Homework Review for Exam

Knowledge Exam   Nov 24   25%

Format: The exam is divided into three parts:

(1) the "knowledge" section addresses concepts;
(2) the "application" section focuses on the use of these concepts in real conservation issues; and
(3) the "interpretation" section deals with the analysis of data in the context of conservation applications.

Each section is worth 33 points + 1 bonus point

You can use a calculator – but not a smart phone.

Homework Review for Exam

Knowledge Exam **Nov 24** **25%**

Content:

Homework and Background Readings

Assigned Book and Article Readings

Debate and Background Readings

Homework Review for Exam

Homework 1: Linear Trends

The study starts at time 0 – the baseline year before the annual surveys started and the relative abundance was 100% – and runs for 50 years. You will consider three sampling methods, with different built-in error rates:

One method has no error (“abundance_noerror”)
One method has a 10% error (“abundance_10percent”)
One method has a 50% error (“abundance_50percent”)

Homework Review for Exam

Homework 1:

What metrics do we use to assess linear trends ?

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	10643.803	10643.803	285.512	0.000
Residual	49	1826.707	37.280		
Total	50	12470.51			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	99.438	1.685	59.010	0.000	96.052	102.824
year	-0.981	0.058	-16.897	0.000	-1.098	-0.865

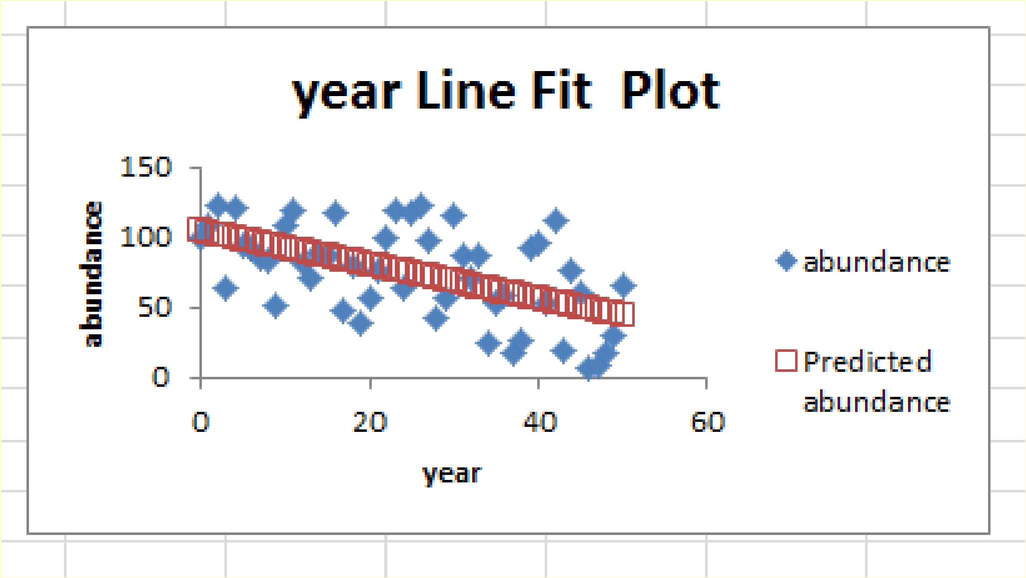
Homework Review for Exam

Homework 1:

What metrics do we use to assess linear trends ?

SUMMARY OUTPUT

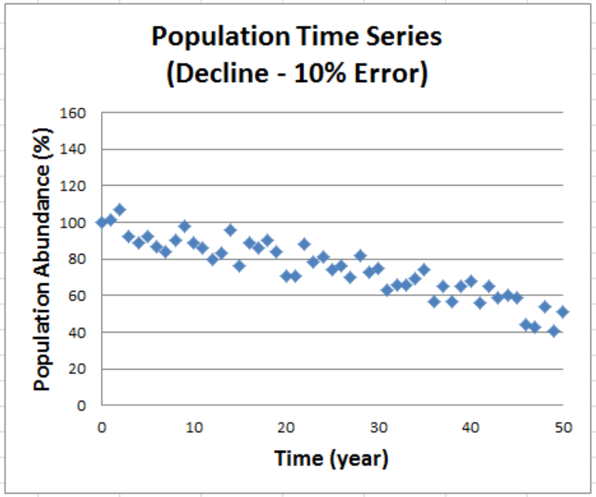
Regression Statistics	
Multiple R	0.924
R Square	0.854
Adj R Square	0.851

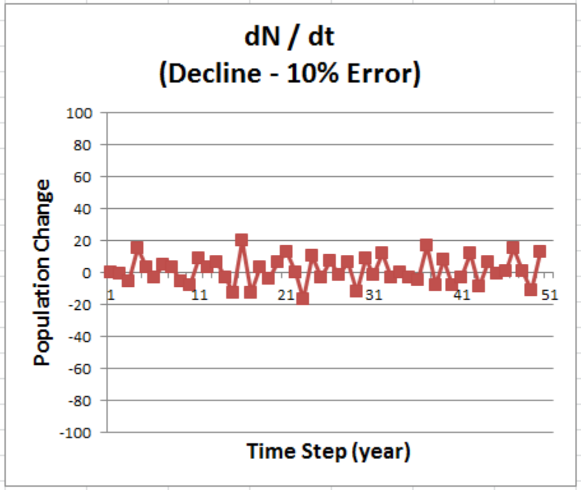


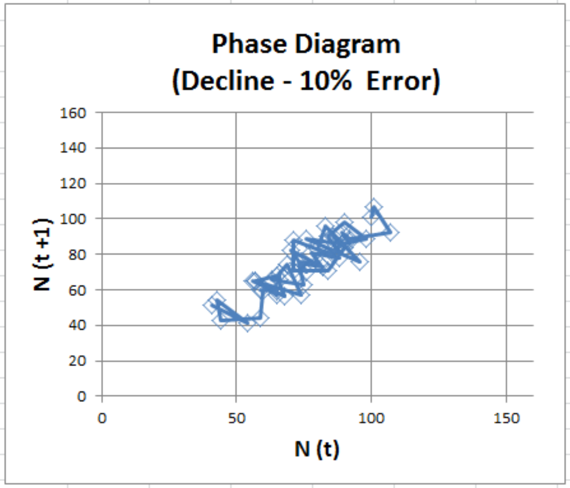
Homework Review for Exam

Homework 1:

What types of plots do we use to assess trends ?



