BauchRhoMFig

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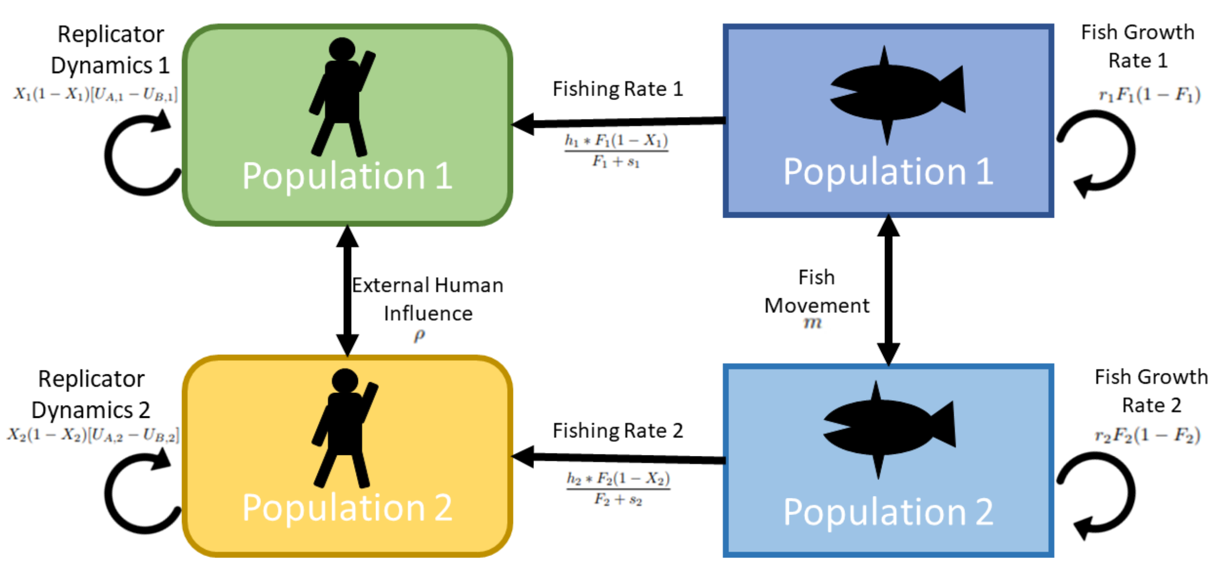


Figure 1: A conceptual representation of our model as a two-patch extension of @bauchEarlyWarningSignals2016. Here, each fish population (F_i) in each patch i increase through natural growth and movement of fish into the patch. Fish populations are decreased through emigration out of the patch and fishing mortality. The number of fishers (X_i) in each patch i change in response to fish population levels, the cost of stopping fishing activity, and the opinions of those in the patch and those in the other patch.

1 MOVEMENT

2 SOCIAL INFLUENCE STUFF

3 SCENARIOS

Table 1: Parameter values used in this analysis. Taken from Bauch et al appendix where oscillations are observed. DOUBLE CHECK THAT

Parameter	Population_1	Population_2	Def
r	0.16	0.16	Fish net growth
s	0.8	0.8	Supply and demand
h	0.25	0.25	Harvesting efficiency
k	0.17	0.17	Social learning rate
w	1.44	1.44	Conservation cost
c	0.5	0.5	Rarity valuation
d	0.3	0.3	Social norm strength (within pop)
m	0	0	Fish movement (from opposite patch)
rho	0	0	Social norm strength (opposite pop)

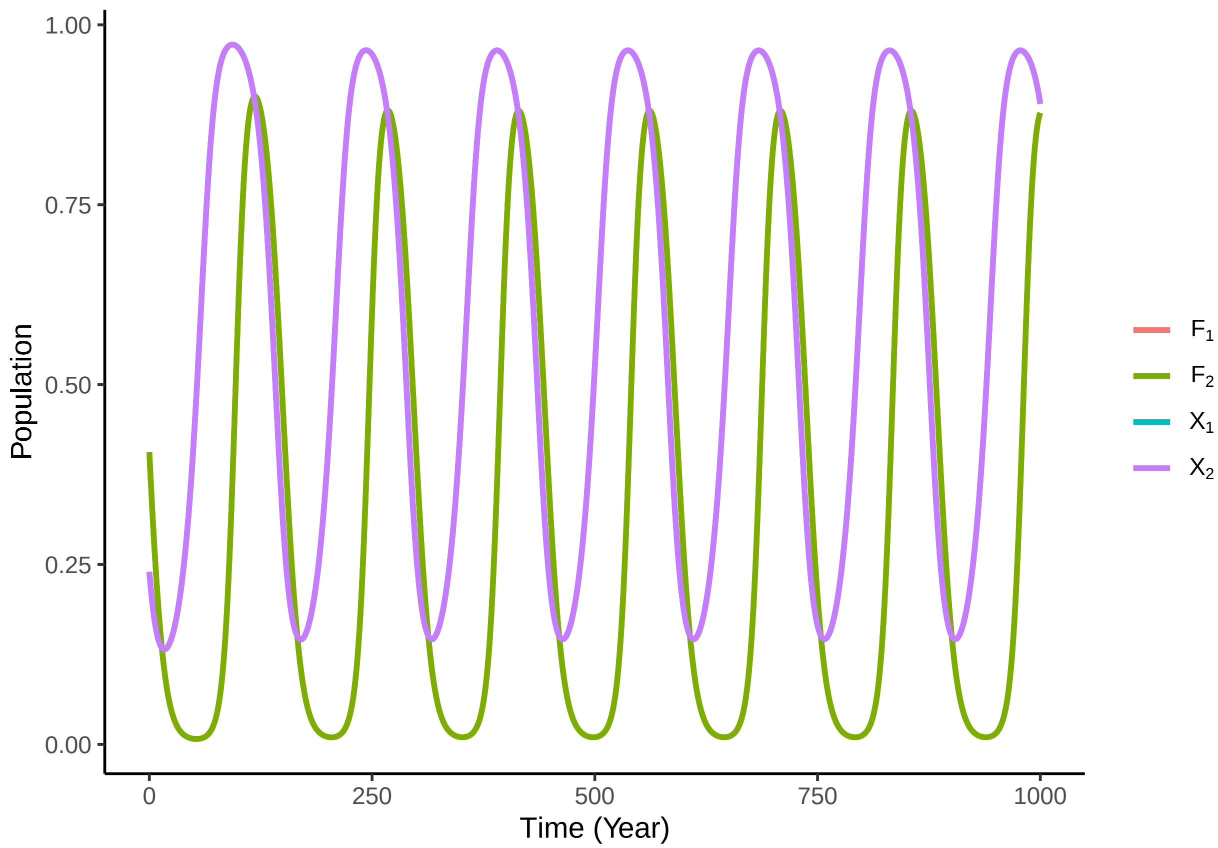


Figure 2: (#fig:Bauch.Coupled)New Model with default paramters given in Bauch et al. Demonstrating homogenous populations.

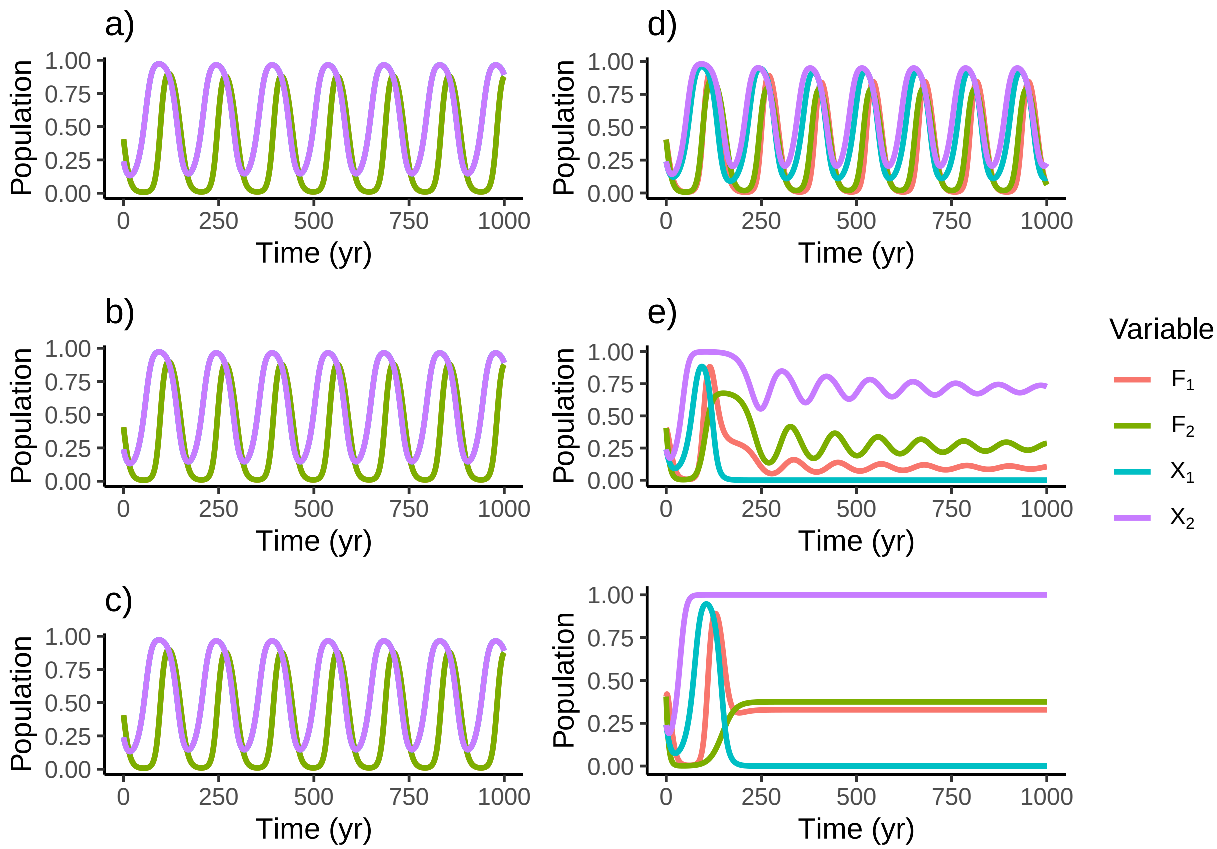


Figure 3: Showing that movement only matters when there is asymmetry. This can be asymmetry in other params. When this is the case, high movement dampens oscillatory effects

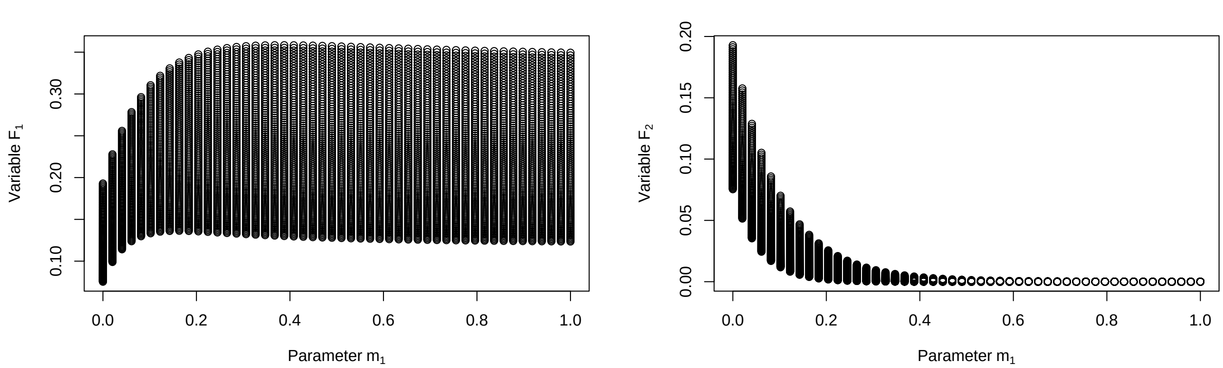


Figure 4: Bifurcation curves of fish pops in response to changes in m1 paramter. Shows how high m parameters eliminates oscillations.

