Project Proposal

Comparing the anadromous Atlantic salmon in Iceland and UK to study the impacts of temperature on anadromous Atlantic salmon

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1 Key words

Bayesian Life-cycle Model; Population Ecology; Salmon; North Atlantic

2 Introduction

Atlantic salmon (*Salmo salar*) are found to have two forms of life cycle in North Atlantic, the non-anadromous form and anadromous form [Verspoor et al., 2007]. The non-anadromous Atlantic salmon spend their entire life in a landlocked location, While the anadromous ones have more complicated life cycle. The anadromous Atlantic salmon are first born as eggs in freshwater, where they spend 2-4 years to slowly grow into smolts [Verspoor et al., 2007]. Then they go into the marine and live most of their time there except spawning. The first time of anadromous Atlantic salmon returning to spawn in rivers can range from 3 to 14 years after entering the sea [Chaput, 2012]. Due to complicated historical factors, the production of Atlantic salmon in North Atlantic declined steeply since 1989 and has never recovered, which calls the attention of the society to conserve the species and control fisheries .

The global average temperature of marine keeps increasing since 1950, temperature can be a potential crucial factor that lead to the reduction of Atlantic salmon population [Brohan et al., 2006]. According to previous study in Prof. Woodward's lab, the Atlantic salmon in Iceland grow in rivers for 3 years and first return to spawn after 7-year in marine, while the ones in UK only grow for 1 year in rivers and first return to spawn after 2-year in marine. Thus, the anadromous Atlantic salmon in Iceland and UK can be excellent examples to represent the cold area and warm area in North Atlantic, which helps study the impacts of temperature on anadromous Atlantic salmon. The population model of salmon in Iceland has already been completed by Prof. Woodward's lab. The population model of salmon in UK is required to be constructed to compare with the ones in Iceland [Parrish et al., 1998].

3 Methods

The project is mainly conducted by computational methods. We intend to use Bayesian life-cycle model to construct the stage-structured population model of anadromous Atlantic salmon in UK. Bayesian life-cycle model is able to link different life stages of salmon and estimate stage-specific population of salmon under the effects of intrinsic and extrinsic factors [Ohlberger et al., 2018].

4 Objectives

The project is expected to construct the stage-structured population model of anadromous Atlantic salmon in UK. This model can improve stock assessment and calculation of conservation limits(CLs) and Quotas(QU), which provides both guidance on the conservation and fisheries. Further more, the project aims at comparing the anadromous Atlantic salmon between Iceland and UK to study the impacts of rising temperature on anadromous Atlantic salmon. By doing this analysis, the project is able to explore the potential effects of climate changes on anadromous Atlantic salmon.

5 Project feasibility

The project is part of the SAlmonoid MAnagement Round the CHannel(SAMARCH). SAMARCH is a 7.8m five-year project (2017-2022) part funded by the France England Interreg Channel programme. The timeline of tasks is listed Figure.1.

Task		Month								
		1	2	3	4	5	6	7	8	9
1. Data preparation	1.1 Revision of Iceland data	■	■							
	1.2 Preparation of UK data						■	■		
2. Model construction	2.1 Revision of Iceland model			■	■					
	2.2 Construction of UK model							■	■	
3. Analysis	3.1 Analyzing the influence of temperature								■	■
4. Write-up	4.1 Introduction			■	■	■				
	4.2 Methods and results						■	■	■	■
	4.3 Discussion and conclusion							■	■	■
5. Milestone	*5.1 Research plan*	■								
	5.2 Introduction submission						■			
	5.3 Presentation and viva									■
	5.4 Report submission									■

Figure 1: Gantt chart of the project

6 Budget

No budget is required.

References

[Brohan et al., 2006] Brohan, P., Kennedy, J. J., Harris, I., Tett, S. F., and Jones, P. D. (2006). Uncertainty estimates in regional and global observed temperature changes: A new data set from 1850. *Journal of Geophysical Research: Atmospheres*, 111(D12).

[Chaput, 2012] Chaput, G. (2012). Overview of the status of atlantic salmon (salmo salar) in the north atlantic and trends in marine mortality. *ICES Journal of Marine Science*, 69(9):1538–1548.

[Ohlberger et al., 2018] Ohlberger, J., Brenkman, S. J., Crain, P., Pess, G. R., Duda, J. J., Buehrens, T. W., Quinn, T. P., and Hilborn, R. (2018). A bayesian life-cycle model to estimate escapement at maximum sustained yield in salmon based on limited information. *Canadian Journal of Fisheries and Aquatic Sciences*, (999):1–9.

[Parrish et al., 1998] Parrish, D. L., Behnke, R. J., Gephard, S. R., McCormick, S. D., and Reeves, G. H. (1998). Why aren't there more atlantic salmon (salmo salar)? *Canadian Journal of Fisheries and Aquatic Sciences*, 55(S1):281–287.

[Verspoor et al., 2007] Verspoor, E., Olesen, I., Bentsen, H., Glover, K., McGinnity, P., and Norris, A. (2007). Atlantic salmon–salmo salar. *Sväsand, T., Crosetti, D., Garcia-Vazques, E., Verspoor, E.(lead editors) Genetic impact of aquaculture activities on native populations*, 6.

I have seen and approved the proposal and the budget.

Signature:

Date: