Lotka-Volterra Räuber-Beute-Model (≠ Konkurrenz-Model (!))

$\frac{dx}{dt} = x(\alpha - \beta y), x = \text{Häsli} = 5000,\ \frac{dy}{dt} = -y(\gamma - \delta y), y = \text{Füchsli} = 100$

$\alpha = 2, \beta = 0.01, \gamma = 0.8, \delta = 2 \cdot 10^{-4}, t = [1 : 100]$

```
> library(deSolve)
> lotvmod<-function(time,state,pars) {
+  with(as.list(c(state,pars)), {
+   dx= x*(alpha-beta *y)
+   dy=-y*(gamma-delta*x)
+   return(list(c(dx,dy)))
+  })
+ }
> pars<-c(alpha=2, beta=0.01, gamma=0.8, delta=0.0002)
> state<-c(x=5000,y=100); time<-seq(0,10,by=0.1)
> output<-as.data.frame(ode(func=lotvmod, y=state,parms=pars,times=time))
> output[,3]<-output[,3]*10 #I'll scale those, to see it better
> matplot(output[,-1], type="l", xlab="time", ylab="# ind")
> legend("topright",c("Playboy-Häsli", "Hefner-Füchs*10"),lty=c(1,2),col=c(1,2))
> dev.new();plot(output[,2], output[,3], xlab="#Playboy-Häsli", ylab="#Hefner-Füchs*10")
```

