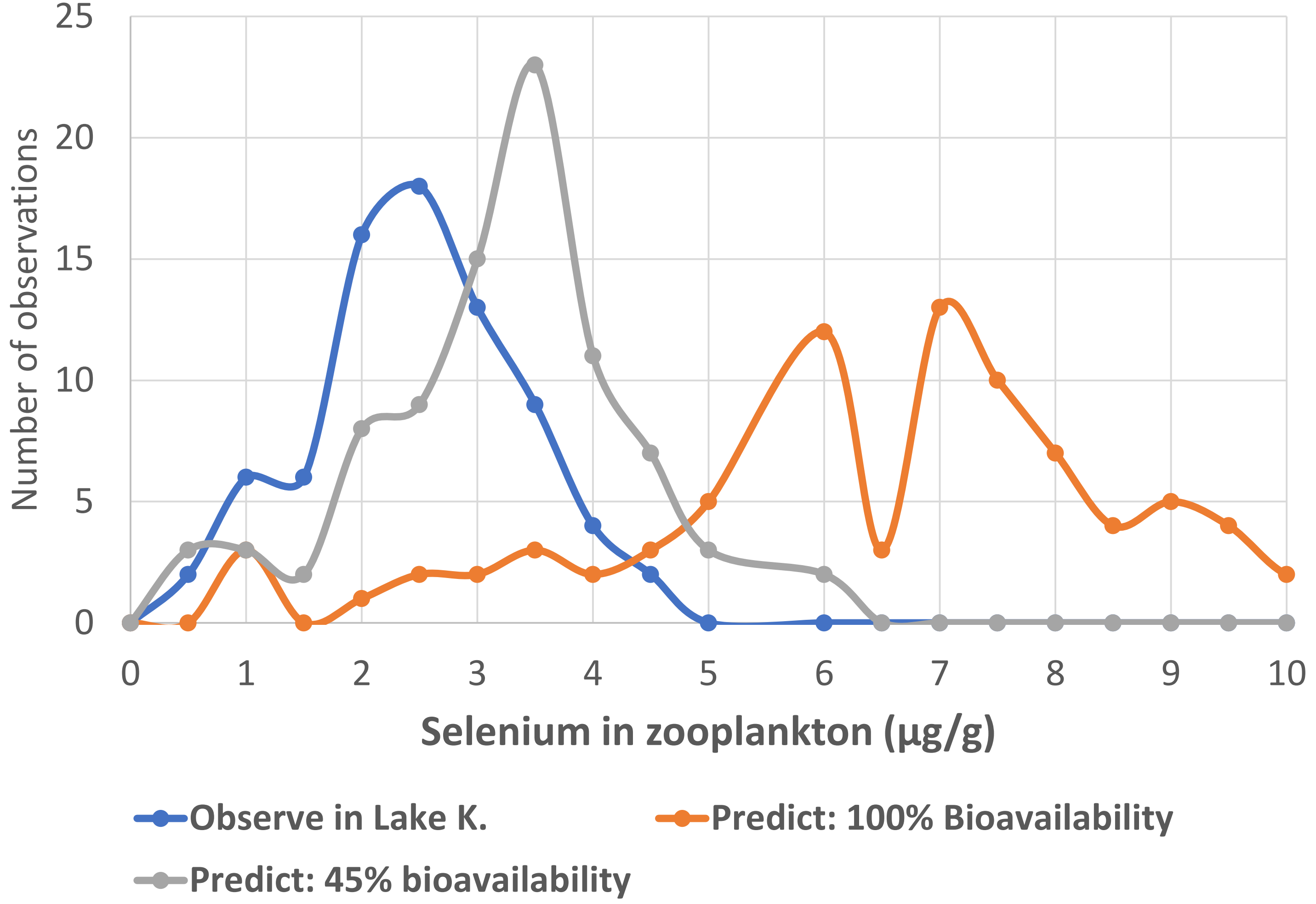
↑ ← **Bioavailability**

Selenium in zooplankton (**Step 2 of food chain**)

