Science, Service, Stewardship

Octopus Update Sept 2016

1) Update of Consumption Estimate for BSAI
2) Research Update: Tagging, Discard Mortality
3) Octopus Population Simulation Model

NOAA FISHERIES SERVICE

Octopus Tagging Study Results
Reid Brewer, UAF

- VIE tags work well for octopus
- Higher temperature, growth rates, movement, maturity in autumn
- SGR 0.2 – 1.3%/day, decreases with size, higher in warmer temps
- Average annual survival 3.3% for pot-caught octopus (M=3.4), highly variable with octopus size, sex, maturity. Strongly influenced by prevalence of mature adults in tagged population.
- abundance estimate for study area 3,180 octopus or 127 per km^2
- Expanded to stat areas 509,517,519: estimate is 1.47 million octopus, 20,697mt

Octopus Discard Mortality Research

Observer special project 2006-2007, 2010-2011:
Condition of Octopus at discard by region, season, gear type

Field project Jan 2013, F/V *Aleutian Mariner* cod pot fishing:
36 octopus held 24-60 hrs, NO observed mortality or decline
(in press *Fisheries Research*, Conners and Levine 2016)

Lab project, AFSC Kodiak Labs, octopus held 21 days
Uninjured octopus NO delayed mortality, injured octopus, 50% delayed mortality (Conrath and Sisson, in review *Fisheries Research*)

Observer Special Project Data

Condition Reported for Observed Octopus

2006-2007

Gear	No. Alive	No. Dead	Total	%Alive
Bottom Trawl	32	43	75	42.7%
Pelagic Trawl	28	161	189	14.8%
Pots	431	2	433	99.5%
Longline	132	36	168	78.6%

2010-2011

Gear	Excellent	Poor	Dead	Total	%Excellent
Bottom Trawl	16	11	35	62	25.8%
Pelagic Trawl	8	7	42	58	13.8%
Pots	506	14	16	536	94.4%
Longline	122	7	16	146	83.6%

Cod Pot Field Study –

Octopus DMRs: Example

ion		Excellent	Poor	Dead
		0%	50%	100%
ty	Pel trawl	26%	18%	56%
	NP trawl	14%	12%	72%
	LongL	94%	3%	3%
	Pot	84%	5%	11%
		Discarded	Retained	
	Pel trawl	0.3	1.6	
	NP trawl	44.8	17	
	LongL	49.7	9.7	
	Pot	488	356	
	Tot	583	385	968

	Retained Catch	Discard Mortality DiscE	DiscP	DiscD	To Ta
Pel trawl	1.6	0.00	0.03	0.17	
NP trawl	17.0	0.00	0.00	0.00	
LongL	9.7	12.11	0.23	0.84	
Pot	356	56.2	2.8	38.7	
Total	385	68.4	3.1	39.7	

Octopus Discard Mortality: Plan Team Actions

No Action. Archive study results, revisit if/when octopus retention or market increases. DMR remains 100%

Use DMR in catch accounting, with current results.

Plan for DMR in catch accounting, gather more data.

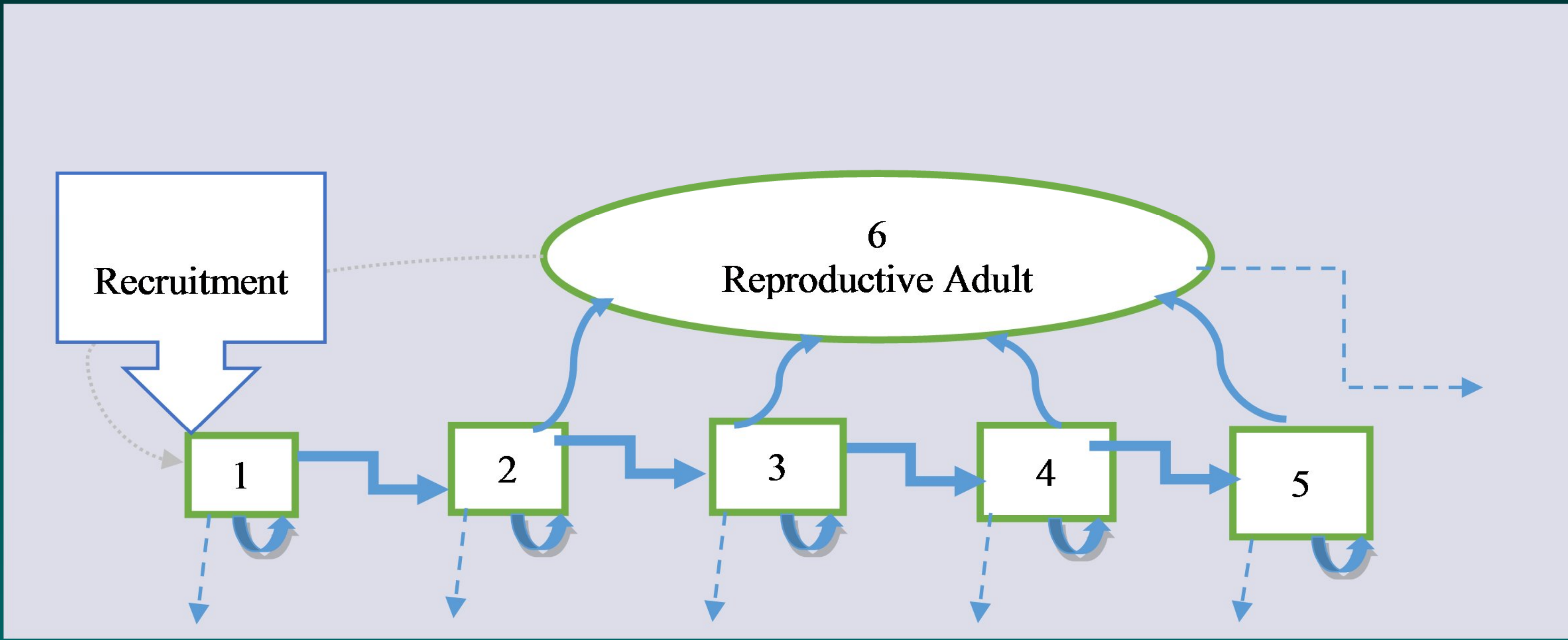
– Update viability key based on Lab study

– Observers collect new set of vitality data by gear, CV/CP etc.

– Apply DMRs from published research.

– Use methodology from new Halibut DMRs

Octopus Population Model



Population Structure and Growth Variables

	1	2	3	4	5	Adult
Size (kg)	< 3	3 < 9	9 < 15	15 < 21	21 +	
Mean Wt (kg)	0.5	6	12	18	24	22
Mnat	0.7	0.5	0.2	0.1	0.1	10
Pr(Mature)	0	0.1	0.5	0.75	1.0	
Pr(grow 0)	0	0	0	0	0	
Pr(grow 1)	1.0	0.9	0.5	0.25	0	
InitSize%	0.55	0.15	0.10	0.08	0.02	0.1
N0	5,500	1,500	1,000	800	200	1,000
Fsel – Pots	0	0.1	0.5	1.0	1.0	1.0
Fsel– BTsur	1.0	0.1	0.1	0.1	0.1	0.1
Fsel- Cod	1.0	0.5	0	0	0	0

Run Variables

Nclass	6
Yrs, burn	60,10
N0_all	1,460,000
Rbar	5,000,000
sigmaR	0
Ftot - Pots	0
Ftot- BTsurv	0
Ftot- Cod	0

Calculated Variables / Outputs (units)

N(t,i) vector	Numbers at stage i	#	Matrix
N(t+1,i)	Numbers next year	#	
SF(t,i)	Size Frequency	%	Matrix
R(t)	Recruitment	#	Vector
B(t,i), B(t)	Biomass	mt	Vector
SpB(t,i), SpB(t)	Spawning Biomass	mt	Vector
CAAF(t,i)	Catch by stage	#/stage	Matrix
Yield (t)	Fishery Yield	mt	Vector

R screen output:

Initial Biomass and Population Size = 83.4 10000

Final Biomass and Population Size = 64.19 12850

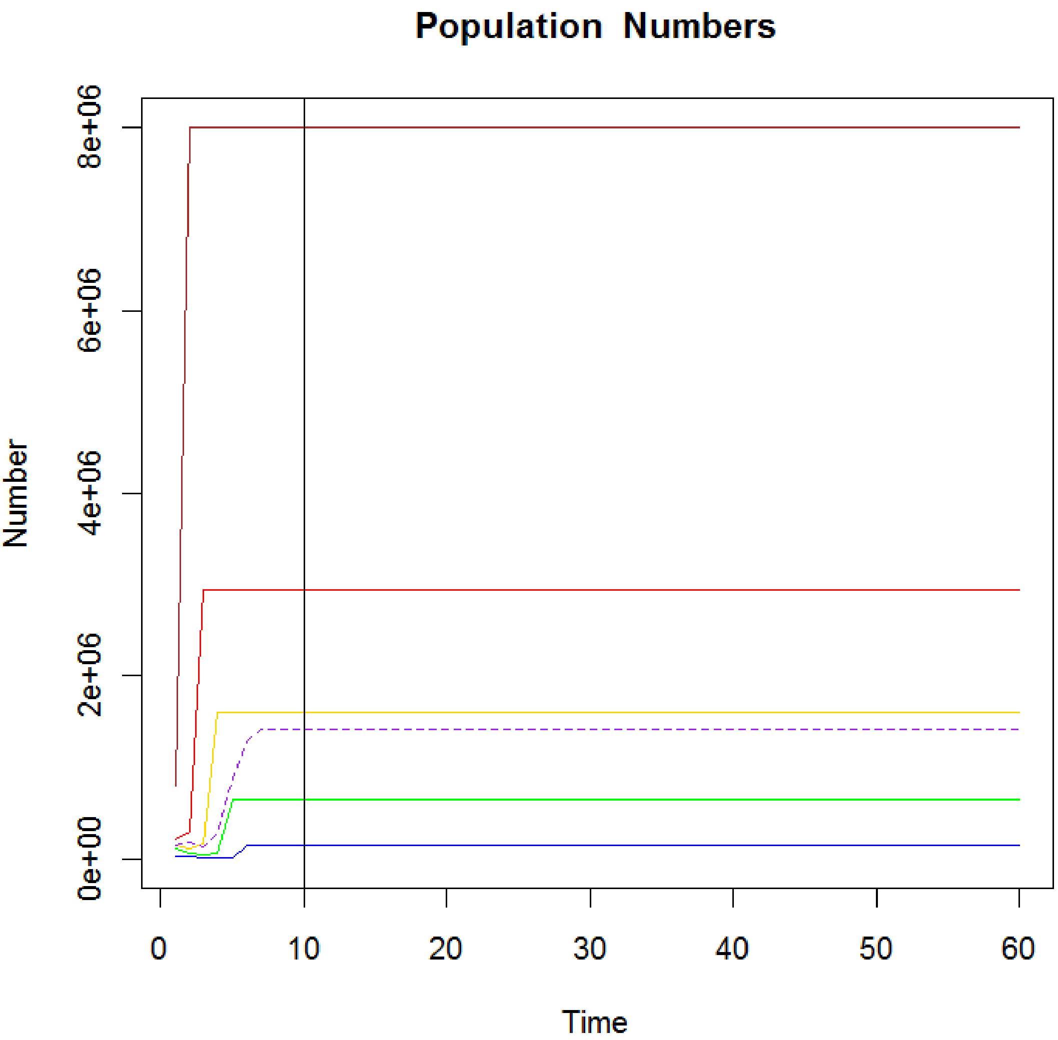
Average Fishery Yield = 2.77

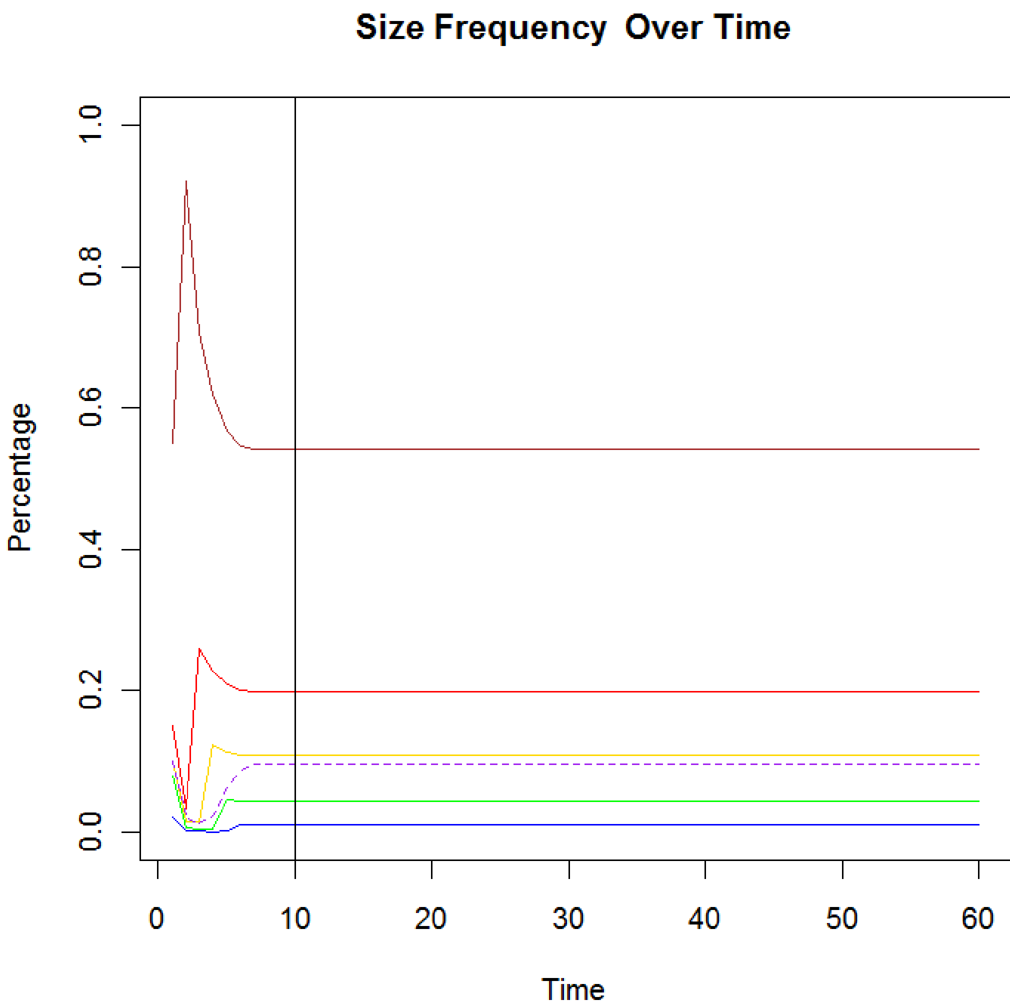
Ending Size Frequency = 0.642 0.212 0.082 0.017 0.001 0.042

Mean, Stdev, Min, and Max of time series (after burn-in) for Nt[i] plus Rt, Bt, SBt, Yield

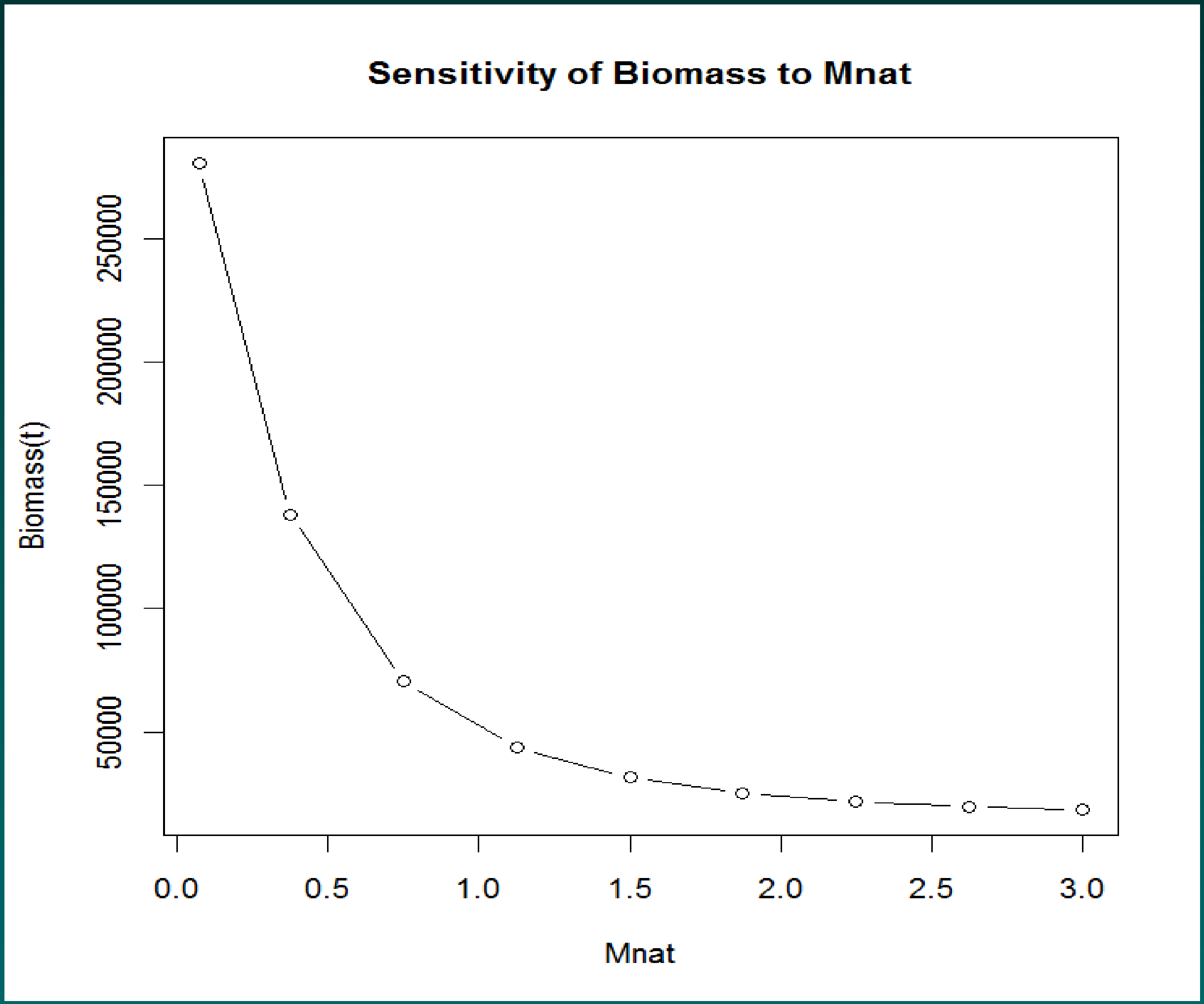
	Mean	StDev	Min	Max
N1	5439.621	1928.922	2396.300	9362.232
N2	2111.981	655.904	1080.014	3517.209
N3	926.392	273.844	508.435	1494.725
N4	297.731	82.156	173.443	475.272
N5	36.803	10.030	21.300	58.368
N6	678.445	129.686	452.450	946.847
Rt	5439.621	1928.922	2396.300	9362.232
Bt	64.956	10.011	45.855	84.812
SBt	14.926	2.853	9.954	20.831
Yield	2.752	0.515	1.840	3.776

Model 0 – Deterministic, Constant R, No Fishing





Model 0 – Sensitivity Analysis – Natural Mortality



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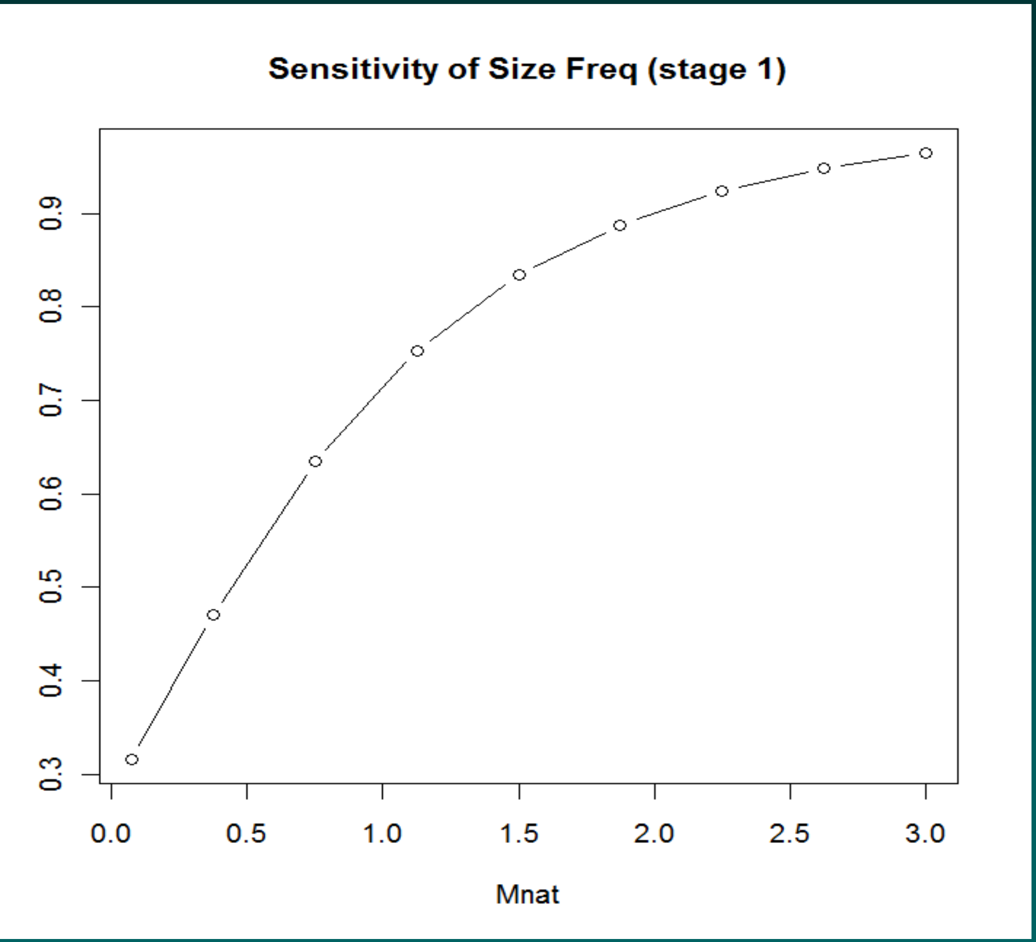

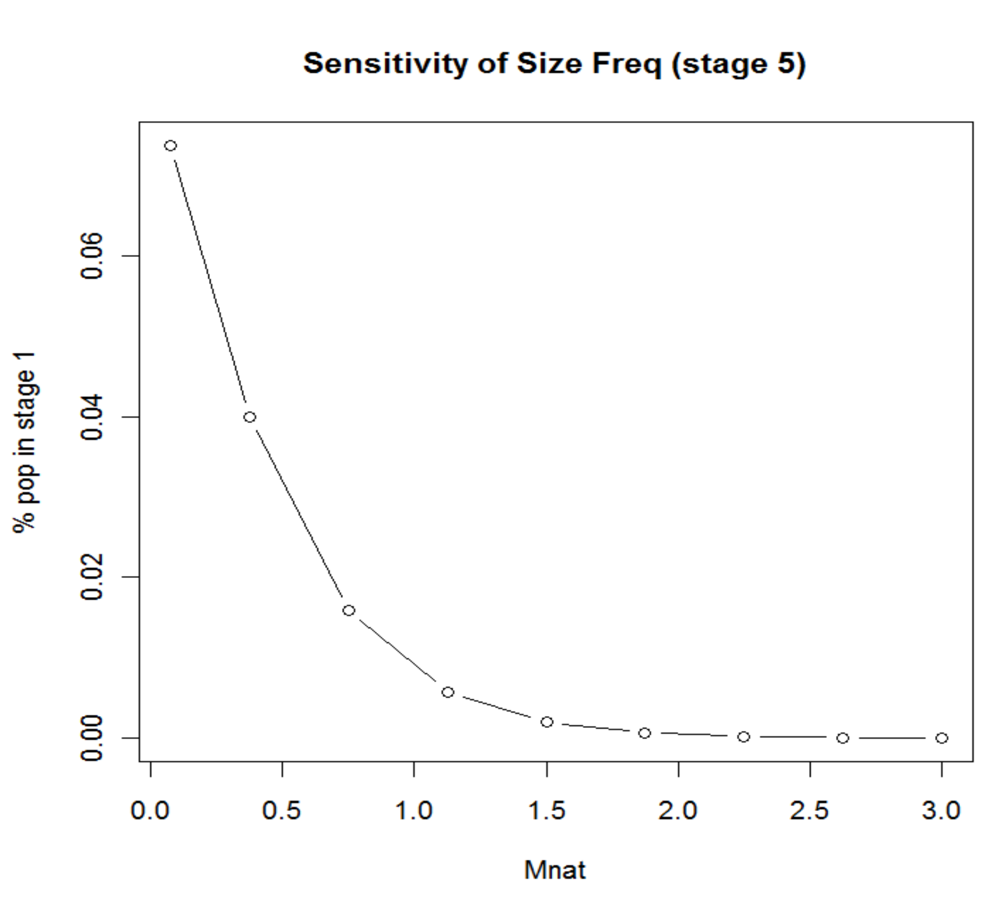

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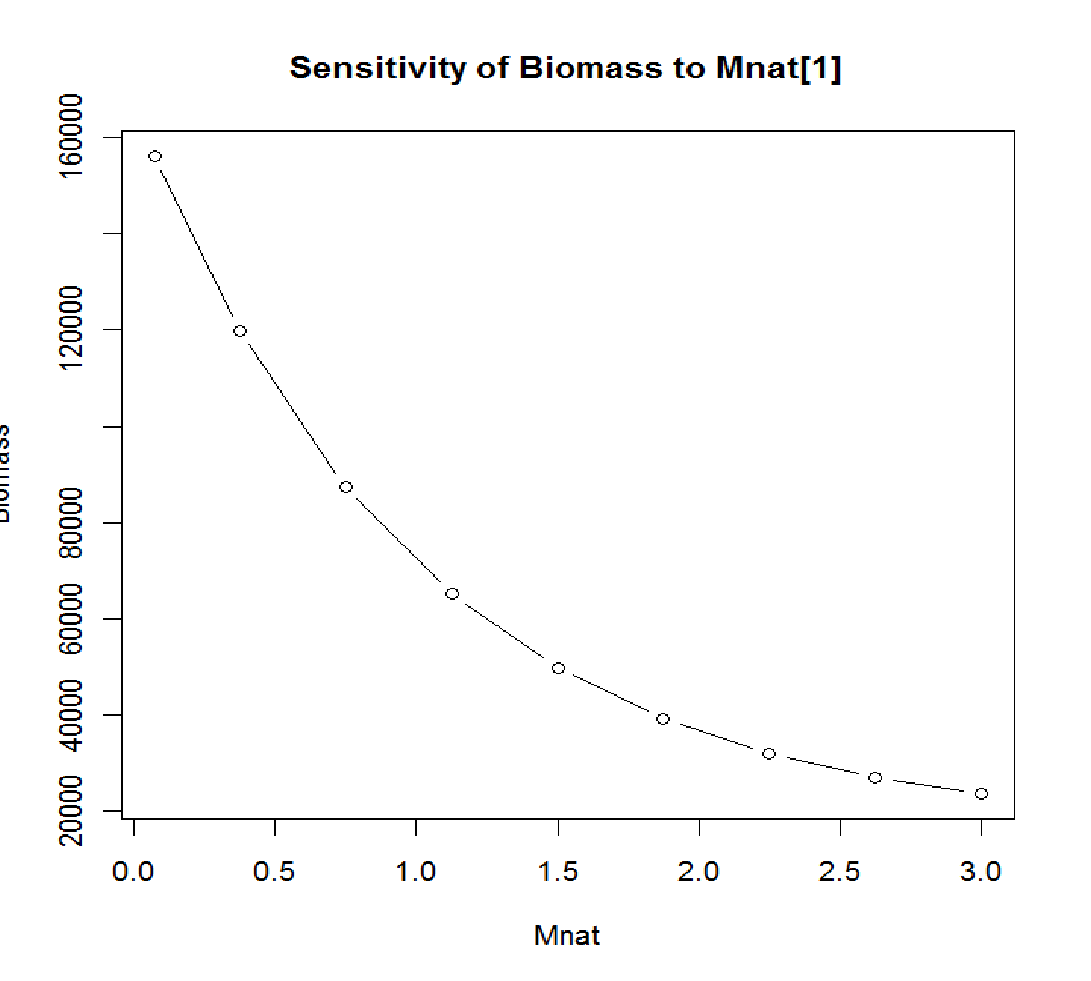
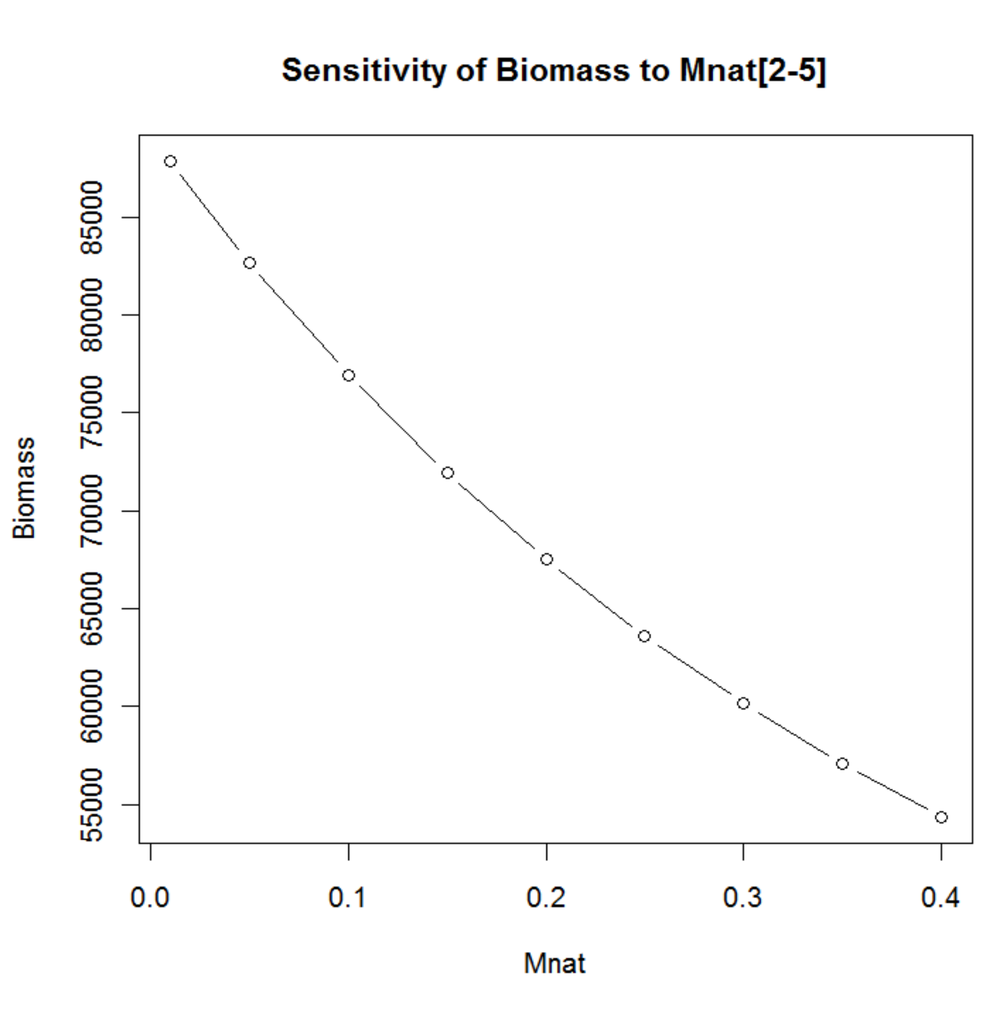
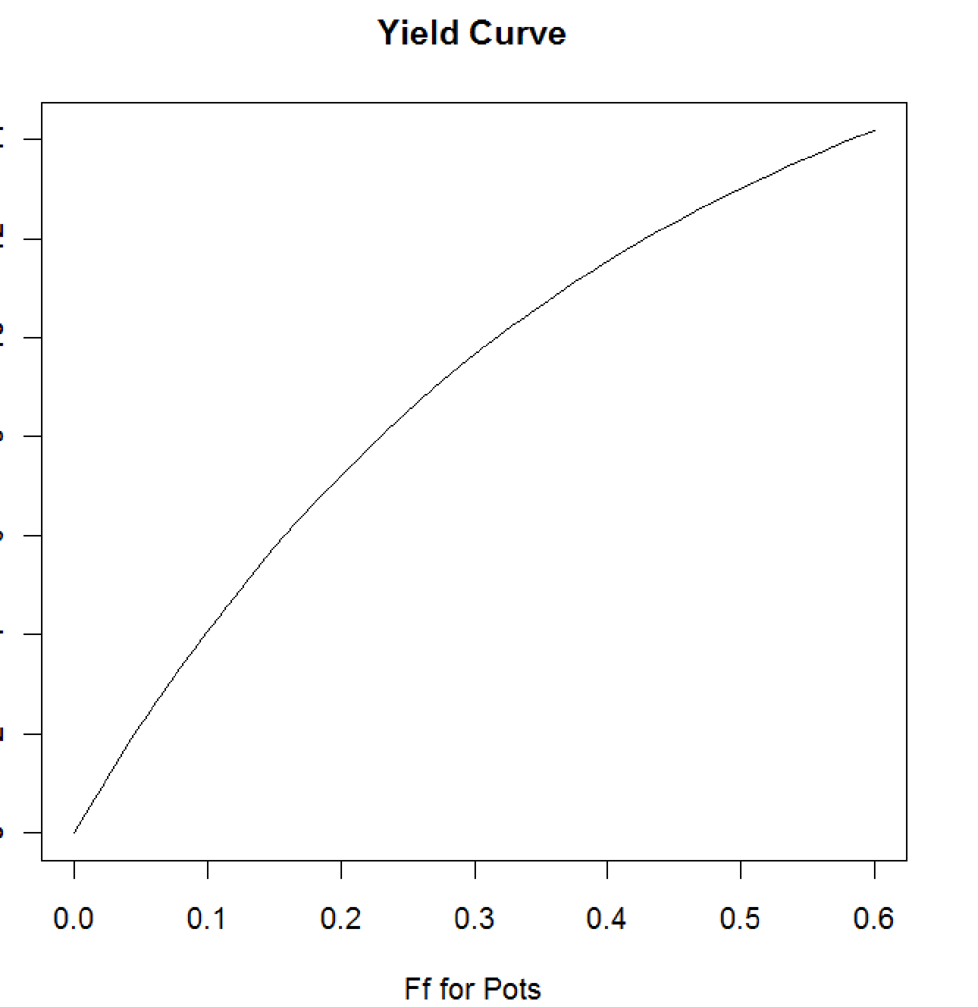
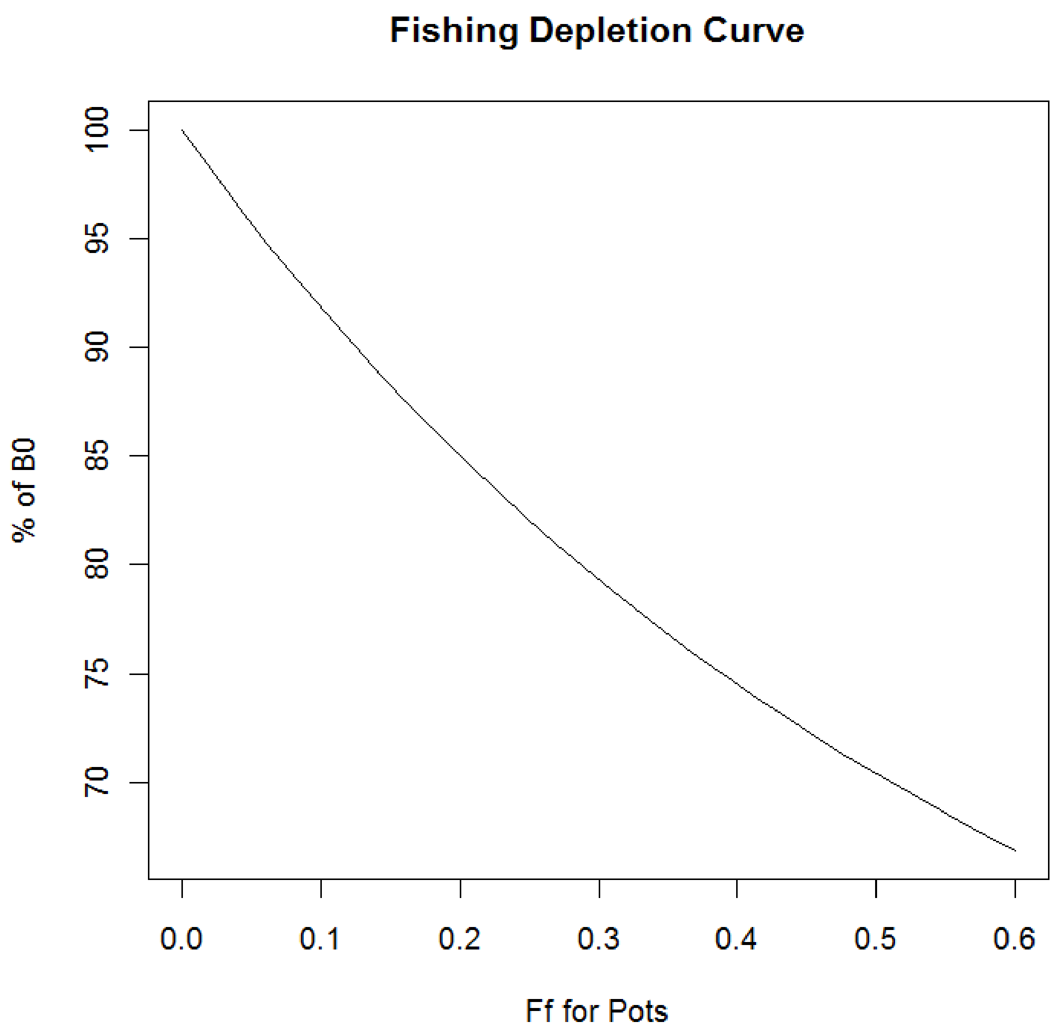