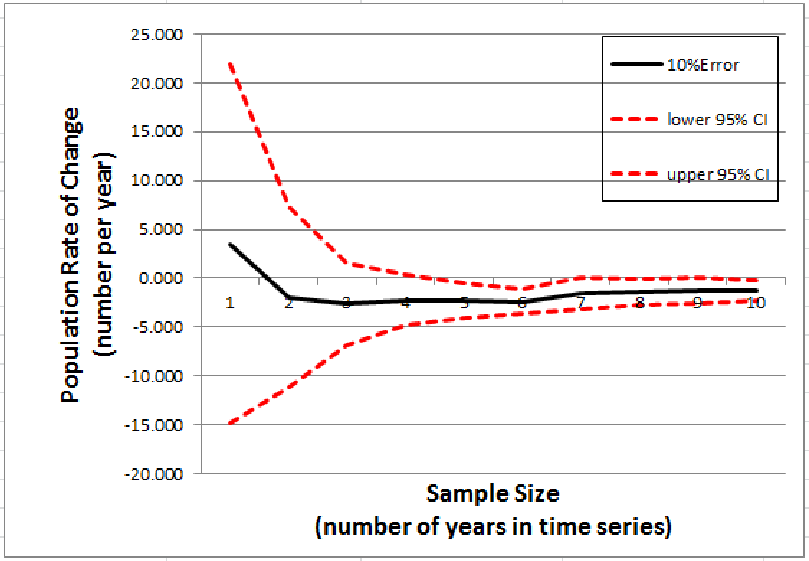


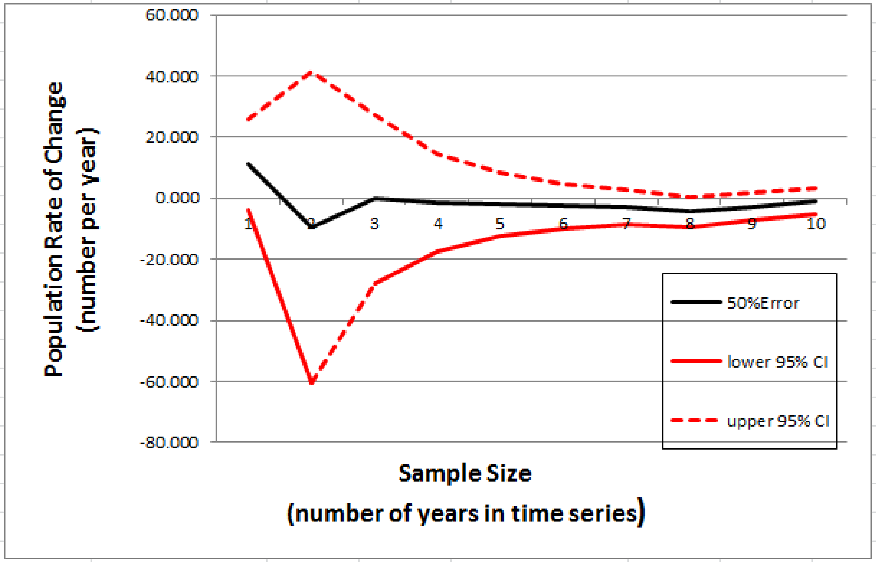


Homework Review for Exam

Homework 1:

How does noise affect our ability to detect trends ?





Homework Review for Exam

Homework 1:

How does noise affect our ability to detect trends ?

Barbara L. Taylor and Tim Gerrodette. 1993.
The Uses of Statistical Power in Conservation Biology: The Vaquita and Northern Spotted Owl. Conservation Biology, 7: 489-500.

The power (or ability of a test to detect a trend) is an increasing function of the Effect Size (the signal, ES) and a decreasing function of the test statistic (bigger alpha level, bigger power).

The power is inversely related to Data Variability

(the noise, V).

$$Power = f\left(\frac{ES - T_{1\text{-}\alpha}}{V}\right)$$

Homework Review for Exam

Homework 2:

Trend of a protected species, censused every 10 years.

year	number	ln(number)
1940	68	4.220
1950	40	3.689
1960	30	3.401
1970	27	3.296
1980	22	3.091
1990	17	2.833
2000	15	2.708

$$Nt = No\ e^{rt}$$

$$Ln\ (Nt) = Ln(No) + rt * Ln(e)$$

(note: $Ln(e) = 1$)

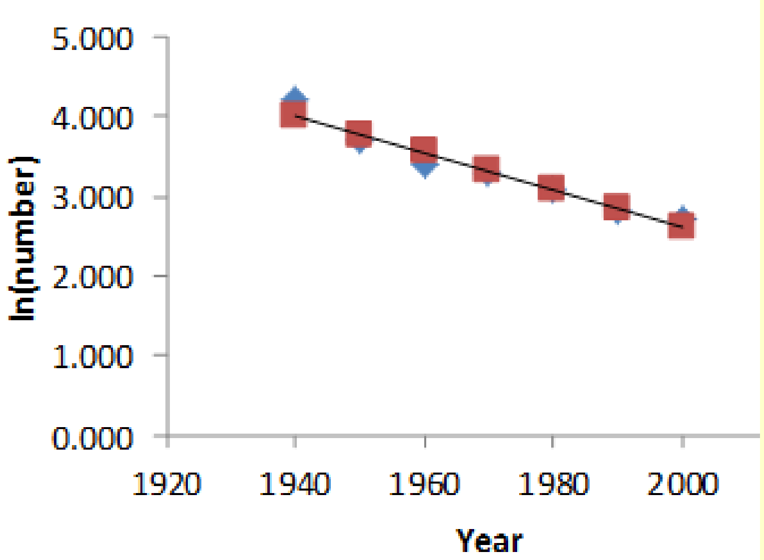
$$Ln\ (Nt) = Ln(No) + rt$$

$$y \quad = a \quad + bx$$

Homework Review for Exam

Homework 2:

Regression Statistics	
Multiple R	0.974539317
R Square	0.94972688
Adjusted R Square	0.939672256
Standard Error	0.12747769
Observations	7



ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.534974853	1.534975	94.45673	0.000195965
Residual	5	0.081252807	0.016251		
Total	6	1.61622766			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	49.44483081	4.746175303	10.41783	0.00014	37.24439879	61.64526284
X Variable 1	-0.02341378	0.002409102	-9.71889	0.000196	-0.02960658	-0.01722099

Homework Review for Exam

$$\ln(N_t) = \ln(N_o) + rt$$

scenario	ln(1/68)	r	time	year
Point estimate	-4.219	-0.023	183.434	2123
upper 95% CI	-4.219	-0.017	248.176	2188
lower 95% CI	-4.219	-0.030	140.633	2081

Briefly discuss how you could use this range of estimates (95% CI) to build a safety factor into your management decisions

(Hint: Check out Taylor and Wade paper).

