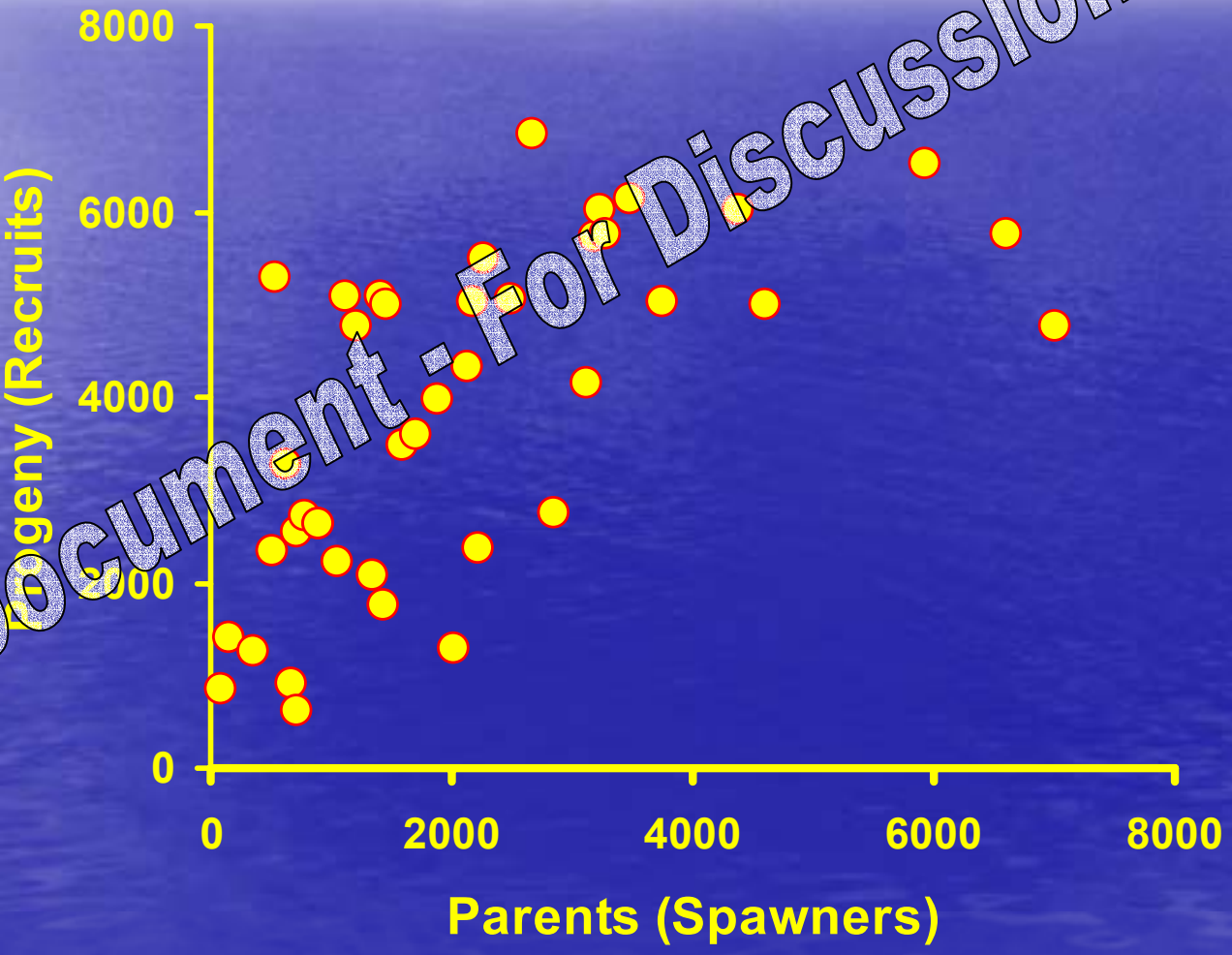
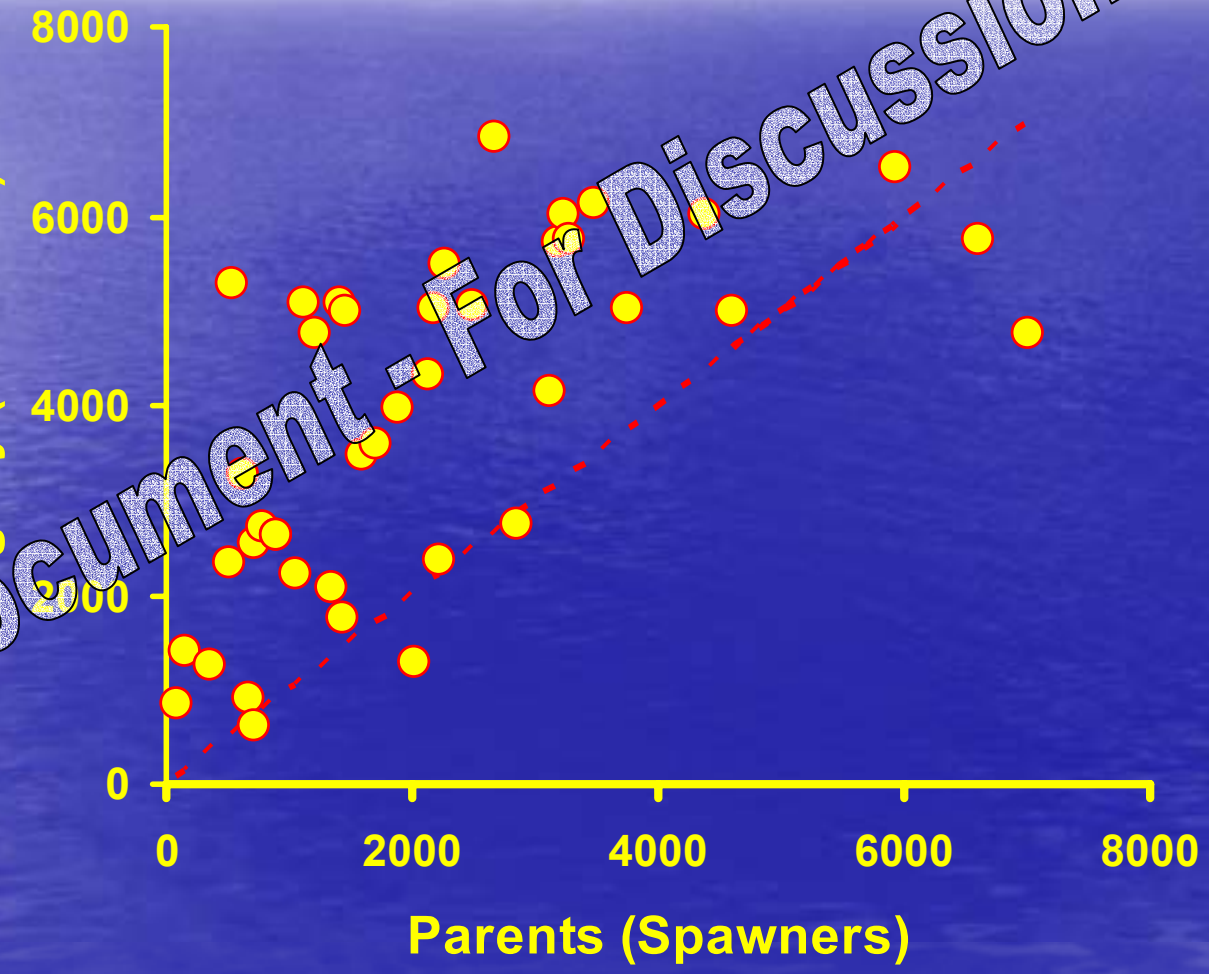
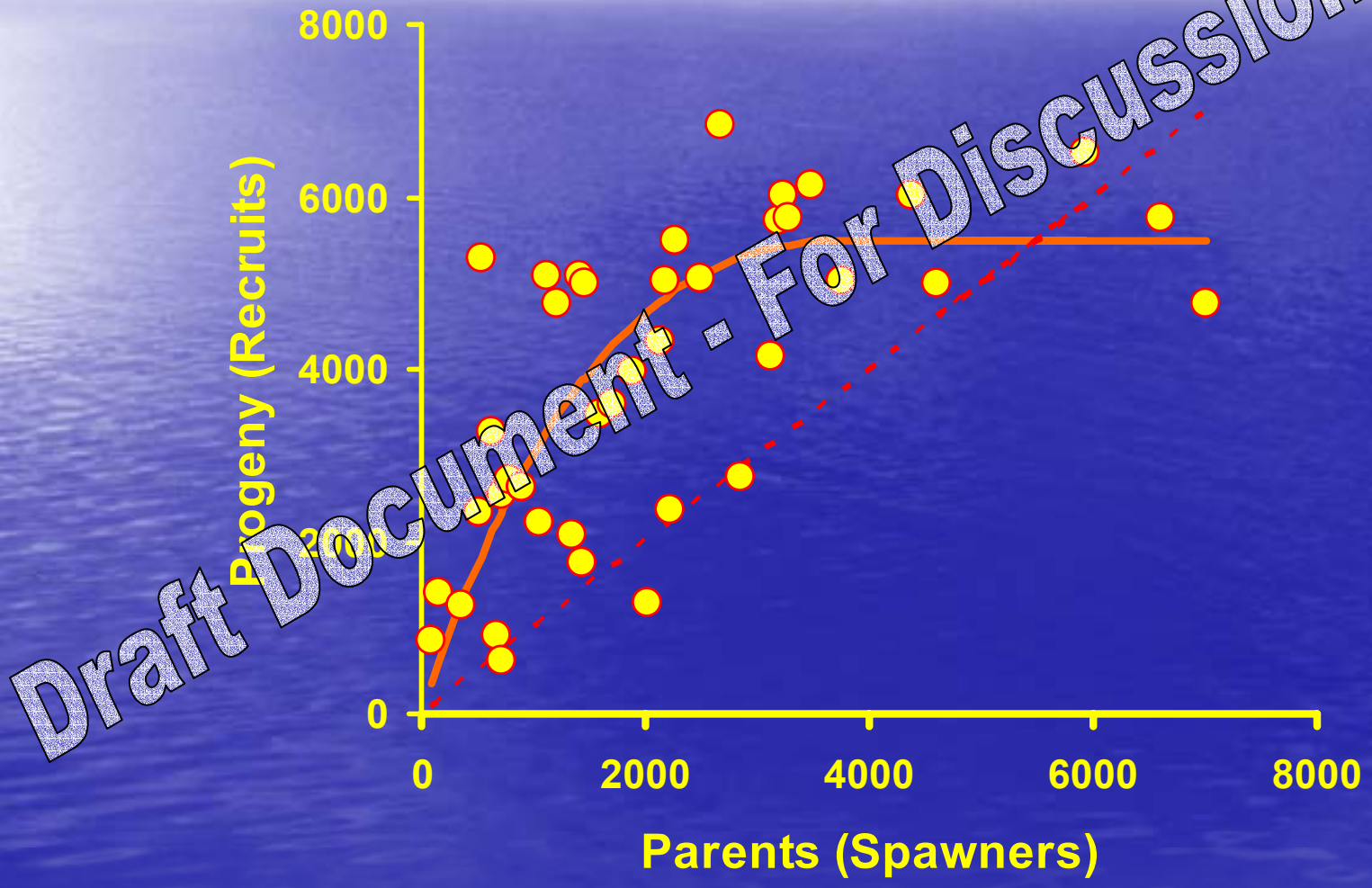
Background Concepts