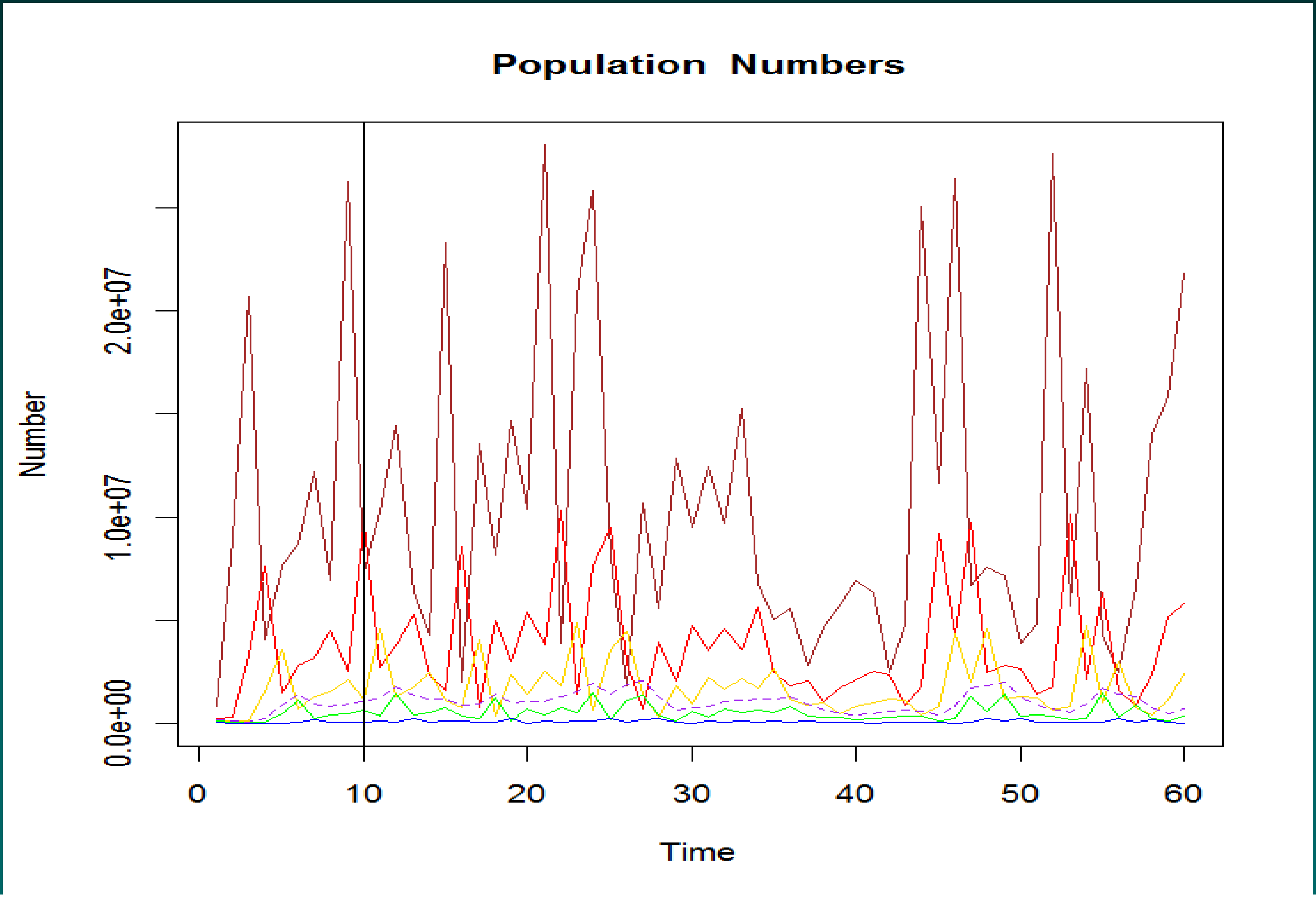


Model 1 – Deterministic, Constant R, Fishing Effects





Model 2 – Deterministic, Random R, Fishing Effects



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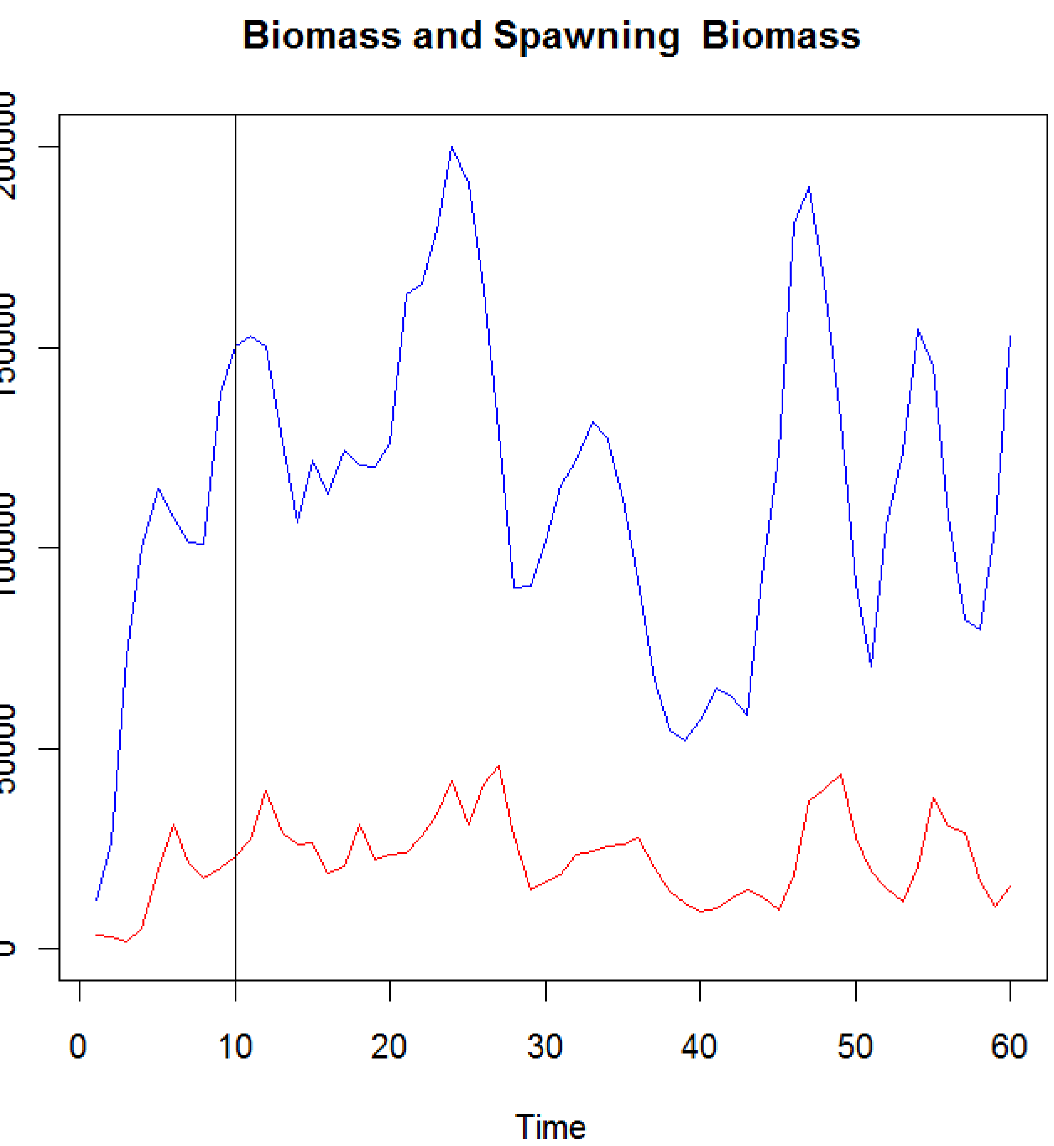
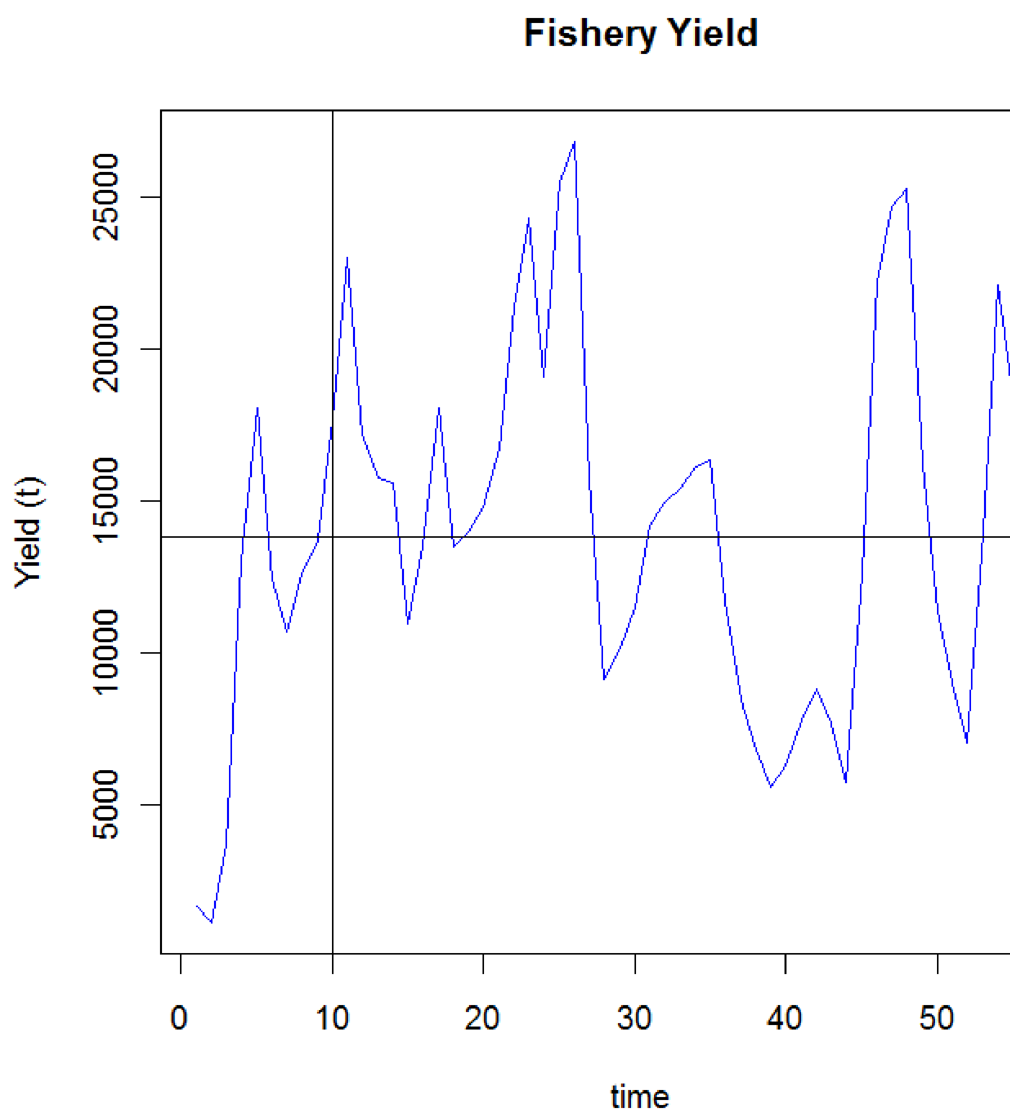
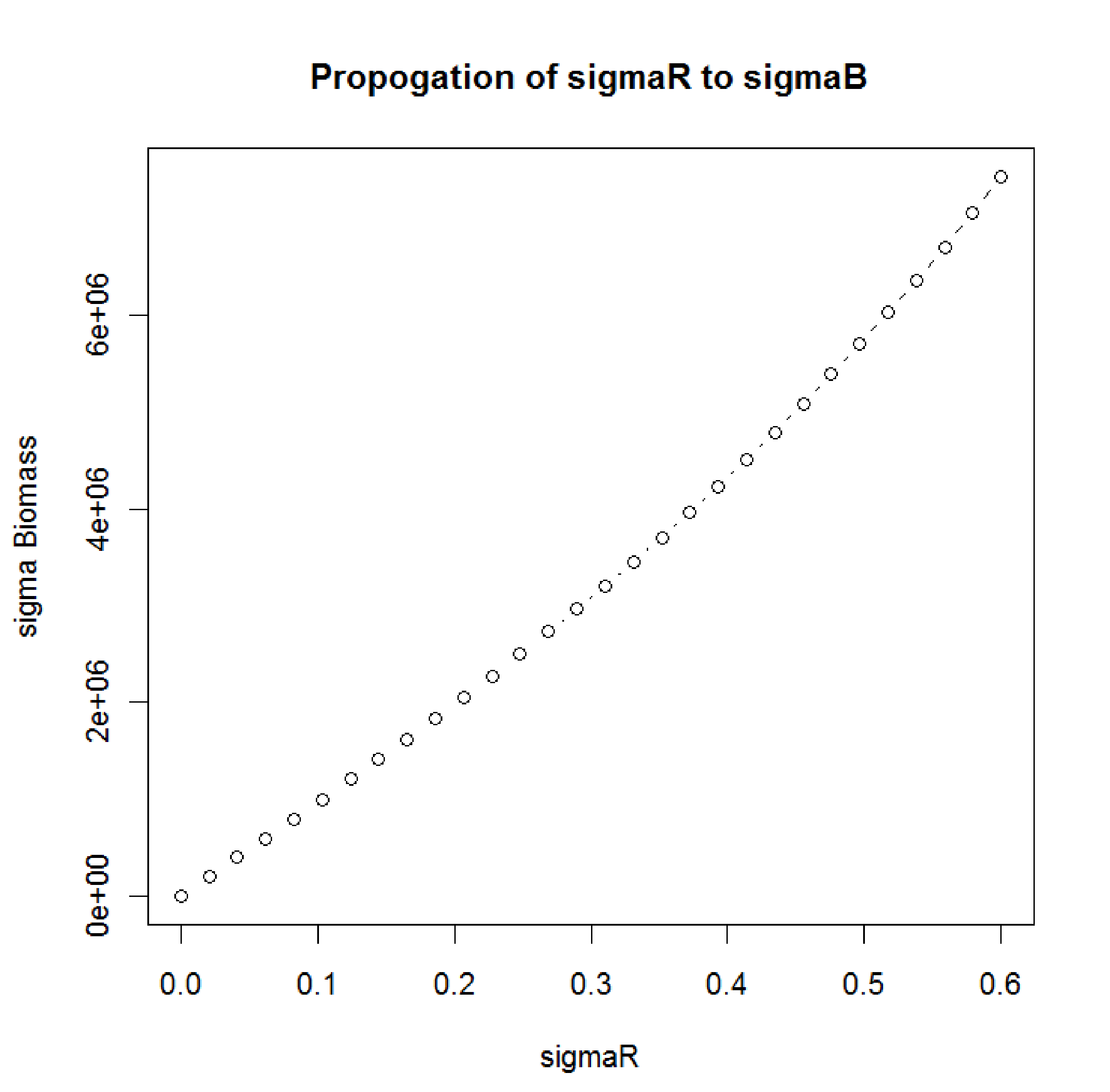




Model 2 – Propogation of Recruitment Variability



Model 2 – Propogation of Recruitment Variability

With sigmaR = 0.1, Ff=0.3

Std/mean for:

Rt	0.70
N1	0.70
N2	0.70
N3	0.72
N4	0.73
N5	0.72
N6	0.41
Bt	0.33
SBt	0.41
Yield	0.40

Further Development:

- Add variation in Mnat, Growth, Maturity
- Generate CAA data for fishery & surveys for known parameters, fit with ADMB or SS3, see how close estimates of R, B, etc are to simulated values
- Decrease/Increase variance on specific variables: which data stream has most effect on fit to true underlying Biomass time series?
- **Other Ideas ?**