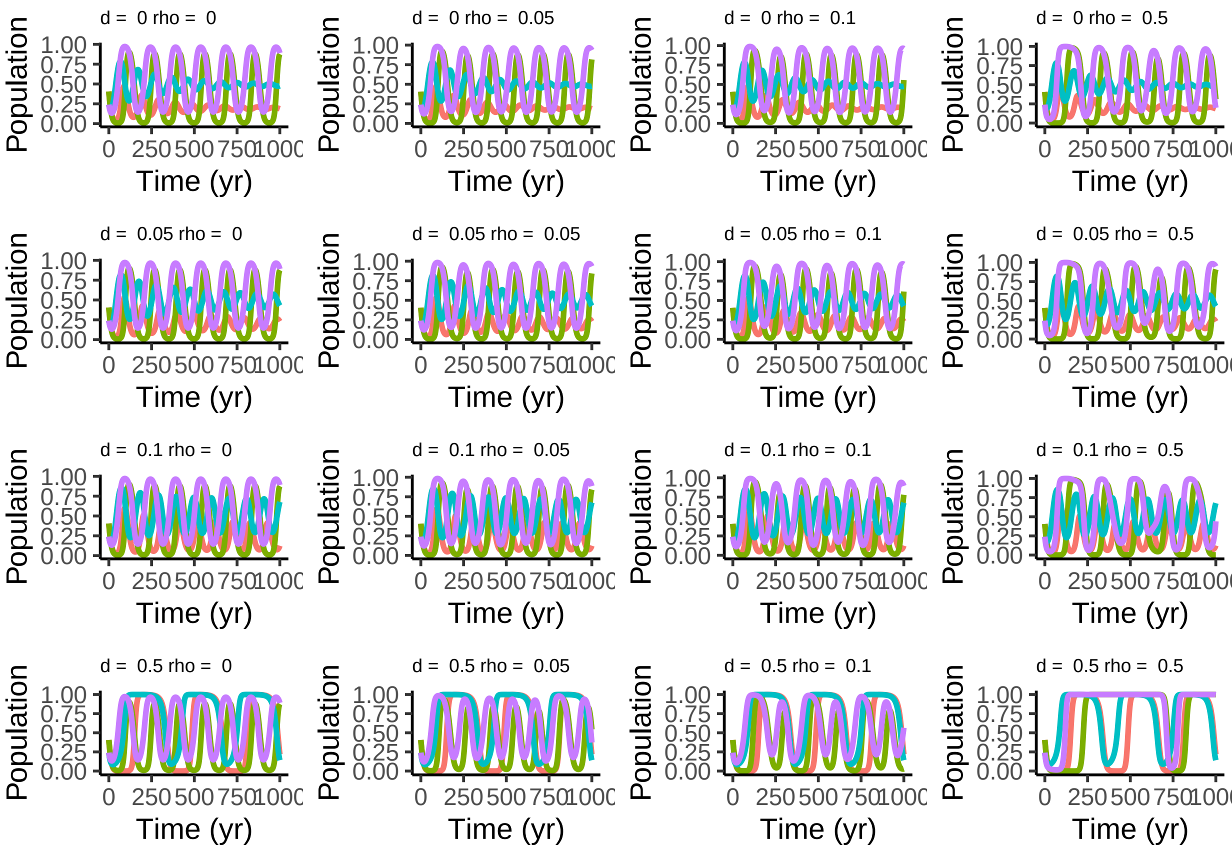


Figure 5: This shows the difference between a pop 1 listening to themselves vs. other pop. Looking at red line (which is fish in pop 1), this demonstrates that a portfolio effect can smooth over variation in dynamics. See how red line levels out when rho is high but with a low d. high d and low rho results in high fluctuations in stocks

Table 2: Parameter values used to simulate sustainable fishing practices in patch 1 and overfishing in patch 2.

Parameter	Population 1	Population 2	Definition
r	0.4	0.35	Fish net growth
s	0.8	0.8	Supply and demand
h	0.25	0.5	Harvesting efficiency
k	1.014	1.014	Rate of sampling opinions or social interaction
ω	0.2	0.35	Conservation cost
c	1.5	1.5	Rarity valuation
d	0.5	0.5	Strength of social influence (within population)
m	0.2	0.2	Fish movement (from opposite patch)
ρ	0.5	0.1	Strength of social influence (opposite population)