Background Concepts
Replacement



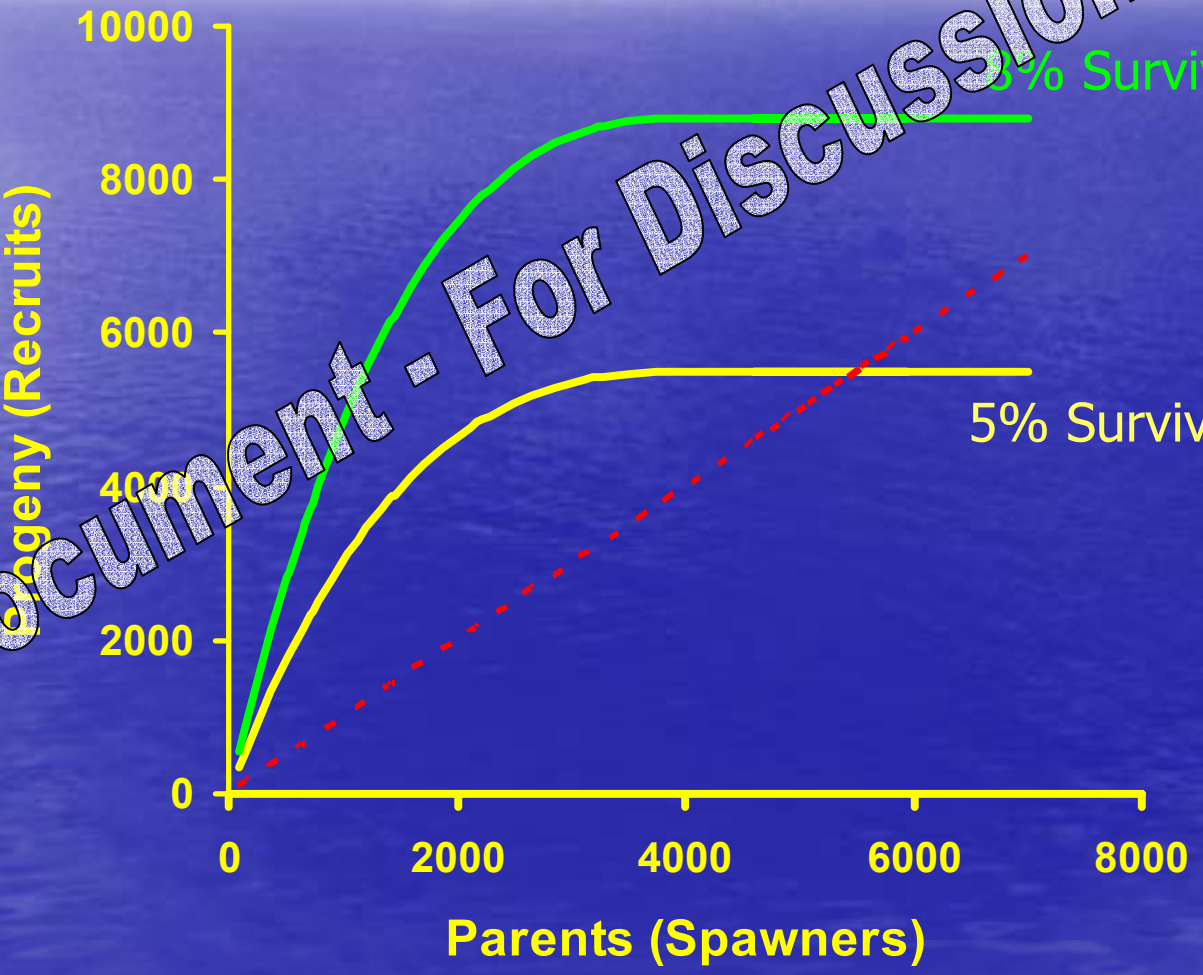
Background Concepts
Recruitment Curve



Background Concepts

Impact of Marine Survival

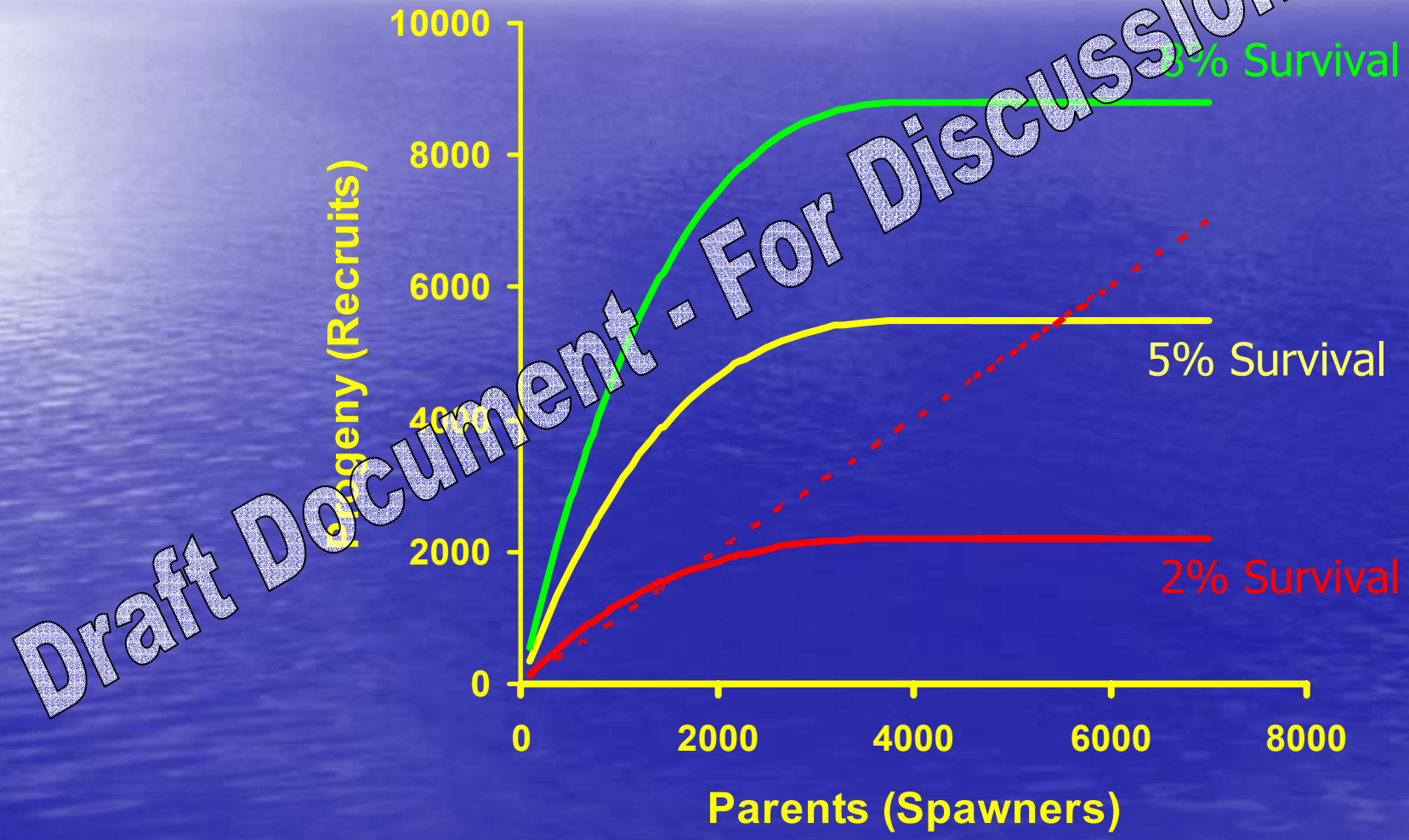
Average and Good Conditions



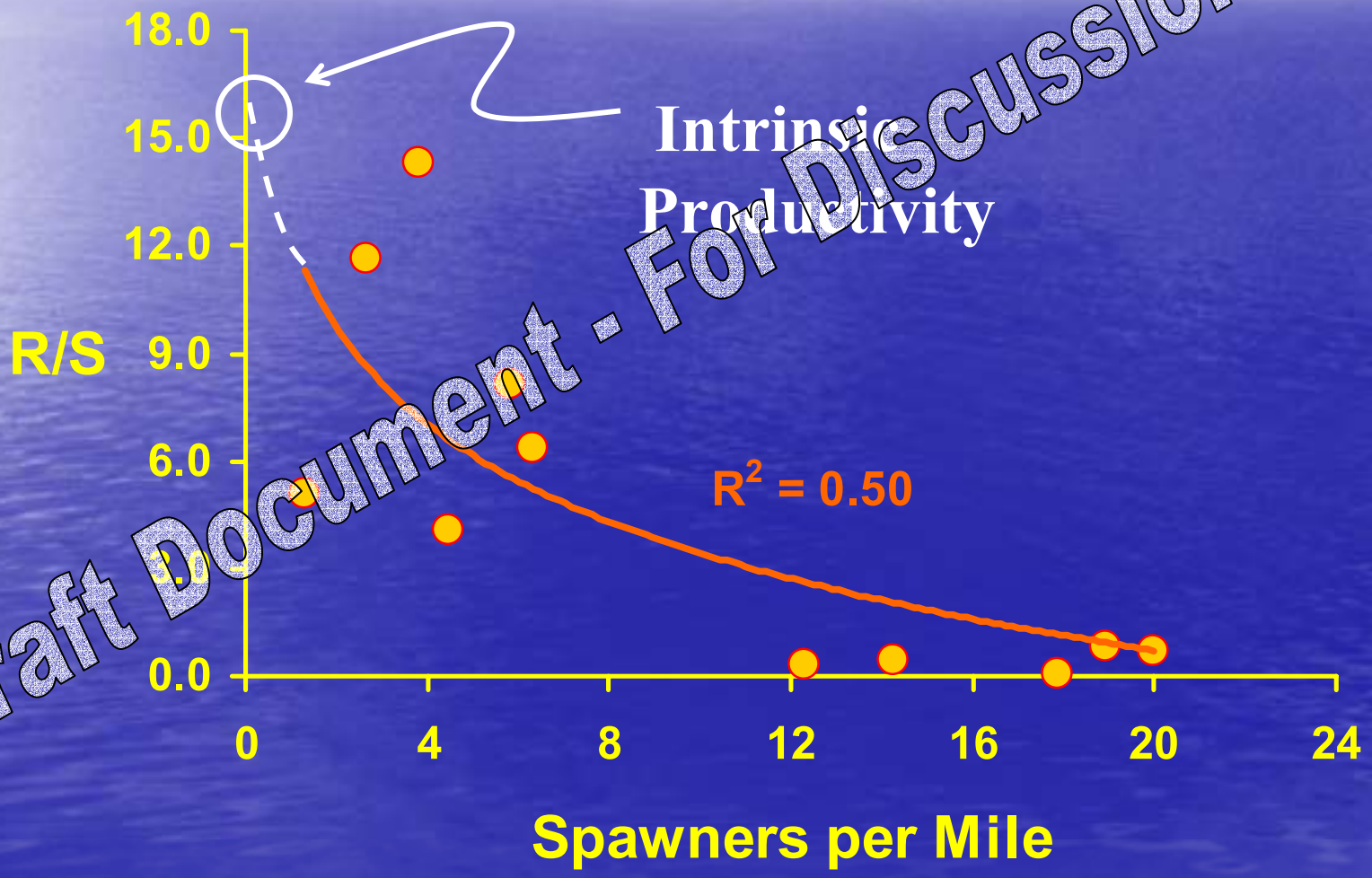
Background Concepts

Impact of Marine Survival

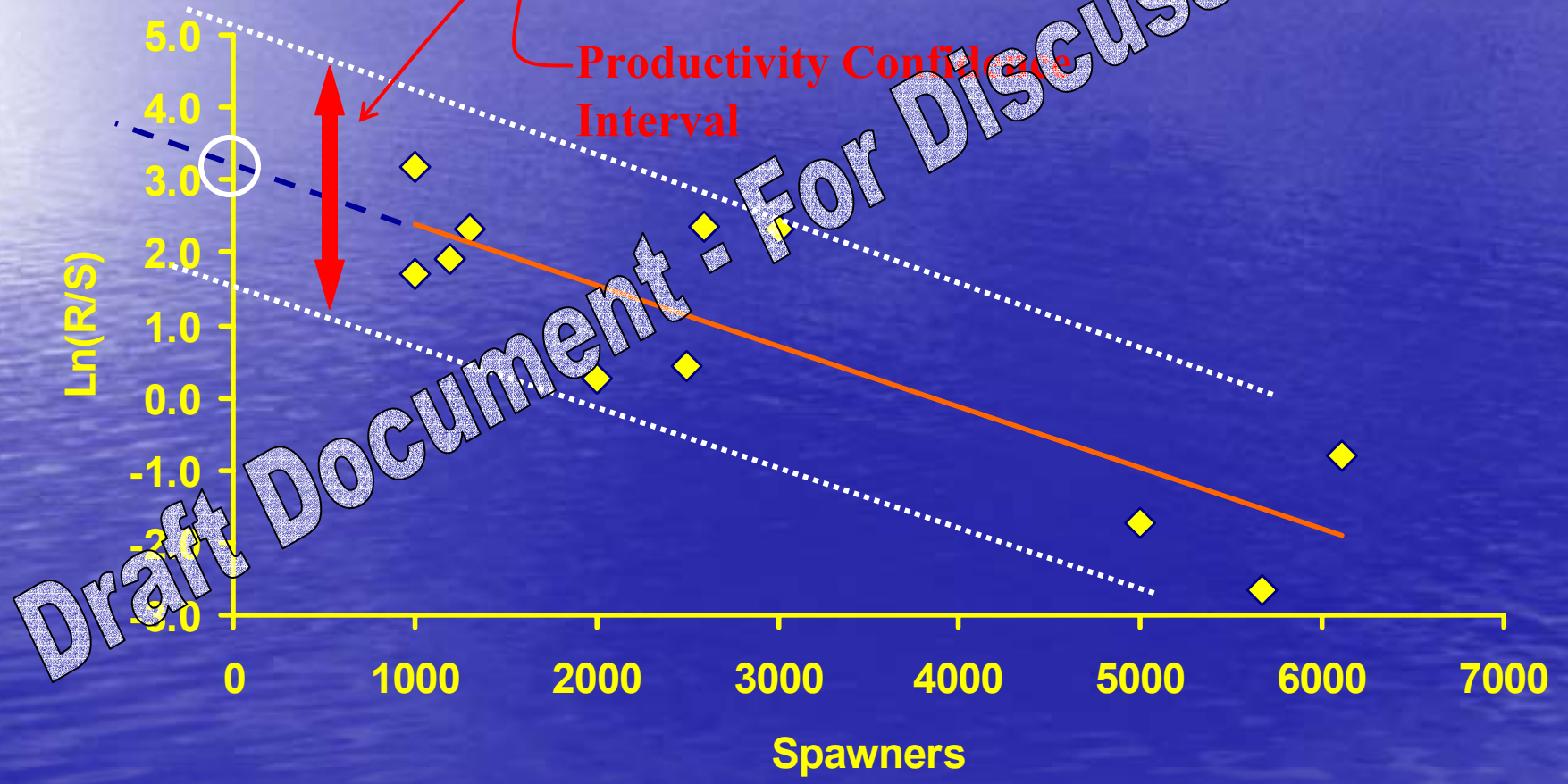
Average, Good, and Bad Conditions



Relationship between Productivity and Spawner Density



Level of Confidence for Coho Productivity



Quasi Extinction Threshold


Oregon Coastal Coho
Draft Document - For Discussion Only
Biological Criteria for ESU Assessment

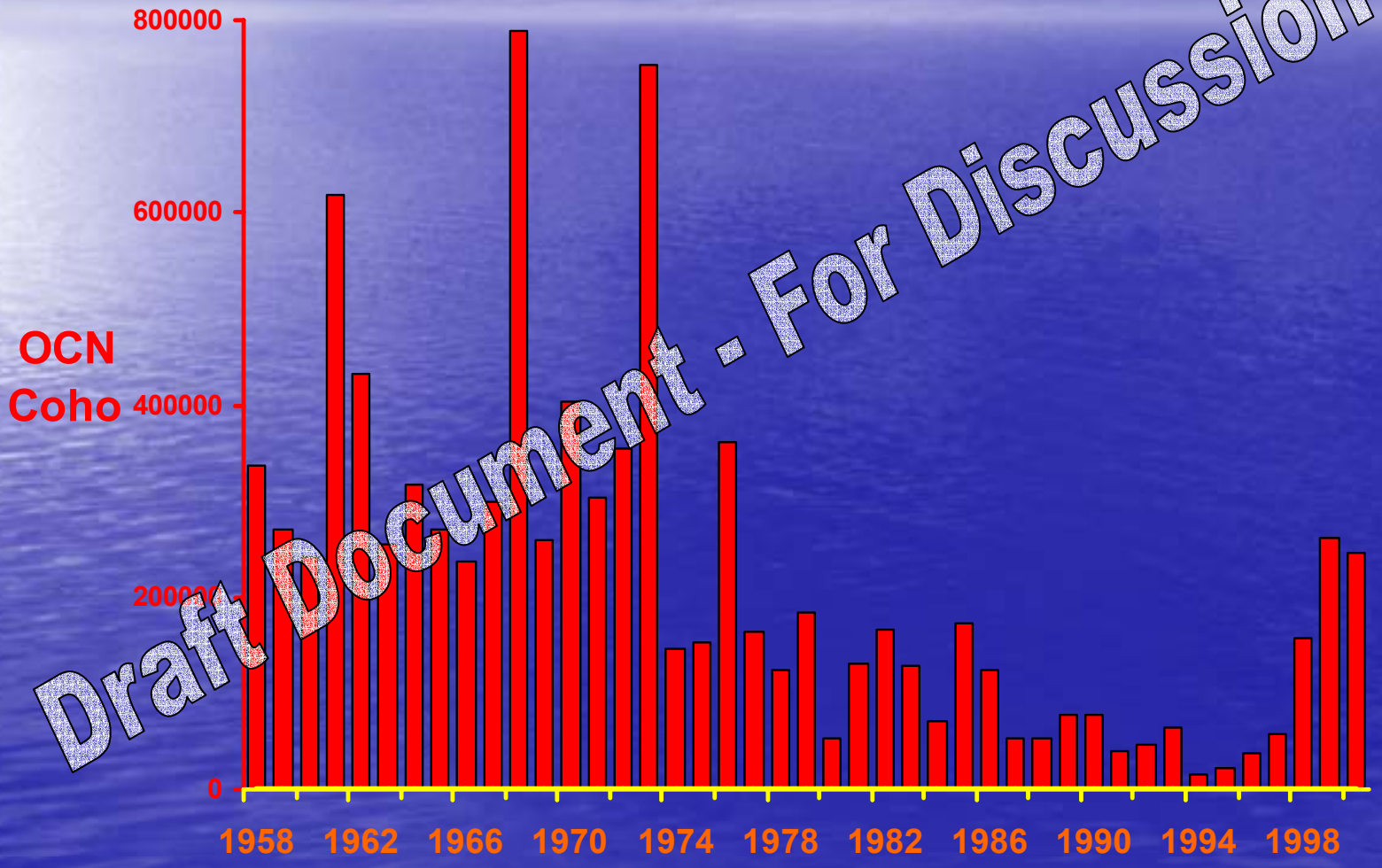
Draft 2-18-04

Necanicum
Ecola
Nehalem
Rockaway
Tillamook
Netarts
Nestucca
Neskowin
Salmon
Devils Lake
Depoe Bay
Siletz
Thiel Creek
Beaver
Yaquina
Seal Rock
Yachats
Alsea
Siuslaw
Tahkenitch
Tenmile Creek
Lower Umpqua
Tenmile
Coos
Cape Arago
China Creek
Upper Umpqua
Floras
Coquille
Sixes