Homework Review for Exam

Homework 2: Expected Population Trends

Given p(good) = p (bad) = 0.5,
we would expect the population to grow at

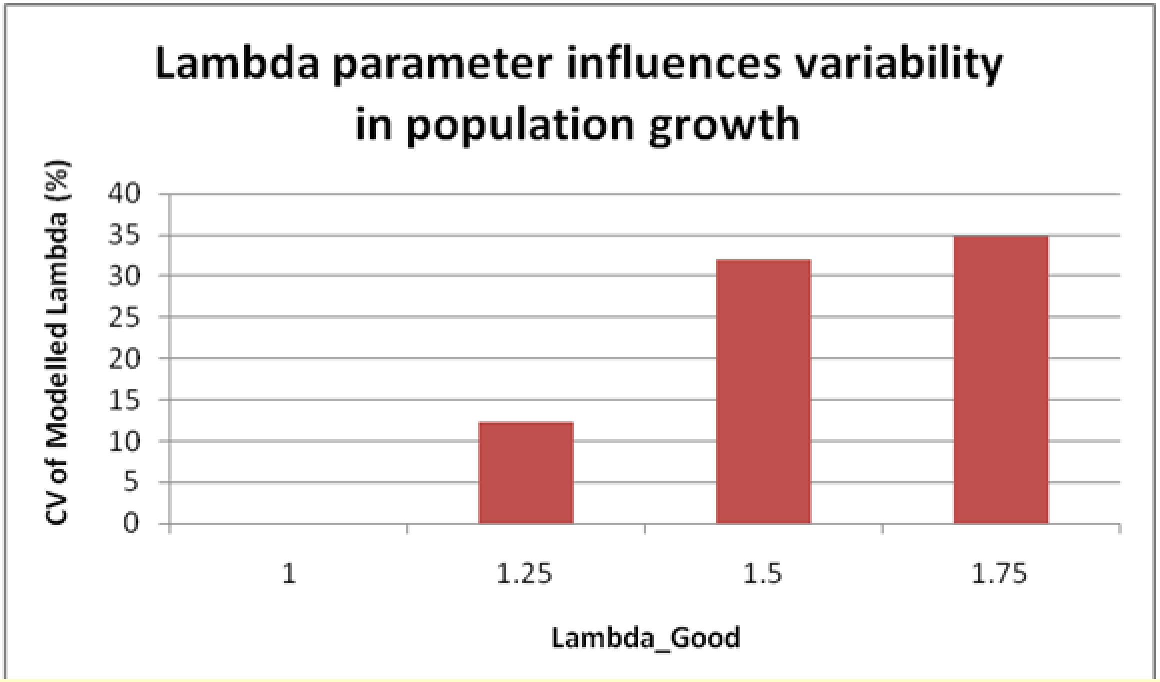
Expected_Realized_Lambda =
[(1.2) * (0.8) * (1.2) * (0.8)] ^ 1/4 = 0.979

Expected_Population_Size =
1000 * 0.979 *0.979 * 0.979 * 0.979 = 922

Homework Review for Exam

Homework 2: Observed Population Trends

	Modelled		Calculated
Lambda_good	Lambda_mean	Lambda_cv	Lambda_realized
1	1	0	1.000
1.25	0.9627	12.312	0.968
1.5	0.905	31.997	0.866
1.75	0.734	34.882	0.661



Homework Review for Exam

Homework 3: Density Dependent Growth

N(t+1) = Lambda * N(t) * (1 – b N(t))
Where: Mean Lambda = 3.1 and 95% CI Lambda = 2.1 – 4.6
What is the Equilibrium Population Size ?

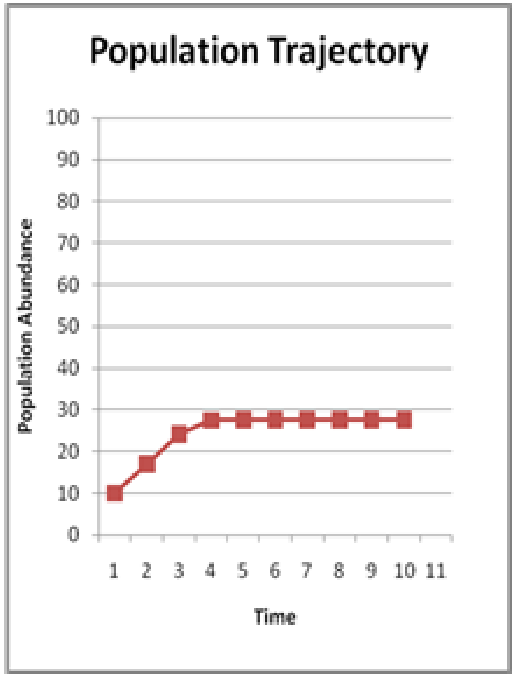
Note: Based on definition of equilibrium: N(t) = N(t+1) = Ne