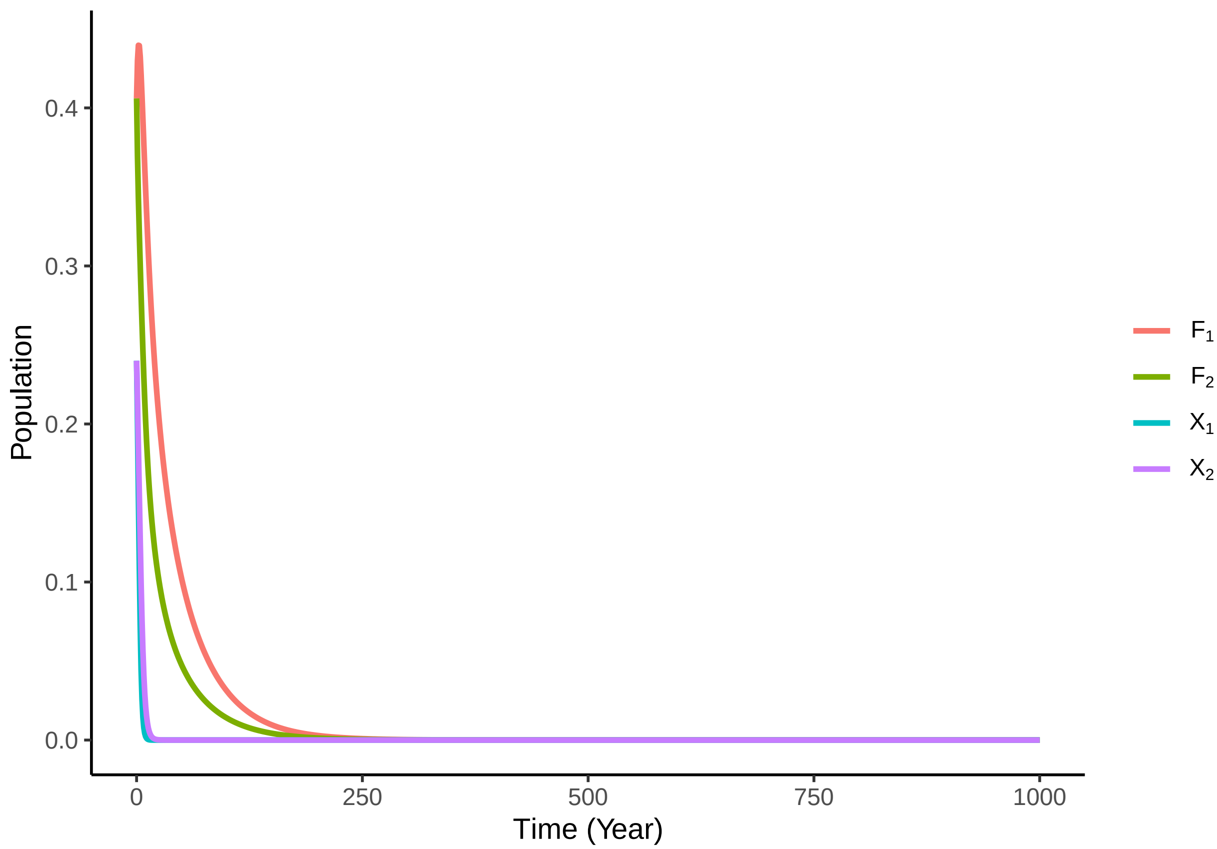


Figure 6: Representation of the dynamics of both the fish populations (F_i) and human conservationists (X_i) in each patch with default parameters from table 2 after 1000 years. This just shows how the unsustainable fishing results in the whole thing collapsing

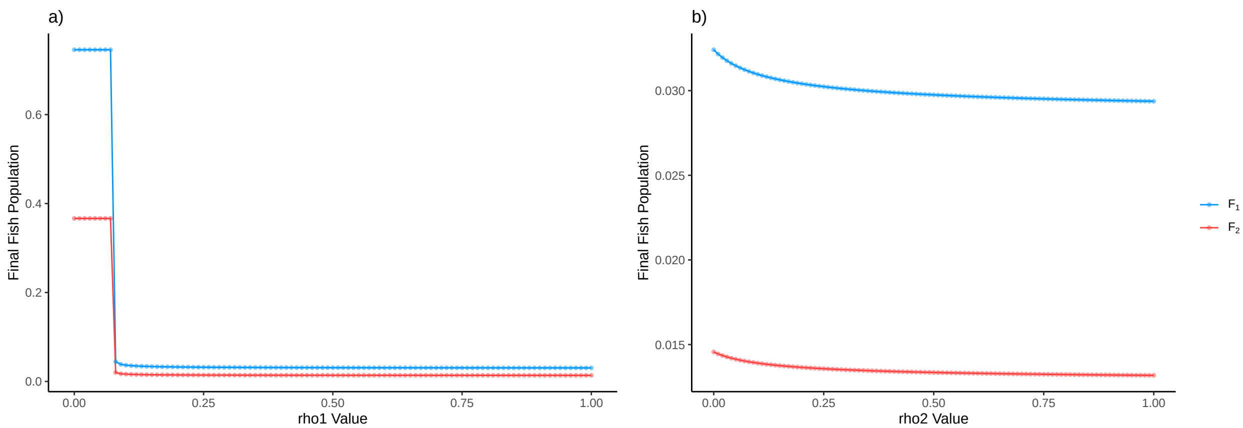


Figure 7: Each rho individually. Ok so here's my confusion, above in **??**influenceasym I say that incorporating new information will increase stability but here, as pop 2 (which is unsustainable) listens to pop 1 more, the whole thing crashes. Earlier we said this was because pop 1 is continuing to fish, so therefore encouraging pop 2 to fish more (looking at graph a)