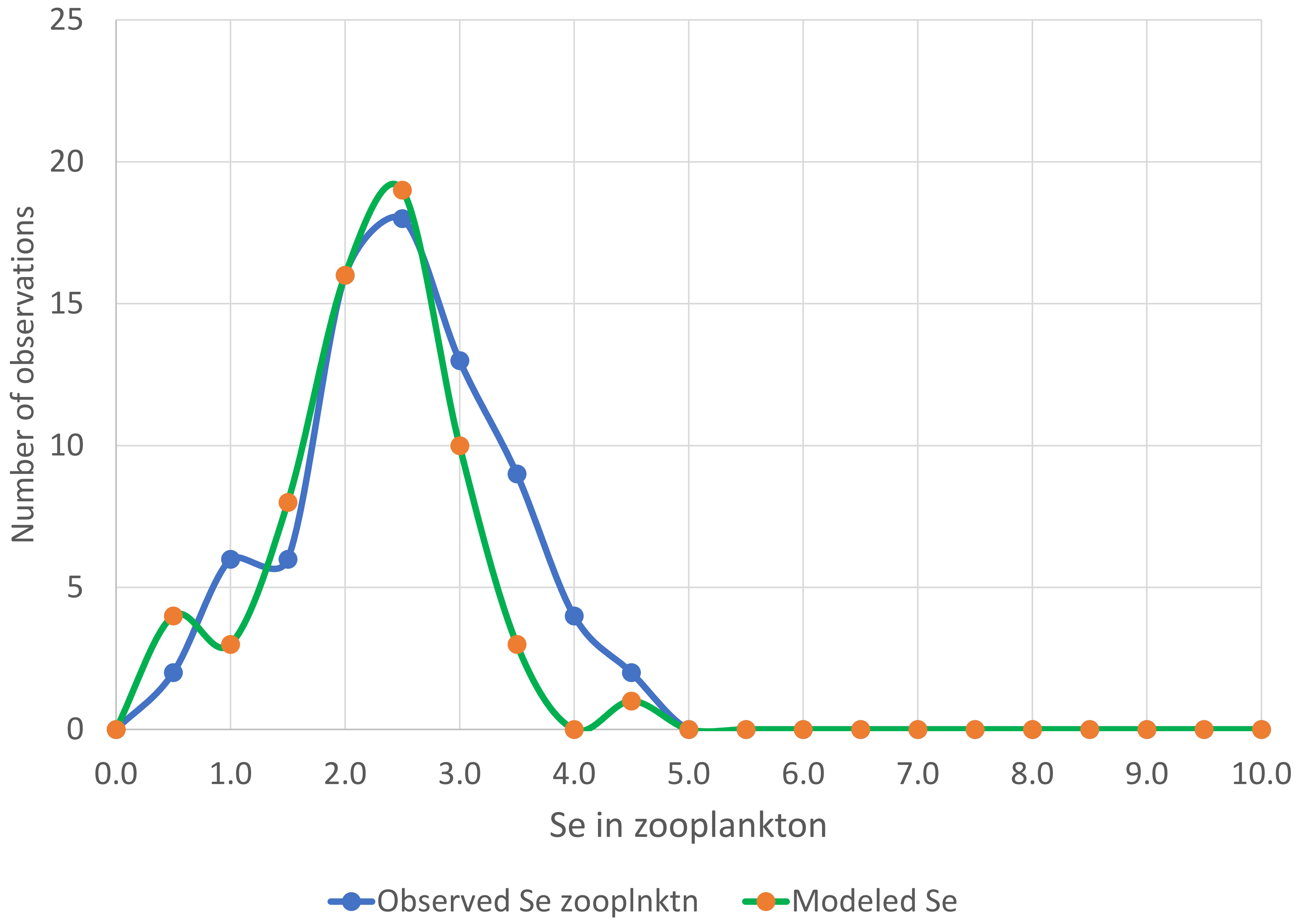
↑

Selenium in fish (**Step 3 of food chain**)