Oregon Coastal Coho ESU

- Dependent
- Independent
- Potentially Independent

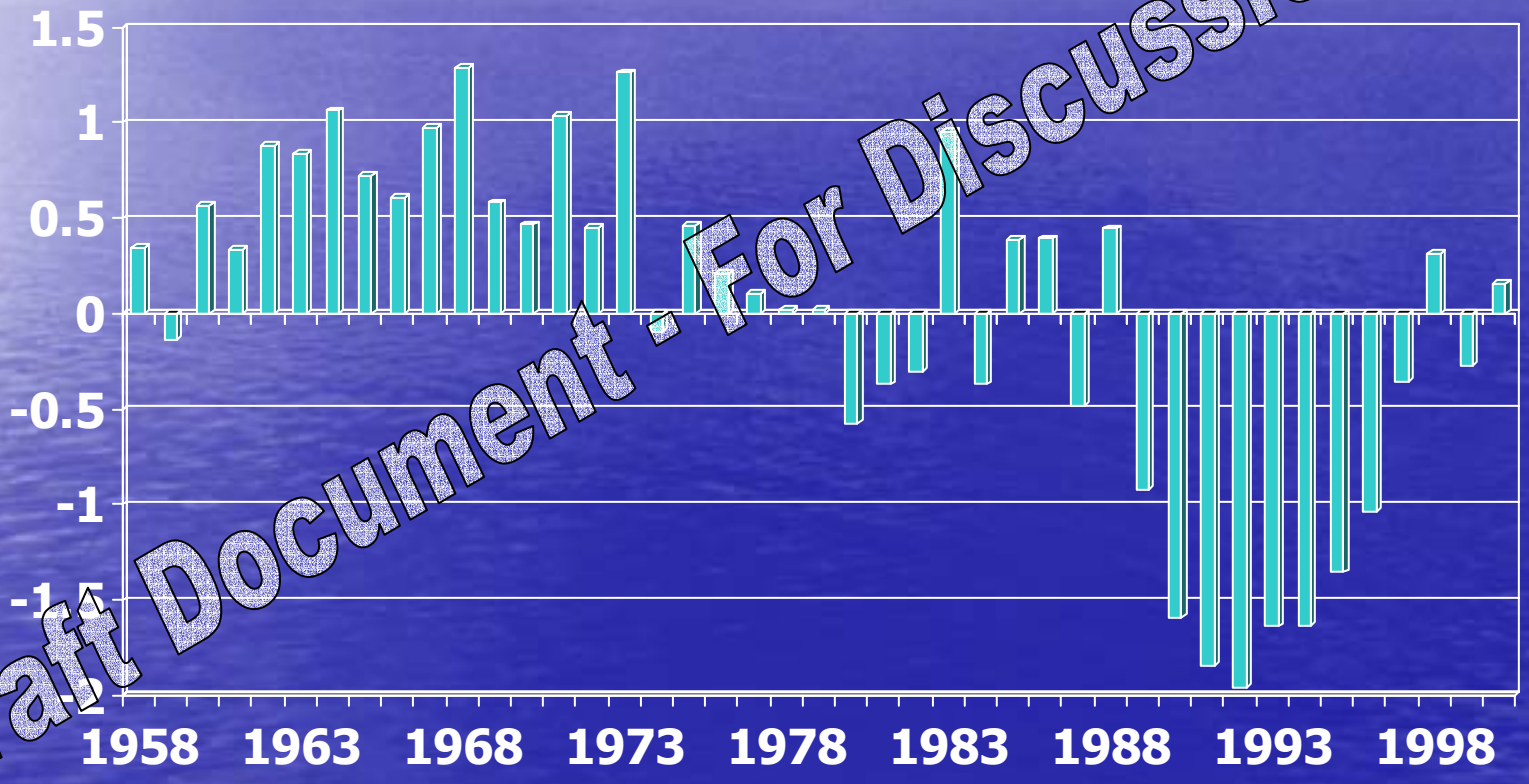
Coho Abundance



Variations in Ocean Survival

Deviations from 45-year mean

Expressed as Ln(Smolt to Adult Survival * 100)



Viable Salmonid Populations (VSP) Attributes

- Abundance
- Productivity
- Persistence
- Distribution/Diversity

Viable Salmonid Populations (VSP) Attributes

- Abundance
- Productivity
- Persistence
- Distribution/Diversity

Example Abundance Questions

- How many fish are needed at the front end of a bad ocean cycle to avoid dropping close to extinction levels during the downturn?
- If standardized to poor ocean conditions, how high should abundance be at any point in time?
- How high should abundance be during good ocean cycles?

Example Productivity Questions

- At low spawner densities do parents produce enough adult progeny to replace themselves (i.e. stabilize above extinction levels)?
- During the record downturn of the 1990s, did populations average above replacement?

Example Persistence Question

- Considering possible combinations of habitat capacity, intrinsic productivity and ocean variability, what is the probability that coastal coho will persist for the next 100 years?

Example Distribution/Diversity Questions

- Are coastal coho distributed throughout their natural range and occupying a variety of habitats?
- How resilient are coho populations in filling available habitats when ocean conditions become favorable?
- Is long-term genetic diversity and adaptability at risk?

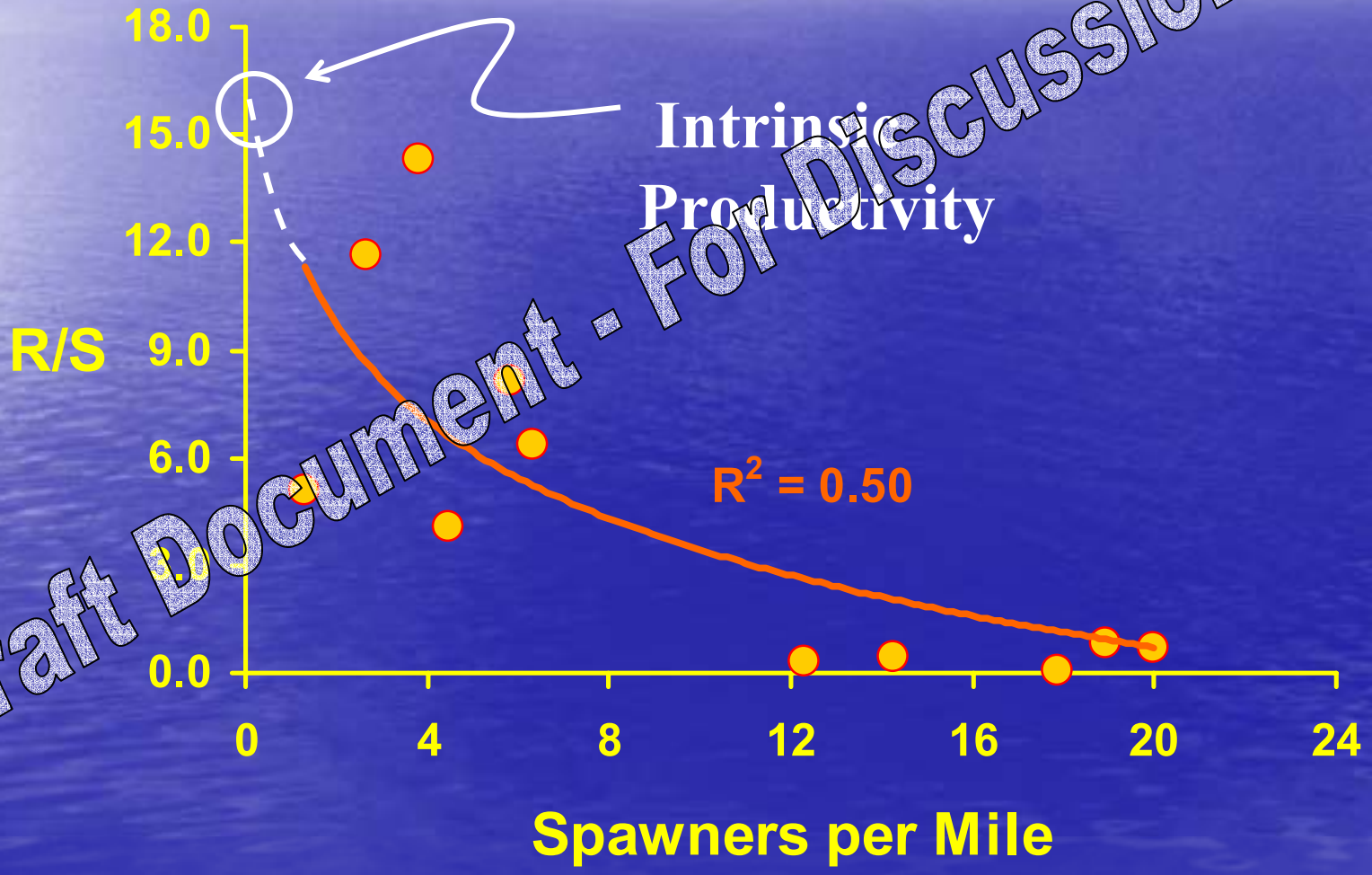
Attribute Criteria Preview

- Abundance
  - (Least useful. Use as mile posts rather than criteria)
- Productivity
  - Pro1 – During poor ocean, the average recruits per spawner (R/S) is above replacement when spawner density <5/mi.
  - Pro2 – During poor ocean, the average R/S is above replacement for all years below full seeding, or below 50% full seeding.
- Persistence
  - Per1 – Probability <5% of hitting extinction threshold over forecasted 100-year period.
- Distribution/Diversity
  - ≥50% of sample reaches within ≥50% of watersheds have ≥4 spawners/mi.
  - Harmonic mean of forecasted abundance exceeds 550 spawners to avoid loss of 5% genetic diversity over 100 yrs.

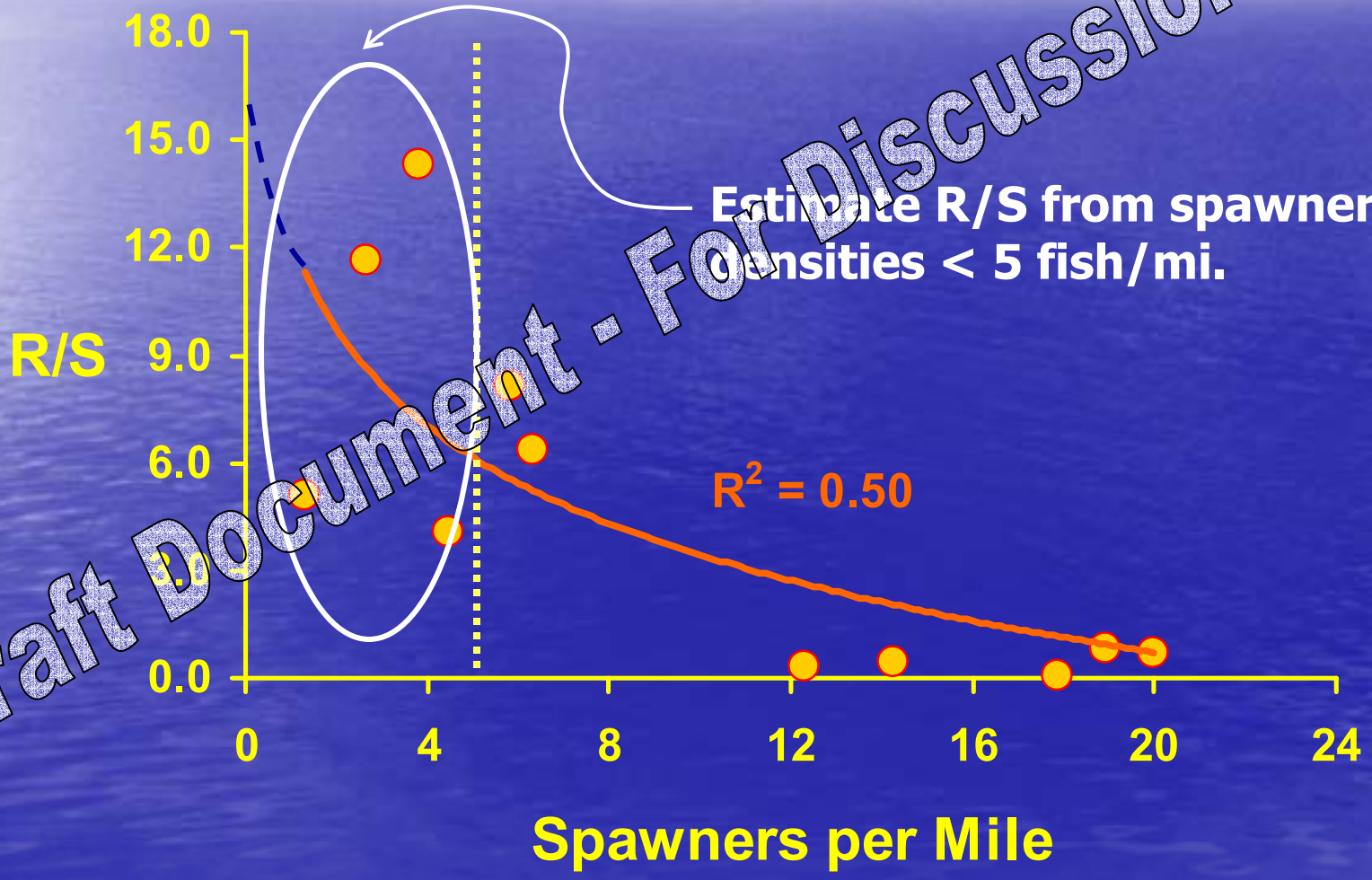
Attribute Criteria Preview

- Abundance
  - (Least useful. Use as mile posts rather than criteria)
- **Productivity**
  - **Pro1 – During poor ocean, the average recruits per spawner (R/S) is above replacement when spawner density <5/mi.**
  - Pro2 – During poor ocean, the average R/S is above replacement for all years below full seeding or below 50% full seeding.
- Persistence
  - **Per1 – Probability <5% of hitting extinction threshold over forecasted 100-year period.**
- Distribution/Diversity
  - **≥50% of sample reaches within ≥50% of watersheds have ≥4 spawners/mi.**
  - **Harmonic mean of forecasted abundance exceeds 550 spawners to avoid loss of 5% genetic diversity over 100 yrs.**

Relationship between Productivity (R/S) and Spawner Density



Relationship between Productivity (R/S) and Sawner Density



Pro1 Productivity Criterion
Risk Classification

For low spawner densities (less than 5 fish/mile) that were observed during the recent poor ocean survival cycle (1990 – 96 brood years), the following risk classification applies:

RED = The average, low density R/S was less than 1.1.