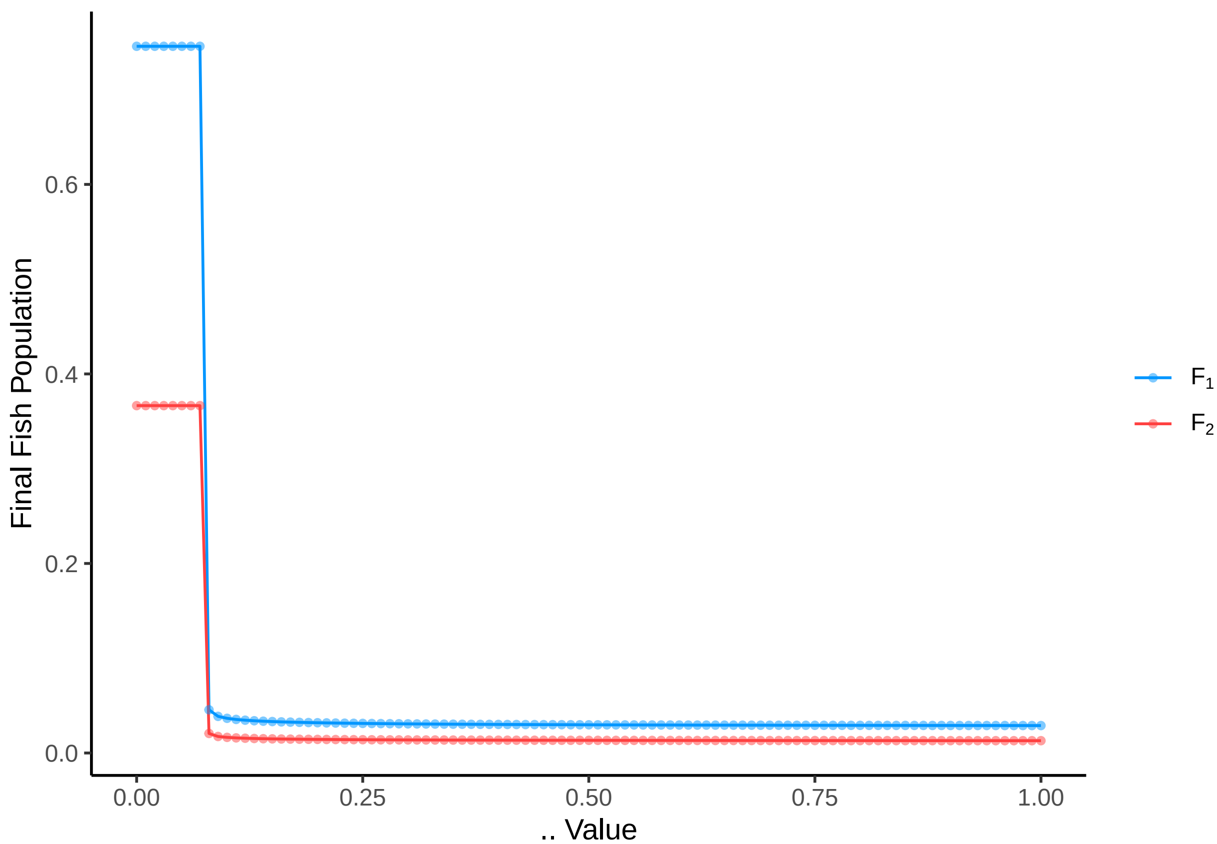


Figure 8: Final fish populations after 100 years in the two-patch fishing model where the F_1 population in patch 1 is fished sustainably but human population 1 has a lower social influence than humans in patch 2, where F_2 is being fished unsustainably. Both ρ_1 and ρ_2 were increased simultaneously.