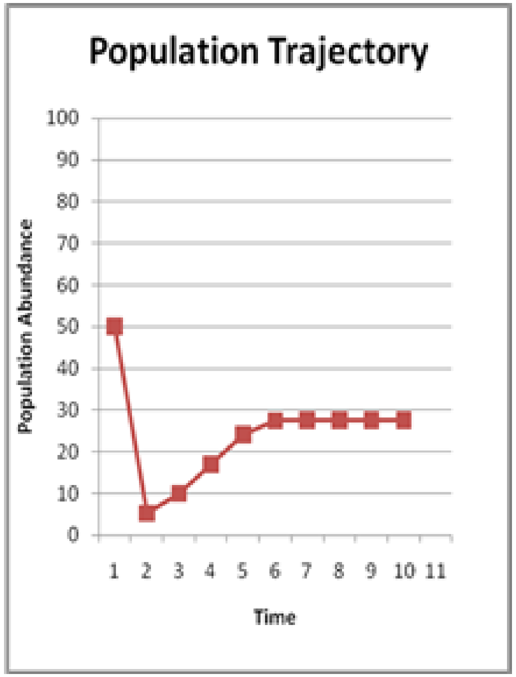
Ne = Lambda * Ne * (1 – b Ne) (multiply out the terms)
1 = Lambda – (Lambda * b * Ne) (divide both sides by Ne)
Ne = (1 - Lambda) / (Lambda * b)

- lambda: 2.1 Ne: 27.56
- lambda : 3.1 Ne: 35.65
- lambda : 4.6 Ne: 41.19

Homework Review for Exam

Homework 3: Population Dynamics





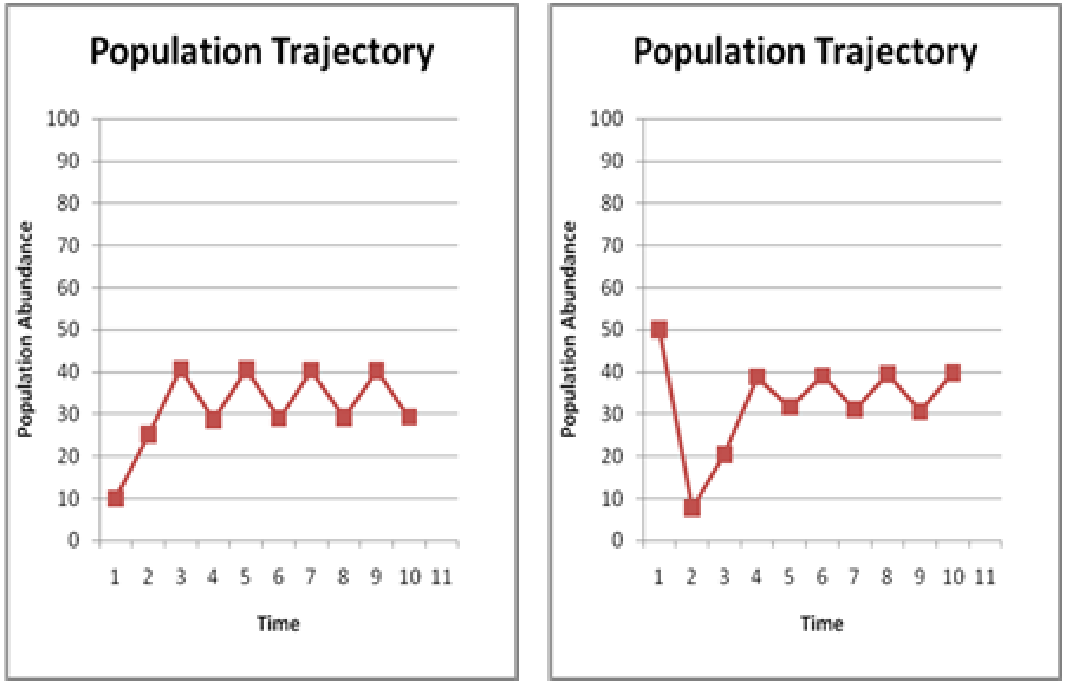
- lambda: 2.1

Population reaches equilibrium level (~ 27.56) smoothly, without overshooting or describing cycles.

The population trajectories do not vary whether we start with 10 or 50 individuals.

Homework Review for Exam

Homework 3: Population Dynamics



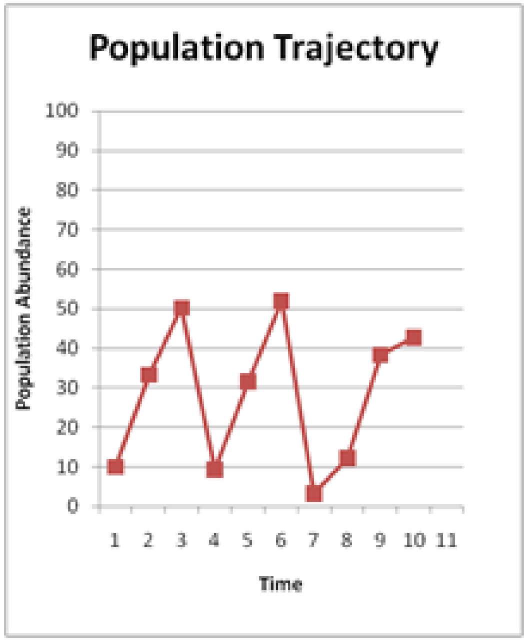
- lambda: 3.1

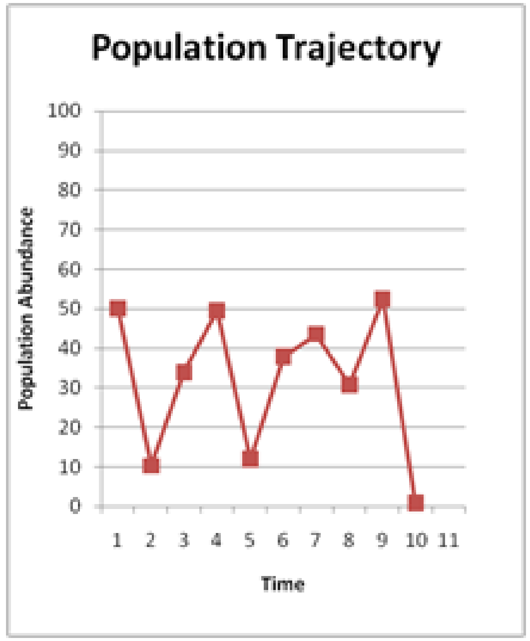
Population dos not reach the calculated equilibrium point (35.65), but cycles between two values (describing a two-point cycle).

The population trajectories do not vary whether we start with 10 or 50 individuals.

Homework Review for Exam

Homework 3: Population Dynamics





- lambda: 4.6

Population dos not reach the calculated equilibrium point (41.19), and does not undergo any cycles. Rather, the population undergoes wild fluctuations. Moreover, the population trajectories vary whether we start with 10 or 50 individuals.