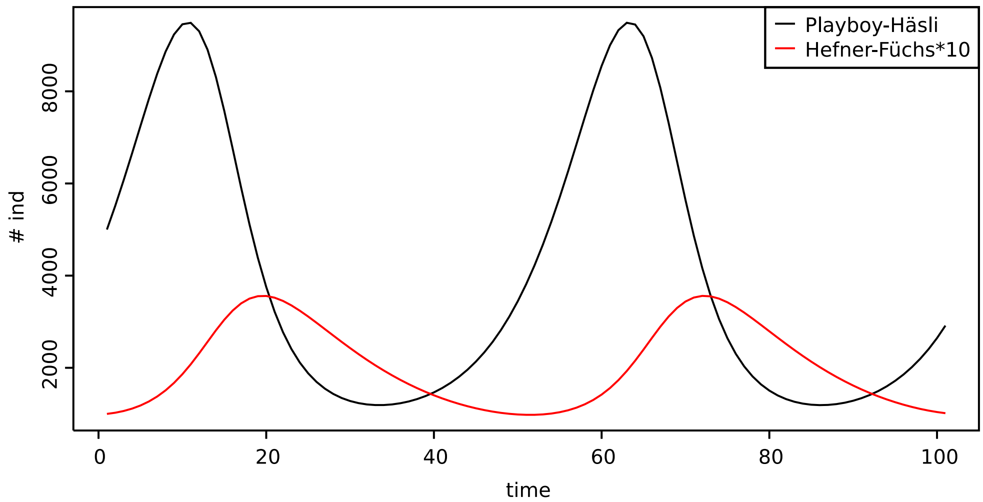


Abbildung 1: # Individuals vs. t

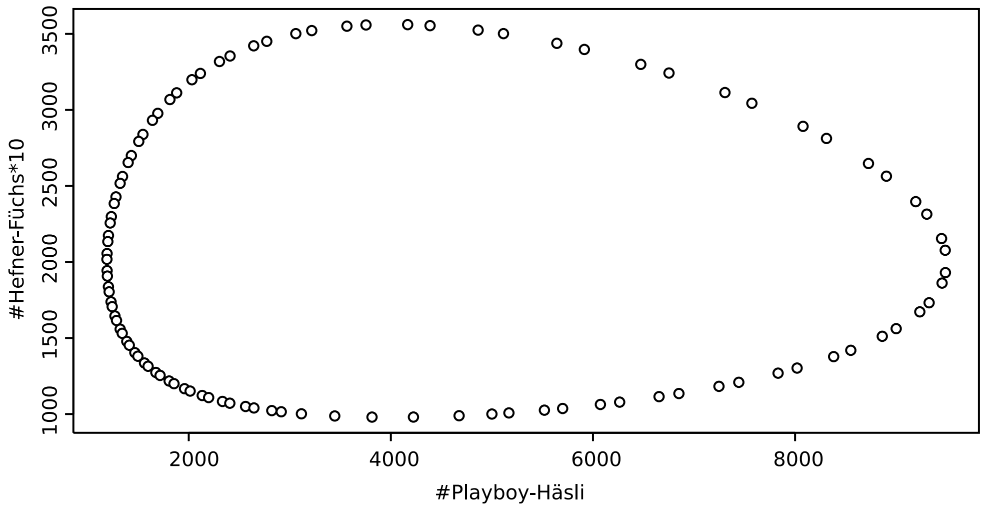


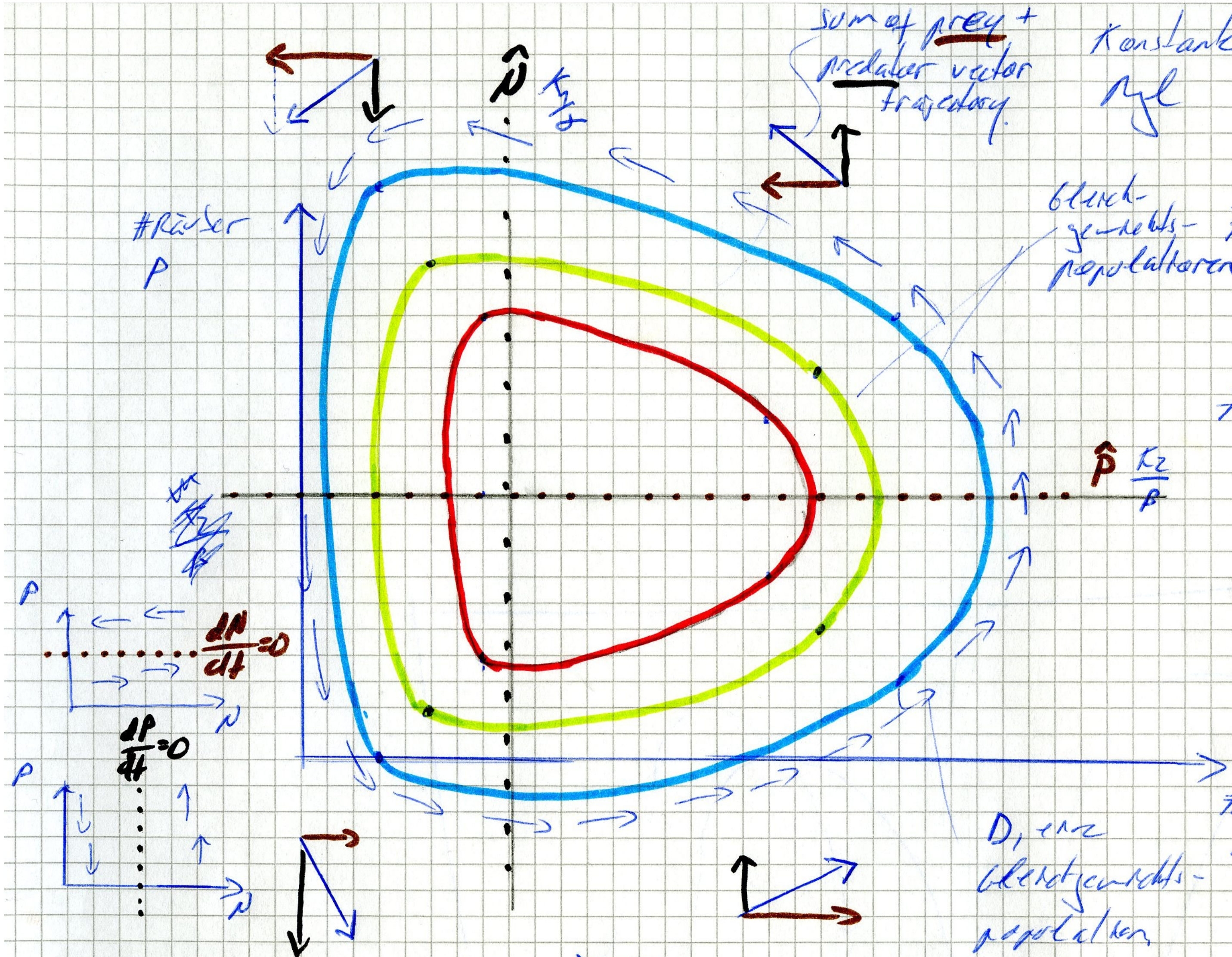
Abbildung 2: # Häsli vs. # 10·Füchsli

Konstant Løsung der Lotka-Volterra Syl #5

$$\left.\begin{aligned} N(\alpha-\beta P) &\doteq 0 \\ P(\gamma N-\delta) &\doteq 0 \end{aligned}\right\}$$ sbl. aus $\frac{dN}{dt}=N(\alpha-\beta P)$, $\frac{dP}{dt}=P(\gamma-\delta N)$

For (N,P) - Punkt:

$$(N,P)=\left(\frac{\delta}{\gamma},\frac{\alpha}{\beta}\right)$$



For nicht konstant Løsungen

$$\cancel{\gamma}\frac{dN}{dt}+\beta\frac{dP}{dt}=\alpha\cdot\gamma\cdot N-\cancel{\alpha}\beta\cdot\delta P$$