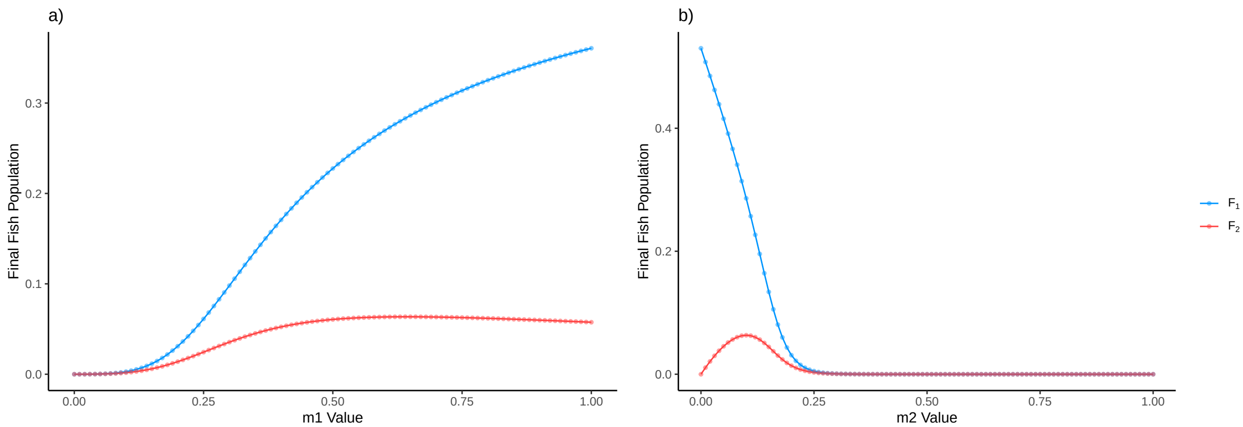


Figure 9: Final fish populations after 100 years in the two-patch fishing model where patch 1 (F_1) is fished sustainably but human population 1 has a lower social influence than patch 2, where F_2 is being fished unsustainably. a) shows how increases in fish movement into patch 1 (m_1) affect final populations and b) shows how increases in fish movement into patch 2 (m_2) affect final populations. More fish moving to sustainable patch (a). Will result in both grousps increasing fish. Showing how one patch CAN save whole system if enough fish are subject to their fishing. b) shows how if more fish move to unsustained patch, whole system will crash.

