A Practical Approach to Allocation

This model assumes that:

1) fish are distributed uniformly distributed over the fishing area,

2) fishing effort is distributed randomly over the fishing area,

(3) each unit of effort is independent,

and that the fishery consists of

4) many price taking buyers and sellers

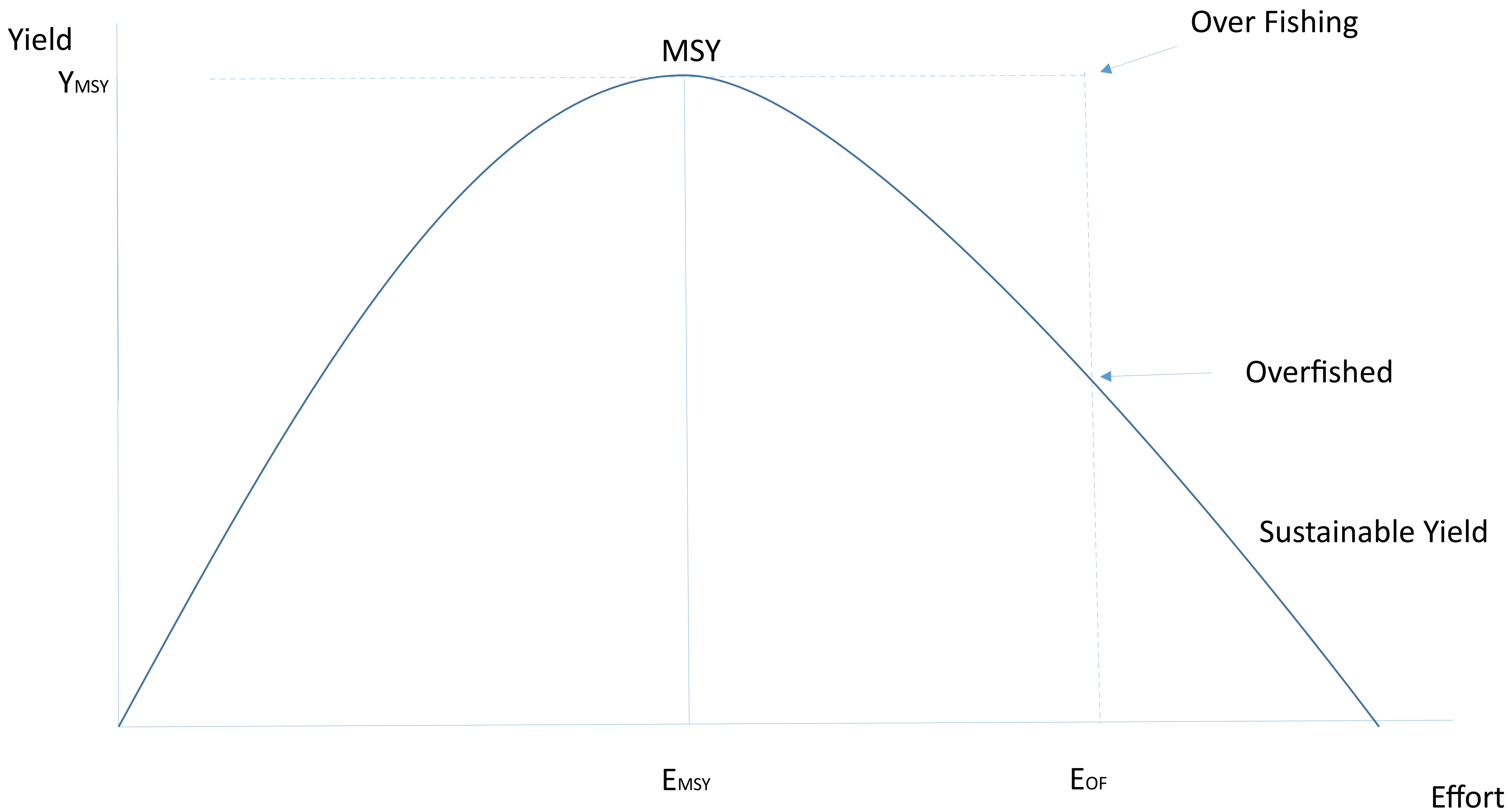
5) a homogeneous perfectly divisible product,

6) perfect information,

7) no transactions costs or externalities

and

(8) free mobility of inputs and outputs.



Yield
Y MSY
MSY
Over Fishing
Overfished
Sustainable Yield
E MSY
E OF
Effort

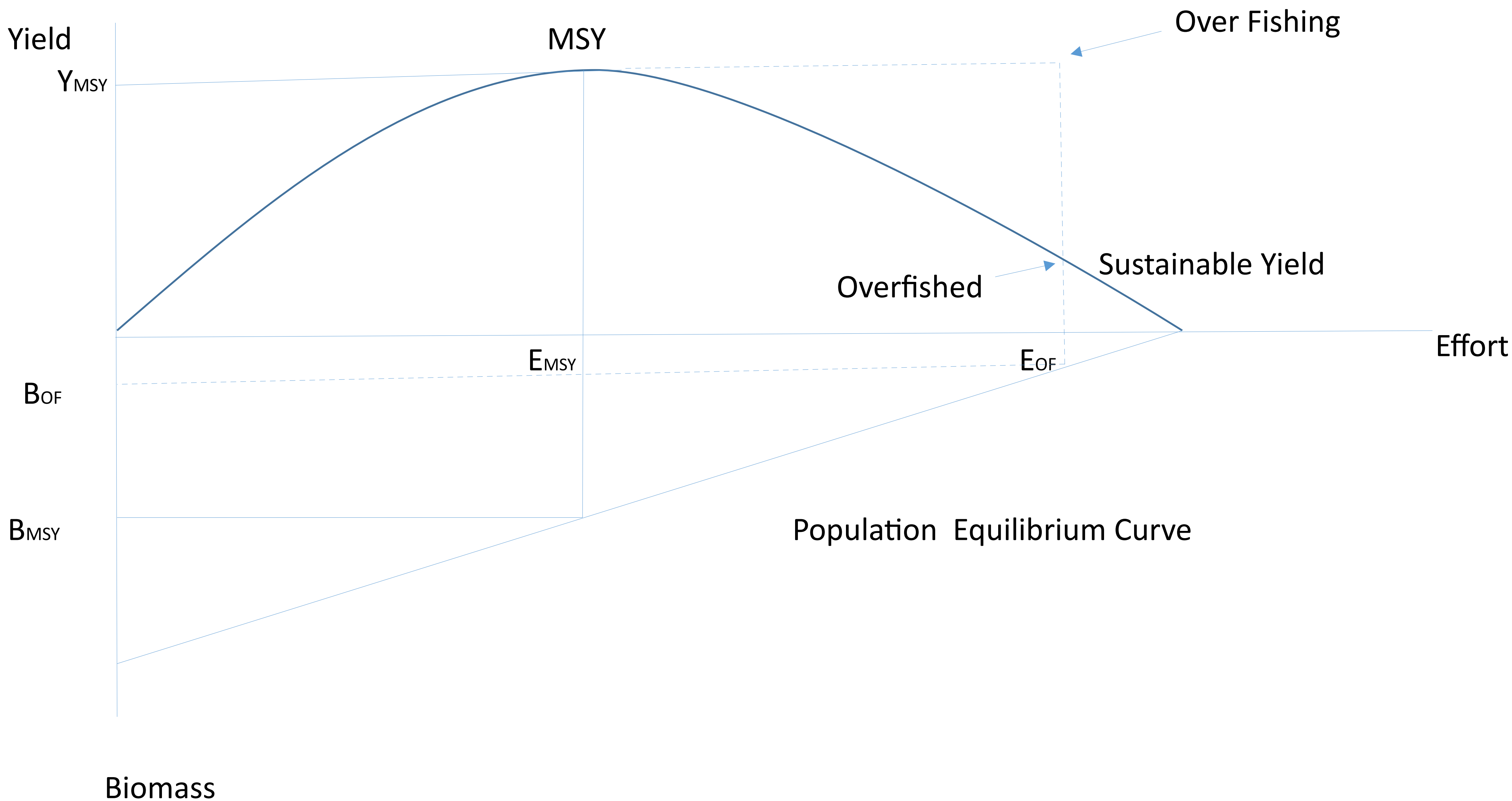
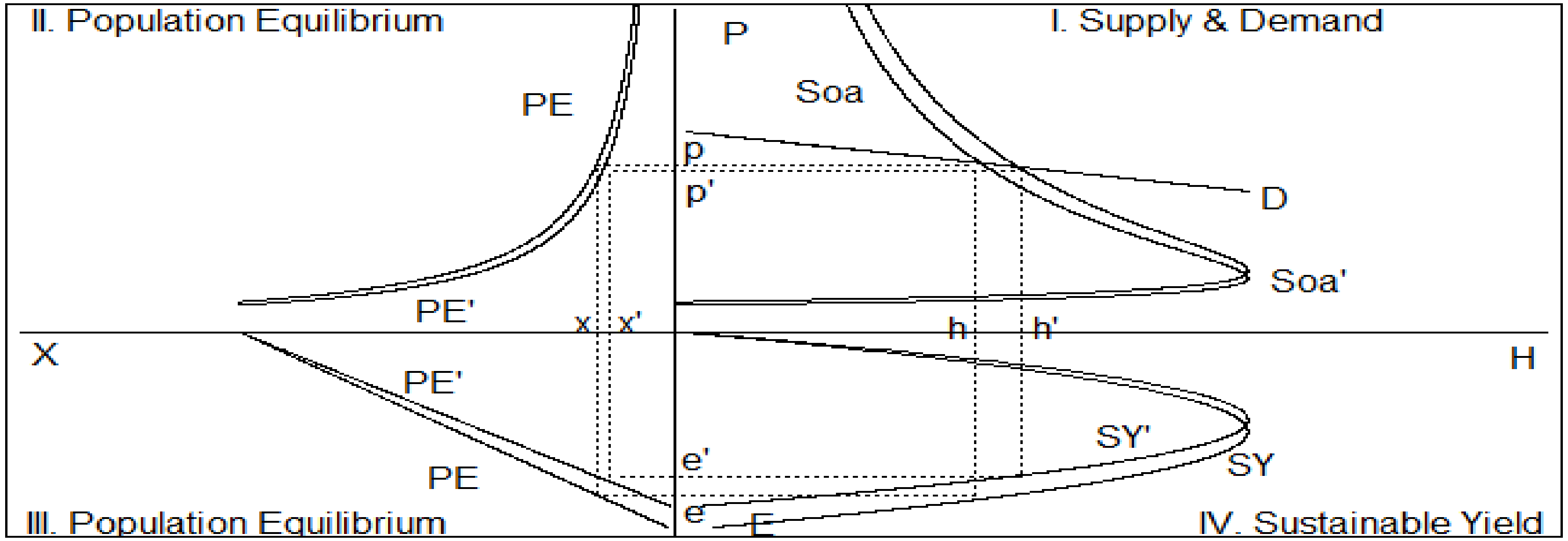
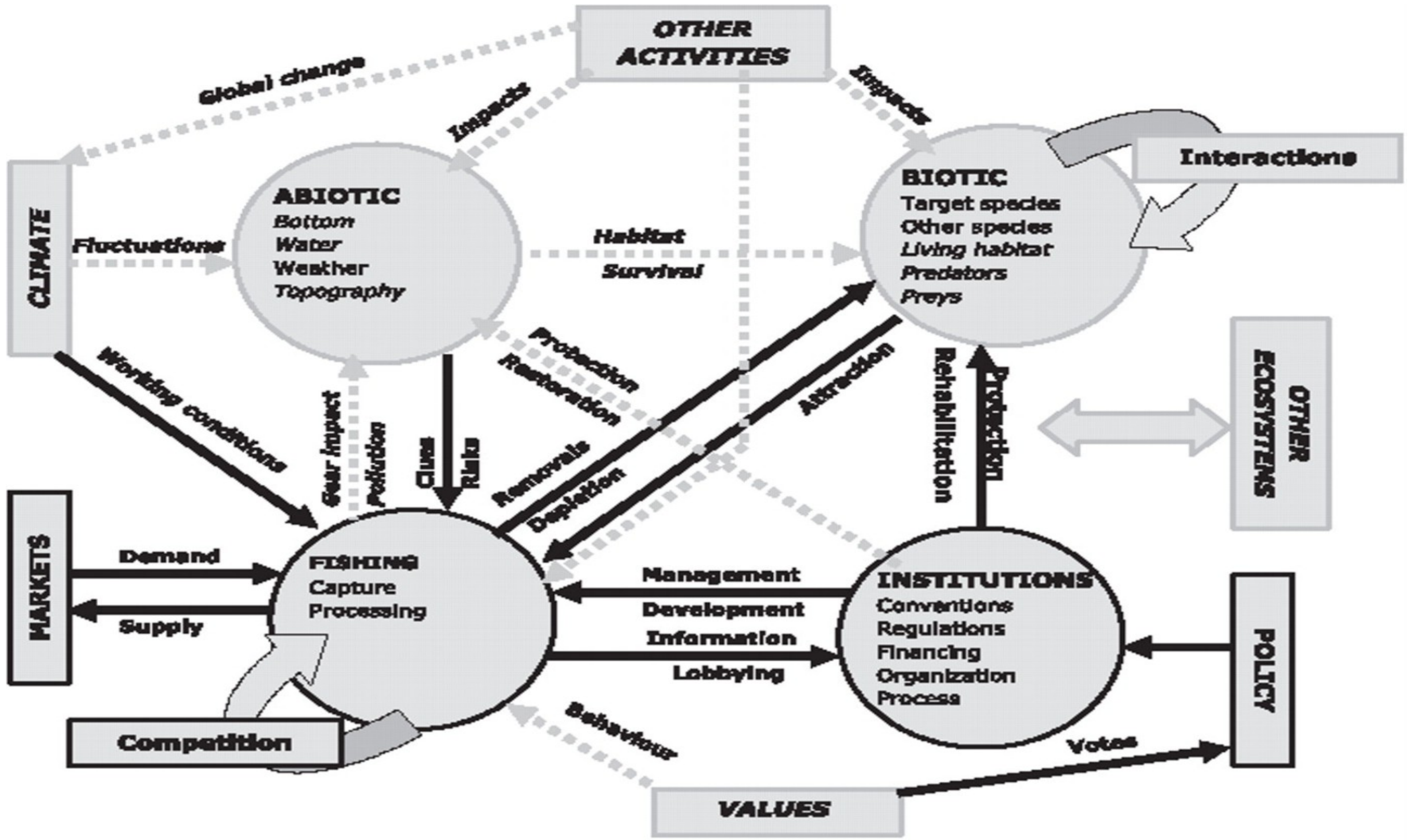

Yield
MSY
Over Fishing
Y_{MSY}
Sustainable Yield
Overfished
Effort
E_{MSY}
E_{OF}
B_{OF}
B_{MSY}
Population Equilibrium Curve
Biomass

Figure 2. Catchability Coefficient



Long-run Equilibrium Solutions for Gordon-Schaefer-Copes Model of a Stylized Fishery

	Open Access ($f_{\partial=\infty}$)	MSY	MEY ($f_{\partial=0}$)
Biomass (B)	K(1 – E q/r)	K/2	(Kpq + c)/2pq
Yield (Y)	rB(1 – B/K)	rK/4	$[r(pqK - c)(Kpq + c)]/4p^2 q^2 K$
Fishing Effort (E)	(1-B/K) r/q	r/2q	$(pqK – c)r/2pq^2K$
$f_{\partial=\infty}$	r(1 – B/K)		
f_{MSY}		r/2	
$f_{\partial=0}$			(pqK – c)r/2pqK



OTHER ACTIVITIES
Global change
Impacts
Impacts
CLIMATE
Fluctuations
ABIOTIC
Bottom
Water
Weather
Topography
Habitat
Survival
BIOTIC
Target species
Other species
Living habitat
Predators
Preys
Interactions
OTHER ECOSYSTEMS
Working conditions
Gear impact
Pollution
Clues
Risks
Protection
Restoration
Removals
Depletion
Attraction
Rehabilitation
Protection
MARKETS
Demand
Supply
FISHING
Capture
Processing
Competition
Management
Development
Information
Lobbying
INSTITUTIONS
Conventions
Regulations
Financing
Organization
Process
POLICY
Behaviour
Votes
VALUES

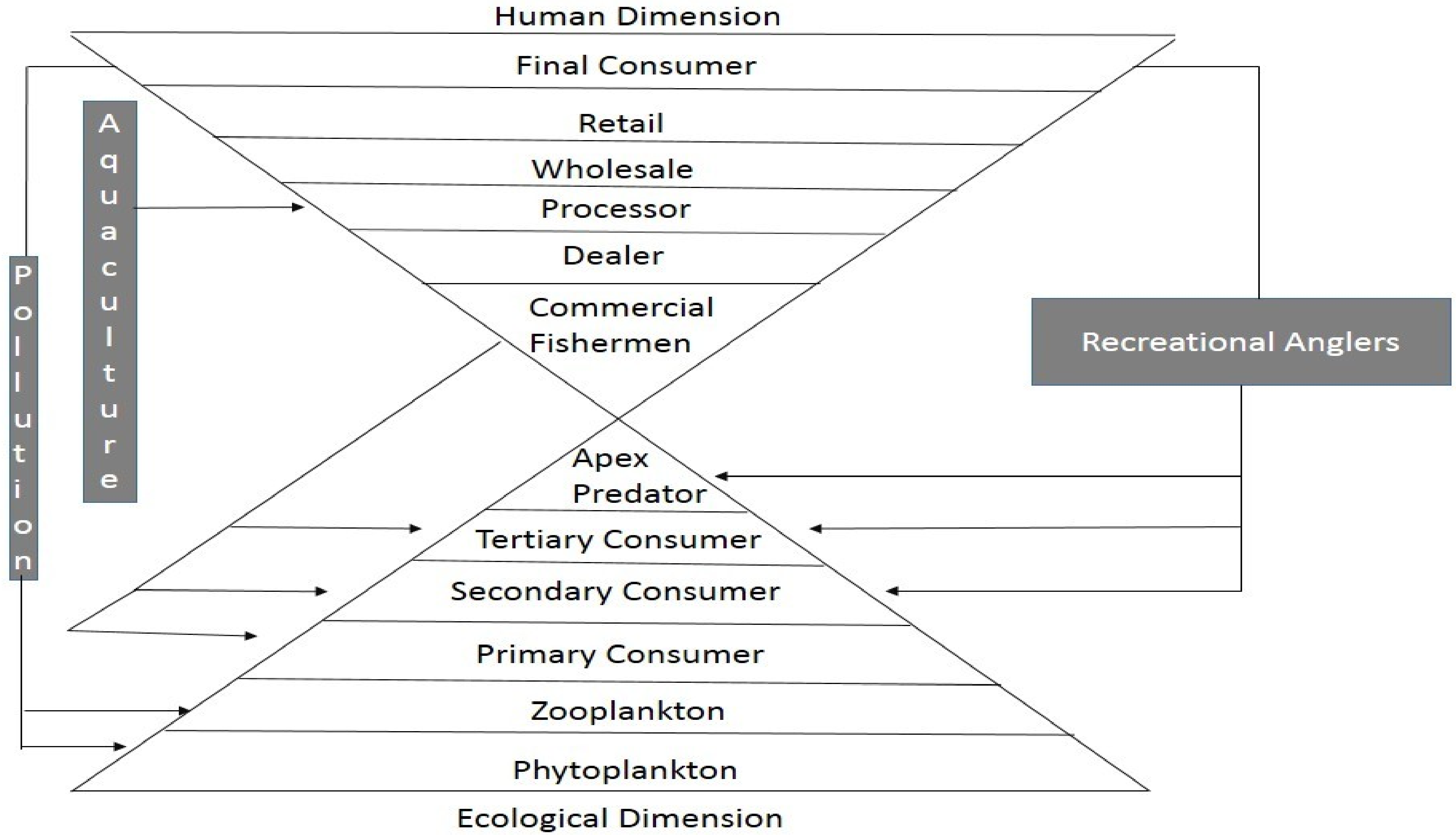
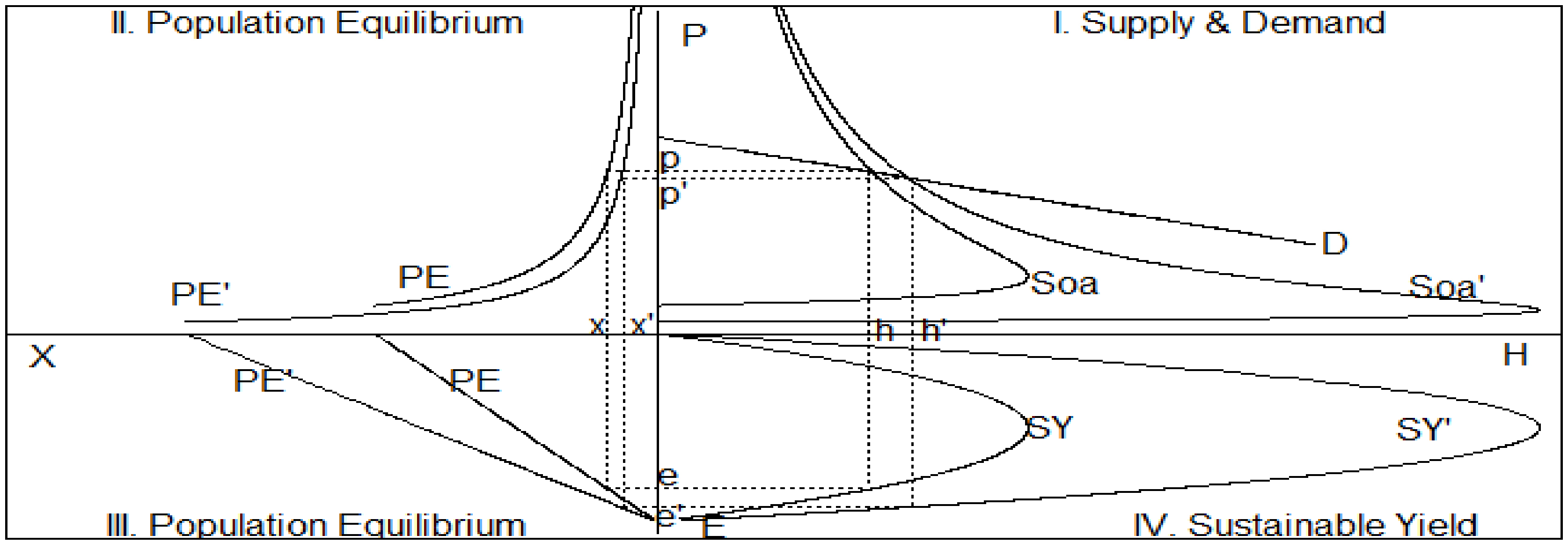

Human Dimension
Final Consumer
Retail
Wholesale
Processor
Dealer
Commercial Fishermen
Aquaculture
Pollution
Recreational Anglers
Apex Predator
Tertiary Consumer
Secondary Consumer
Primary Consumer
Zooplankton
Phytoplankton
Ecological Dimension

Figure 1. Growth Rate and Environmental Carrying Capacity



$$\text{Max } J(H) = \int \varepsilon^{-\partial t} \pi \, dt + \int \varepsilon^{-\kappa t} \mu \, dt + + \int \varepsilon^{-\vartheta t} \mu \, dt$$

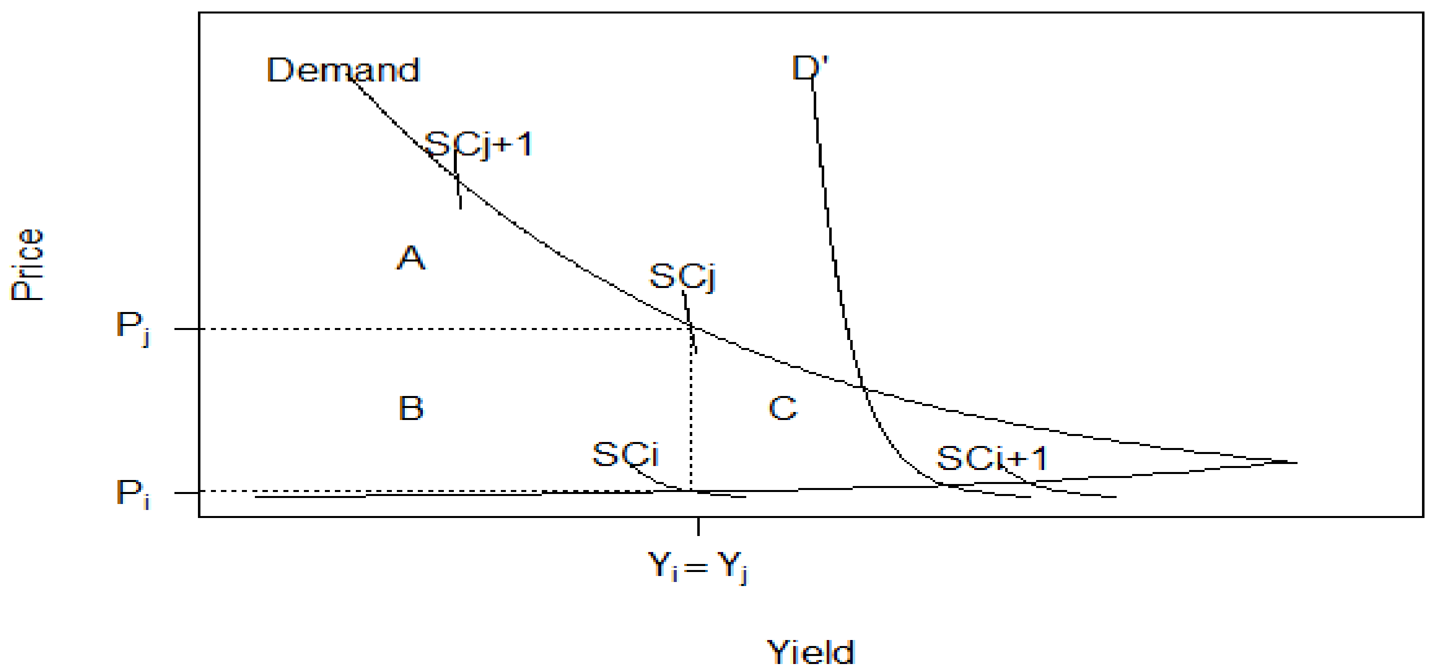
s.t.

$$\mathring{B} = B(t)[\mathring{w}(t)/w(t) - M - f_{\partial=\infty} - f_{\kappa=\infty}]$$

$$h(0) = h_0 h(T) \geq 0$$

$$E = \sum e_i \geq 0 f_{\partial=0} = qE_{so}$$

Figure 1. Demand Model Specification



$$E = \frac{[F'(X) - \delta]\,[P(qEX) - c]}{[\delta - F'(X)]\,P'(qEX) + F(X)/X\,P'(qEX) - P^{X}(qEX)qX}$$

Household Production Function Model
R-Square & Global Null Hypothesis Test

R-Square	0.8059	Max-rescaled R-Square	0.8109

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	172608.919	111	<.0001
Score	47802.8058	111	<.0001
Wald	84672.6883	111	<.0001

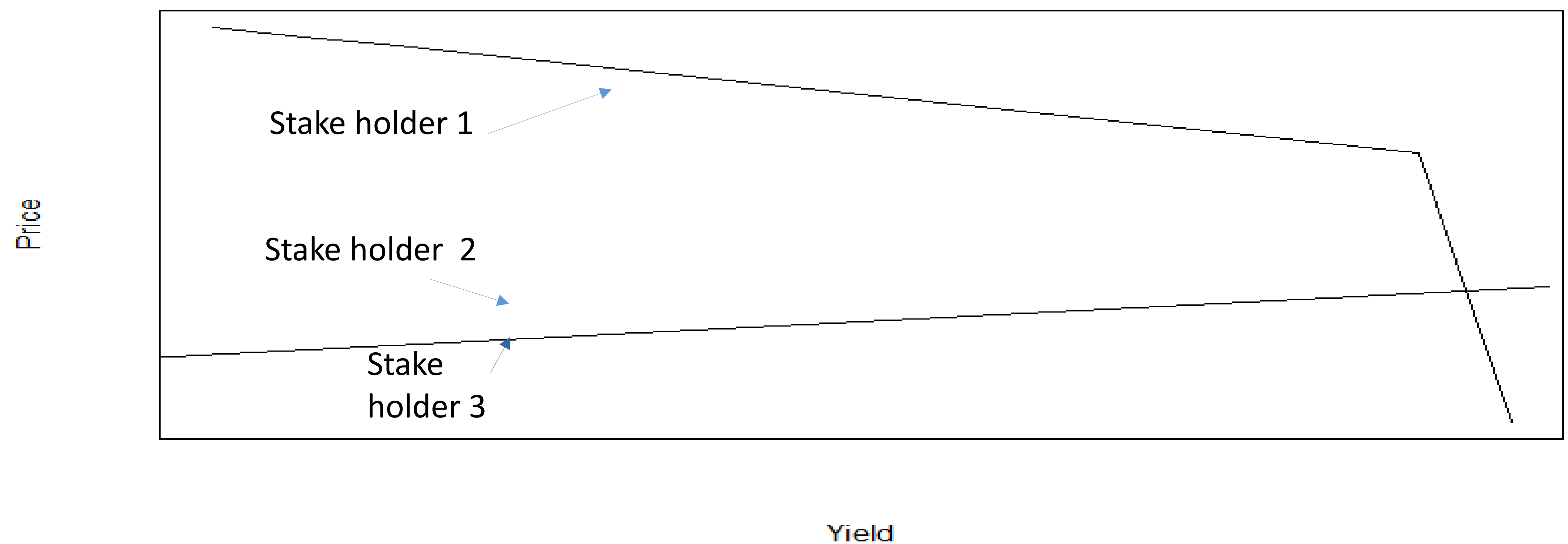
Ecosystem Level Interactions: West Greenland Sea Kraken vs. Bluefin Tuna Example

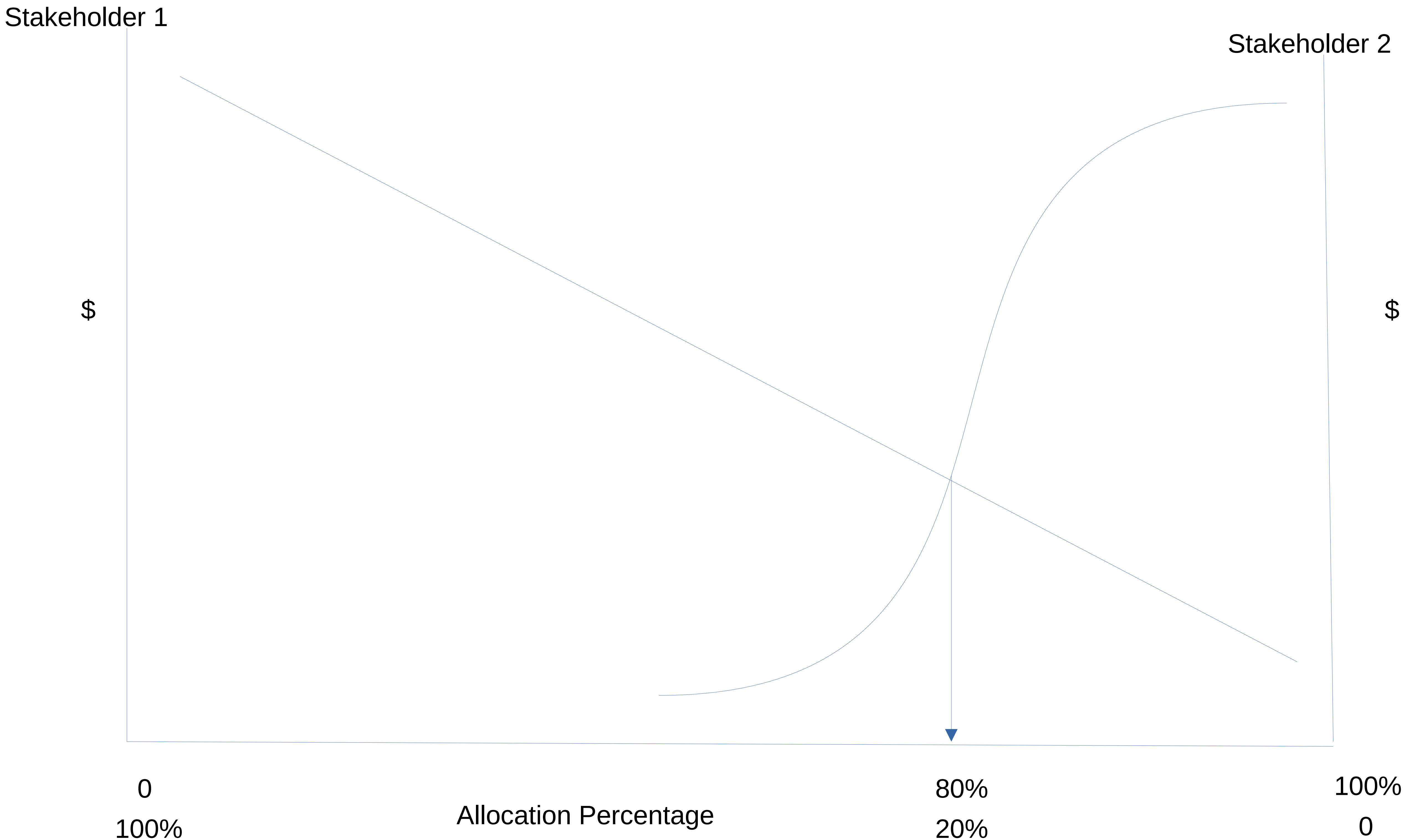
	Bluefin Tuna	W.G.S Kraken
Bluefin Tuna	-0.07405	0.00863
White Shrimp	-0.20251	0.00078
Brown Shrimp	-0.35575	-0.15879
Pink Shrimp	0.05875	-0.04834
Summer Flounder	0.0206	-0.01833
Atlantic Cod	0.0364	-0.02808
Sea Scallops	0.00249	-0.02994
Blue Crab	-0.00934	0.00275
Soft and Peeler Blue Crab	0.02846	-0.06075
Eastern Oyster	0.02164	0.01587
Monk Fish	-0.03181	-0.01717
Wreckfish	0.01295	-0.00575
Striped Bass	0.02332	0.00682
Surf Clam	-0.35435	-0.38469
Ocean Quohog	-0.15857	-0.27064
Scup	0.0129	-0.06235
Menhaden	-0.02609	0.03549
Channel Whelk	0.01146	0.36542
Knobbed Whelk	-0.01119	-0.02368