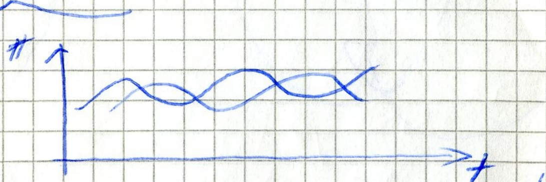
$$\cancel{\gamma}\frac{dN}{dt}\cdot\frac{\delta}{N}+\frac{\alpha}{P}\cdot\frac{dP}{dt}$$

$$=\alpha\cdot\gamma\cdot N-\beta\cdot\delta\cdot P$$

$$\gamma\frac{dN}{dt}-\frac{\cancel{\gamma}\delta\,dN}{N\cdot dt}+\beta\frac{dP}{dt}-\frac{\alpha\,dP}{P\,dt}=0\,!$$

$$\left(\gamma-\frac{\delta}{N}\right)N\cdot(\alpha-\beta\cdot P)+\left(\beta-\frac{\alpha}{P}\right)P\cdot(\gamma N-\delta)=0$$

⇐ invariant auf D



$N \Rightarrow$ prey

$P \Rightarrow$ predator

$\hat{D} \Rightarrow$ predator's isocline.

$\hat{P} \Rightarrow$ prey's isocline.

Nicolas Weyland
13. Juni 2012

Deal with it!