YELLOW = The average, low density R/S was greater than 1.1, but less than 2.1.

GREEN = The average, low density R/S was greater than 2.1.

Attribute Criteria Preview

- Abundance
  - (Least useful. Use as mile posts rather than criteria)
- **Productivity**
  - Pro1 – During poor ocean, the average recruits per spawner (R/S) is above replacement when spawner density <5/mi.
  - **Pro2 – During poor ocean, the average R/S is above replacement for all years below full seeding, or below 50% full seeding.**
- Persistence
  - **Per1 – Probability <5% of hitting extinction threshold over forecasted 100-year period.**
- Distribution/Diversity
  - **≥50% of sample reaches within ≥50% of watersheds have ≥1 spawners/mi.**
  - **Harmonic mean of forecasted abundance exceeds 550 spawners to avoid loss of 5% genetic diversity over 100 yrs.**

Pro2 Productivity Criterion Risk Classification

For spawner densities less than full seeding or less than 50% full seeding, calculated for the recent poor ocean survival cycle (1990 – 96 brood years), the following risk classification applies:

RED = Greater than 50% chance that the mean R/S was less than 1.1.

YELLOW = Less than 50% chance, but greater than 25% chance that the mean R/S was less than 1.1.

GREEN = Less than 25% chance that the mean R/S was less than 1.1.

Attribute Criteria Preview

- Abundance
  - (Least useful. Use as mile posts rather than criteria)
- Productivity
  - Pro1 – During poor ocean, the average recruits per spawner (R/S) is above replacement when spawner density <5/mi.
  - Pro2 – During poor ocean, the average R/S is above replacement for all years below full seeding or below 50% full seeding.
- **Persistence**
  - **Per1 – Probability ≤5% of hitting extinction threshold over forecasted 100-year period.**
- Distribution/Diversity
  - ≥50% of sample reaches within ≥50% of watersheds have ≥4 spawners/mi.
  - Harmonic mean of forecasted abundance exceeds 550 spawners to avoid loss of 5% genetic diversity over 100 yrs.

Per1 Persistence Criterion

- **Modeling Approach:** "What are the possible combinations of intrinsic productivity and habitat capacity that will ensure a population has a high probability of persistence over a period of 100 years under a full range of likely environmental fluctuations ?"

Per1 Persistence Criterion

Key Considerations and Assumptions

1. What are the characteristics of the model used to predict recruitment ?

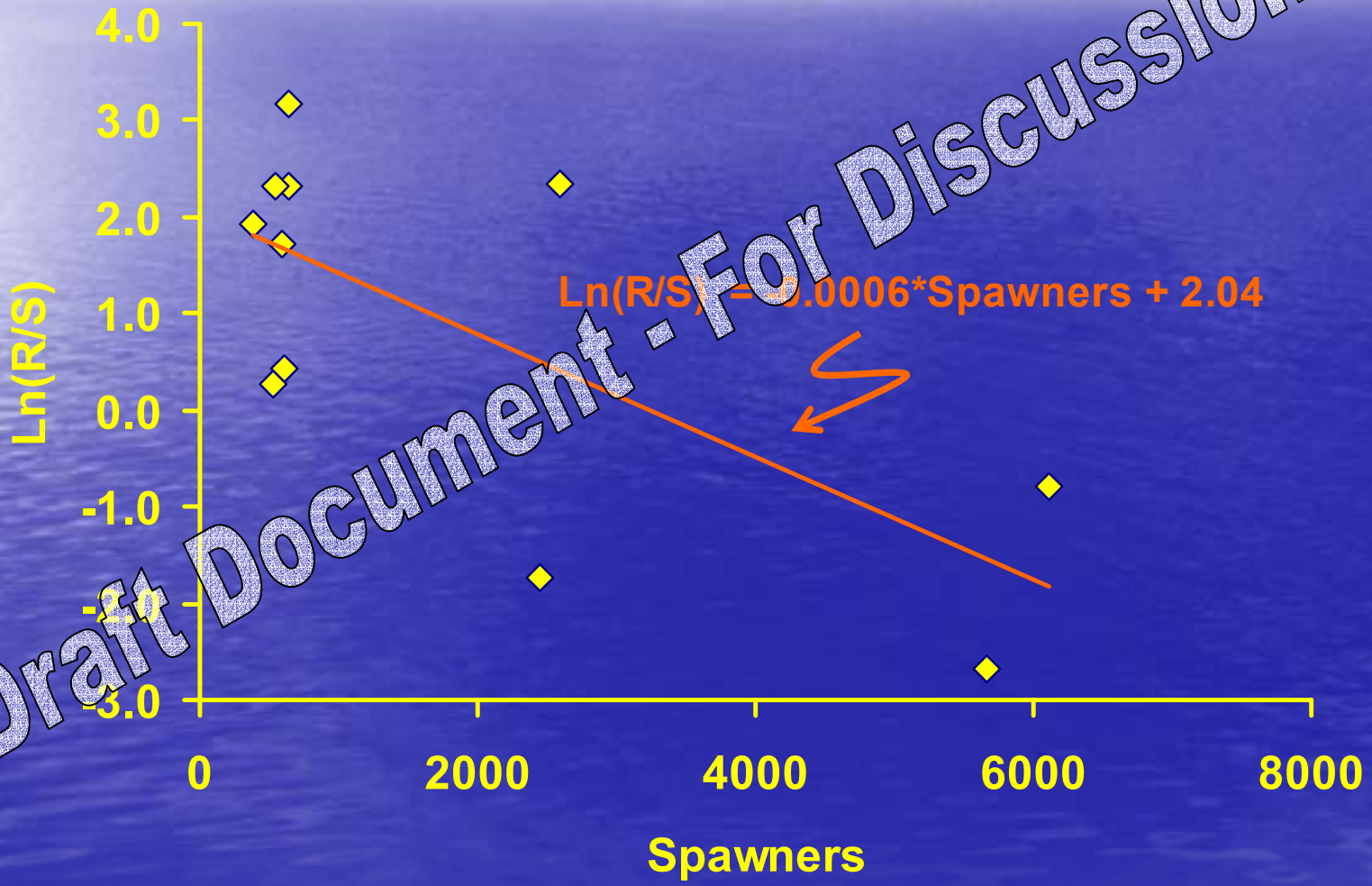
   = Ricker recruitment model with an additional parameter to incorporate annual variation in marine survival.

2. How variable is the recruitment process ?

   = a standardized measure of the difference between the assumed recruitment model prediction and the observed data points. This was expressed as the standard deviation of the regression's independent variable Ln(R/S) on the dependent variables.

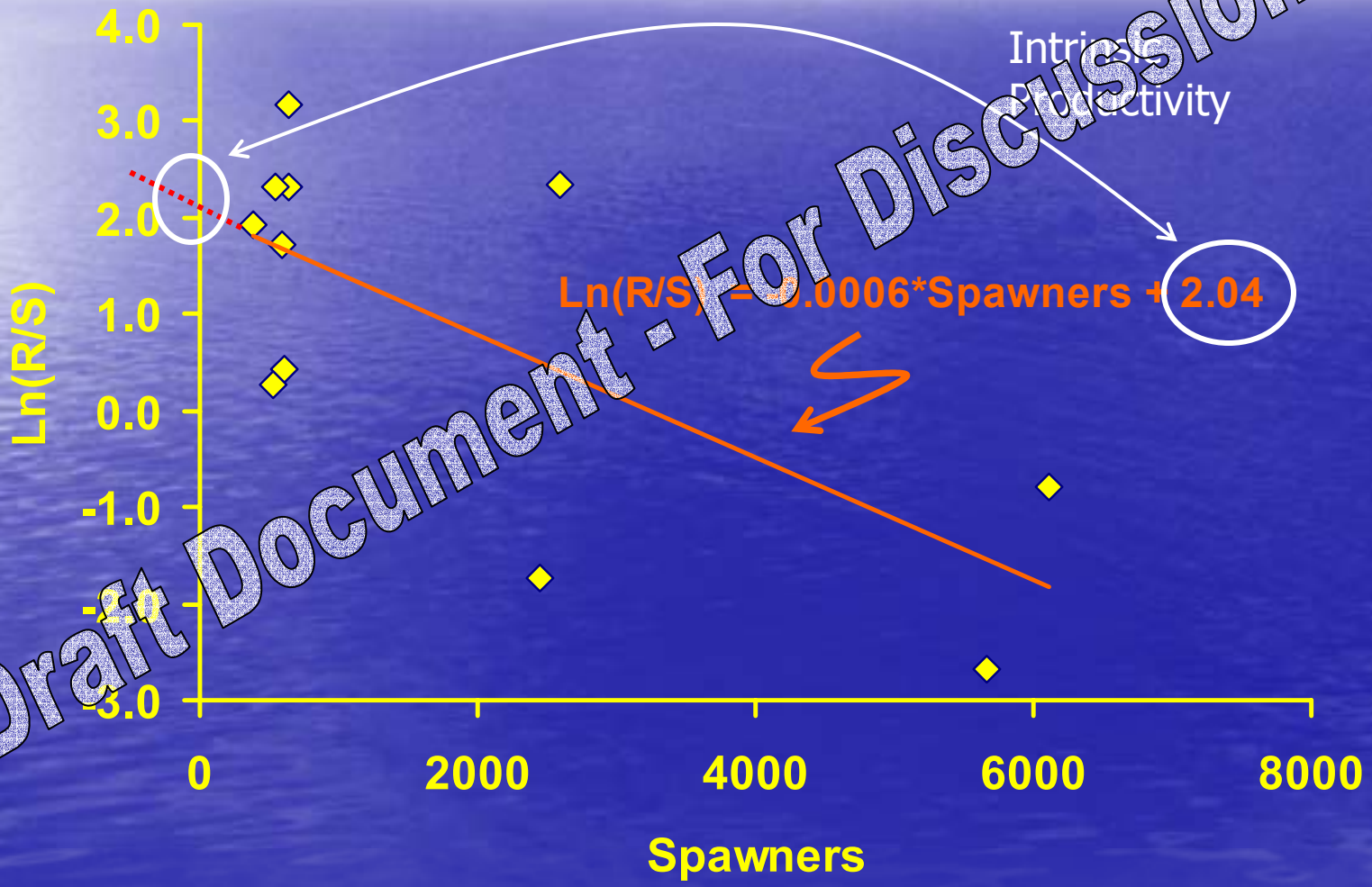
Per1 Persistence Criterion

Estimating Parameters for Habitat Capacity, Intrinsic Productivity, and Recruitment Variability – Ex: Yakutma



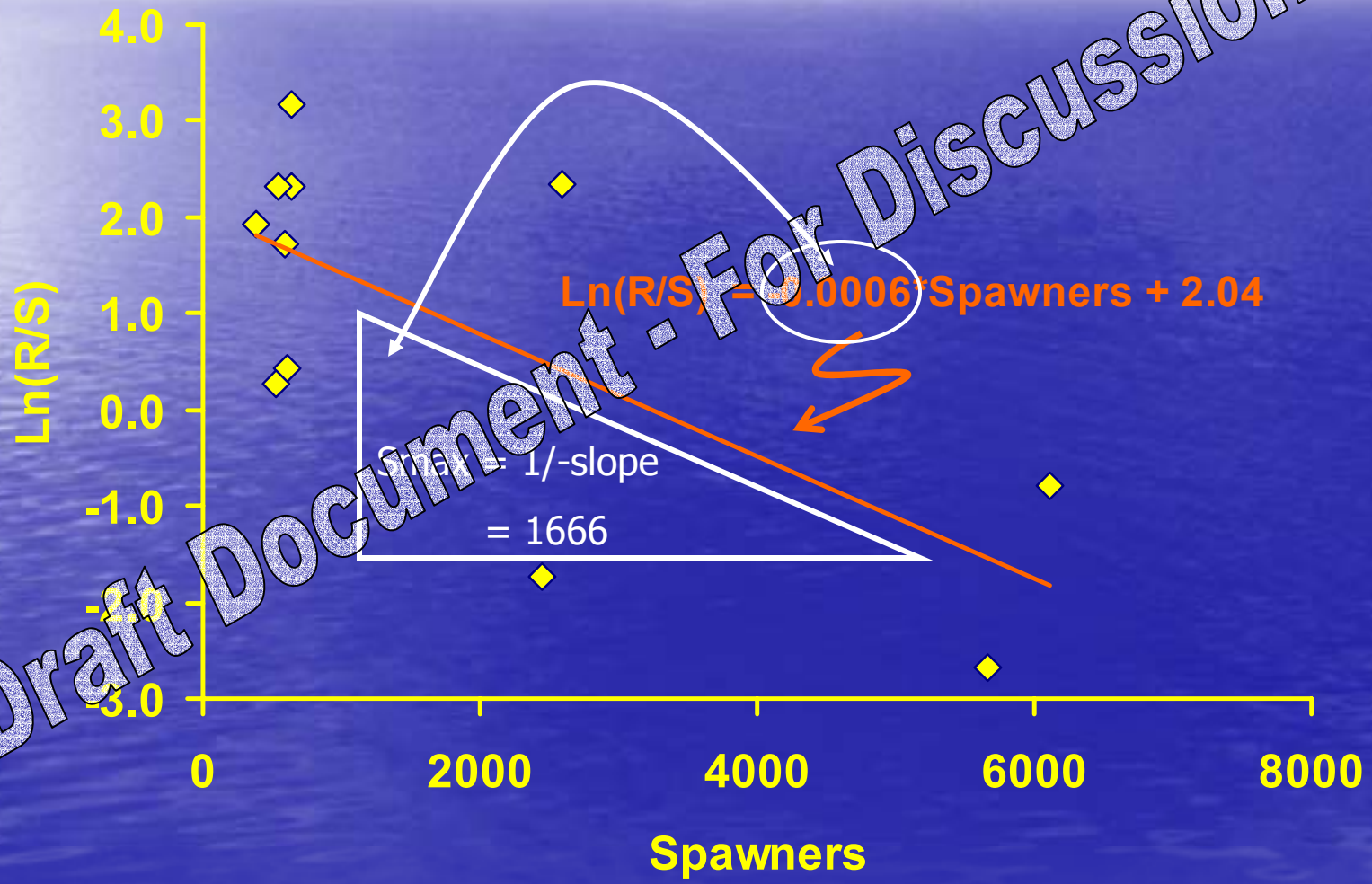
Per1 Persistence Criterion

Estimating Parameters for Habitat Capacity, Intrinsic Productivity, and Recruitment Variability – Ex: Yakima