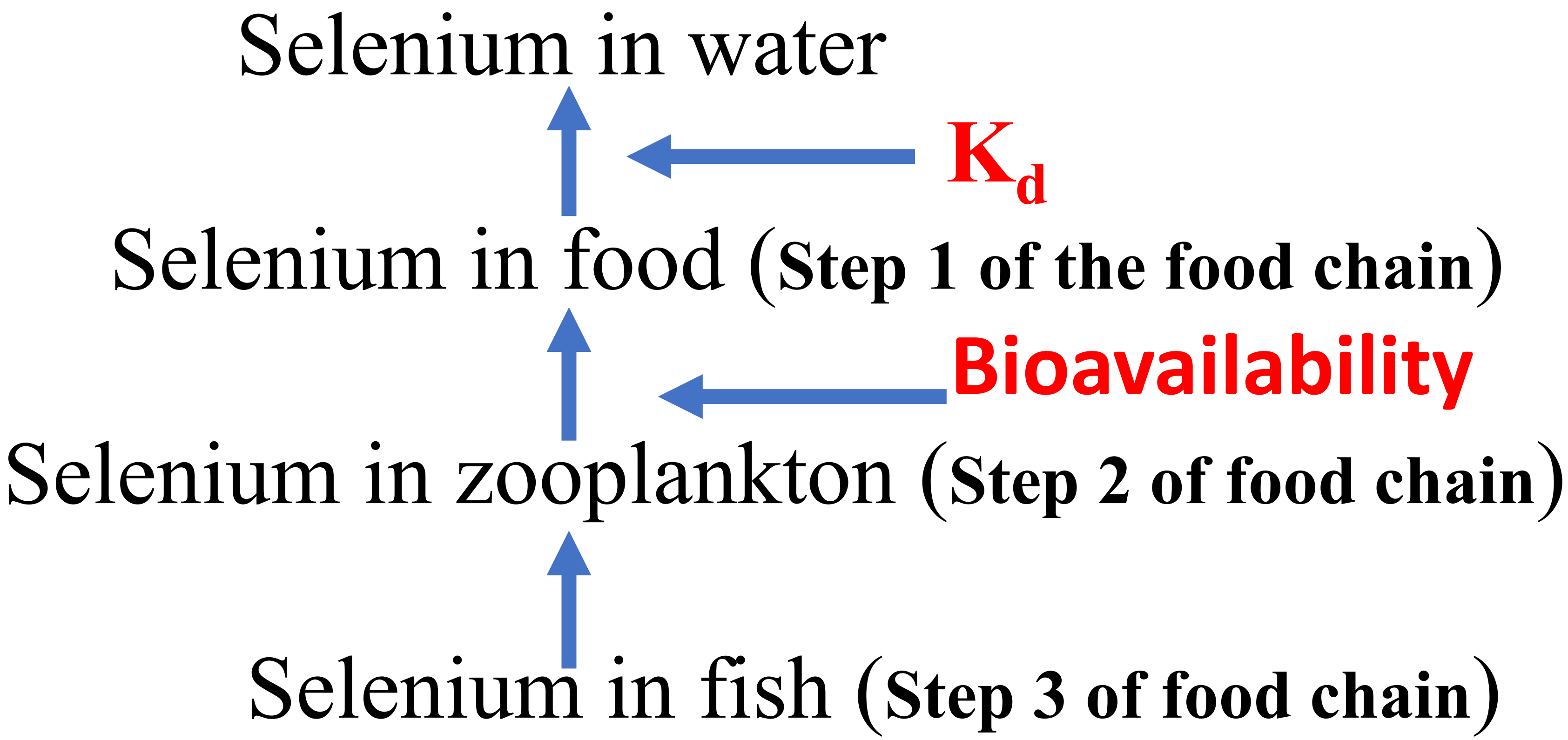
Observed versus Predicted selenium in Zooplankton: All water and food data