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N Weyland

```
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```
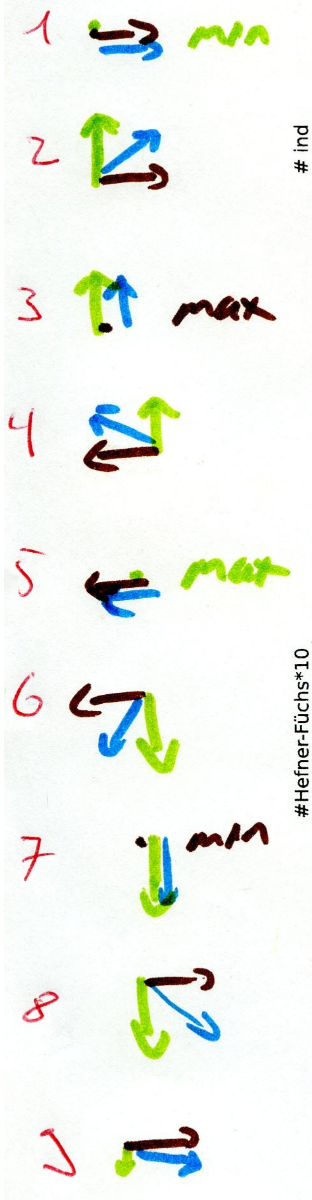

~1 Periode/Zyklus

damit Serie in den Plot passen!



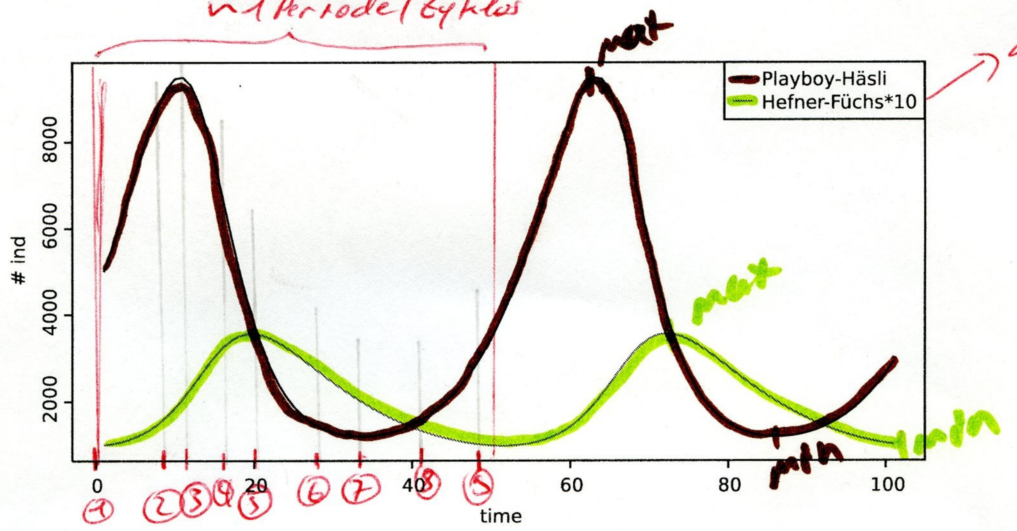


Abbildung 1: # Individuals vs. t

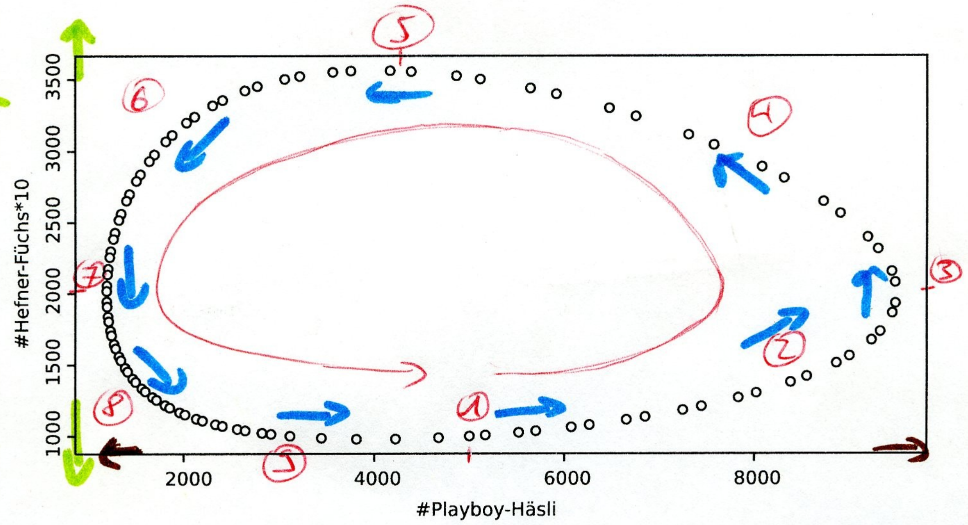


Abbildung 2: # Häsli vs. # 10·Füchsli

≙ ↑ # Füchse
≙ ↓ # Füchse

≙ ↑ # Häsli
≙ ↓ # Häsli

keine Änderung in dt