	Bluefin Tuna	White Shrimp	Brown Shrimp	Pink Shrimp	Summer Flounder	Atlantic Cod	Sea Scallops	Blue Crab	Soft and Peeler Blue Crab	Eastern Oyster	Monk Fish	Wreckfish	Striped Bass	Surf Clam	Ocean Quohog	Scup	Menhaden	Channel Whelk	Knobbed Whelk	Other Fish Species
Bluefin Tuna	0.02858	0.01785	-0.11143	0.08777	0.01121	0.02485	0.05983	-0.00496	0.03194	0.00522	-0.02551	-0.0034	0.00558	0.04172	-0.01061	0.01031	-0.03593	0.01164	-0.01221	-0.00071
White Shrimp	0.01785	2.47179	1.28208	-1.88405	-0.02772	-0.01613	0.09683	-0.12537	-0.26184	-0.02697	-0.06024	-0.1251	-0.09466	0.28133	0.14029	-0.13011	0.16007	0.10583	-0.14106	0.00017
Brown Shrimp	-0.11143	1.28208	-1.40531	1.0667	-0.04718	-0.18227	0.18287	0.11929	0.07617	0.03755	0.14049	0.0725	0.07404	-0.32811	-0.68089	0.08854	0.196	0.05123	0.31504	0.00014
Pink Shrimp	0.08777	-1.88405	1.0667	1.5465	0.07025	0.19494	-0.05	-0.04918	0.27863	-0.01141	0.01091	-0.0131	0.0953	0.0392	0.12789	-0.00017	-0.17856	0.01578	0.01831	-0.00025
Summer Flounder	0.01121	-0.02772	-0.04718	0.07025	1.81846	-0.00771	-0.04463	0.03497	0.01903	-0.00675	-0.02455	0.0018	0.06029	-0.0132	0.02213	-0.00847	-0.02911	-0.01794	0.07913	-8.00E-04
Atlantic Cod	0.02485	-0.01613	-0.18227	0.19494	-0.00771	1.29962	0.23135	-0.03369	0.03767	0.00555	0.04998	0.0065	0.00378	-0.03605	-0.02868	0.00736	0.0918	-0.0016	-0.00014	0.00049
Sea Scallops	0.05983	0.09683	0.18287	-0.05	-0.04463	0.23135	0.21514	-0.02652	0.49182	0.04018	0.18381	-0.1409	-0.38016	-0.0084	-0.05057	0.0354	0.57551	0.02547	-0.42435	-0.00192
Blue Crab	-0.00496	-0.12537	0.11929	-0.04918	0.03497	-0.03369	-0.02652	2.64803	-0.10375	0.05296	-0.13121	-0.0301	-0.13365	0.07079	0.10795	-0.01603	0.02124	-0.00678	0.00955	-0.00035
Soft and Peeler Blue Crab	0.03194	-0.26184	0.07617	0.27863	0.01903	0.03767	0.49182	-0.10375	0.97886	0.00022	0.01559	-0.146	-0.182	-0.06648	0.04464	-0.05204	-0.06427	-0.03957	-0.05817	-0.00047
Eastern Oyster	0.00522	-0.02697	0.03755	-0.01141	-0.00675	0.00555	0.04018	0.05296	0.00022	1.27156	0.05557	0.0112	0.06143	-0.02603	0.04377	0.00332	0.08006	0.00984	0.03691	-0.00023
Monk Fish	-0.02551	-0.06024	0.14049	0.01091	-0.02455	0.04998	0.18381	-0.13121	0.01559	0.05557	0.04998	0.0086	0.15767	0.28983	-0.01691	0.02723	0.18469	-0.02455	-6.00E-05	0.00792
Wreckfish	-0.00342	-0.1251	0.07255	-0.01314	0.00183	0.00654	-0.14093	-0.03005	-0.14598	0.01118	0.00864	1.1497	0.03803	-0.31483	-0.12264	-0.01863	-0.05767	0.02696	0.27534	0.00033
Striped Bass	0.00558	-0.09466	0.07404	0.0953	0.06029	0.00378	-0.38016	-0.13365	-0.182	0.06143	0.15767	0.038	1.10622	0.08221	0.12857	0.02725	0.43073	0.02925	0.10443	-0.00074
Surf Clam	0.04172	0.28133	-0.32811	0.0392	-0.0132	-0.03605	-0.0084	0.07079	-0.06648	0.03998	0.28983	-0.3148	0.08221	4.5121	-0.02013	-0.23361	-0.56918	-0.12701	0.1418	0.00271
Ocean Quohog	-0.01061	0.14029	-0.68089	0.12789	0.02213	-0.02868	-0.05057	0.10795	0.04464	0.04377	-0.01691	-0.1226	0.12857	-0.02013	0.42314	0.03923	0.67456	-0.05177	0.02448	-1.00E-05
Scup	0.01031	-0.13011	0.08854	-0.00017	-0.00847	0.00736	0.0354	-0.01603	-0.05204	0.00332	0.02723	-0.0186	0.02725	-0.23361	0.03923	2.47815	0.00722	-0.06478	-0.07081	0.00028
Menhaden	-0.03593	0.16007	0.196	-0.17856	-0.02911	0.0918	0.57551	0.02124	-0.06427	0.08006	0.18469	-0.0577	0.43073	-0.56918	0.67456	0.00722	1.13744	0.01878	-0.00339	-0.00078
Channel Whelk	0.01164	0.10583	0.05123	0.01578	-0.01794	-0.0016	0.02547	-0.00678	-0.03957	0.00984	-0.02455	-0.0245	0.02925	-0.12701	-0.05177	-0.06478	0.01878	0.36148	-0.0289	-4.00E-05
Knobbed Whelk	-0.01221	-0.14106	0.31504	0.01831	0.07913	-0.00014	-0.42435	0.00955	-0.05817	0.03691	-6.00E-05	-1.00E-04	0.10443	0.1418	0.02448	-0.07081	-0.00339	-0.0289	2.12964	-4.00E-05
Other Fish Species	-0.00071	0.00017	0.00014	-0.00025	-8.00E-04	0.00049	-0.00192	-0.00035	-0.00047	-0.00023	0.00792	3.00E-04	-0.00074	0.00271	-1.00E-05	-1.00E-05	-0.00078	-4.00E-05	-3.00E-04	1.98672

Initial Conditions	Observed ∂^*	f	Abundance	Rent
Open Access; $\partial = \infty$	626,153.03	1.93489E-9	1,507,064,728.7	9.2917E-35
ACL; $\partial = \infty$	216,285.06	1.87592E-9	1,507,064,729.3	9.2917E-35
ACL with ITQ; $\partial = \infty$	21,618,994.88	1.593E-6	1,507,062,741.8	3.5049E-32
Sole Owner; $\partial = 0$	0	9.9343E-27	1,507,064,755.3	1.07091391E138

Stake Holder Interactions in Fishery Seafood Supply and Demand Markets (Net Benefits)




Stakeholder 1
Stakeholder 2
$
$
0
100%
Allocation Percentage
80%
20%
100%
0