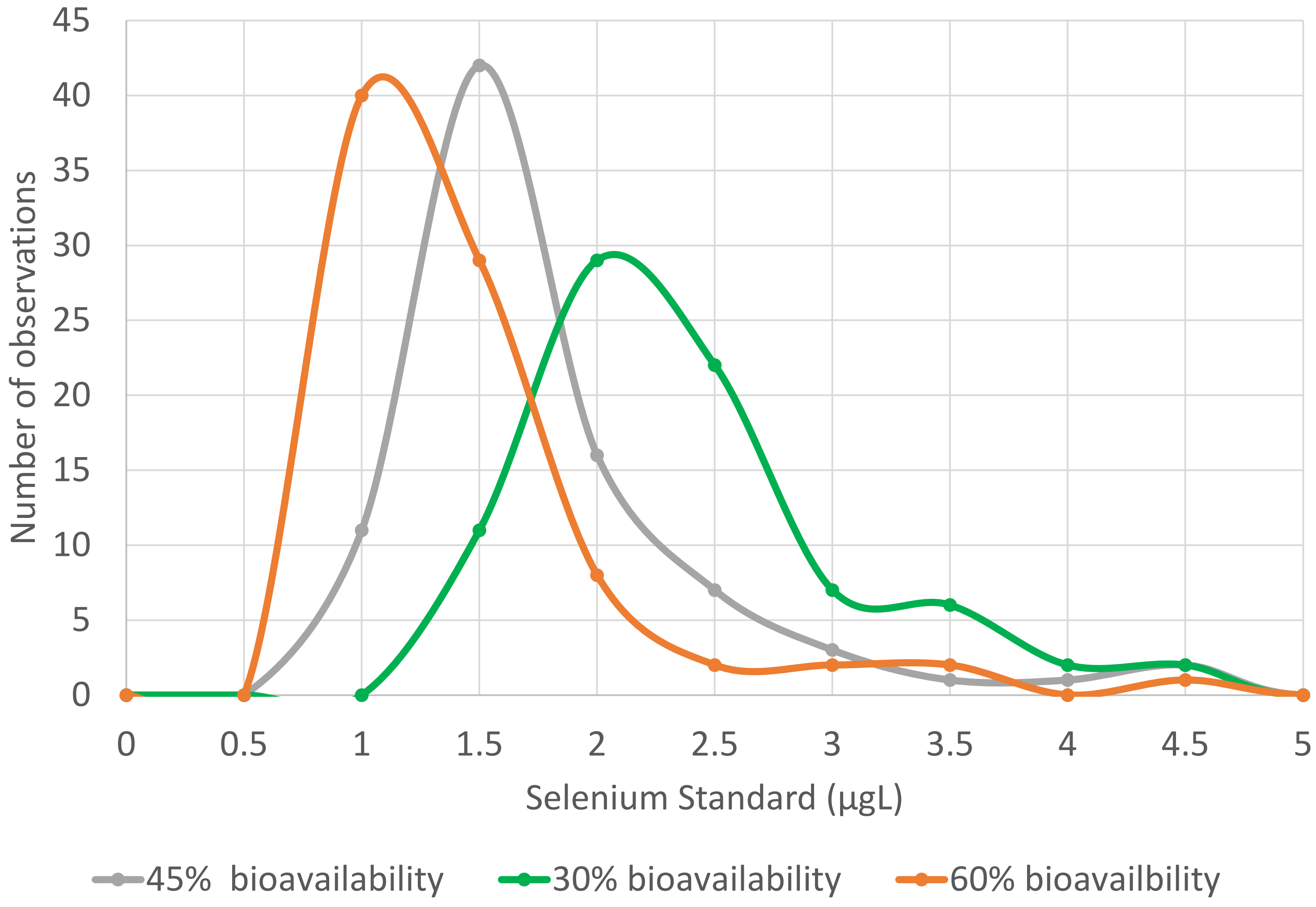
Observed versus Predicted selenium in Zooplankton: 30% Bioavailability