Homework Review for Exam

Homework 3: To figure out the slope, we take the derivative of the formula with respect to N(t):

dN(t+1) / dN(t)= Lambda – (2* b * Lambda * N(t))

Using the b value (0.019), calculate slope at the equilibrium point.

- lambda: 2.1 slope : -0.1 (stable; population stabilizes to K)
- lambda : 3.1 slope: -1.1 (two-point cycle; population cycles)
- lambda : 4.6 slope: -2.6 (chaos; population oscillates widely)

Homework Review for Exam

Homework 3:

Starting at initial population size of 10 and with K_good = K_bad = 100, try the following Lambda values: 1.5, 2, 2.5, 3, 3.5, 4.

Describe the behavior of the population for each Lambda scenario (Hint: does the population reach equilibrium smoothly, or does it overshoot K and then reach equilibrium?, does the population undergo cycles? If so, how many values are involved in the oscillations?, does the population show chaotic behavior?)

Homework Review for Exam

Homework 3: Start the population at N(t) = 10 and use a varying K (K_good = 200, K_bad = 50). Try these Lambda values (1.5 and 2), and report on the behavior of the population.

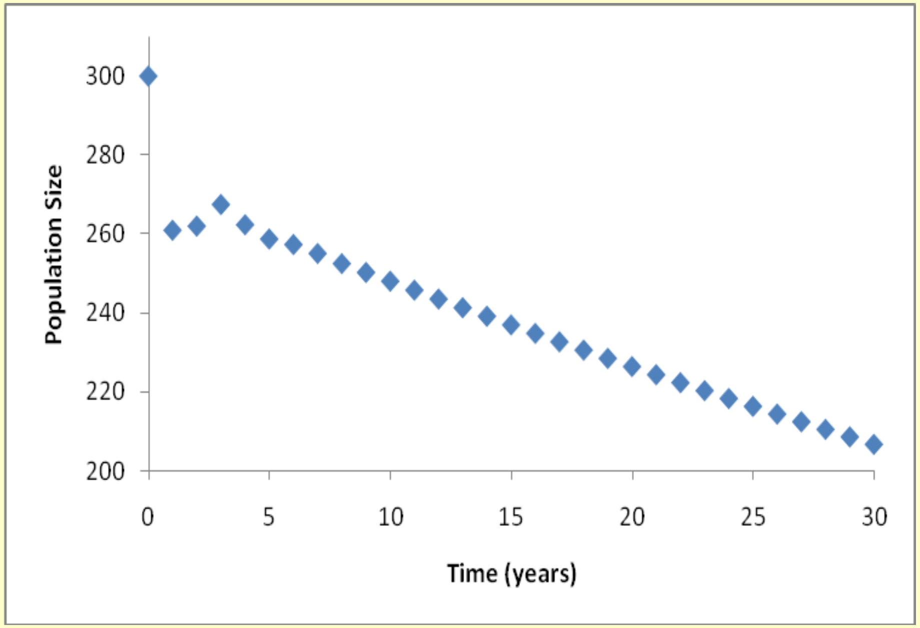
Describe the behavior of the population – in comparison with what you reported in the two answers above (Hint: does the population reach equilibrium smoothly, or does it overshoot K and then reach equilibrium?, does the population undergo cycles? If so, how many values are involved in the oscillations?, does the population show chaotic behavior?)

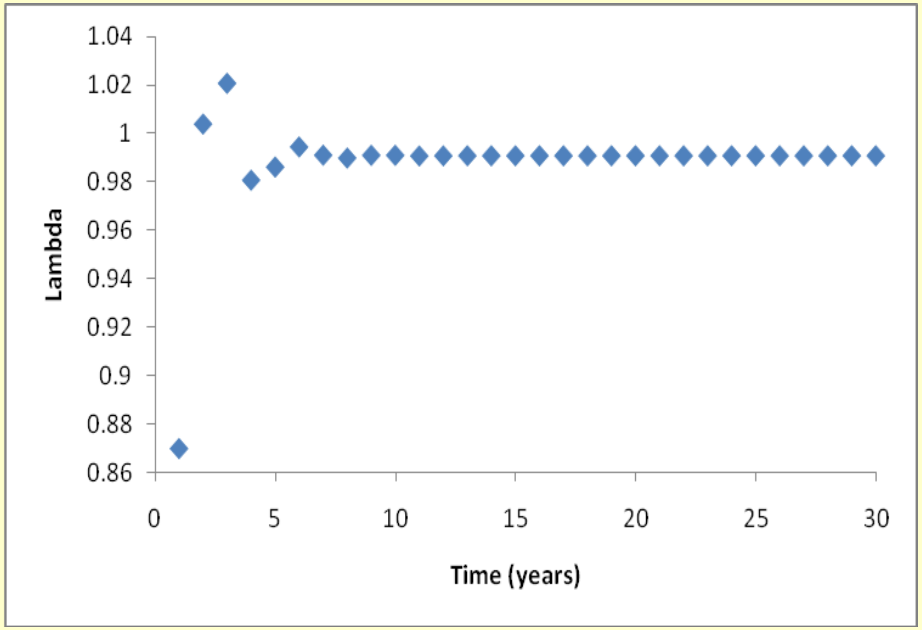
Homework Review for Exam

Homework 4:

Mountain Lion Demography

		FROM:		
		Age class 1	*Age class 2*	*Age class 3*
TO:	*Age class 1*	0.0	0.0	0.56
	Age class 2	0.65	0.0	0.0
	Age class 3	0.0	0.65	0.75





Homework Review for Exam

Homework 4:

Mountain Lion Demography

		FROM: Age class 1	Age class 2	Age class 3
TO:	Age class 1	0.0	0.0	0.56
	Age class 2	0.65	0.0	0.0
	Age class 3	0.0	0.65	0.75

	Mean Lambda	CV	Minimum	Maximum
Years 1-10	0.9820	0.0416174	0.8700	1.0208
Years 11-20	0.9909	0.0000302	0.9908	0.9909
Years 21-30	0.9909	1.62626E-08	0.9909	0.9909

Homework Review for Exam

Homework 5: PBR and Marine Mammal Management

$PBR = (N_{min}) \times (½\ R_{max}) \times (F_r)$

$N_{min} = 48{,}285 \quad R_{max} = 0.04 \quad F_r = 0.5$

$PBR = (48{,}285)\cdot(1/2)\cdot(0.04)\cdot(0.5) = 483$

Because the estimated mortality (1570)
exceeds the PBR (483), this bycatch is NOT sustainable.

