Interactive comment on "Multi-compartment kinetic-allometric model of radionuclide bioaccumulation in marine fish" *by* Roman Bezhenar et al.

Anonymous Referee #3

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The authors present a multi-compartment kinetic-allometric model for radionuclide bioaccumulation in fish. First, the authors present the development of the model. They tested their model on data from laboratory experiments and several radionuclides. Finally, they used their model to simulate real-case scenarios. I believe that the development of such model could have strong contribution for the risk assessment of radionuclides. However, the manuscript would need some clarifications before considering it for publication.

General comments:

The authors should give more information on the MCKA model structure: I would sug-

gest adding a schematic representation of the model (In part 2. Model) as it would be of a great help to visualize the structure of the model and better understand the relationships between the compartments. The authors should also better present the parameters of the model by given a table with the definition of all parameters, their values and units. Especially, the values parameter related to the radionuclides should be clearly presented. Table 1 only presents the parameters in allometric relations.

The last part (Part 4. Model applications) is really interesting as it presents model applications for simulating radionuclide bioaccumulation in real contexts. This part may even represent another manuscript. I understand why the authors wanted to keep this part here, but more explanations should be added. The relationships between the fish and their prey should be better explained. How do you handle the preference type (P_j) in the MCKA models? Could you give the parameter values? Also, you discussed that there was no major impact of temperature on uptake and elimination in laboratory experiments, but what about in real-case scenarios (l. 110)? Similarly, what about salinity? Are the abiotic parameters taken into account in the POSEIDON-R model? Without more information, the coupling between the POSEIDON-R model and the MCKA model is still unclear, and the simulation results could be questioned.

They also compare the results to a one-compartment model that was not presented in the simulation cases before, hence it is hard to conclude on the comparison with this model. Have you compared the simulations of the one-compartment model and your MCKA model for laboratory experiments? It would help to better explain the importance of adding complexity in the MCKA model compared to a single-compartment model.

With more clarifications on those different points, I believe the manuscript would be worth for publication.

Specific comments:

- In your introduction, you do not mention the POSEIDON-R model that you used to do the simulations of the accidental releases, you should at least present it. Without

reading the abstract, you do not expect to have a coupling of two models in the last part. More globally, I am not use to this type of presentation of an article, that is why I was a little bit confused reading the manuscript. I felt more like reading a report, even if I understand the importance of each part.

- l. 48: I am not a specialist of PBPK models but you wrote that fish PBPK models do not include scaling allometric relationship between metabolic rate and organism mass However, the PBPK model of Grech et al. 2019 which takes into account the effect of growth on the cardiac output and oxygen consumption rate.

- l. 107: Could it have not be possible to adapt the dynamic budget theory (DEB) to model this? Could you explain better why this value of $\frac{3}{4}$ power? It is specific to fish?

- l.115. So, if I understand well, the structure of the model if generic for different fish species but the parameters values are specific to the species depending on their weight? Maybe you should mention it for more clearly. For two different fish species of the same weight, could you not have an inter-species variability of the model parameters?

- Fig 4. Why is there no curve for dogfish? If you could not simulate BCF for dogfish, maybe you should withdraw the concerning data points.

- Mathews et al. 2008 (l. 190) should not be Mathews and Fisher 2008? (l. 208)

- l. 242. A graphical representation of the results of the sensitivity analysis in SI rather than a table would be of a great help to clarify the results. Why did not you make a global sensitivity analysis to better understand interactions between parameters?

- l. 275. A schematic representation of the one-compartment model would be required in SI as well as a table with the parameter values.

- l. 276. I do not understand the sentence.

- l. 277. What are the "inner box" and "coastal box" exactly? I do not really understand,

as I am not familiar with the POSEIDON-R model. It should be better clarified.

- Figures 7 and 8 could be coupled (6 panels).

Technical corrections:

- Several spaces are missing: l. 107, l. 241

- Error on the reference: l. 278