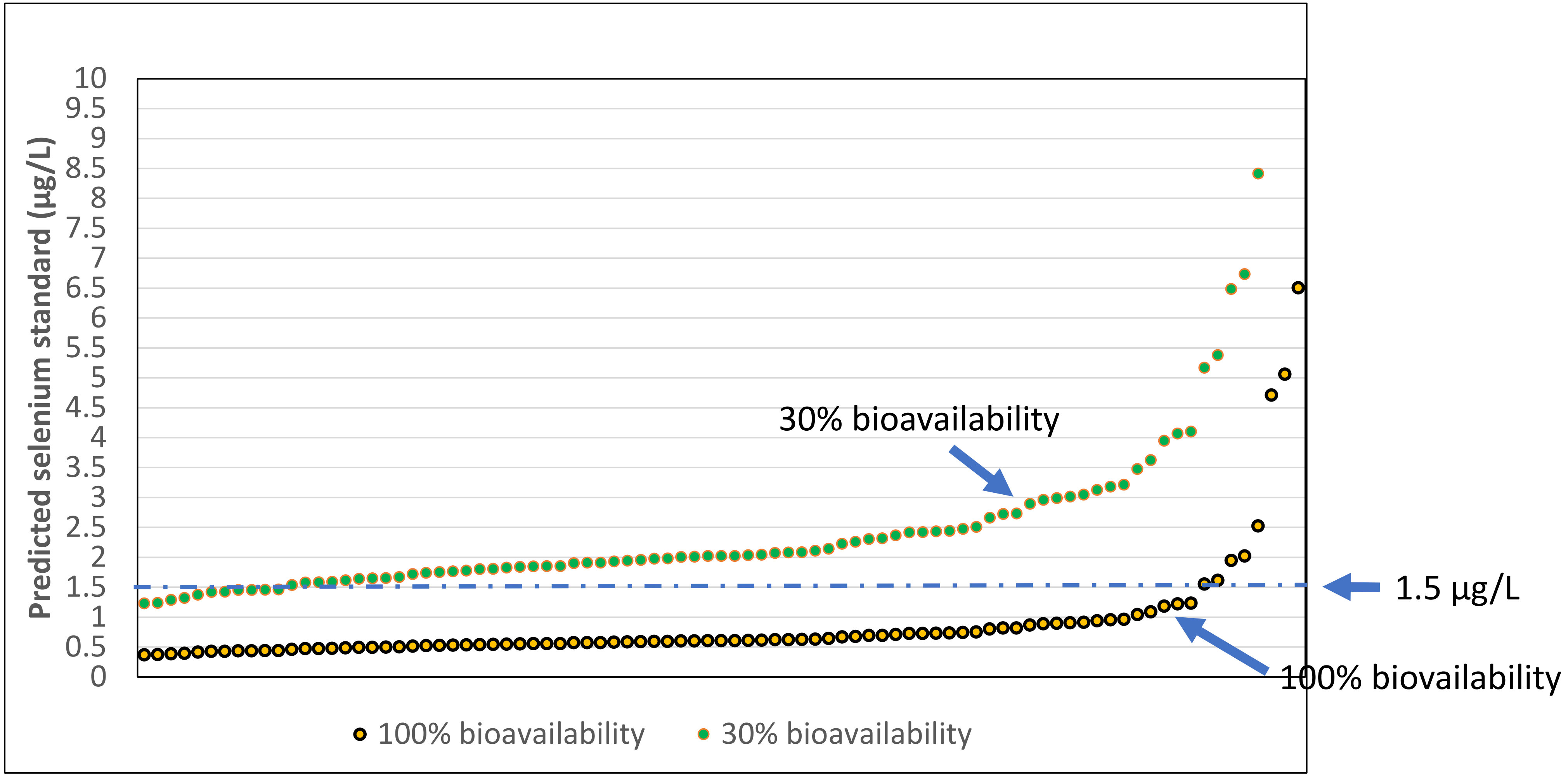
Derive Se standard for water column



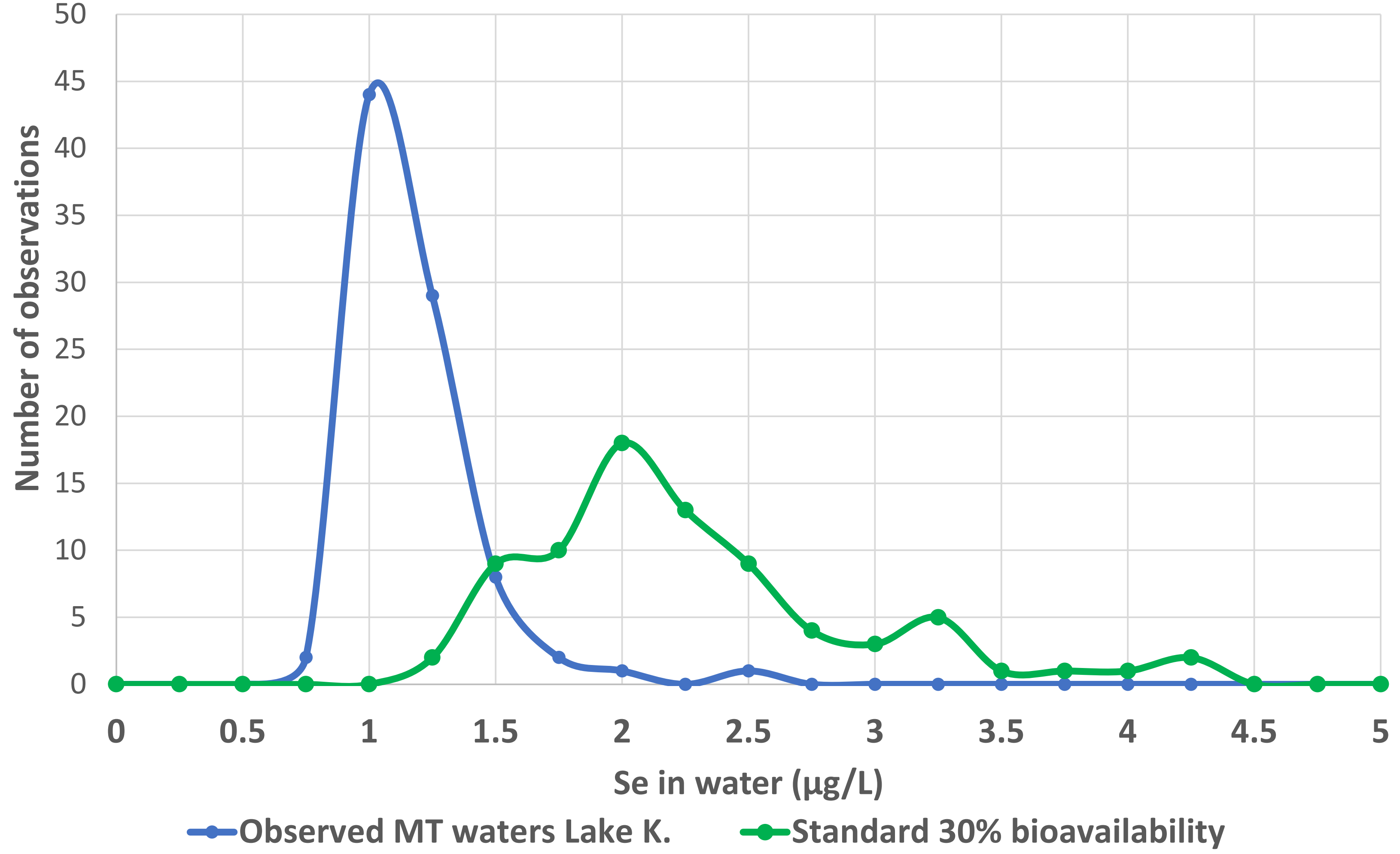
Selenium standard derived from model using different choices of bioavailability and all particle/water ratios (Kd's)