To support this annual bycatch (1570),
the annual Rmax would have to be equal to:

1570 = (48,285) * (1/2 Rmax) * (0.5)

Rmax = [1570 * 2] / [48,285 * 0.5] = 0.130

Homework Review for Exam

Homework 6: PBR and Marine Mammal Management

Real	Imaginary	Age/stage struct	Reprod val
1.475179	0	63.6%	0.642073
-0.73759	-0.65735	25.9%	1.578621
-0.73759	0.657354	10.5%	1.741004
r	0.388779	(rate of increase)	
Ro	2.64	(expected number of replacements)	
T	2.496992	(generation time - time for increase of Ro)	
		(mean age of parents of	

Homework Review for Exam

Homework 6: Pop Tools

DISCRETE

$N = N_0R^t$

CONTINUOUS

$N = N_0\ e^{rt}$

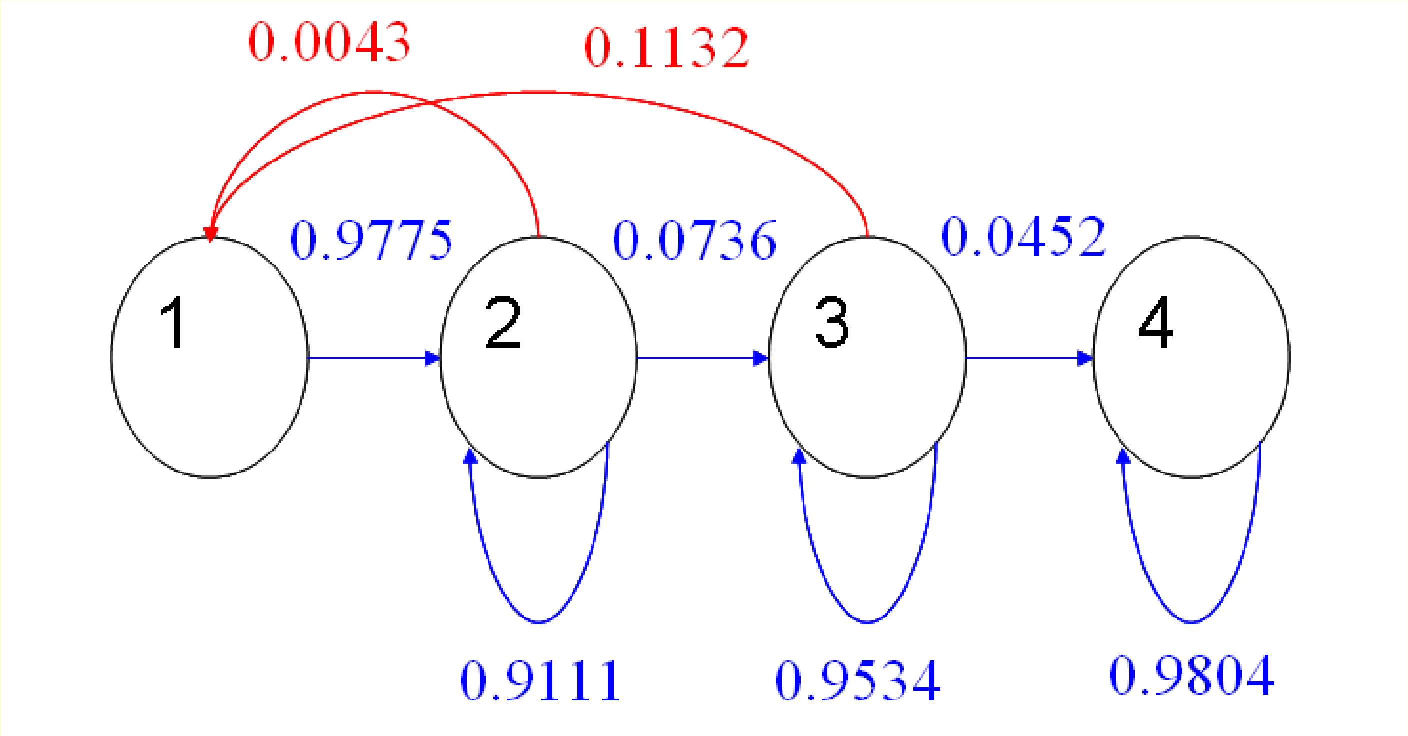
r = ln(lambda)

LAMBDA: 1.475179

r: 0.388779

Homework Review for Exam

Homework 6: Pop Tools



0	0.0043	0.1132	0
0.9775	0.9111	0	0
0	0.0736	0.9534	0
0	0	0.0452	0.9804

Homework Review for Exam

Homework 6: Pop Tools

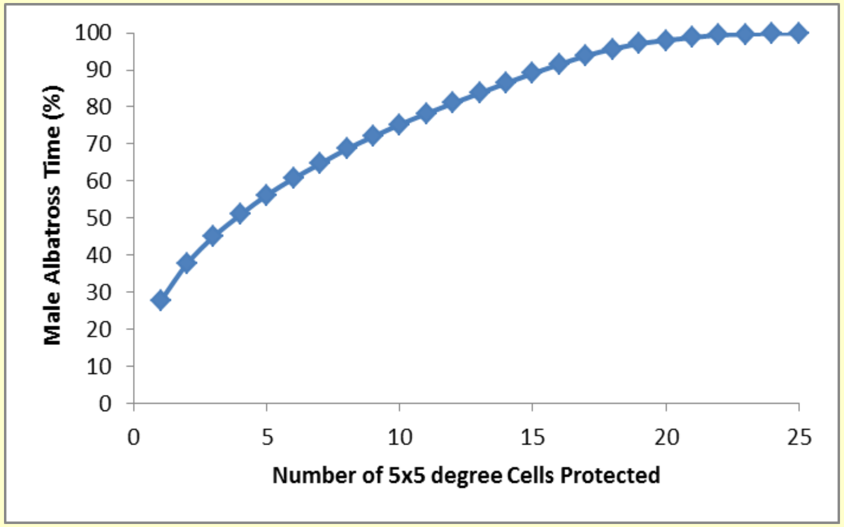
0	0.0043	0.1132	0
0.9775	0.9111	0	0
0	0.0736	0.9534	0
0	0	0.0452	0.9804