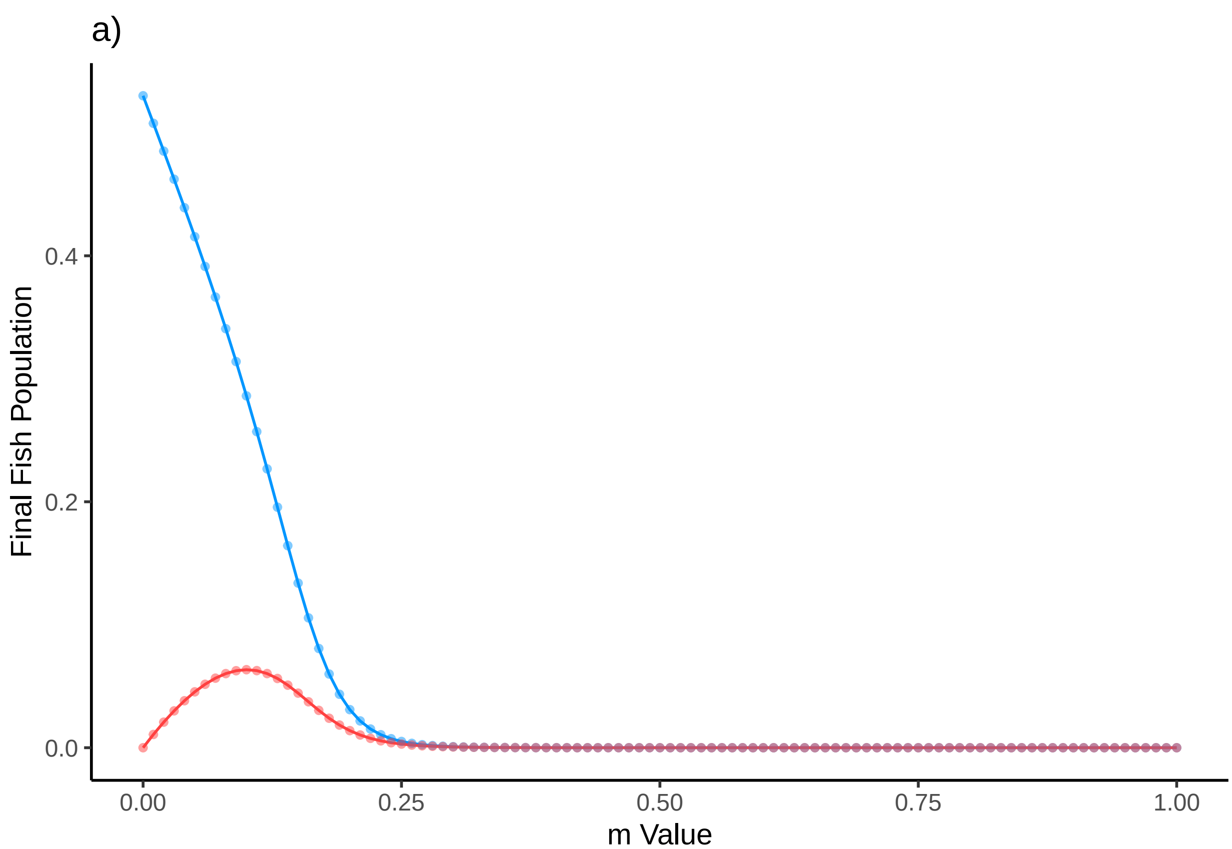
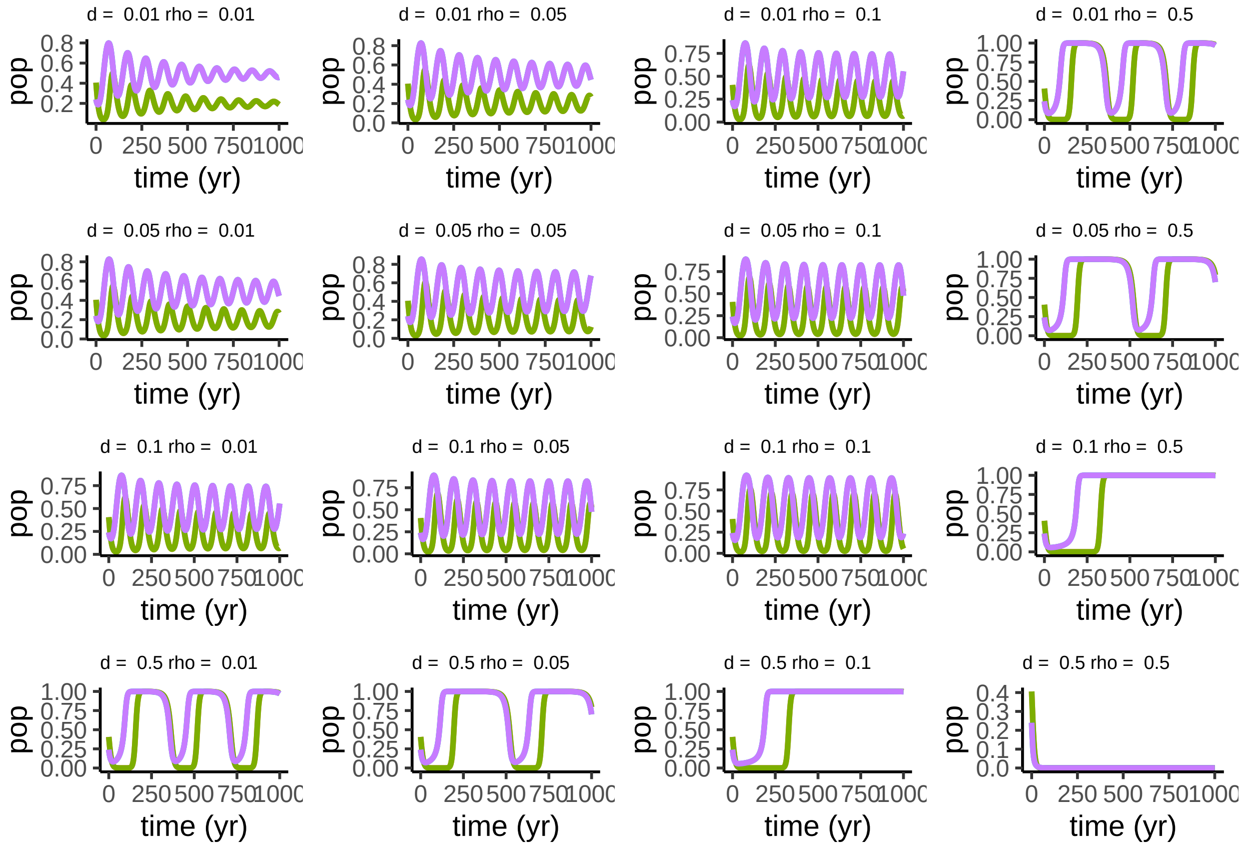


Figure 10: Both ms changing. Increasing both ms results in fishery crashes. Probably due to more fish entering F2 to be overfished more?

4 APPENDIX STUFF



Essentially shows that with symmetry, d and rho act similarly. When one or the other is strong, you get delayed cycles (i.e. delayed reactions to pressure)