The range of model-predicted selenium standards across 86 water and particulate ratios (Kd’s) from Lake Koocanusa, comparing the MDEQ model (MDEQ presentation slide 16) to the calibrated value of 30% bioavailability.



Compare observed Se in MT waters to standard derived at 30% bioavailability using all SPM/water data in Presser and Knapf.



Comparing Tissue Thresholds: Juggled multiple coefficients

Scenario	Whole body tissue threshhold (mg/kg dw)	Diet	TTF Fish	TTF Aquatic Insects	TTF Zoo-plankton	Bio-availability	Kd percentile	Predicted dissolved water column Se (µg/L)
1	5.6	100% Aquatic Insects	1.1	2.8		45%	50th (median)	0.89
2	5.6	75% Aquatic Insects/ 25% Zooplankton	1.1	2.8	1.5	45%	50th (median)	0.91
3	**5.6**	**100% Aquatic Insects**	**1.1**	**2.8**		**45%**	**50th (median)**	**0.8**
4	**8.5**	**100% Aquatic Insects**	**1.1**	**2.8**		**60%**	**75th**	**0.8**

<u>model outcomes</u>

"The recommendations as to which Kd percentile to select was reliant upon the level of conservatism incorporated into *other* model parameters, particularly the whole body tissue criterion."

"There was overall agreement that if applying a lower (more conservative) whole body value, then a median (less protective) Kd *would be protective of the beneficial use*. However, if a less conservative whole body value was used, such as the 8.5 mg/kg, *then a more protective percentile from the distribution would be recommended to ensure adequate protection."*

Juggling model parameters to achieve a desired standard is not best practice in a science-based (model-derived) approach to deriving a standard.

CONCLUSIONS

- Model outcomes are the product of choices among data representations and model coefficients. Site-specific models must be calibrated to the site of interest.

- MDEQ (2020) presented two alternative models that resulted in the 0.8 µg/L standard.
    - One did not consider the model coefficients best calibrated to field data.
        - **That model consistently over-predicted selenium in zooplankton, benthos and fish in the lake.**
    - The other juggled coefficients to yield the same results as the first approach.

Conclusions

- Outcomes based upon best modeling practices would not have unanimously supported the choice of 0.8 µg/L as a standard.

- **The chosen coefficients all yielded lower aqueous standards than would coefficients best justified by a calibrated model.**

- **It is inappropriate to suggest the choice of a standard was supported by the selenium bioaccumulation model**, as was implied by the model's prominent position in the MDEQ (2020) guidance document.

Selenium standard derived from model using different choices of bioavailability and all particle/water ratios (Kd’s)