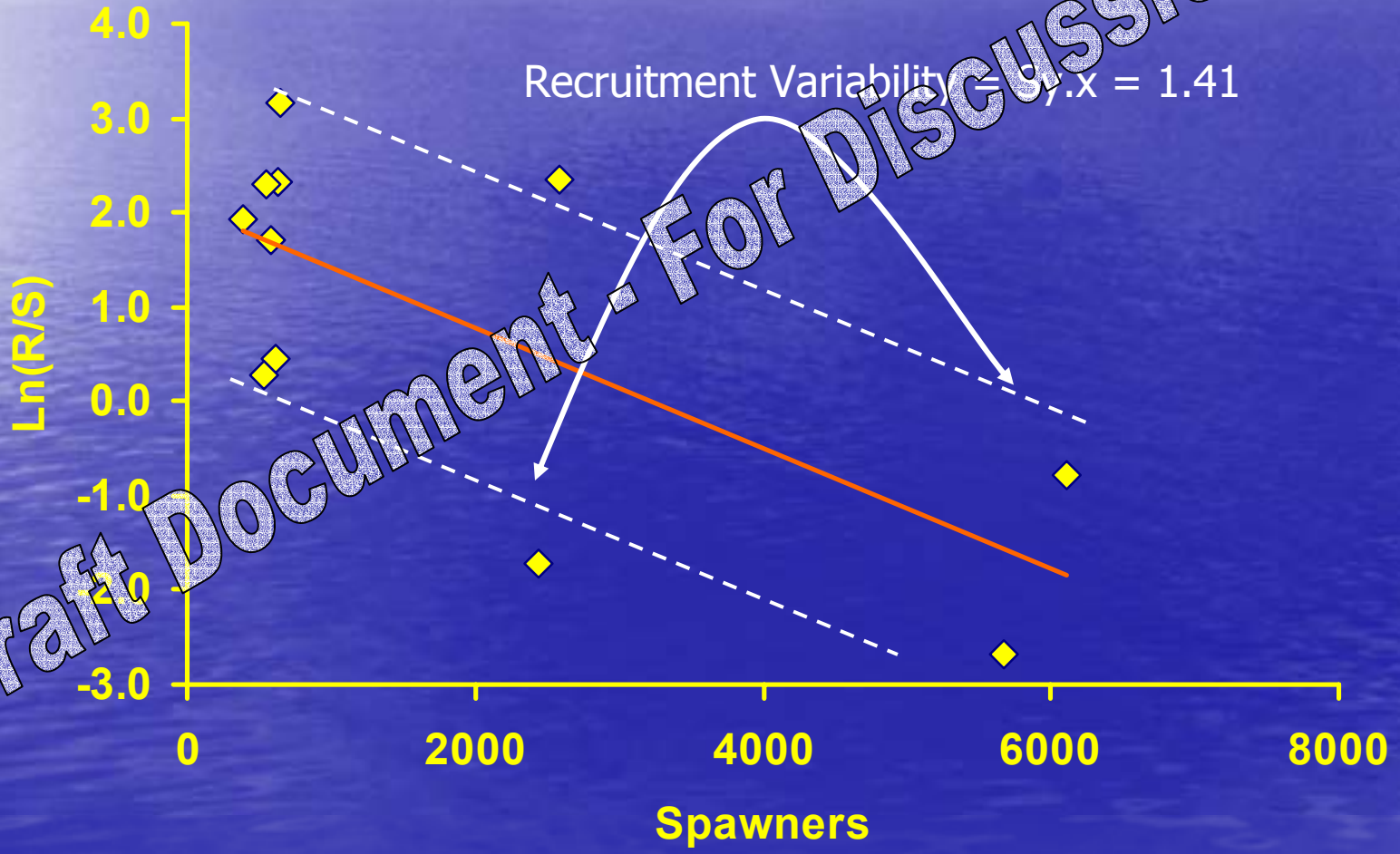
Per1 Persistence Criterion

Estimating Parameters for Habitat Capacity, Intrinsic Productivity, and Recruitment Variability – Ex: Cadiz



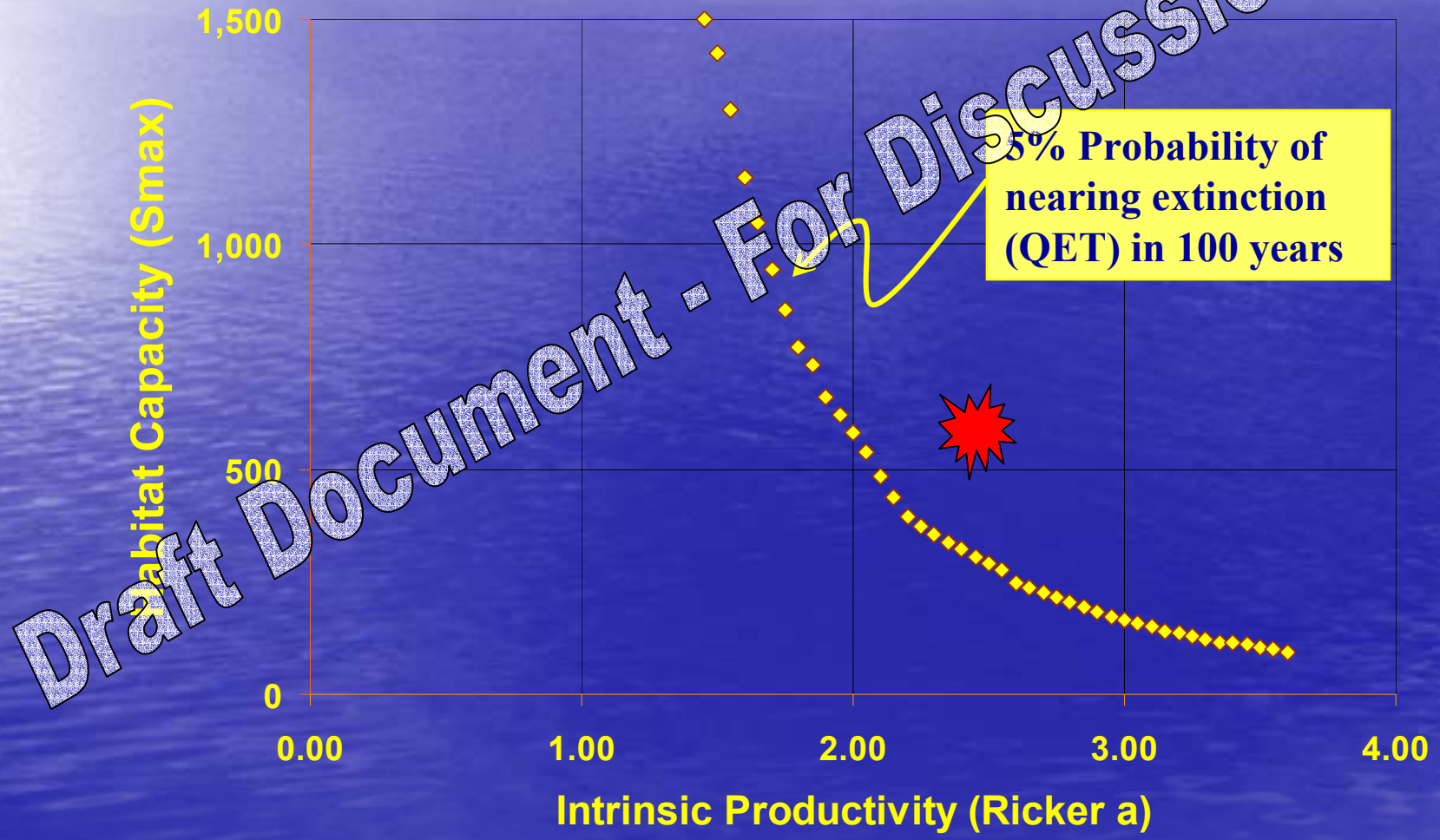
Per1 Persistence Criterion

Estimating Parameters for Habitat Capacity, Intrinsic Productivity, and Recruitment Variability – Ex: Coquina



Evaluating Persistence Using Viability Curves

Example: Necanicum



Persistence Criterion Risk Classification

For a 100 year test period, 3-year average <QET:

RED = >5% probability.

YELLOW = 1-5% probability.

GREEN = <1% probability.

Attribute Criteria Preview

- Abundance
  - (Least useful. Use as mile posts rather than criteria)
- Productivity
  - Pro1 – During poor ocean, the average recruits per spawner (R/S) is above replacement when spawner density <5/mi.
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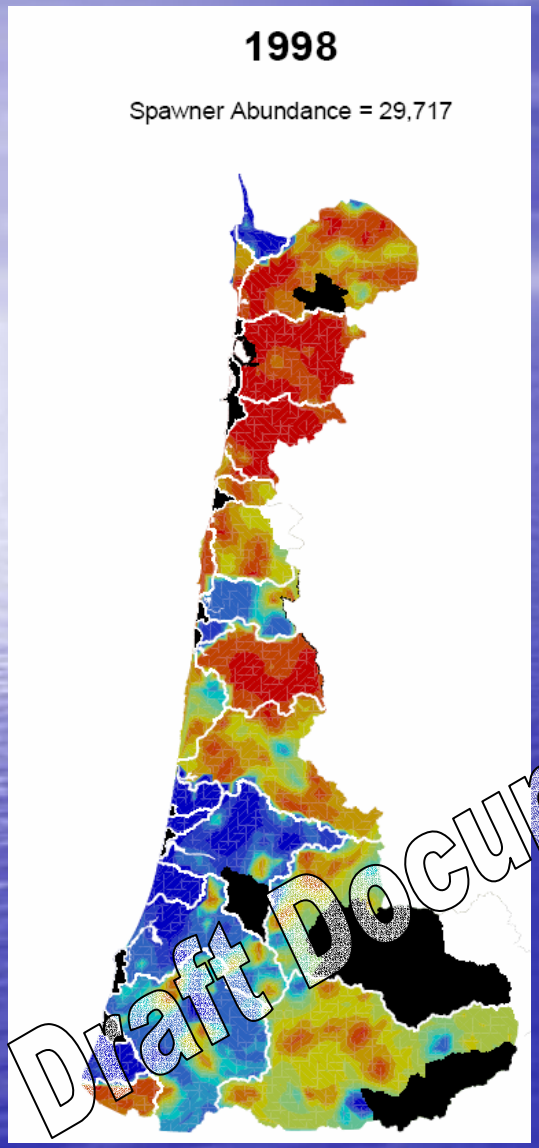
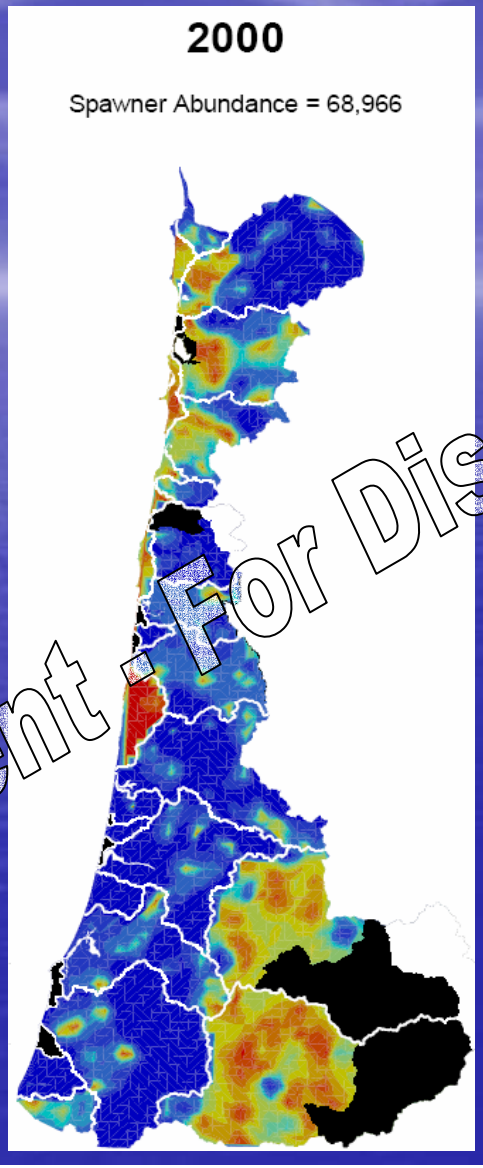
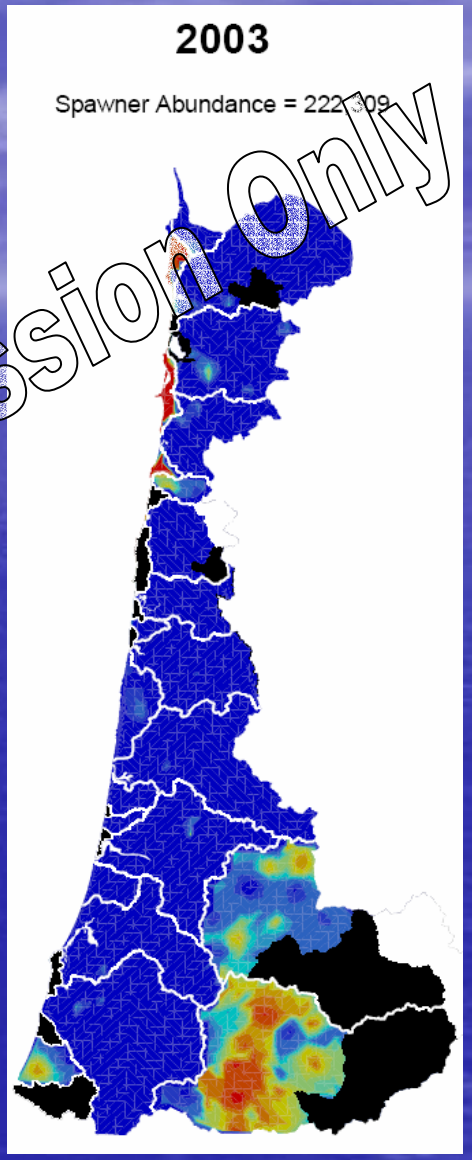
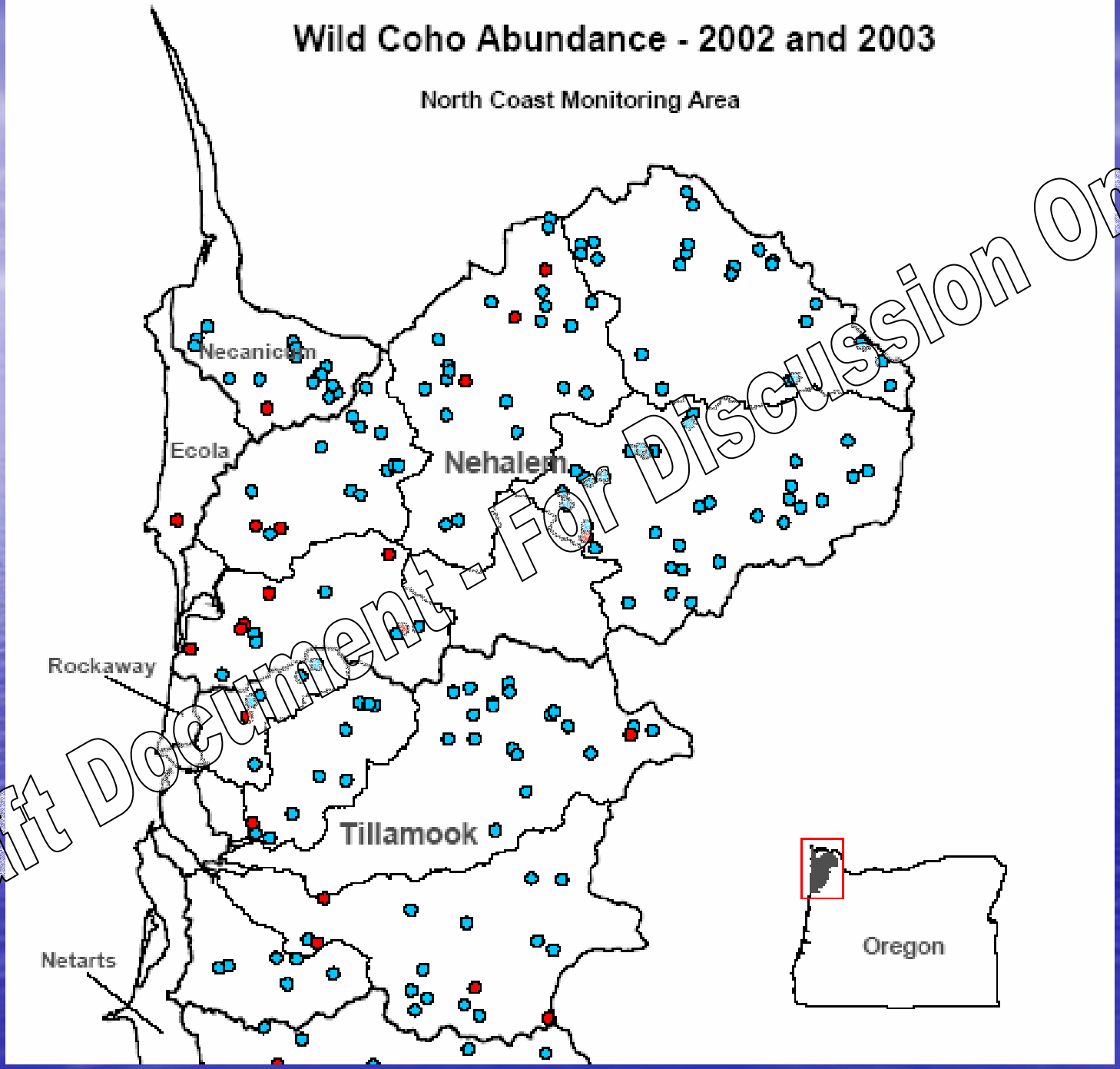
  - Per1 – Probability ≤5% of hitting extinction threshold over forecasted 100-year period.
- **Distribution (Diversity**
  - **≥50% of sample reaches within ≥50% of watersheds have ≥4 spawners/mi.**
  - Harmonic mean of forecasted abundance exceeds 550 spawners to avoid loss of 5% genetic diversity over 100 yrs.

Adult Coho Distribution and Abundance

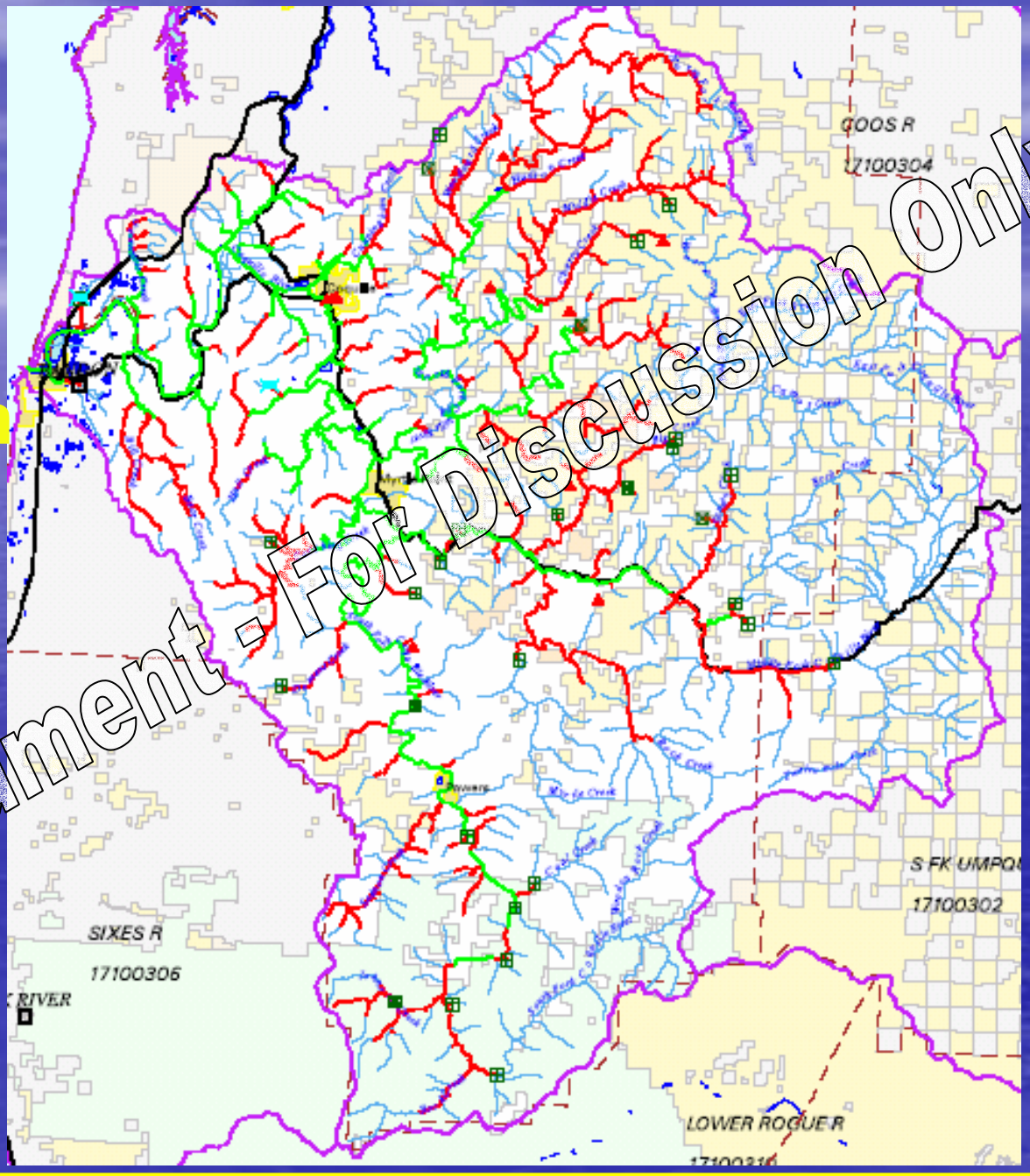







Wild Coho Abundance - 2002 and 2003
North Coast Monitoring Area
Necanicum
Ecola
Nehalem
Rockaway
Tillamook
Netarts
Oregon
Draft Document - For Discussion Only

Coquille Coho Population Distribution



ESU Biological Viability: Population Diversity, Spatial Structure, and Connectivity

Indicator: Coho Population Distribution

Distribution Criteria: Each functionally independent and potentially independent population must meet or exceed the watershed-scale diversity index in four of the last six years and never fail in 3 consecutive years.

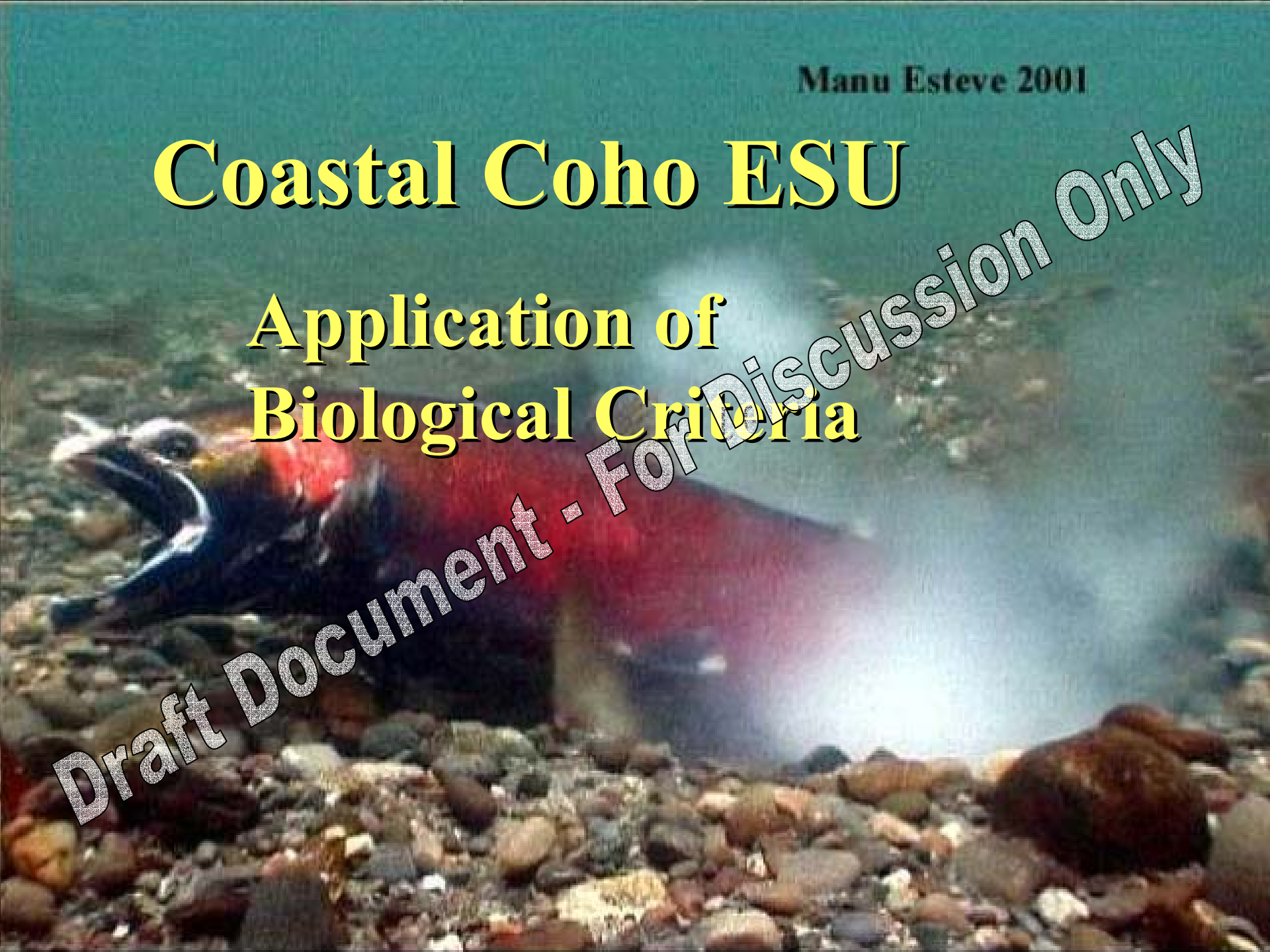
Watershed-Scale Diversity Index

At least 50 percent of the sample reaches within at least 50% of watersheds with spawning habitat support 4 or more spawners/mile.

(Watersheds defined by 5th Field USGS Hydrologic Unit Code – spawners/mile from ODWF AUC or equivalent)

Attribute Criteria Preview

- Abundance
  - (Least useful. Use as mile posts rather than criteria)
- Productivity
  - Pro1 – During poor ocean, the average recruits per spawner (R/S) is above replacement when spawner density <5/mi.
  - Pro2 – During poor ocean, the average R/S is above replacement for all years below full seeding or below 50% full seeding.
- Persistence
  - Per1 – Probability ≤5% of hitting extinction threshold over forecasted 100-year period.
- **Distribution/Diversity**
  - ≥50% of sample reaches within ≥50% of watersheds have ≥4 spawners/mi.
  - **Harmonic mean of forecasted abundance exceeds 550 spawners to avoid loss of 5% genetic diversity over 100 yrs.**



Coastal Coho ESU

Application of Biological Criteria

Criteria for ESU Viability

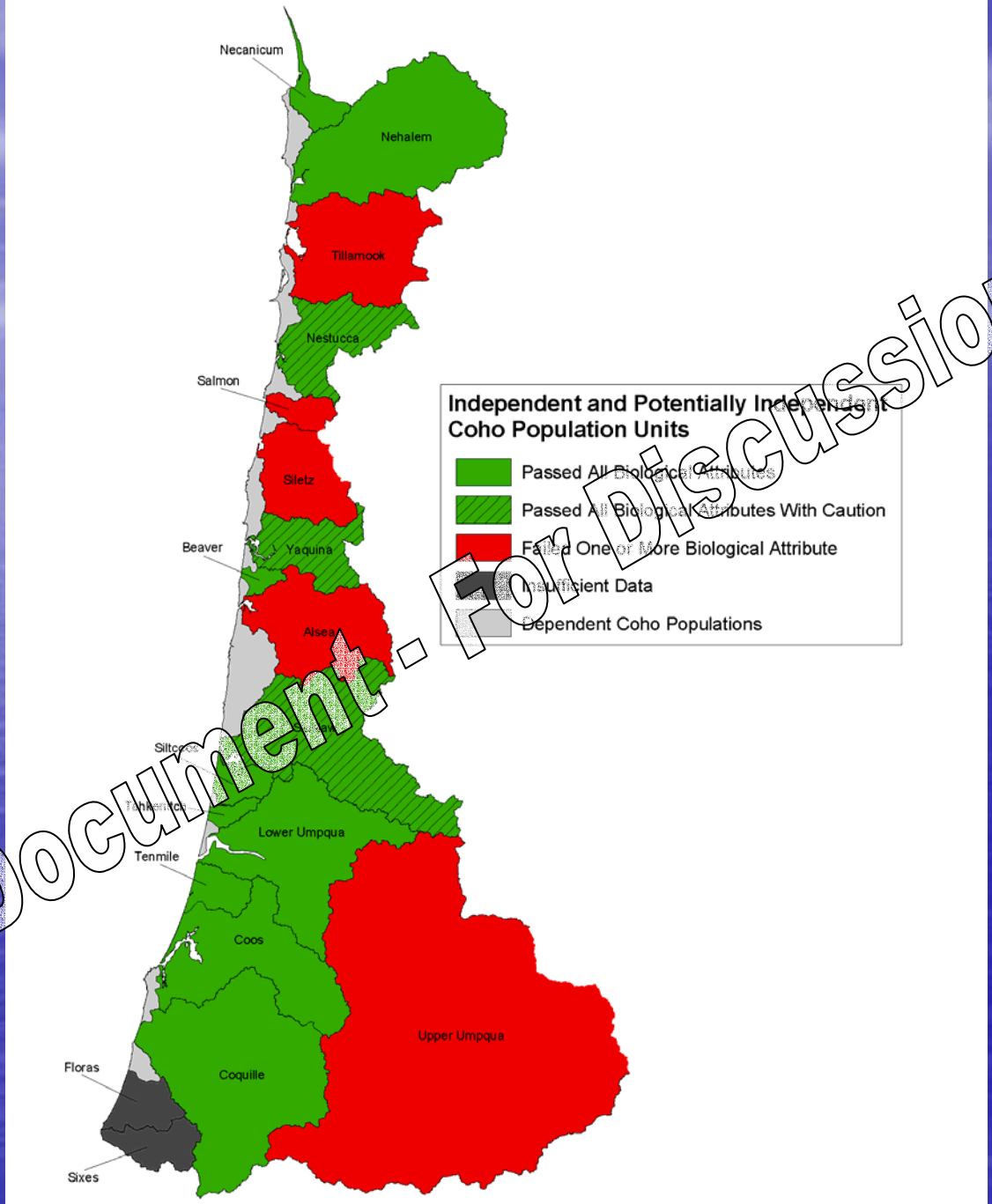
1. At least 10 independent populations pass all population criteria.
2. For each ESU strata, either 50% or 2 independent populations pass all population criteria (1 population must be classified as functionally independent, except in lakes strata).
3. All strata pass.

Preliminary Application of Criteria to Oregon Coastal Coho Populations

Population	Pro1		Pro2		Per1	Distrs	Diverse	Combined Rating
	mean R/S	Prob < 1.1	< 1/2Smax	< Smax	Prob < QET		HarMean	
Necanicum	3.48	0.113	0.124	0.223	0.000	100%	1300	pass
Nehalem	1.31	0.364	0.143	0.472	[illegible]	73%	7159	pass
Tillamook	1.30	0.393	0.405	0.448	[illegible]	83%	847	fail
Nestucca	2.62	0.144	0.062	[illegible]	0.029	85%	1429	pass
Salmon			0.175	[illegible]	0.999	0%	1	fail
Siletz	1.34	0.302	0.493	0.646	0.087	67%	1006	fail
Yaquina			[illegible]	0.058	0.013	80%	1586	pass
Beaver					0.000	100%	2737	pass
Alsea			0.756	0.875	0.400	50%	234	fail
Siuslaw			0.014	0.428	0.013	65%	5999	pass
L. Umpqua			0.128	0.131	0.000	56%	7772	pass
Upper Umpqua				0.976	0.000	47%	10753	fail
Coos					0.000	73%	12381	pass
Coquille				0.272	0.000	60%	9420	pass
Floras/Sixes						55%		
Siltcoos			0.078	0.049	0.000	100%	5681	pass
Tahkenitch				0.022	0.000	100%	2318	pass
Tenmile L.					0.000	100%	10706	pass

Preliminary Strata and ESU Assessment

Population	Combined Rating	At Least 10 Independent Populations Pass all Criteria	At Least 2 or 50% Independent Pops per Strata Pass	ESU Rating
Necanicum	pass	pass	3 Independent Populations Pass	All ESU Criteria Passed; ESU Passes.
Nehalem	pass	pass		
Tillamook	fail	fail		
Nestucca	pass	pass		
Salmon	fail	fail	3 Independent Populations Pass	
Siletz	fail	fail		
Yaquina	pass	pass		
Beaver	pass	pass		
Alsea	fail	fail		
Siuslaw	pass	pass		
L. Umpqua	pass	pass	50% of Populations Pass	
Upper Umpqua	fail	fail		
Coos	pass	pass	2 Independent Populations Pass	
Coquille	pass	pass		
Floras/Sixes				
Siltcoos	pass	pass	3 Independent Populations Pass	
Tahkenitch	pass	pass		
Tenmile L.	pass	pass		
		12 Pops Pass	All Strata Pass	



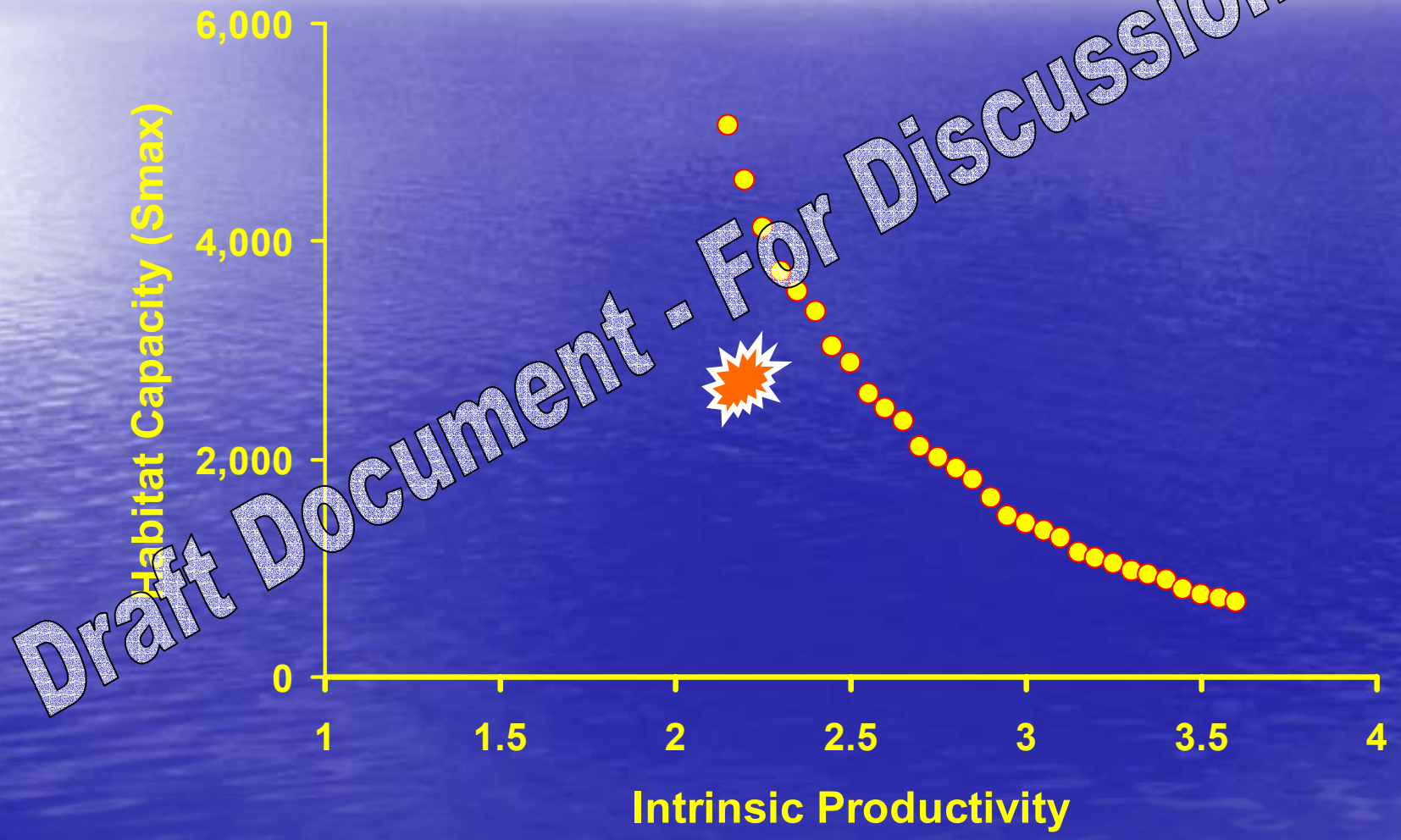
Persistence Under Different Fish Management Scenarios

Base = Current w/o anticipated hatchery improvements
HatchChg = Base w/ hatchery improvements
OldHR70 = Outcome if historical 70% rate had not been changed.

	Probability of < Threshold		
Population	Base	HatchChg	OldHR70
Necanicum	0.000	0.000	0.469
Nehalem	0.004	0.000	0.993
Tillamook	0.138	0.000	1.000
Nestucca	0.029	0.029	0.795
Salmon	0.999	0.947	1.000
Siletz	0.087	0.000	0.999
Yaquina	0.013	0.003	0.609
Beaver	0.000	0.000	0.223
Alsea	0.400	0.000	0.999
Siuslaw	0.013	0.006	0.736
Siltcoos	0.000	0.000	0.000
Tahkenitch	0.000	0.000	0.043
Lower Umpqua	0.000	0.000	0.071
Upper Umpqua	0.000	0.000	0.952
Tenmile	0.000	0.000	0.000
Coos	0.000	0.000	0.000
Coquille	0.000	0.000	0.024

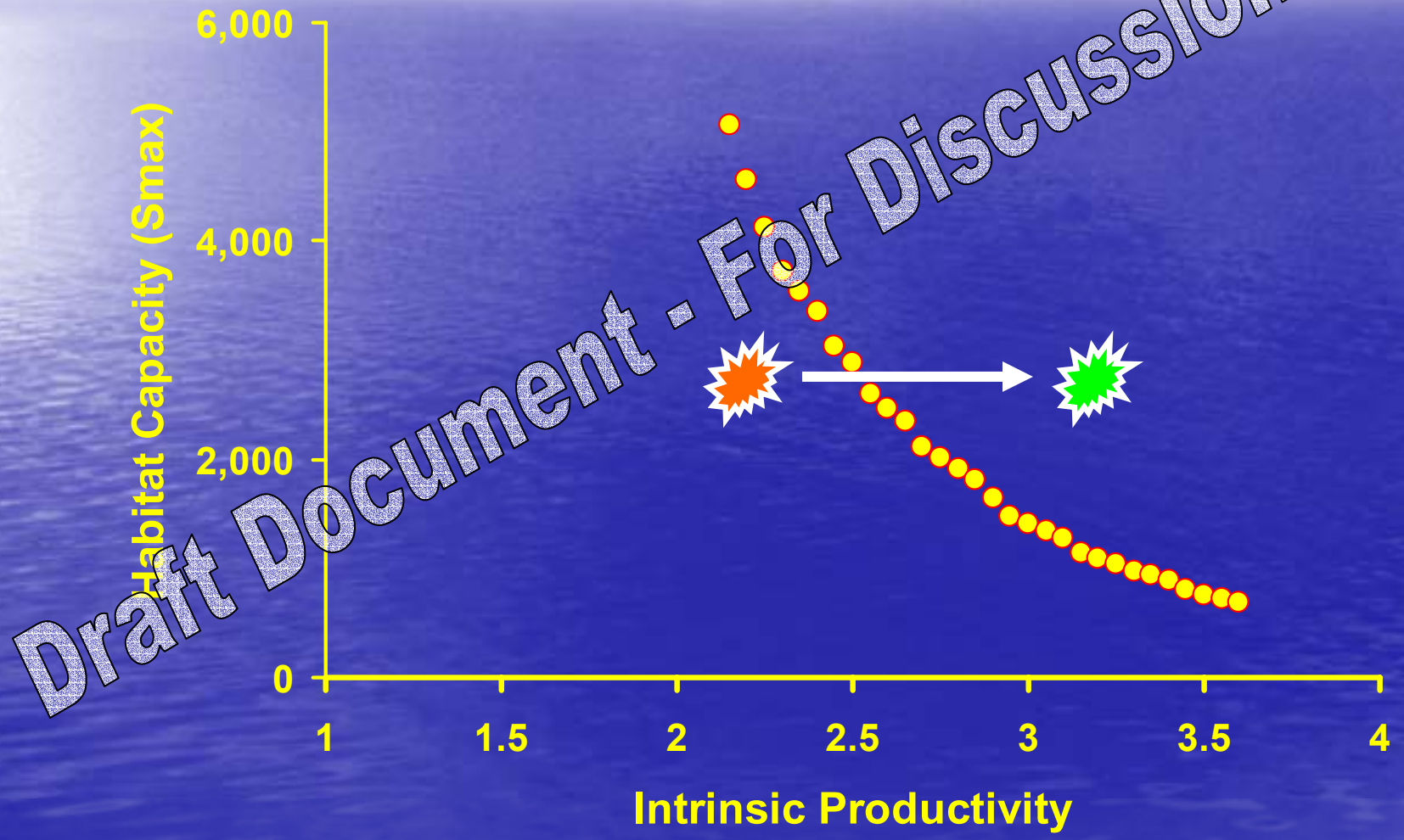
Viability Curves - Tillamook Population

Current Conditions



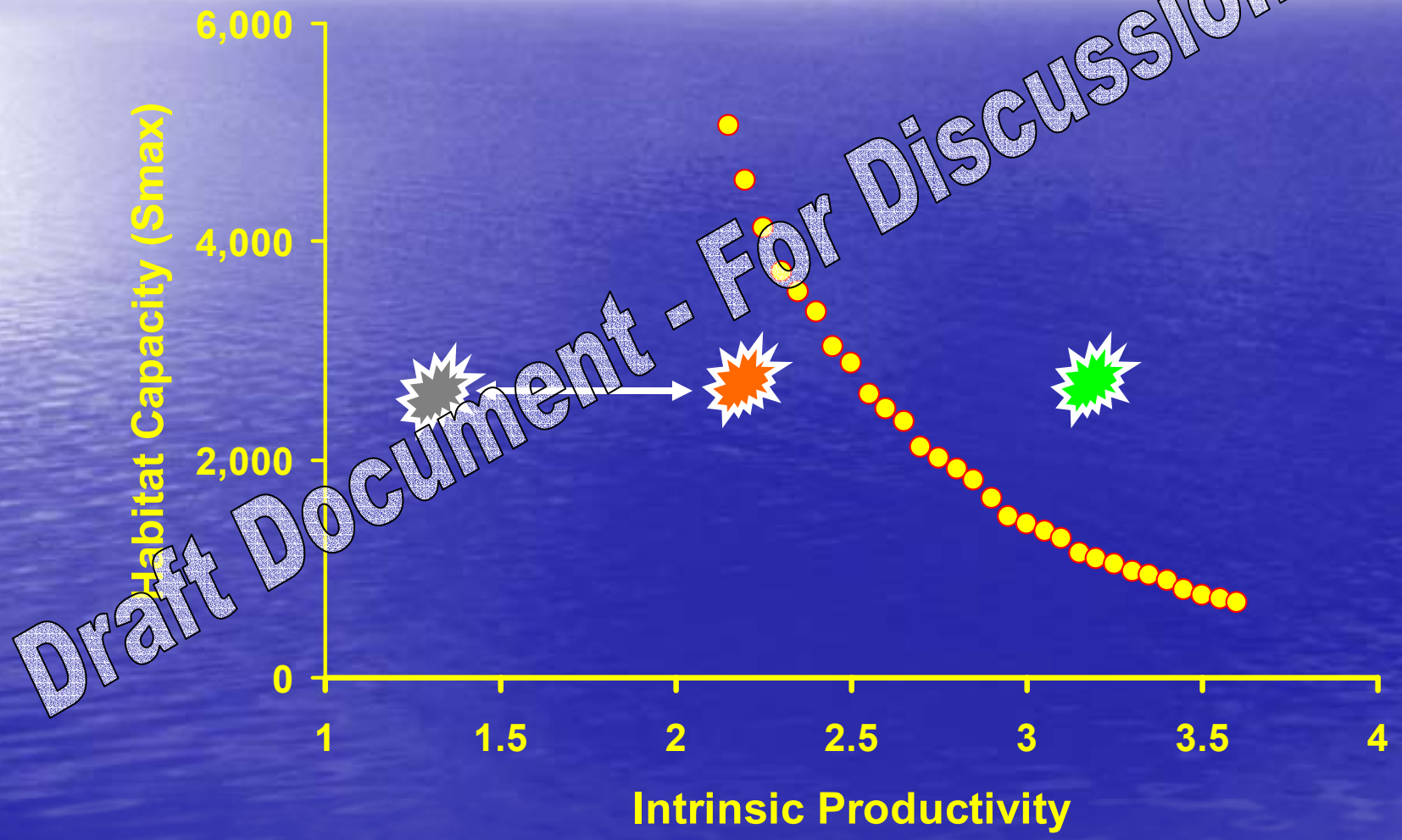
Viability Curves - Tillamook Population

Anticipated Impact of Changes in Hatchery Program



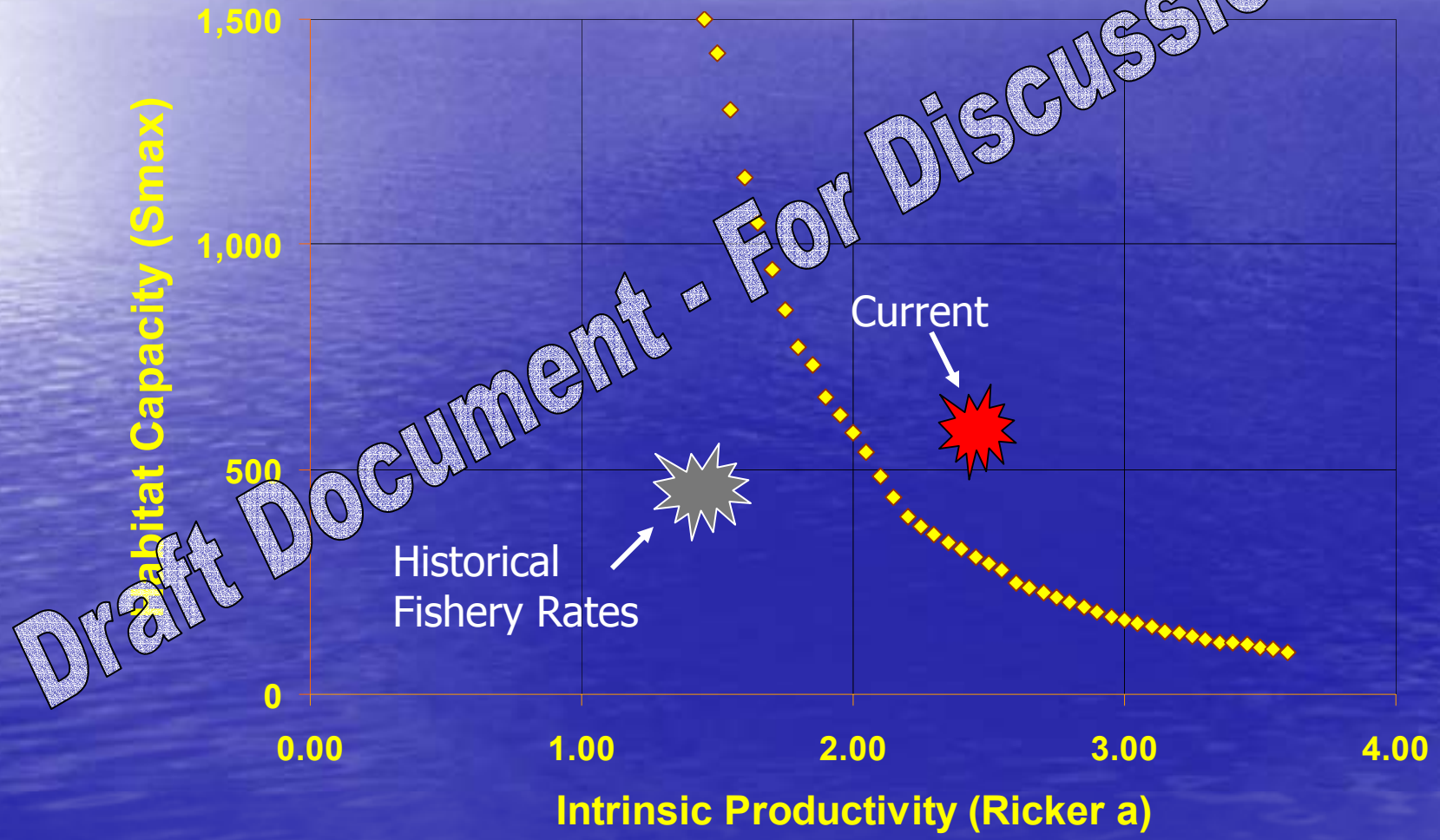
Viability Curves - Tillamook Population

Results in Context of Historical Fishery Impact Rates



Per1 Persistence Criterion

Impact of Historical Harvest Rates
Necanicum Population



Persistence Under Different Fish Ocean Survival Scenarios

	Probability of < Threshold						
Population	1.00Survival	0.85Survival	0.70Survival	0.50Survival	0.38Survival	0.20Survival	0.10Survival
Necanicum	0.000	0.001	0.005	0.104	[illegible]	1.000	1.000
Nehalem	0.004	0.027	0.191	[illegible]	0.993	1.000	1.000
Tillamook	0.138	0.326	0.547	[illegible]	1.000	1.000	1.000
Nestucca	0.029	0.067	[illegible]	0.600	0.795	0.999	1.000
Salmon	0.999	1.000	[illegible]	1.000	1.000	1.000	1.000
Siletz	0.087	0.275	0.572	0.968	0.999	1.000	1.000
Yaquina	0.013	[illegible]	0.077	0.264	0.609	0.994	1.000
Beaver	0.000	[illegible]	0.000	0.008	0.223	1.000	1.000
Alsea	[illegible]	0.619	0.845	0.988	0.999	1.000	1.000
Siuslaw	[illegible]	0.042	0.193	0.402	0.736	0.997	1.000
Siltcoos	0.000	0.000	0.000	0.000	0.000	0.000	0.968
Tahkenitch	0.000	0.000	0.000	0.000	0.043	1.000	1.000
Lower Umpqua	0.000	0.000	0.000	0.013	0.071	0.952	1.000
Upper Umpqua	0.000	0.000	0.007	0.442	0.952	1.000	1.000
Tenmile	0.000	0.000	0.000	0.000	0.000	0.000	0.935
Coos	0.000	0.000	0.000	0.000	0.000	0.124	0.996
Coquille	0.000	0.000	0.000	0.000	0.024	0.996	1.000

Evaluation of Conservation Efforts

- Factors for decline
- Conservation Efforts


Technical Review
• OP Management Partners
• IMST
• Input from Federal TRT
Draft Document - For Discussion Only

Timeline

- Coastal Coho OP Assessment: Winter '04/'05
- NOAA Final Listing determination: June '05
- Conservation/Recovery Plan: Summer/Fall '04 - Winter '05

Additional Questions?

Preliminary Application of Productivity, Persistence, and Distribution Criteria to Oregon Coast Coho

Population	Productivity 1			Productivity 2				Per1	Distrb
	n	mean R/S	Prob < 1.1	n	< 1/2Smax	n	> Smax	Prob < QET	
Necanicum	3	**3.48**	**0.113**	4	**0.124**	9	**0.223**	0.000	100%
Nehalem	3	**1.31**	**0.364**	7	**0.1[illegible]**	9	**0.472**	0.004	73%
Tillamook	5	**1.30**	**0.393**	7	**0.405**	10	**0.448**	0.138	83%
Nestucca	3	**2.62**	**0.144**	[illegible]	**0.062**	9	**0.044**	0.029	85%
Salmon	2	2.23		3	**0.175**	8	**0.917**	0.999	0%
Siletz	4	**1.34**	**0.302**	7	**0.498**	8	**0.646**	0.087	67%
Yaquina	2	8.39		7	**0.058**	7	**0.058**	0.013	80%
Beaver	0			1		1		0.000	100%
Alsea	1	0.09		5	**0.756**	9	**0.875**	0.400	50%
Siuslaw	0			5	**0.014**	10	**0.428**	0.013	65%
L. Umpqua				3	**0.128**	6	**0.131**	0.000	56%
Upper Umpqua	0			0		6	**0.976**	0.000	47%
Coos	0			1		2		0.000	73%
Coquille	0			0		5	**0.272**	0.000	60%
Floras/Sixes	0								55%
Siltcoos	3	**4.76**	**0.078**	3	**0.078**	8	**0.049**	0.000	100%
Tahkenitch	1	5.84		1		5	**0.022**	0.000	100%
Tenmile L.	1	4.55		1		2		0.000	100%

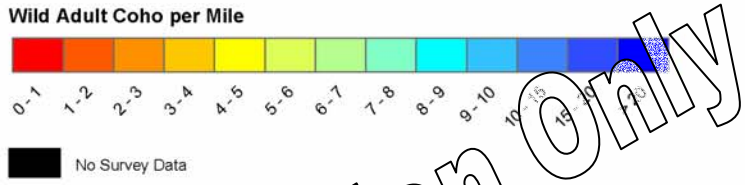
QET Values (Impending Extinction)

(Expanded for miles of habitat occupied during 1990s, rounded to nearest 10, and with no value less than 50)

Population	QET	Population	QET
Necanicum	50	Siuslaw	460
Nehalem	370	Siltcoos	50
Tillamook	170	Tahkenitch	50
Nestucca	100	Lower Umpqua	280
Salmon	50	Upper Umpqua	590
Siletz	170	Tenmile	50
Yaquina	120	Coos	180
Beaver	50	Coquille	240
Alsea	190		

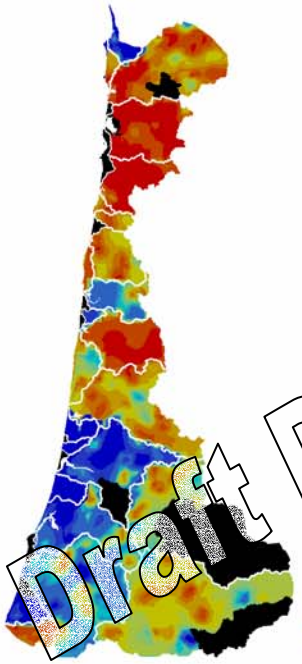
Statistical Distribution Maps of Abundance of Returning Wild Adult Coho for the Oregon Coast Coho ESU

Constrained by Coho Population Unit



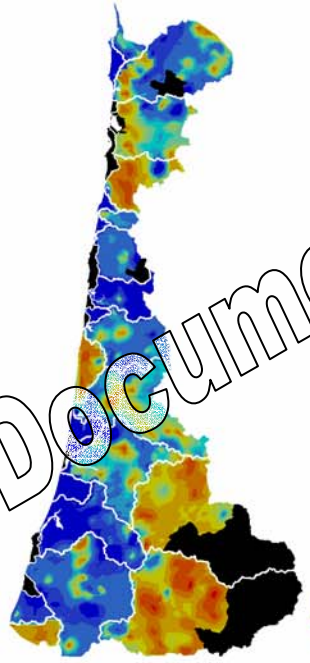
1998

Spawner Abundance = 29,717



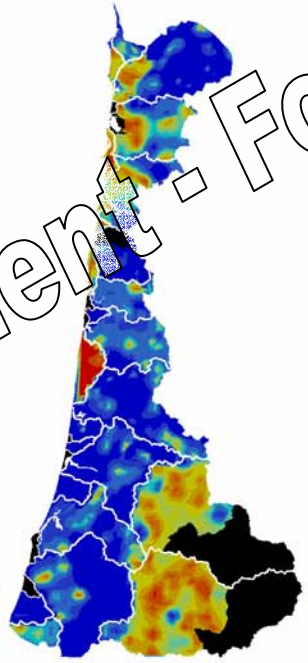
1999

Spawner Abundance = 47,634



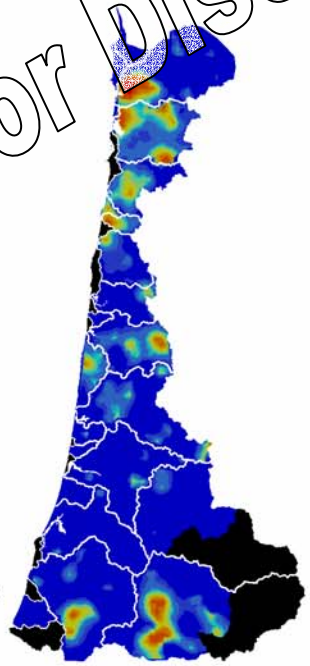
2000

Spawner Abundance = 68,966



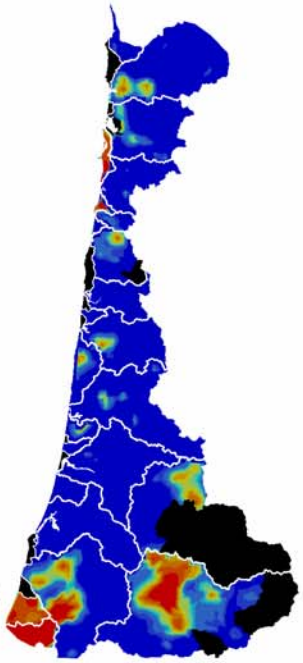
2001

Spawner Abundance = 152,963



2002

Spawner Abundance = 255,714



2003

Spawner Abundance = 222,309