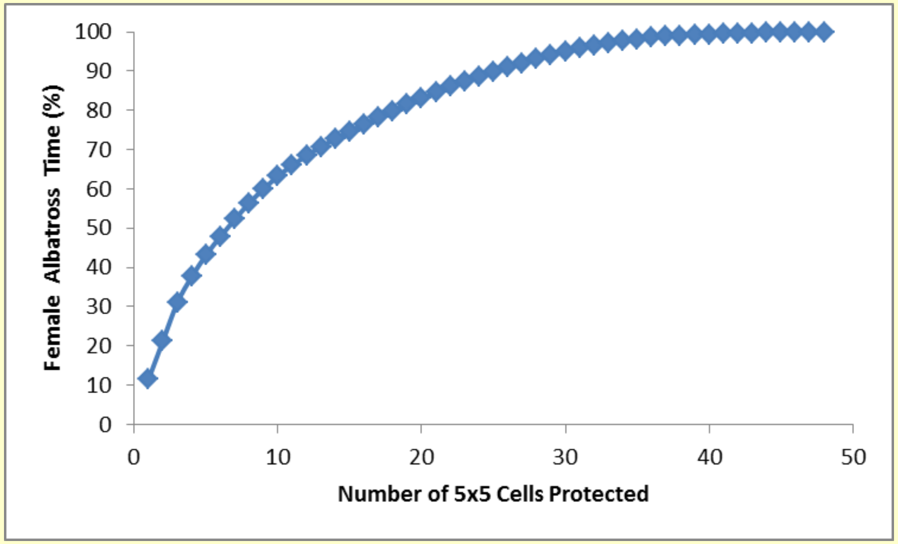
Elasticities

0	0.001513	0.040695	0
0.042208	0.336326	0	0
0	0.040695	0.538563	0
0	0	-0	-0

Homework Review for Exam

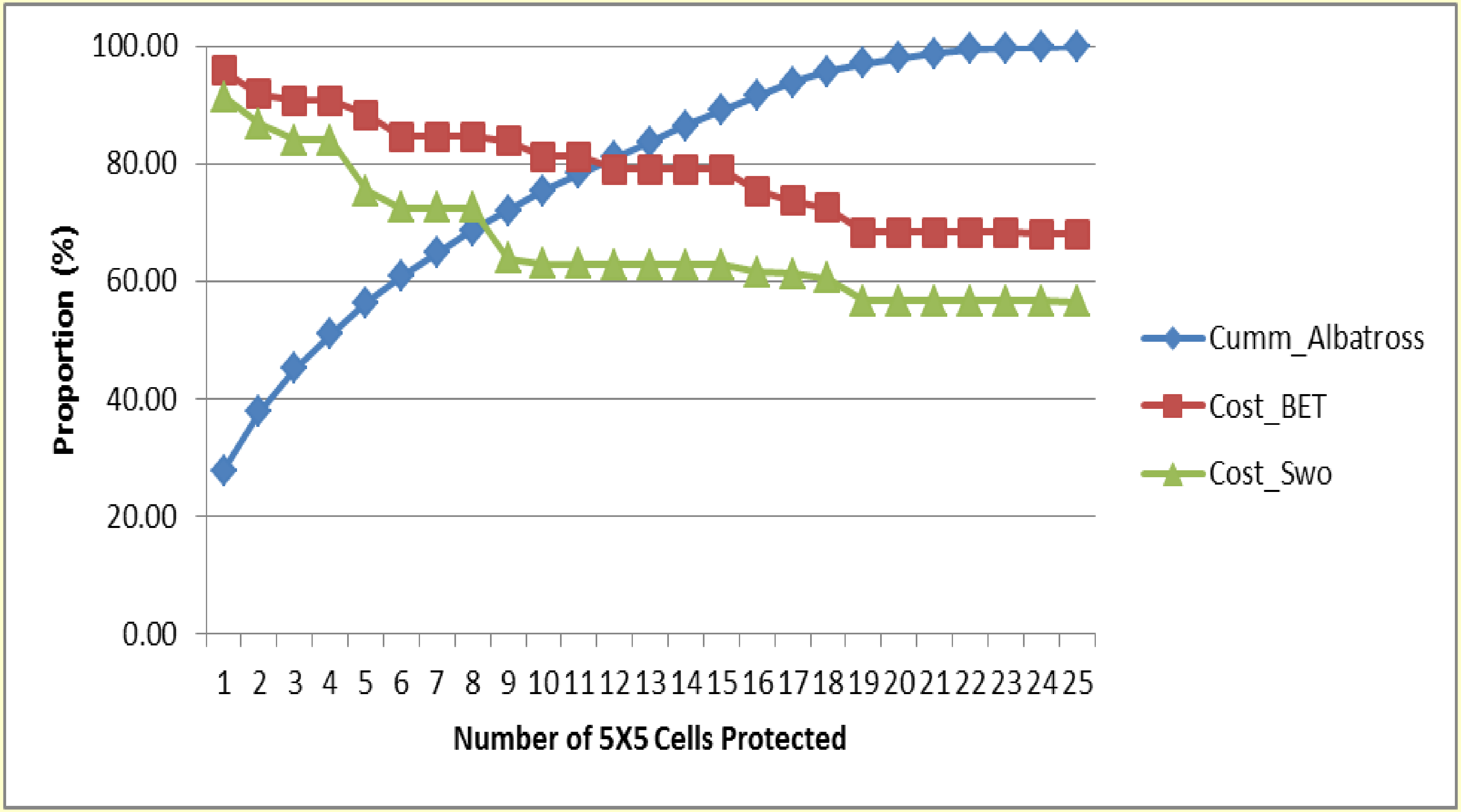
Homework 7: Fisheries





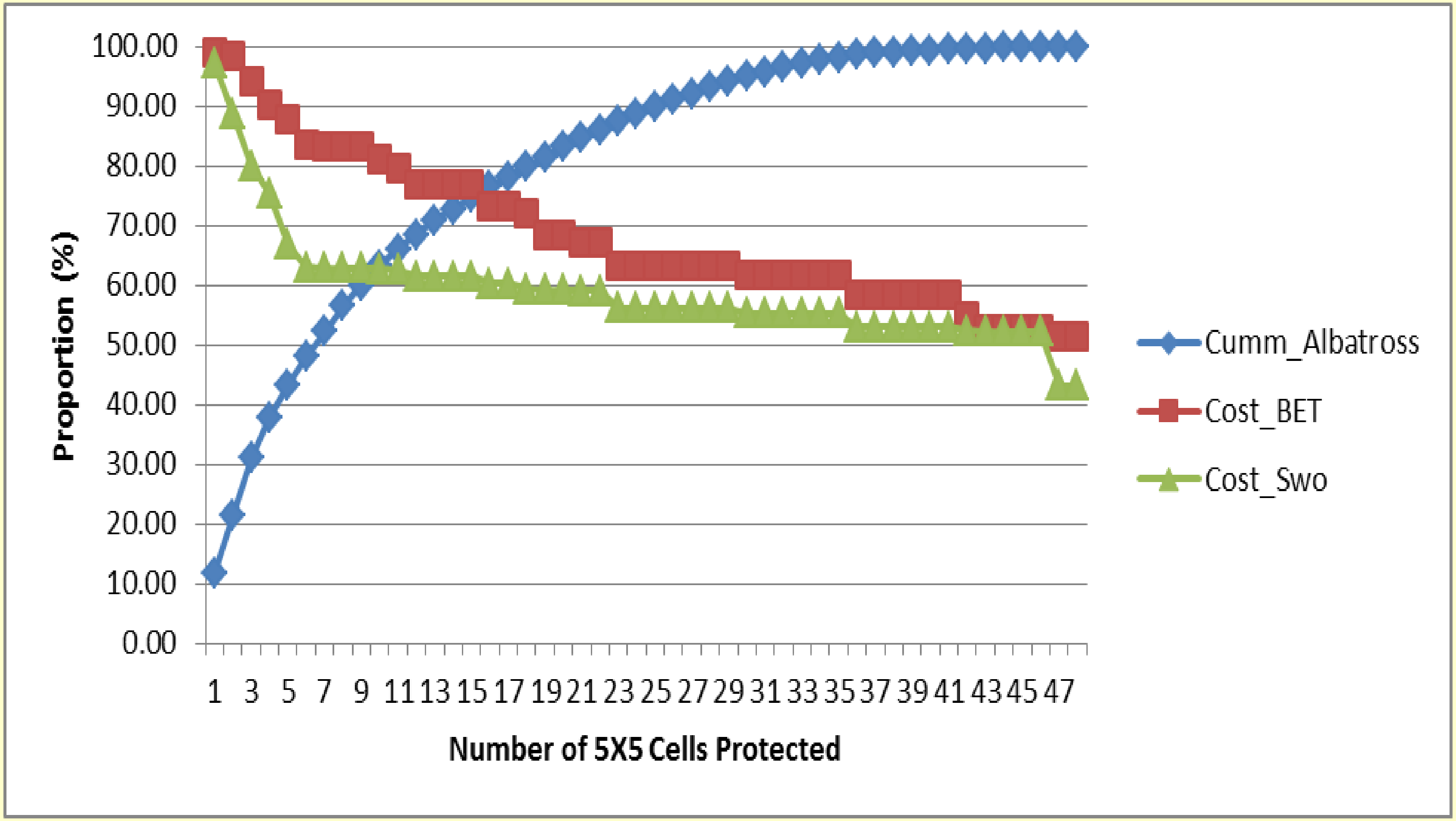
Homework Review for Exam

Homework 7: Fisheries



Homework Review for Exam

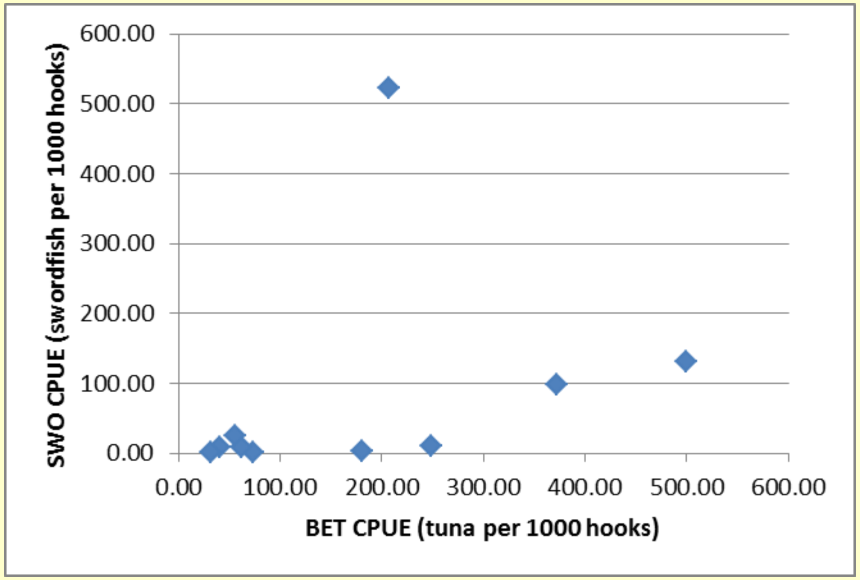
Homework 7: Fisheries



Homework Review for Exam

Homework 7: Fisheries

ID	Bet_CPUE	Swo_CPUE
83	499.63	131.36
65	371.69	97.42
74	248.44	9.61
92	206.56	521.79
144	181.12	2.90
143	74.09	0.72
48	61.64	8.14
131	55.68	24.60
56	40.54	8.16
137	31.92	0.28



Homework Review for Exam

Homework 7: Fisheries

ID	Bet_CPUE	Swo_CPUE
92	206.56	521.78
83	499.63	131.36
65	371.69	97.42
132	0.44	83.19
94	18.51	49.81
109	0.88	24.74
131	55.68	24.60
102	2.44	14.64
76	2.99	13.64
118	20.19	11.93