

## Mysis modeling brainstorm:

Variables:

Time	=	$t$
Average solar radiation	=	$a$
Thermocline's distance from surface	=	$d$
Calories ( $c$ )	=	if migrating: $+\omega$ else: $-\epsilon$

Migrate Desire Model equations:

Mysis engrained desire to migrate:	$M(t) =$	$C_1$ (assuming resolution of a single day)
Pressure not to migrate from light levels:	$L(a) =$	$C_2 \log(a)$
Pressure " " from thermocline depth:	$D(d) =$	$C_3(d)$
Hunger:	$H(c) =$	$c_4 e^c$

Total Mysis model:

Migrate or Not	=	$MoN(t, a, d, c) = M(t) - L(a) - D(d) + H(c)$
If ( $MoN(t, a, d, c) > \alpha$ for day)	=	migrate

A large number of Mysis will be initialized with randomly permuted starting conditions and run through an arbitrary amount of time (say a year). Their migration patterns will be visualized, from this visualizations patterns in migration will be come apparent.

## Light Intensity Equation

$$I_x = I_o e^{-kx}$$

$I_{x,o}$  = intensity at depth x and surface respectively (in lux)

$k$  = extinction coefficient (or water clarity)

So to solve for distance to threshold we find..

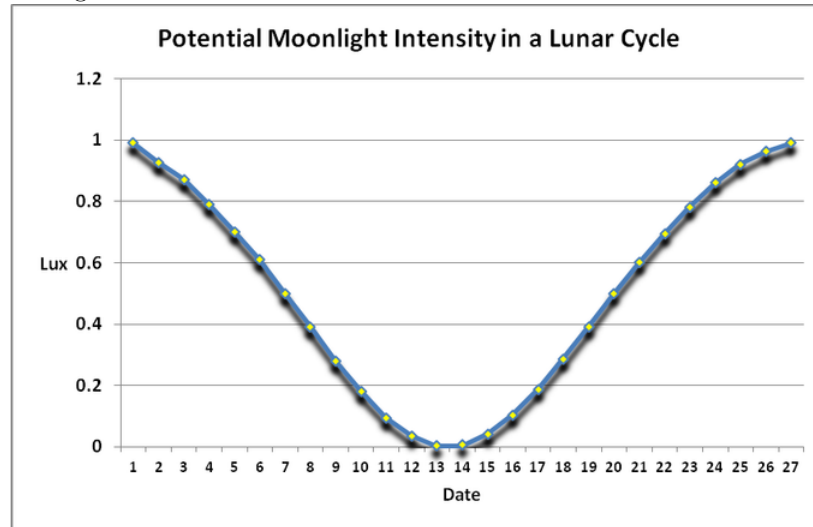
$$\begin{aligned} \frac{I_x}{I_o} &= e^{-kx} \\ \ln\left(\frac{I_x}{I_o}\right) &= -kx \\ \ln(I_x) - \ln(I_o) &= -kx \\ \ln(I_o) - \ln(I_x) &= kx \\ \frac{1}{k}(\ln(I_o) - \ln(I_x)) &= x \end{aligned}$$

We set the threshold ( $I_x$ ) to be  $10^{-2}$  lux (per Boscarino 2007) and the extinction coefficient ( $k$ ) to be 0.15 (per Jensen 2006). This turns the function into one of current light level at surface ( $I_o$ ) in the form of:

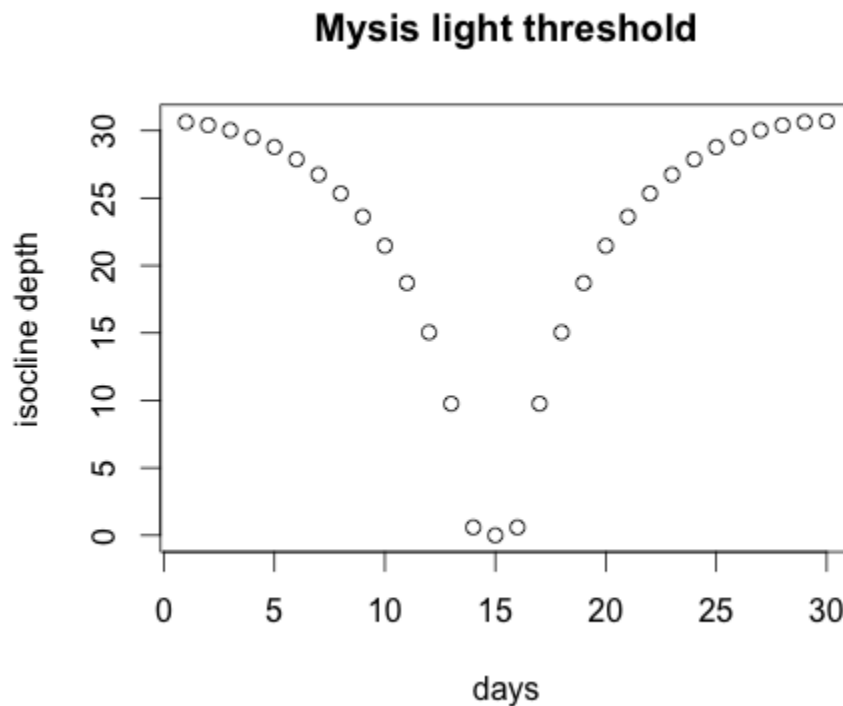
$$\begin{aligned} \text{Distance of light threshold: } f(I_o) &= \frac{1}{k}(\ln(I_o) - \ln(I_x)) \\ \text{or} \\ f(I_o) &= \frac{1}{0.15}(\ln(I_o) + 6.9) \end{aligned}$$

**Note:** make sure to plot the different parameter values for this equation later. Maybe make an interactive visualization of it.

For nighttime light intensity I am currently going off of a fishing website's un-cited figure. This will need to be updated to a more legitimate source when I am on the UVM network.



After running all of this through the r program we get a nice output for a given 30 day lunar cycle of ...



Combined measures:

