Disease Prevention and Treatment Efforts in the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program

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OREGON Fish & Wildlife

NEZ PERCE FISHERIES

Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program

- Designed to rapidly increase the numbers of adults in nature.
  - Collect natural parr in August.
  - Rear them to maturity in captivity and spawn them.
  - Rear offspring to smolt and release into parents' natal stream.
  - Offspring complete life cycle in nature.
- Gene conservation program, not a production program.
  - Used only for populations that are in dire need.
  - Survival of every individual is important for genetic diversity, especially for the F_1 generation.

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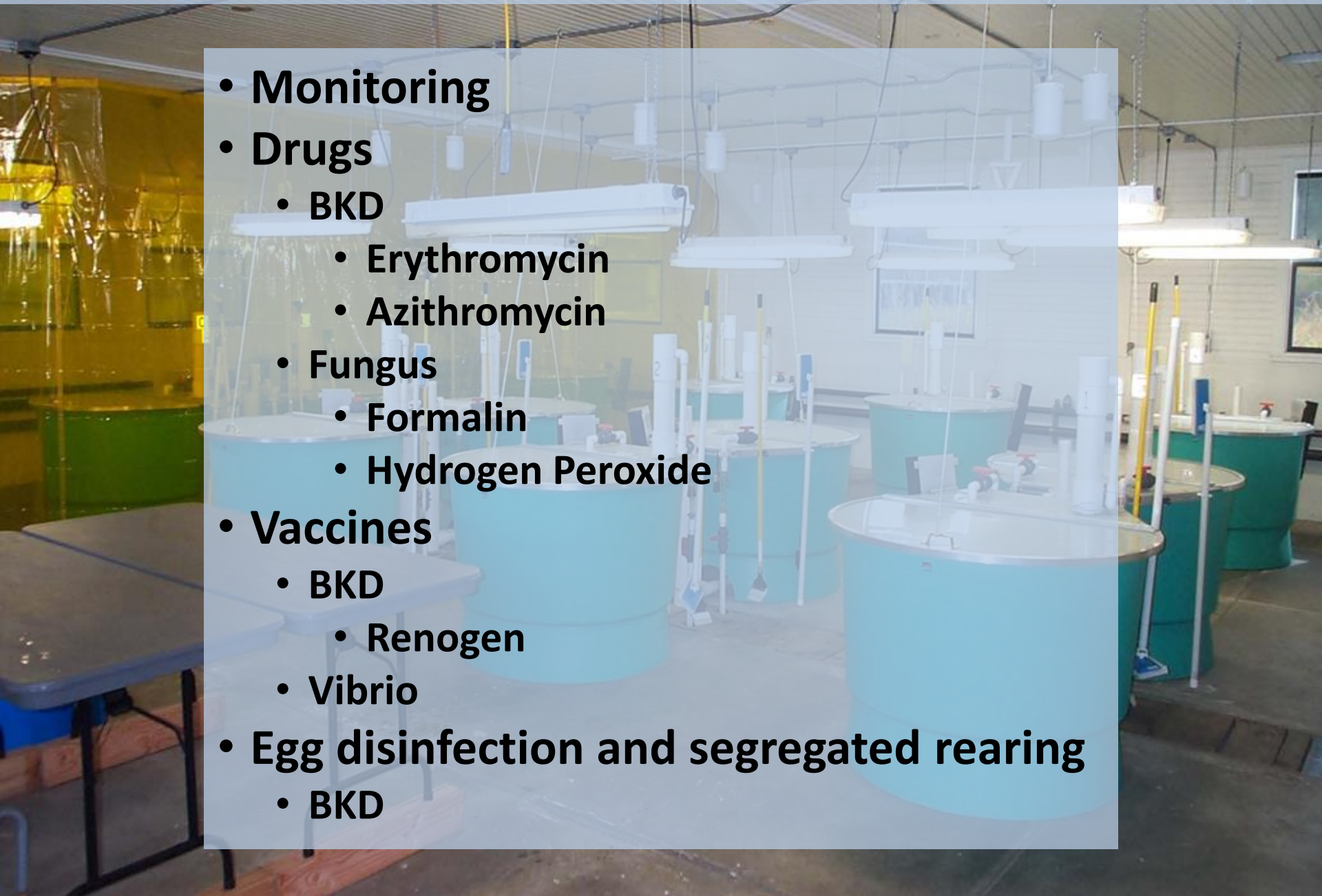
So, maintaining fish health is of the utmost importance.

Anticipated Diseases

- Bacterial Kidney Disease (BKD)
- Vibrio
- Fungus
- Other diseases that we were initially concerned about:
  - Erythrocytic Inclusion Body Syndrome (EIBS)
  - Bacterial Gill Disease
  - Systemic Gram Negative infections
    - Columnaris / *Flavobacterium* sp.
    - Bacterial Cold Water Disease
    - Enteric Redmouth Disease
    - Aeromonad-Pseudomonad septicemia
    - Furunculosis
  - Infectious Hematopoietic Necrosis Virus (IHN)

Disease Prevention and Treatment Efforts



- Monitoring
- Drugs
  - BKD
    - Erythromycin
    - Azithromycin
  - Fungus
    - Formalin
    - Hydrogen Peroxide
- Vaccines
  - BKD
    - Renogen
  - Vibrio
- Egg disinfection and segregated rearing
  - BKD

Results
Causes of Death

Results – Diseases

Disease	Number	Percent
Aeromonad-Pseudomonad Septicemia	160	1%
Arthrobacter	8	0.05%
Bacterial Cold Water Disease	7	0.04%
Bacterial Gill Disease	2	0.01%
Bacterial Kidney Disease (BKD)	3,616	22.3%
Columnaris/Flavobacteriosis	2	0.012%
Erythrocytic Inclusion Body Syndrome (EIBS)	0	0%
Enlarged Hindgut Syndrome	63	0.4%
Enteric Redmouth Disease	0	0%
Fungus	155	1%
Furunculosis	1	0.01%
Hexamita	3	0.02%
Infectious Hematopoietic Necrosis Virus (IHN)	0	0%
Other Parasites	1	0.01%
Tumors (Grande Ronde BY2000)	168	1.04%
Vibriosis	9	0.06%

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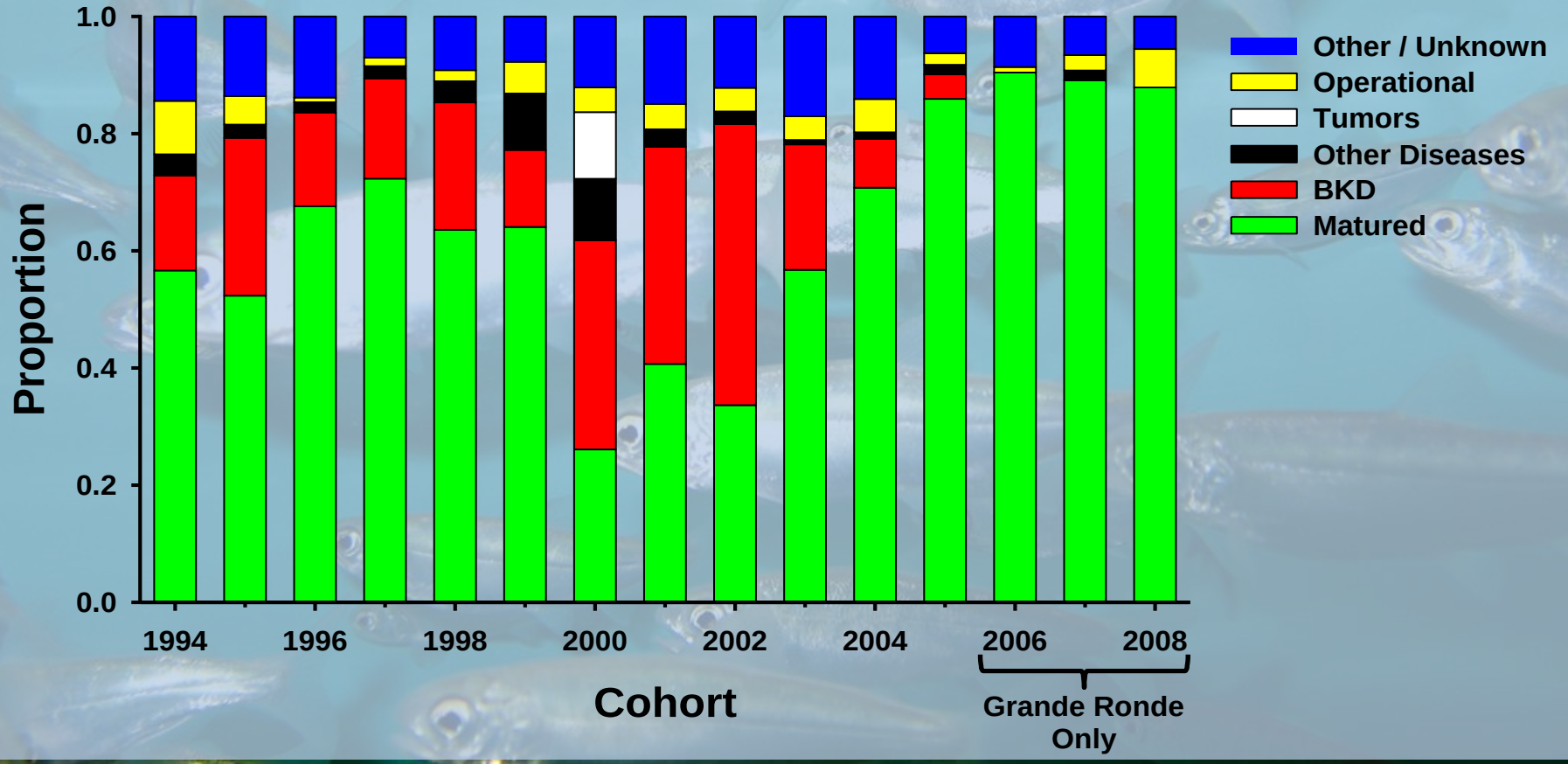
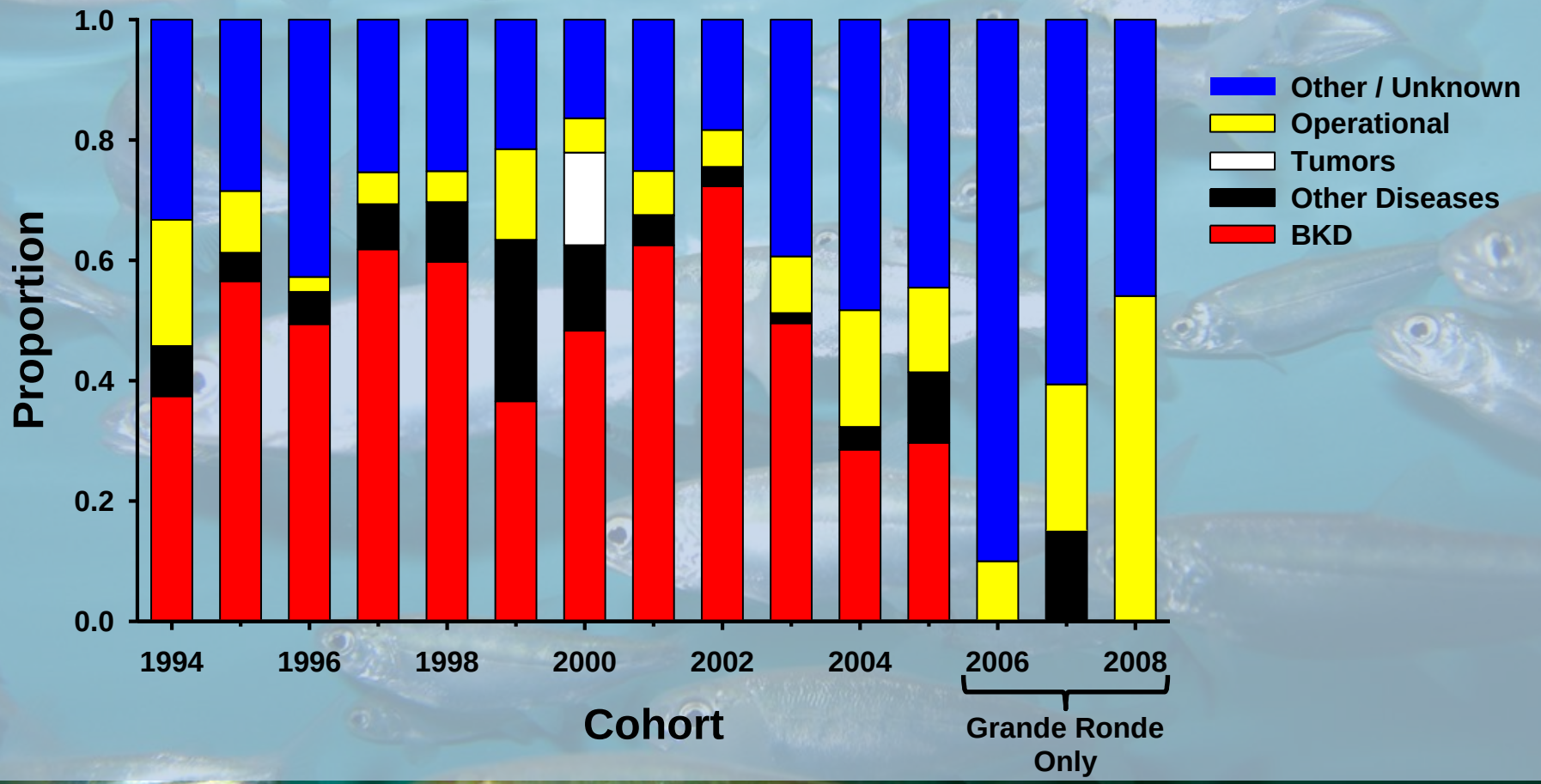
Results – Causes of Death (% Disease)

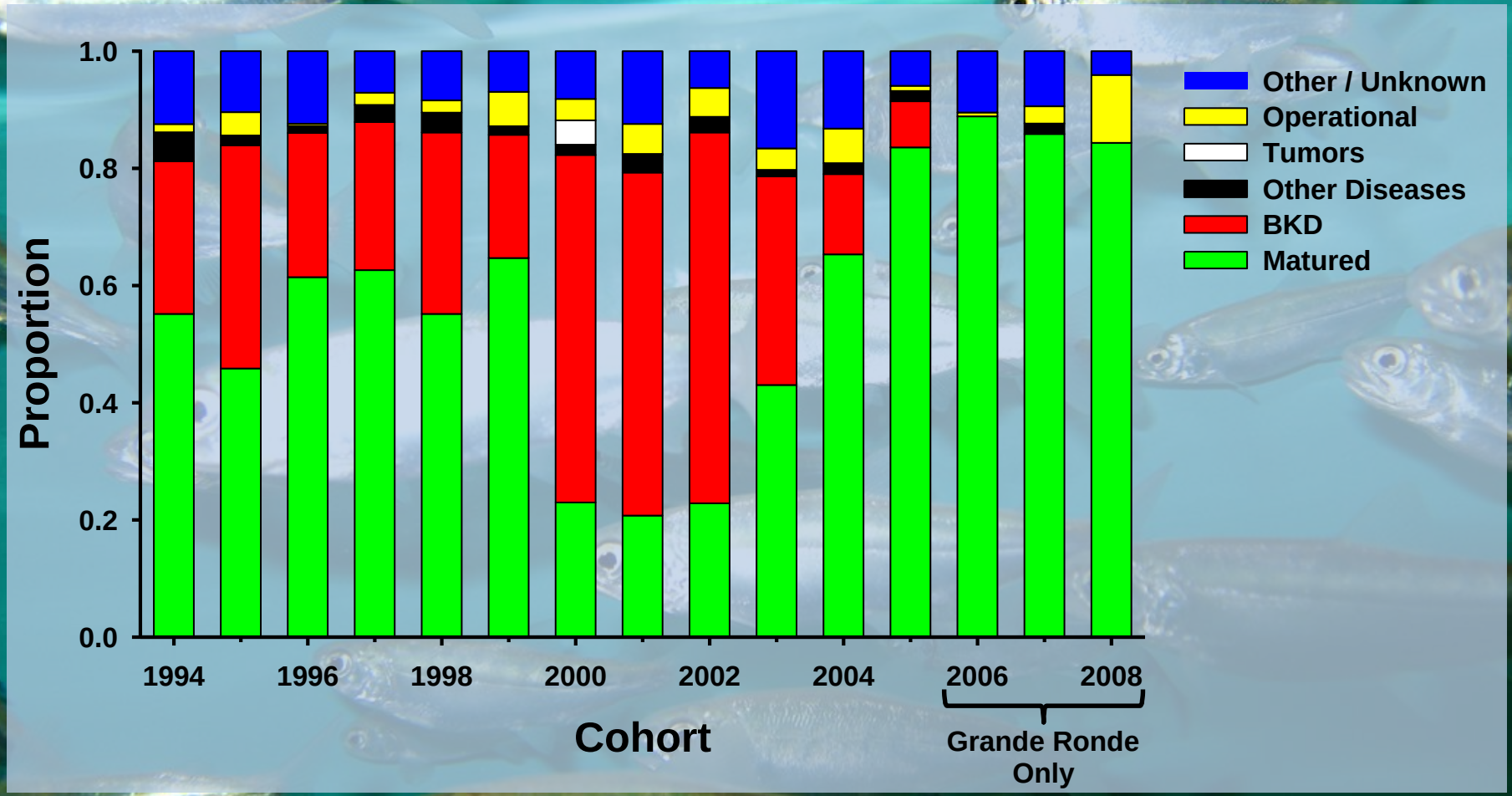
Diseases killed 26% of the Captive Broodstock.



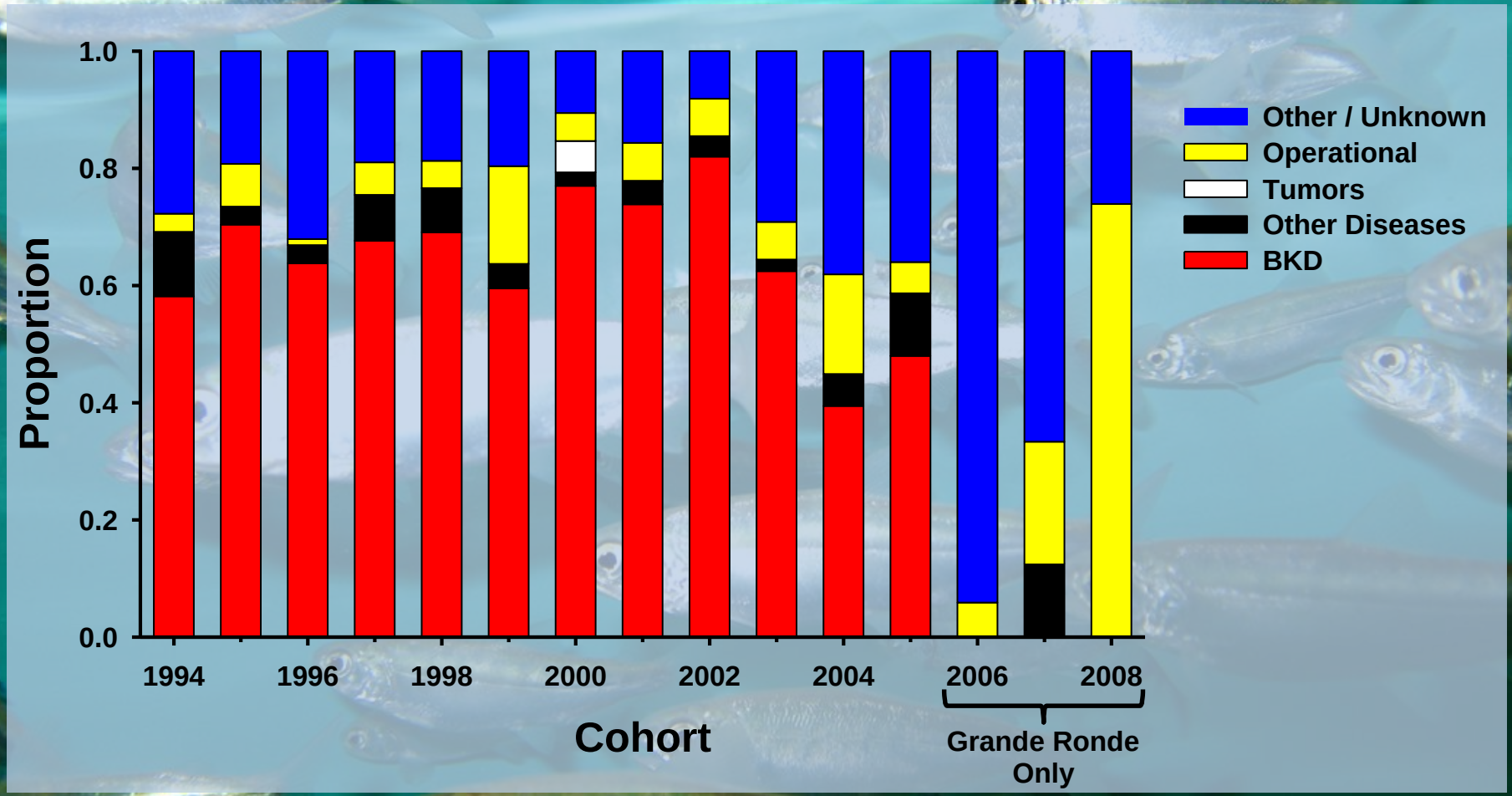
Results – % Mortalities



Results – Causes of Death (% Disease) - Females

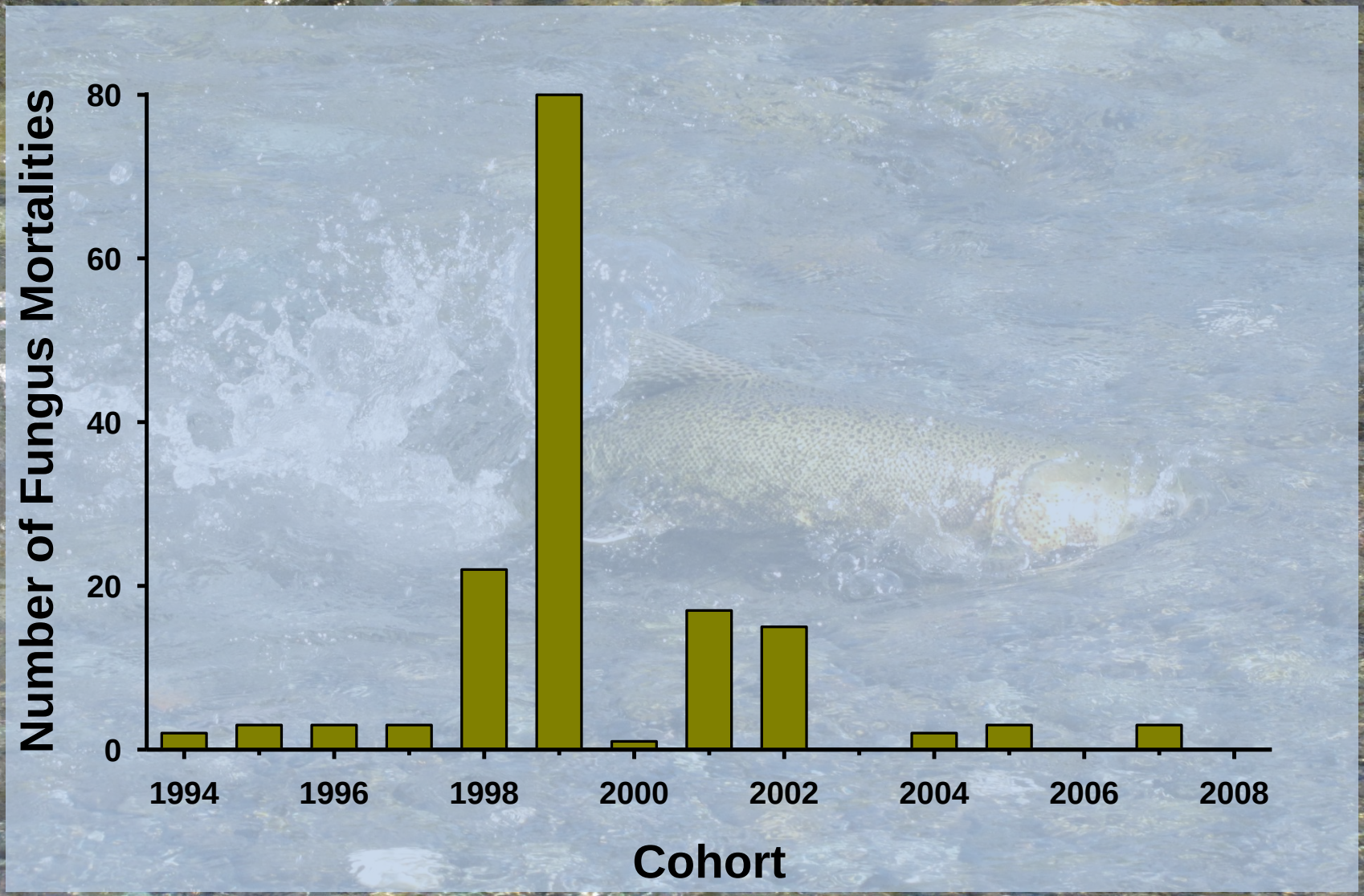


Results – % Mortalities - Females

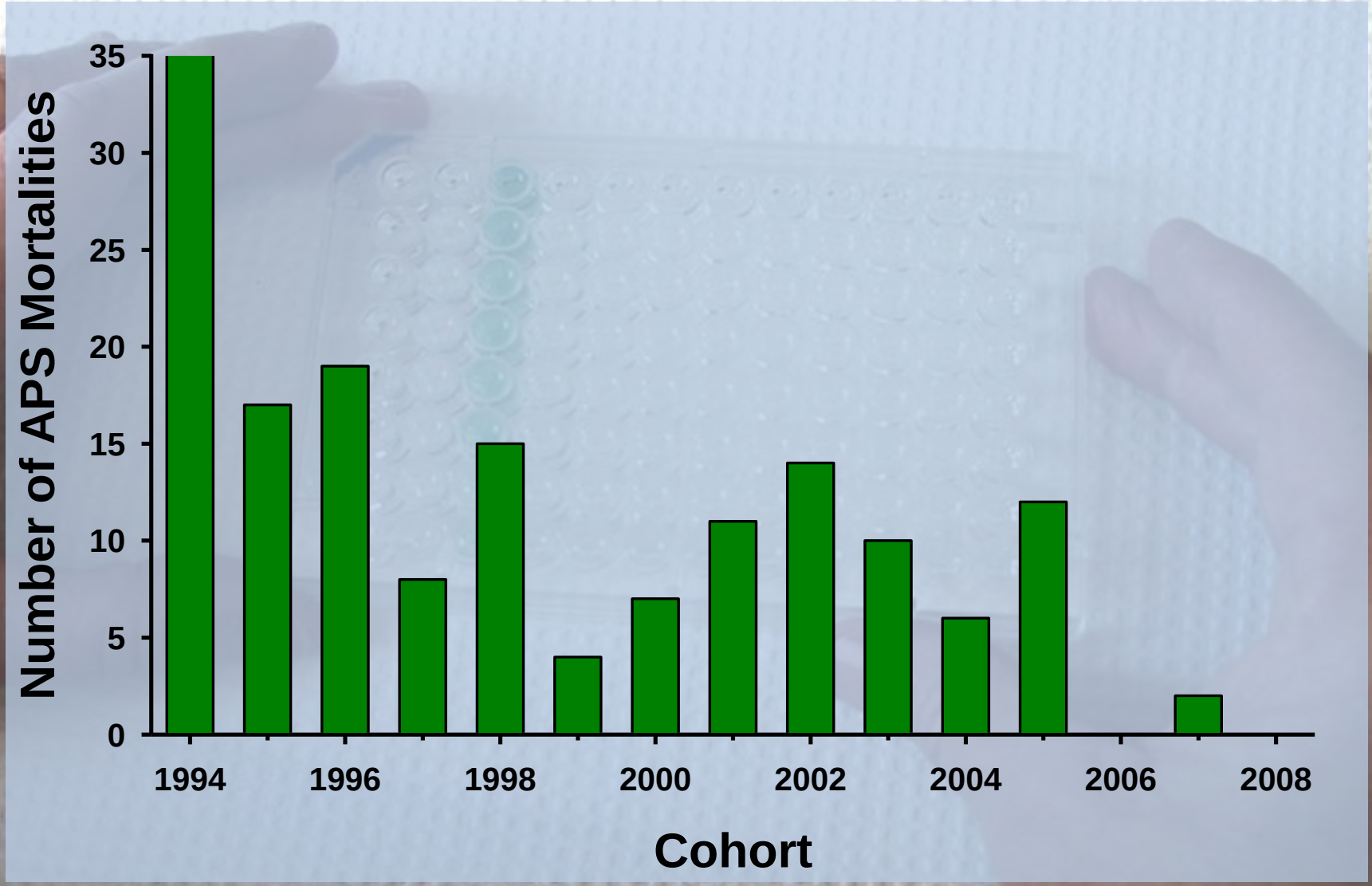


Results - Vibrio

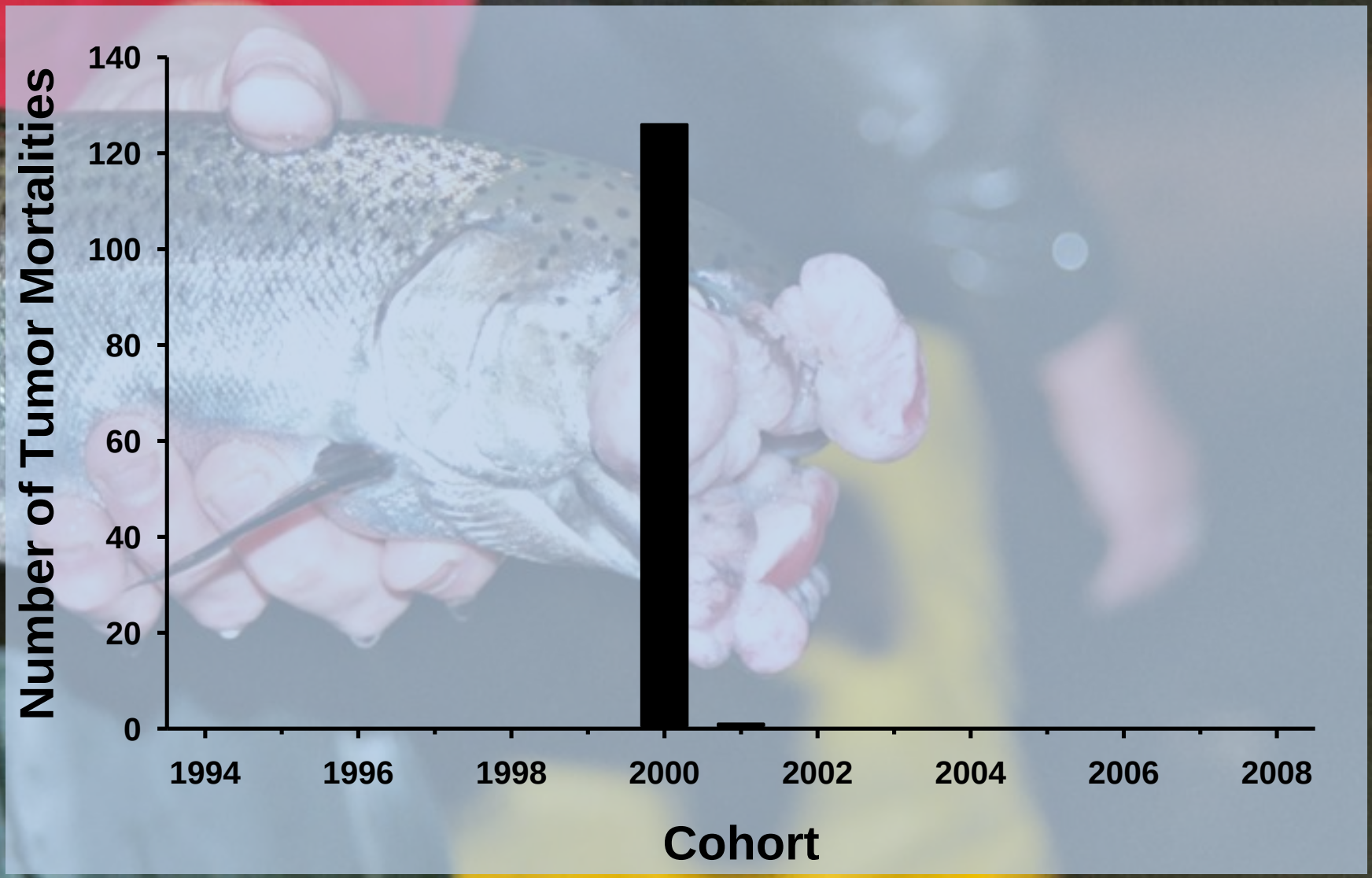
Results – Fungus



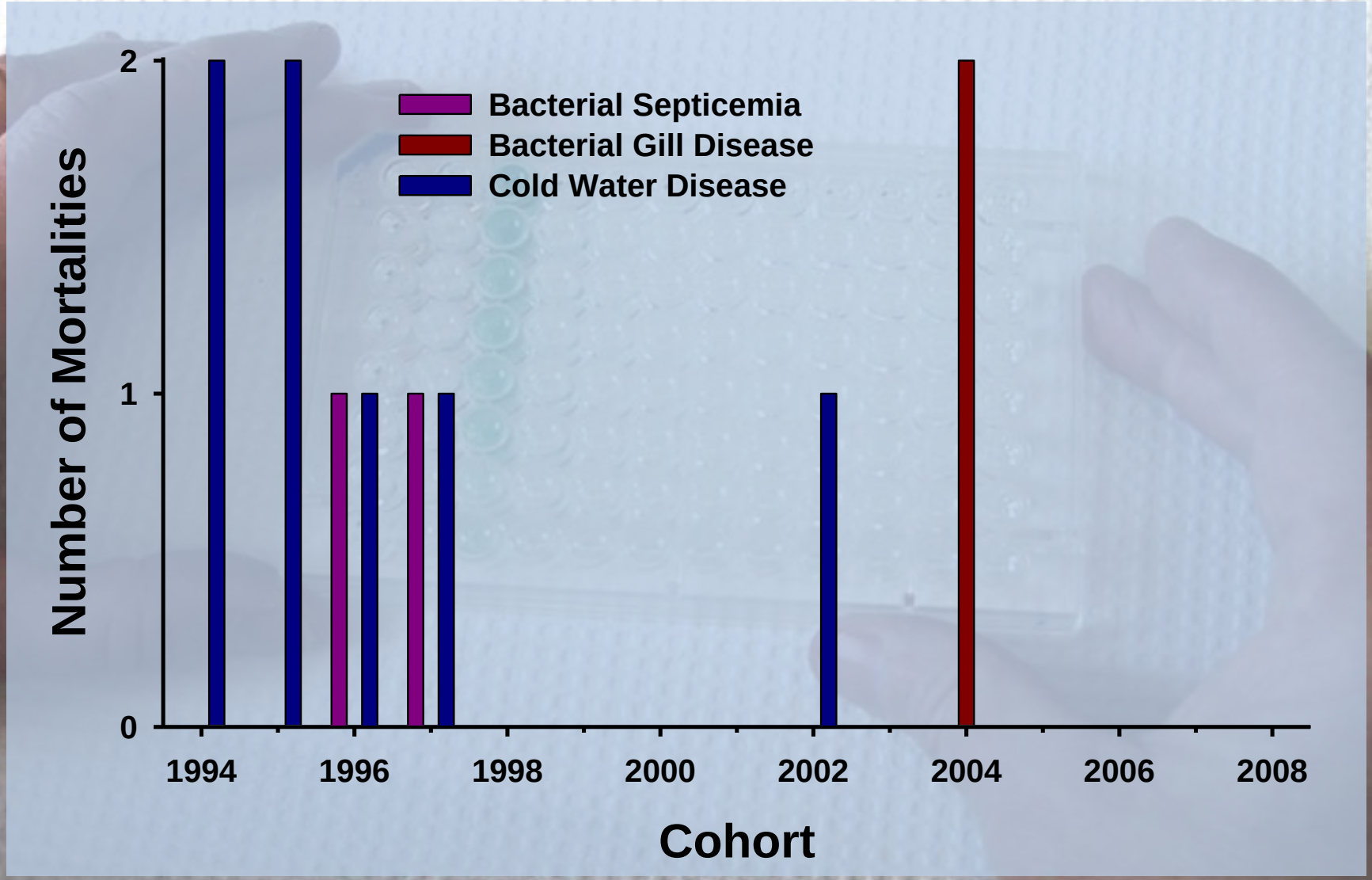
Results – Aeromonad-Pseudomonad septicemia



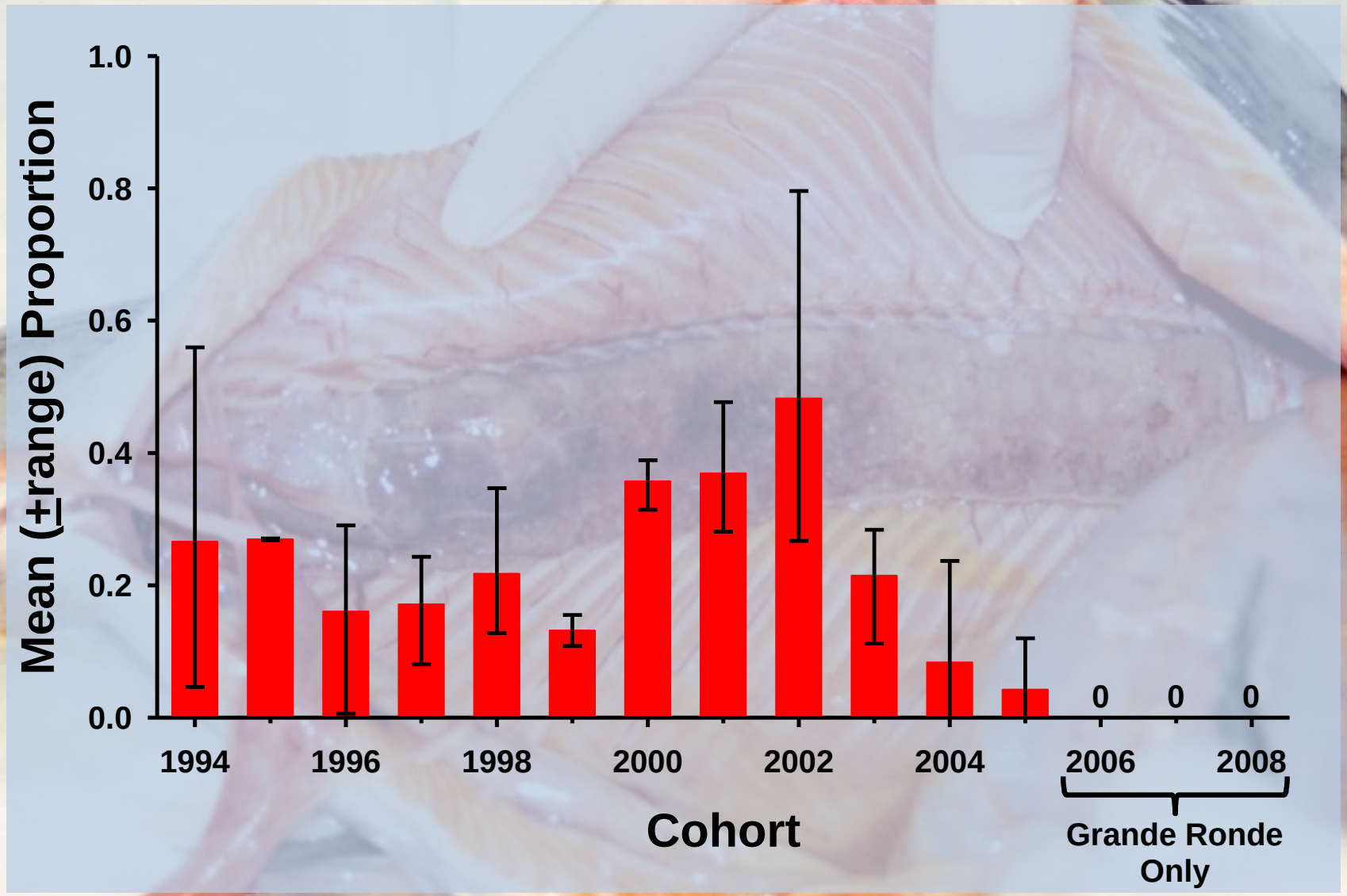
Results - Tumors



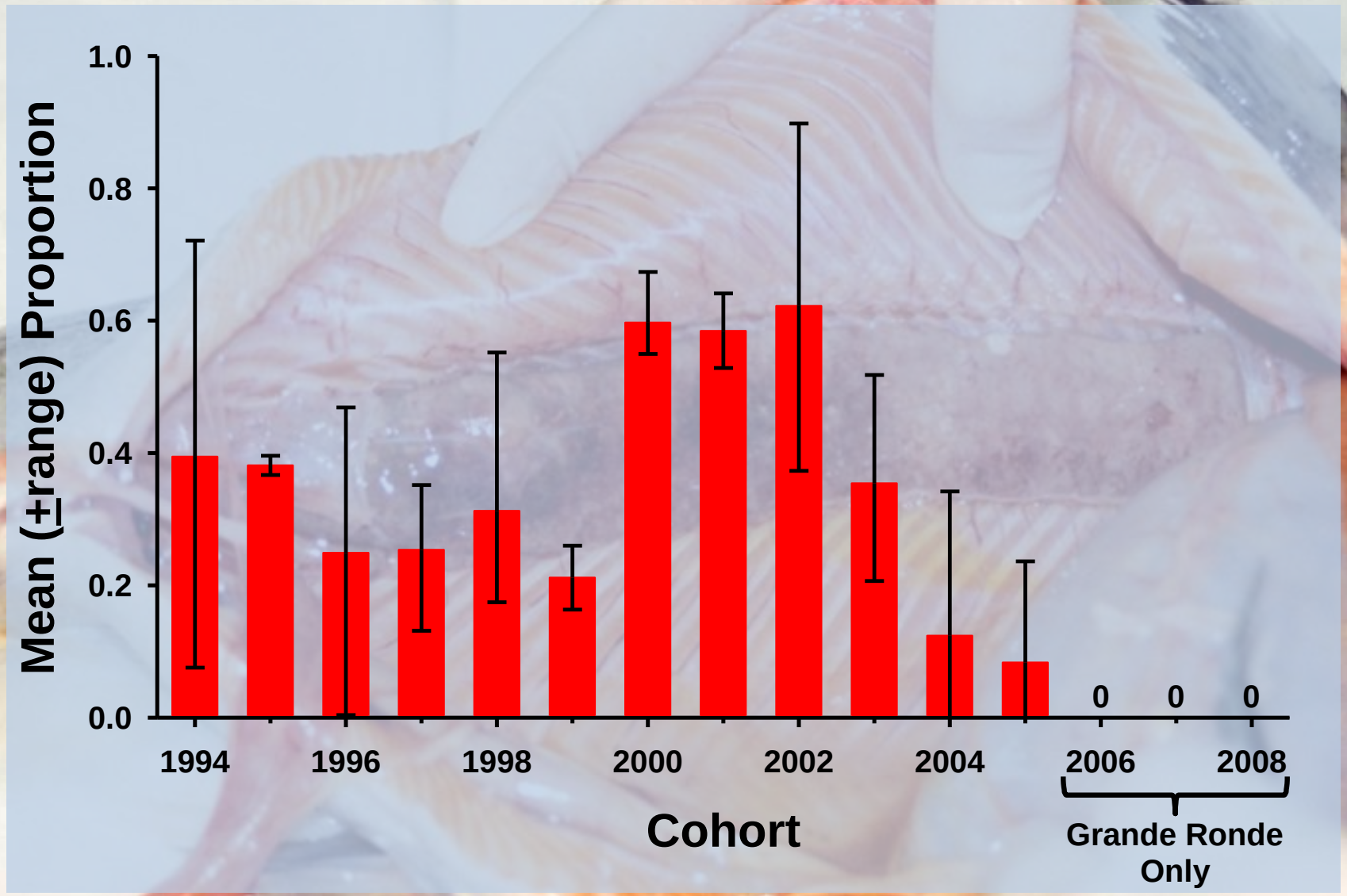
Results – Other Diseases



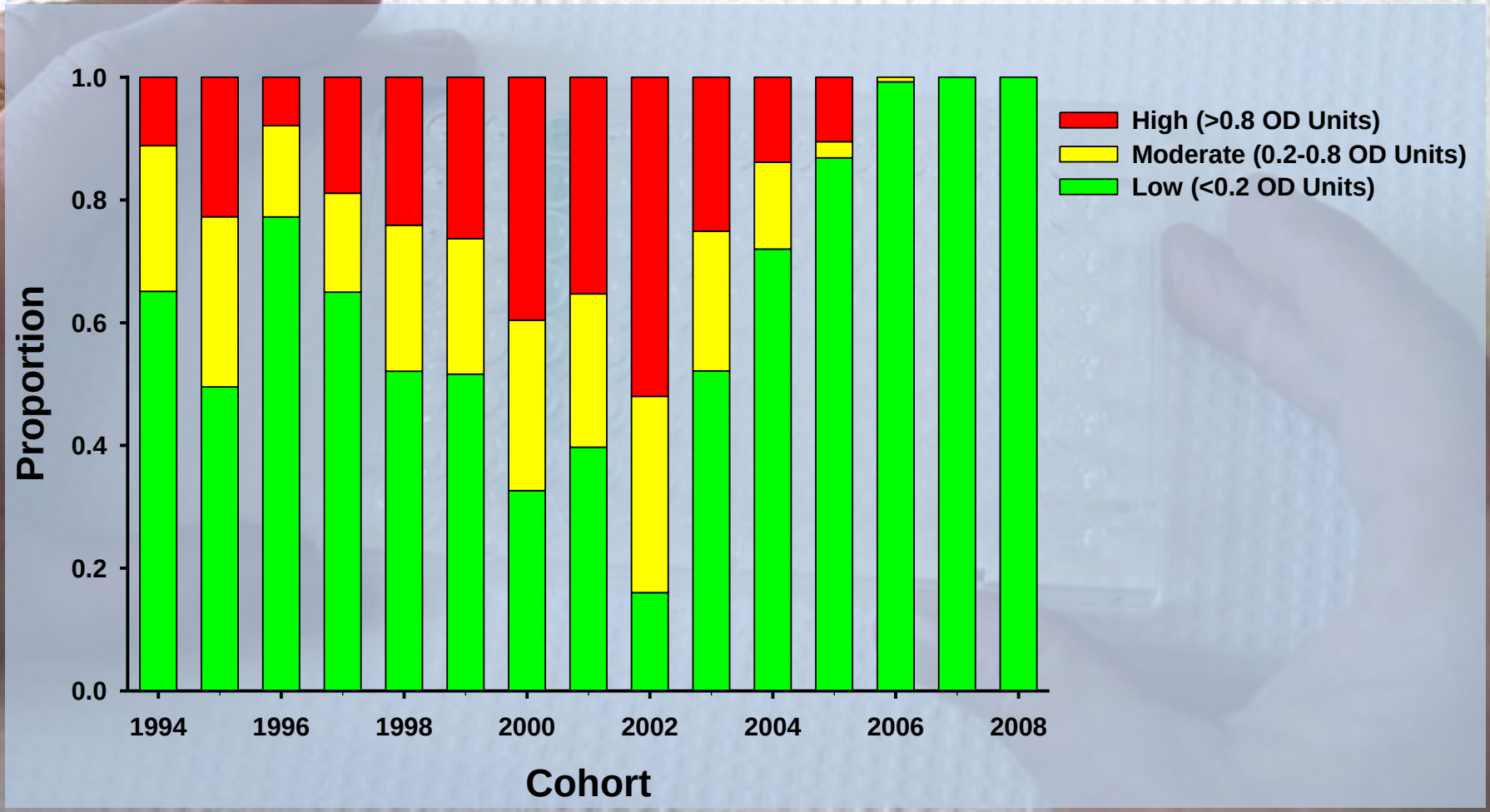
Results - BKD


Mean (±range) Proportion
1.0
0.8
0.6
0.4
0.2
0.0
0
0
0
1994
1996
1998
2000
2002
2004
2006
2008
Cohort
Grande Ronde Only

Results - BKD (Females)



Results – Spawn ELISAs

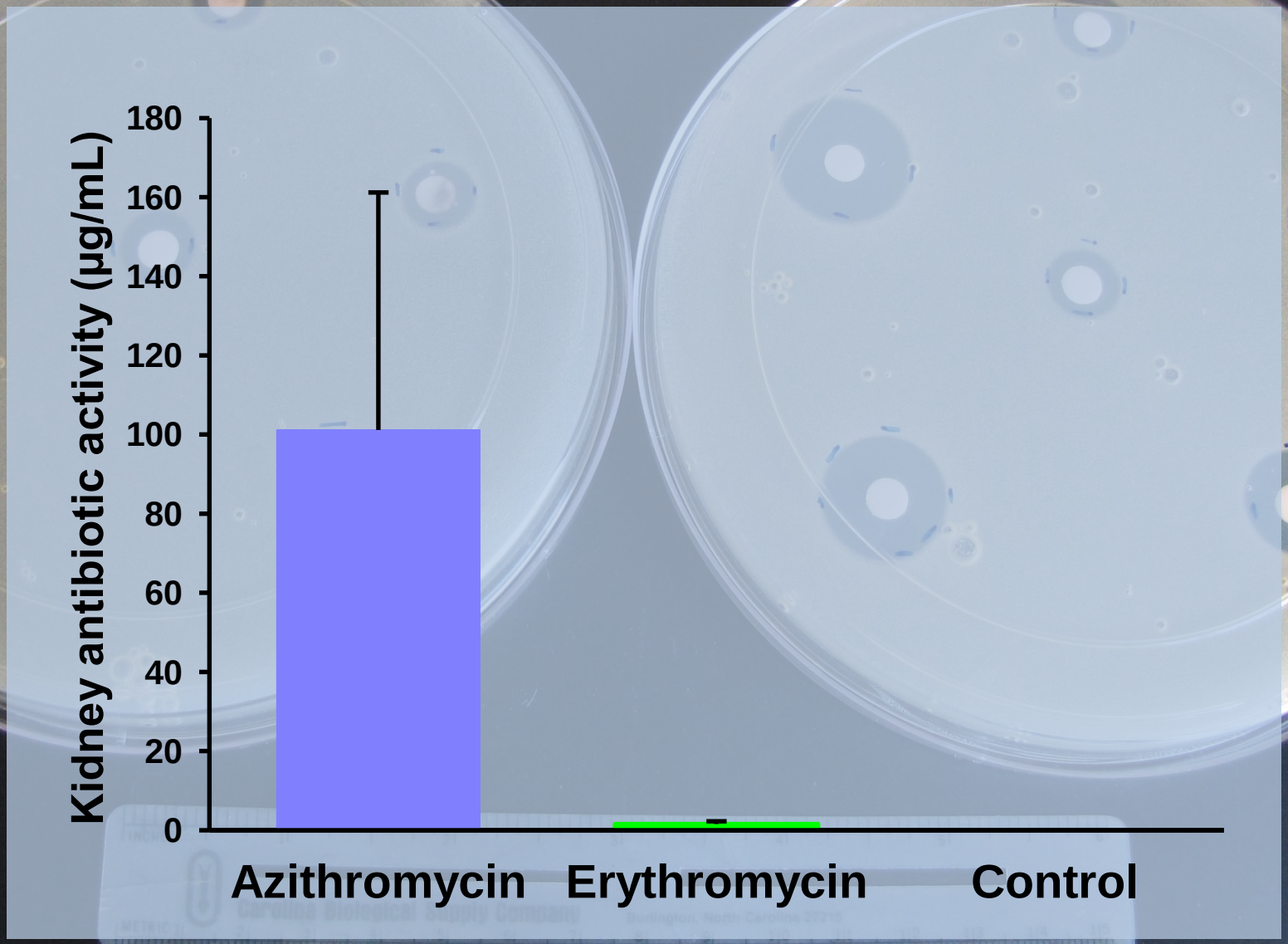


Results
Novel Strategies

Novel Strategies

- Erythromycin vs. Azithromycin
- Intraperitoneal vs. Dorsal Sinus Injections
- Vaccines
  - Renogen
  - Linda Rhodes
- Tests to Predict Vertical Transmission of BKD
  - mFAT Analysis (eggs and ovarian fluid)
  - qPCR (kidney and skein)
- Eggs vs. Parr for Populating the CBS

Novel Strategies – Erythromycin vs. Azithromycin



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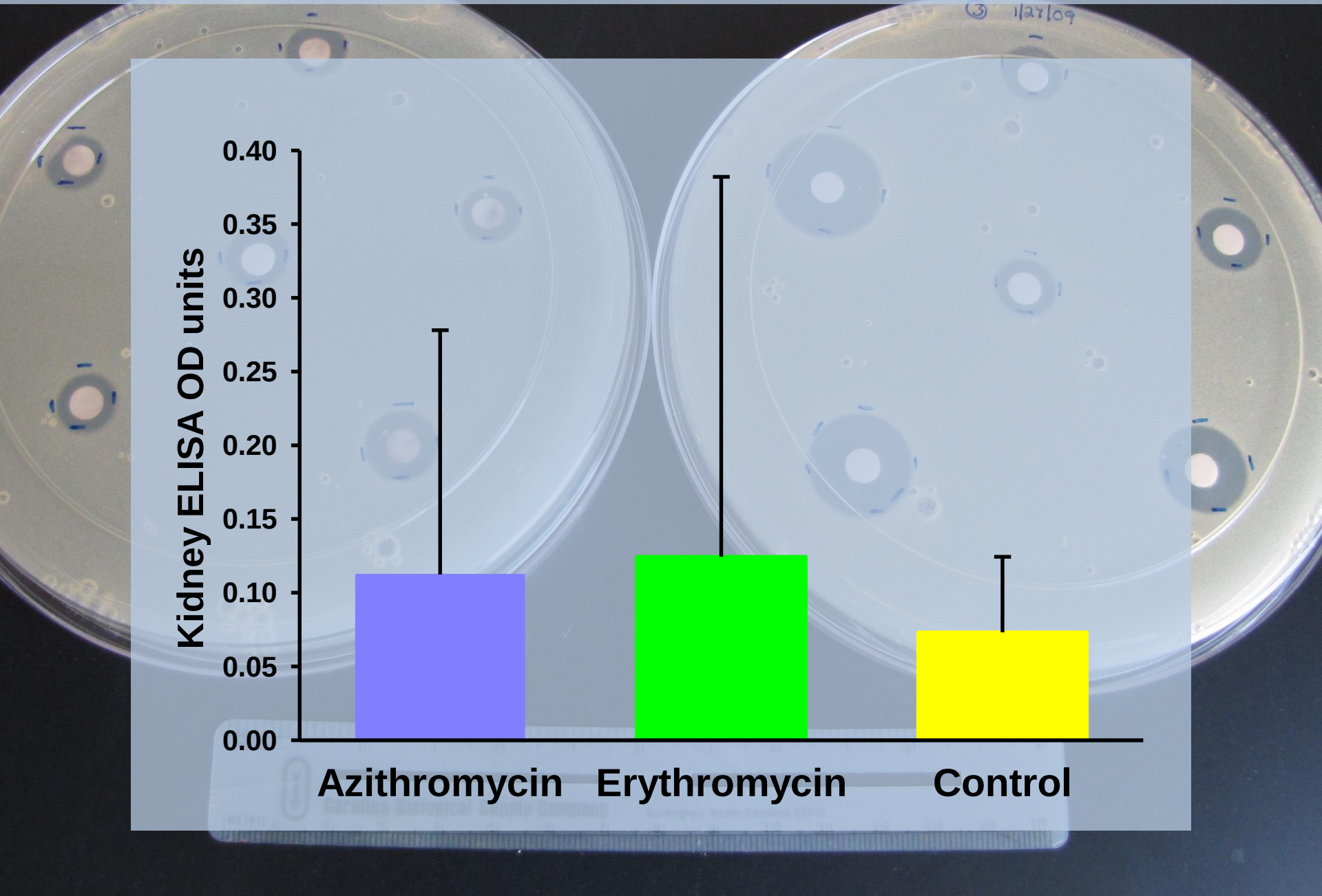

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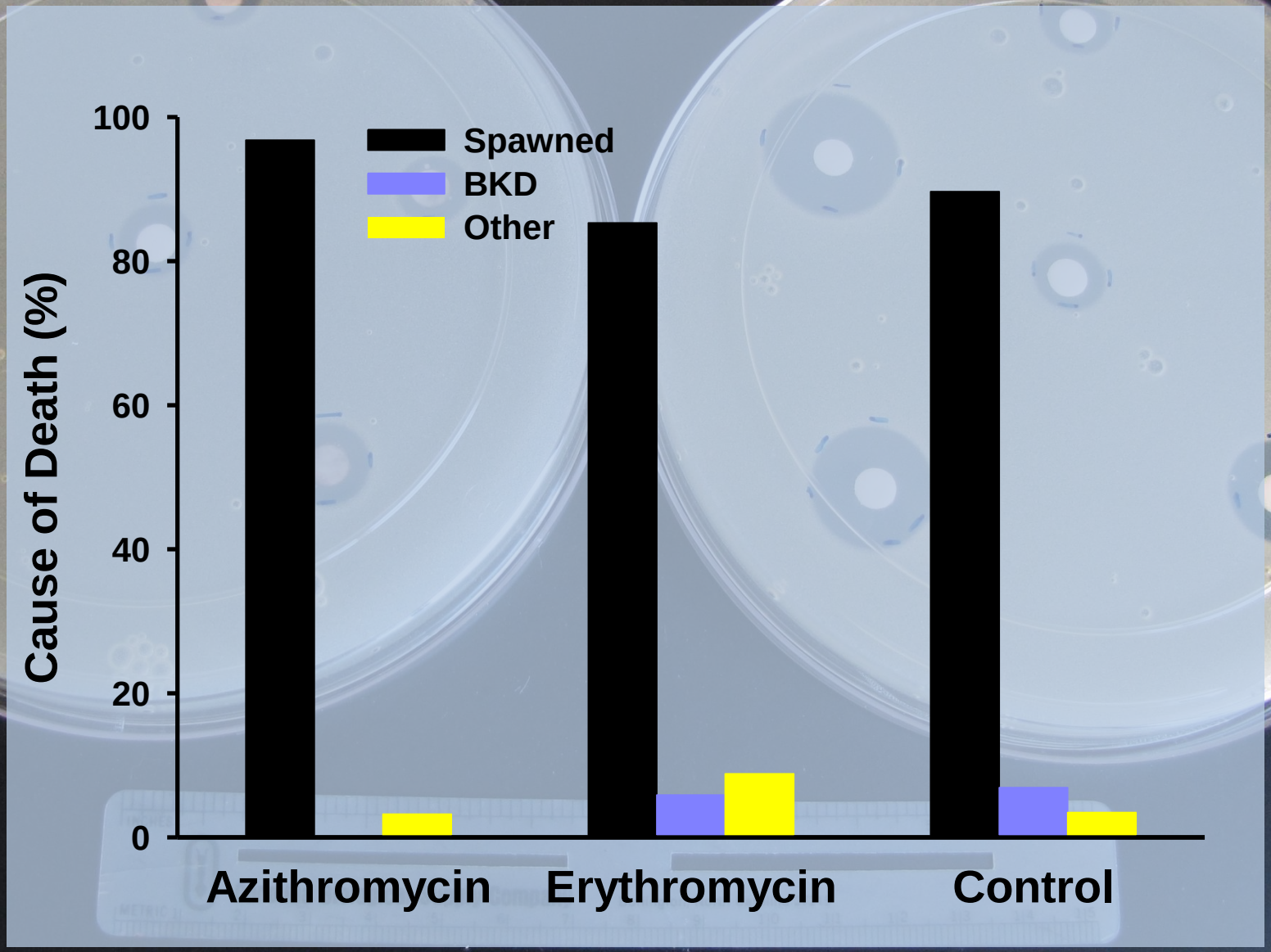
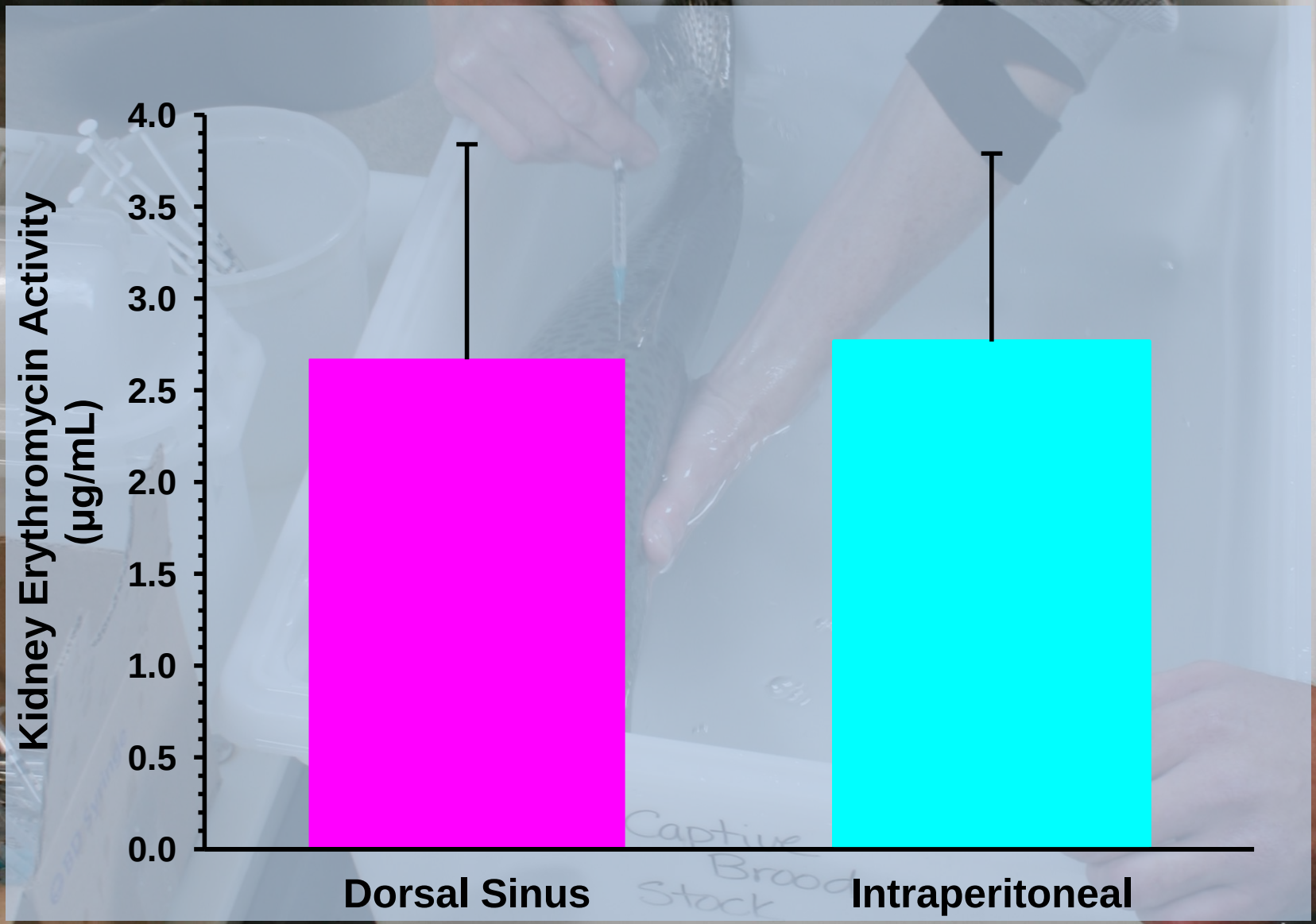


Novel Strategies – Intraperitoneal vs. Dorsal Sinus



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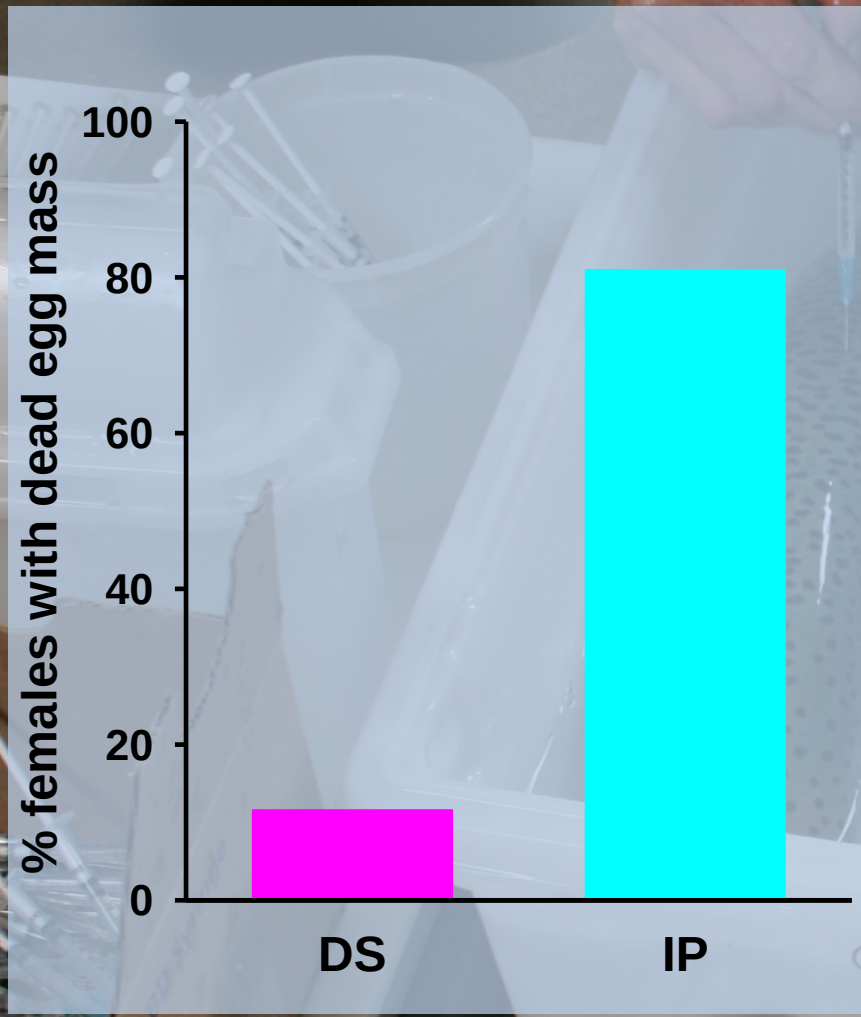

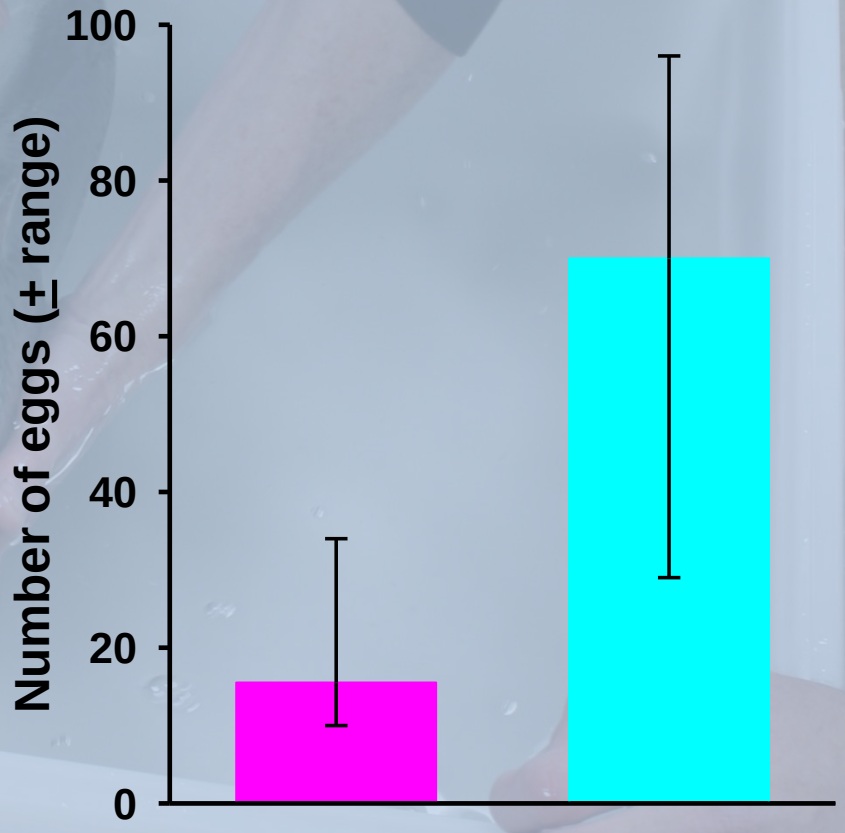

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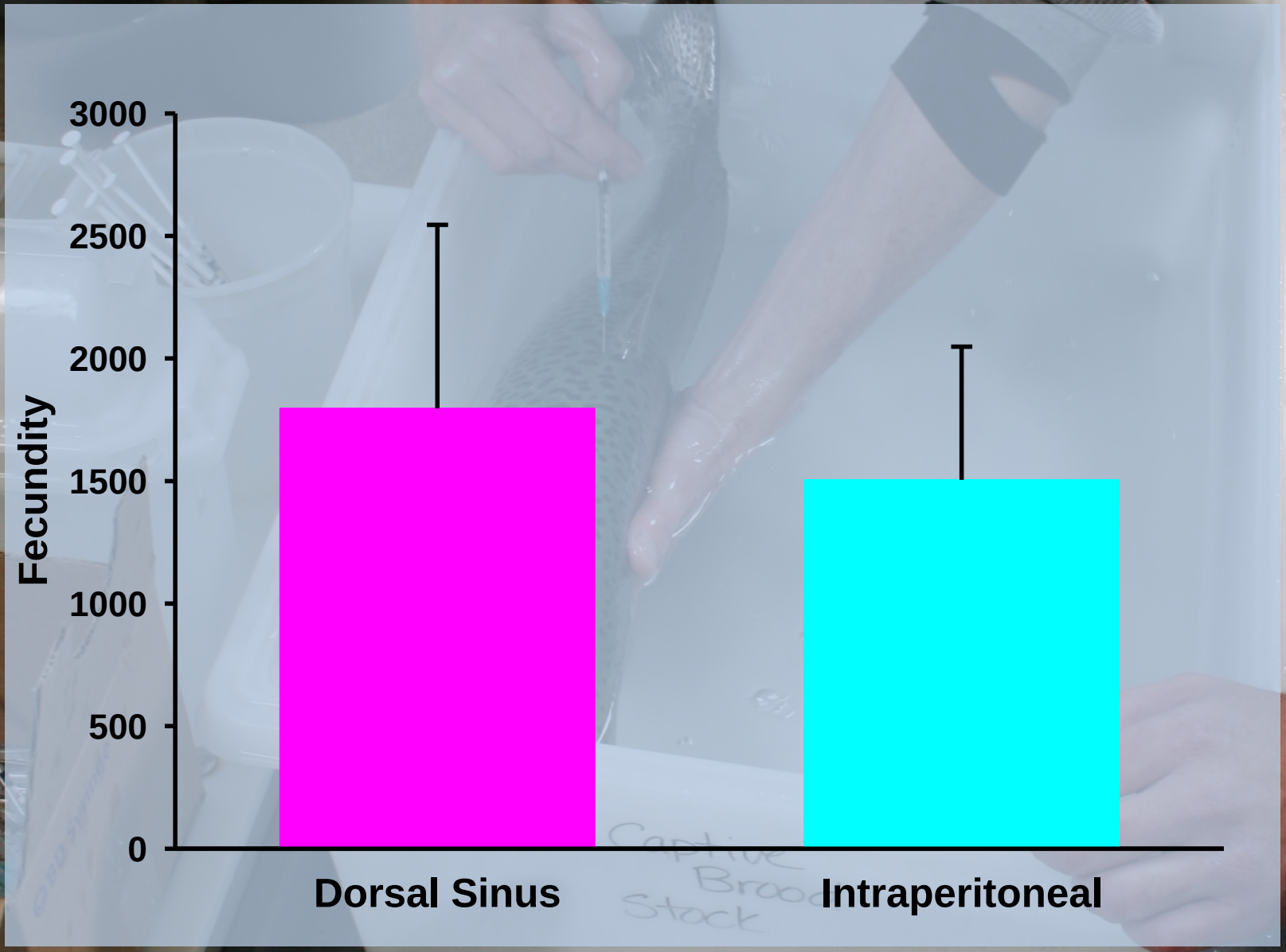
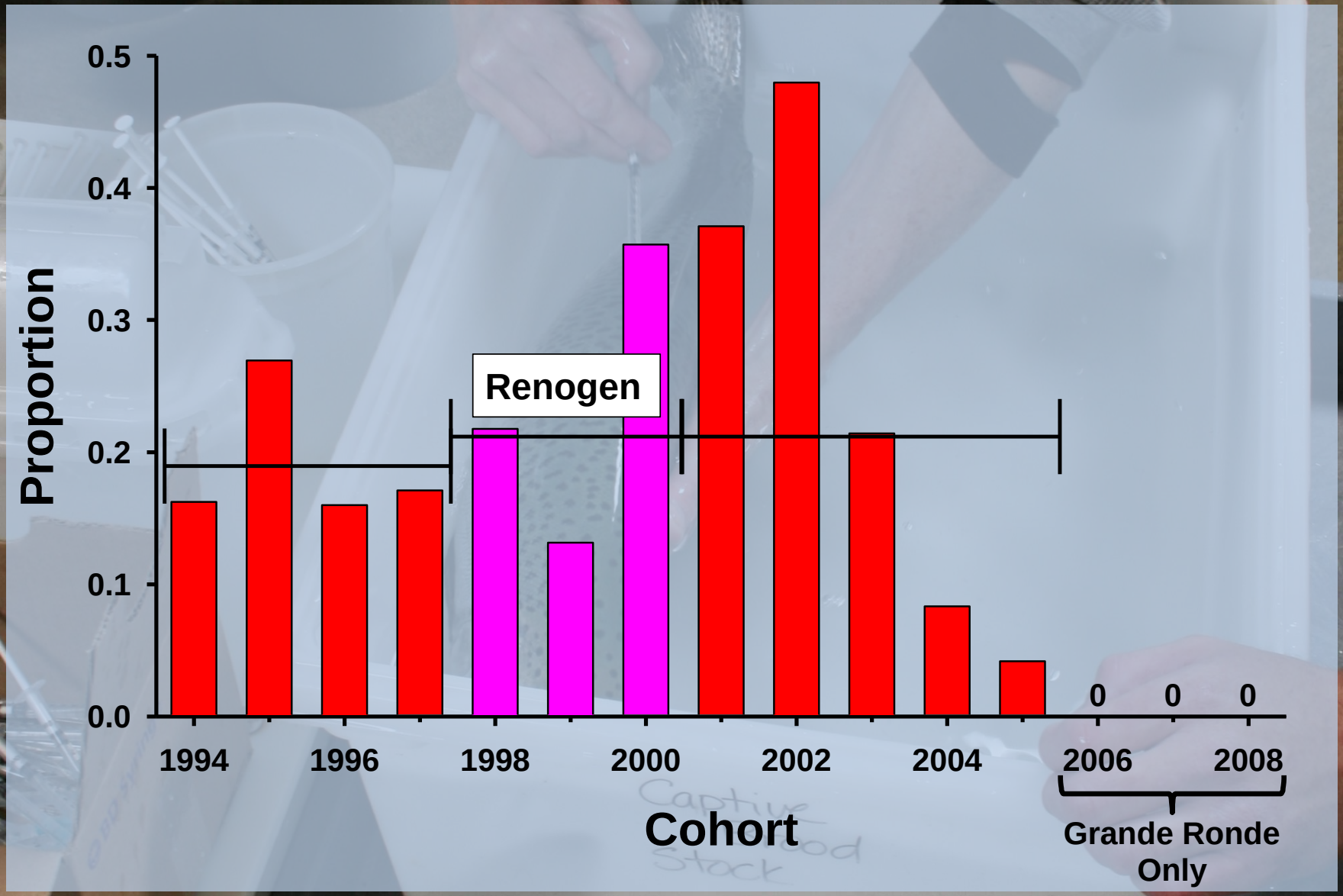
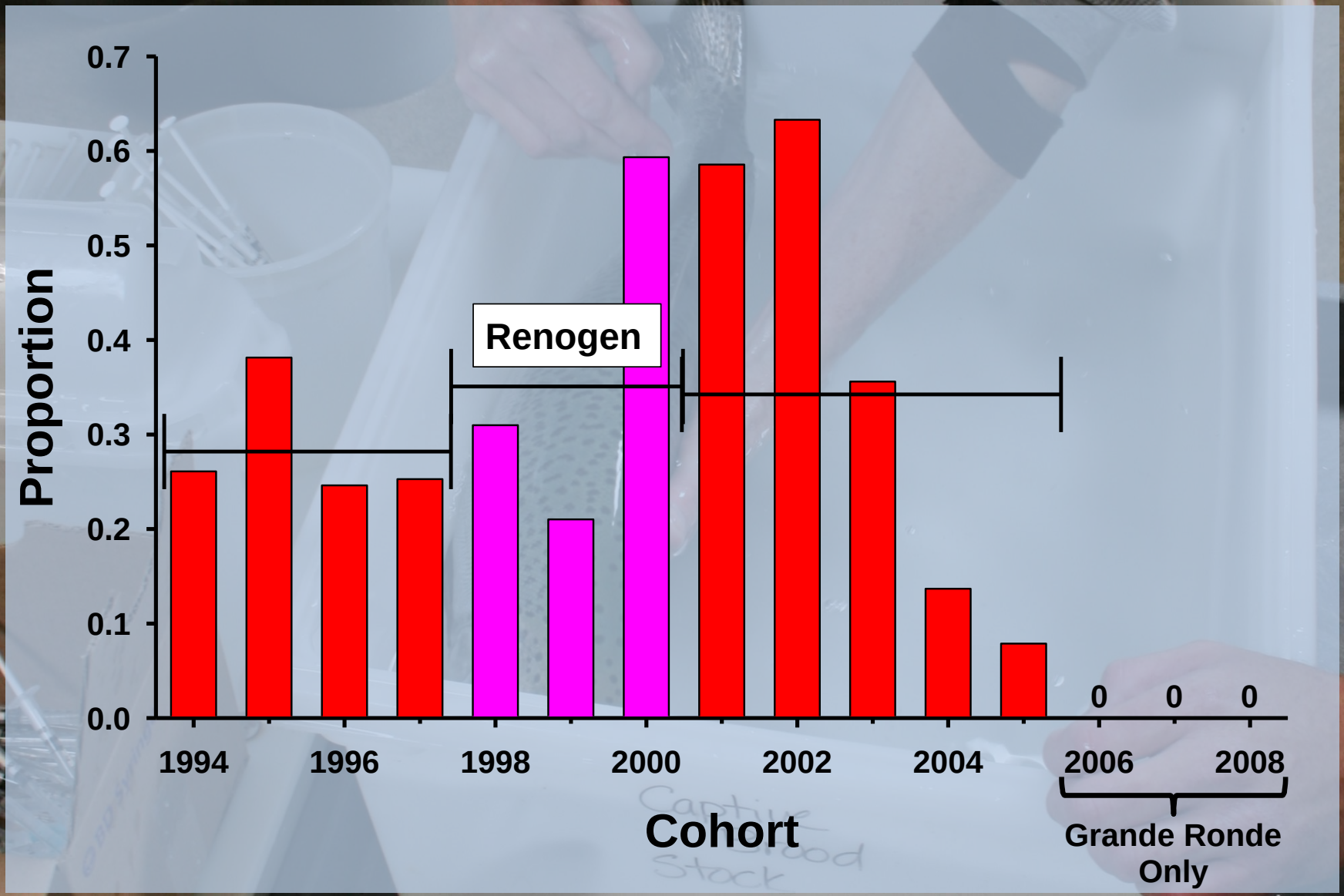


Novel Strategies – Renogen



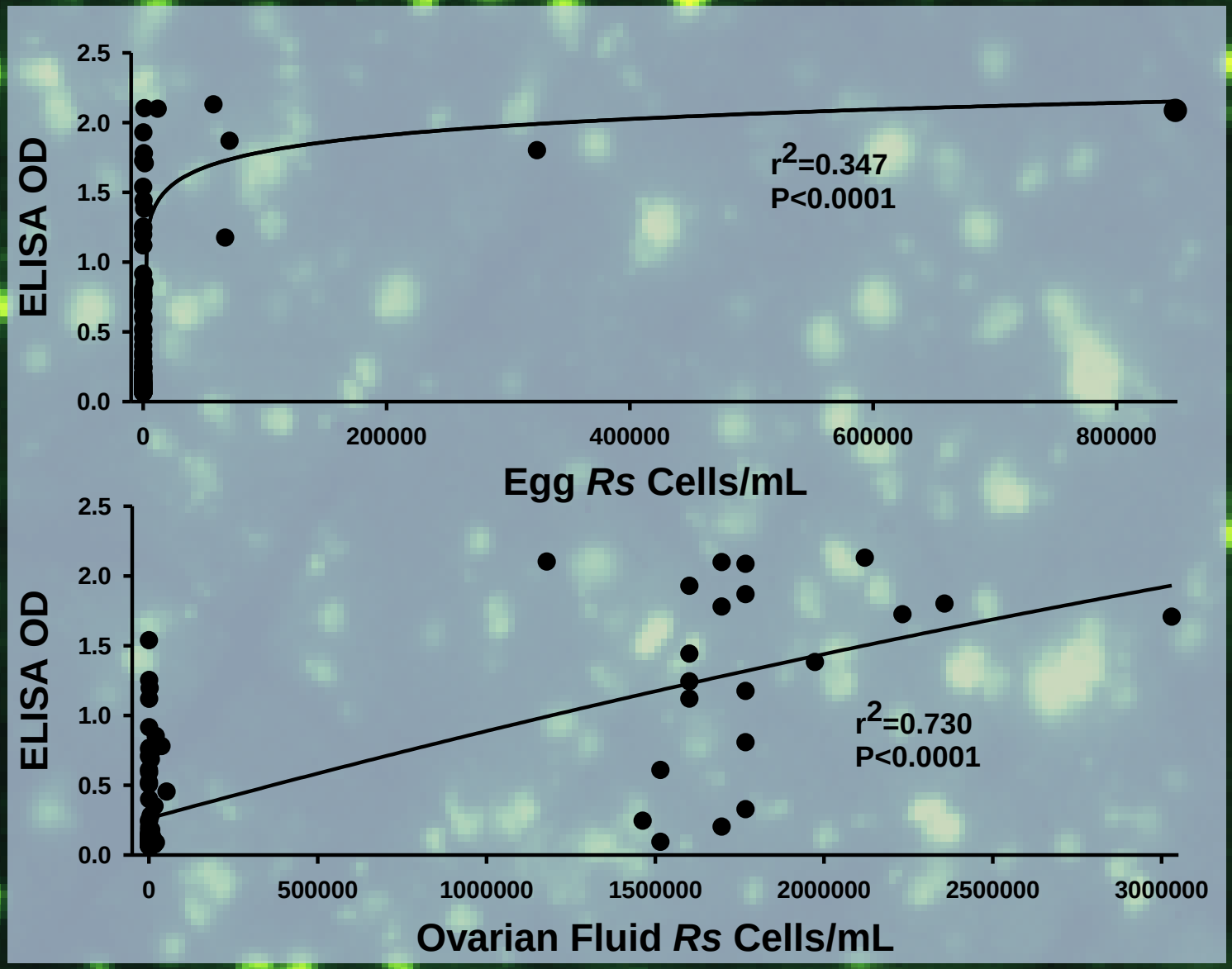
Novel Strategies – Renogen in Females



Novel Strategies – Egg/Ovarian Fluid mFAT

		Ovarian Fluid *Rs* Cells / mL	Total *Rs* Cells / mL	ELISA OD	Fecundity
Egg *Rs* Cells/mL	rho	0.31481	0.4166	0.37358	-0.0939
	P-value	0.0012	<.0001	<.0001	0.345
Ovarian Fluid *Rs* Cells / mL	rho		0.99402	0.73007	0.0305
	P-value		<.0001	<.0001	0.761
Total *Rs* Cells / mL	rho			0.74223	0.0189
	P-value			<.0001	0.851
ELISA OD	rho				0.0681
	P-value				0.494

Novel Strategies – Mary's mFAT



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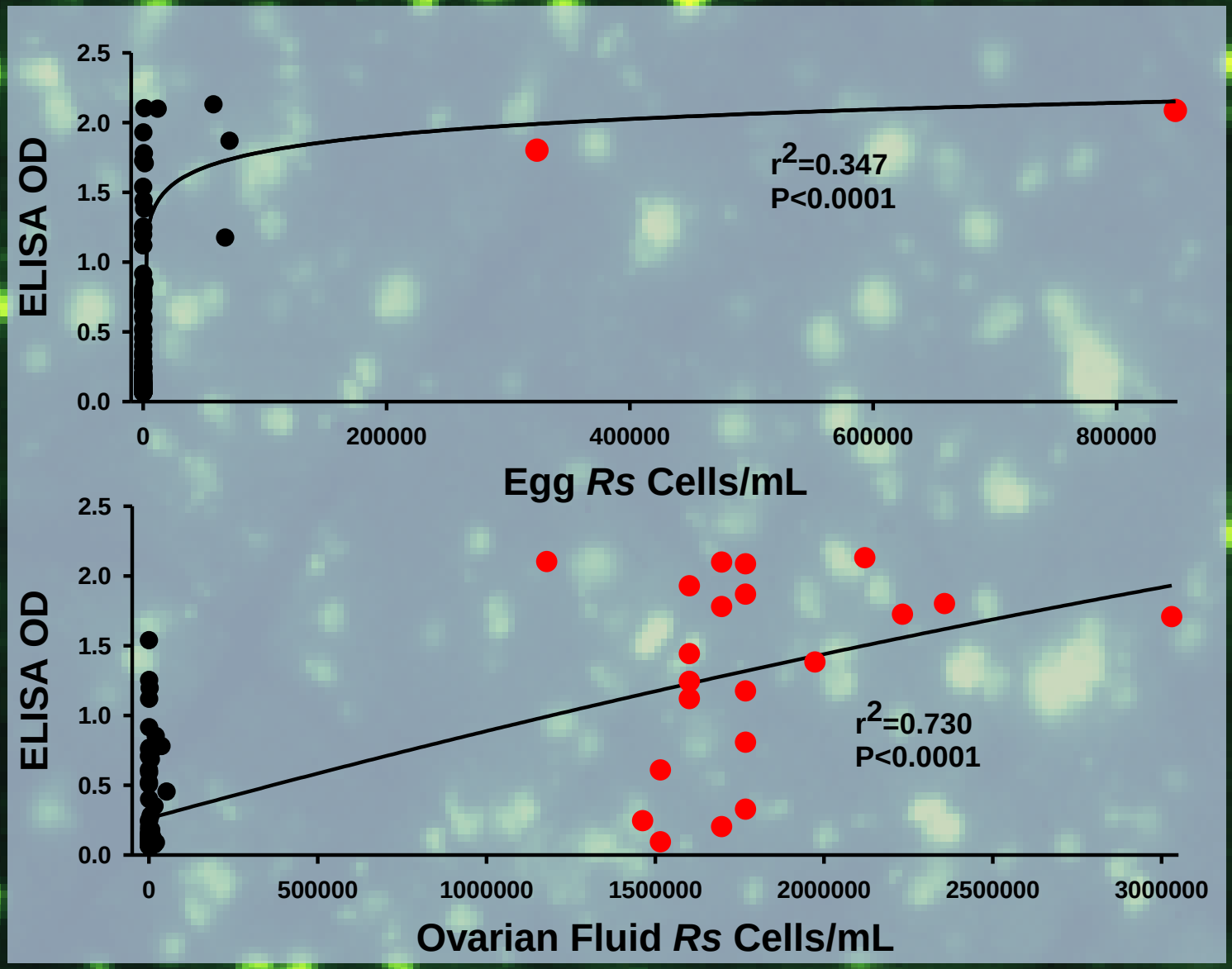

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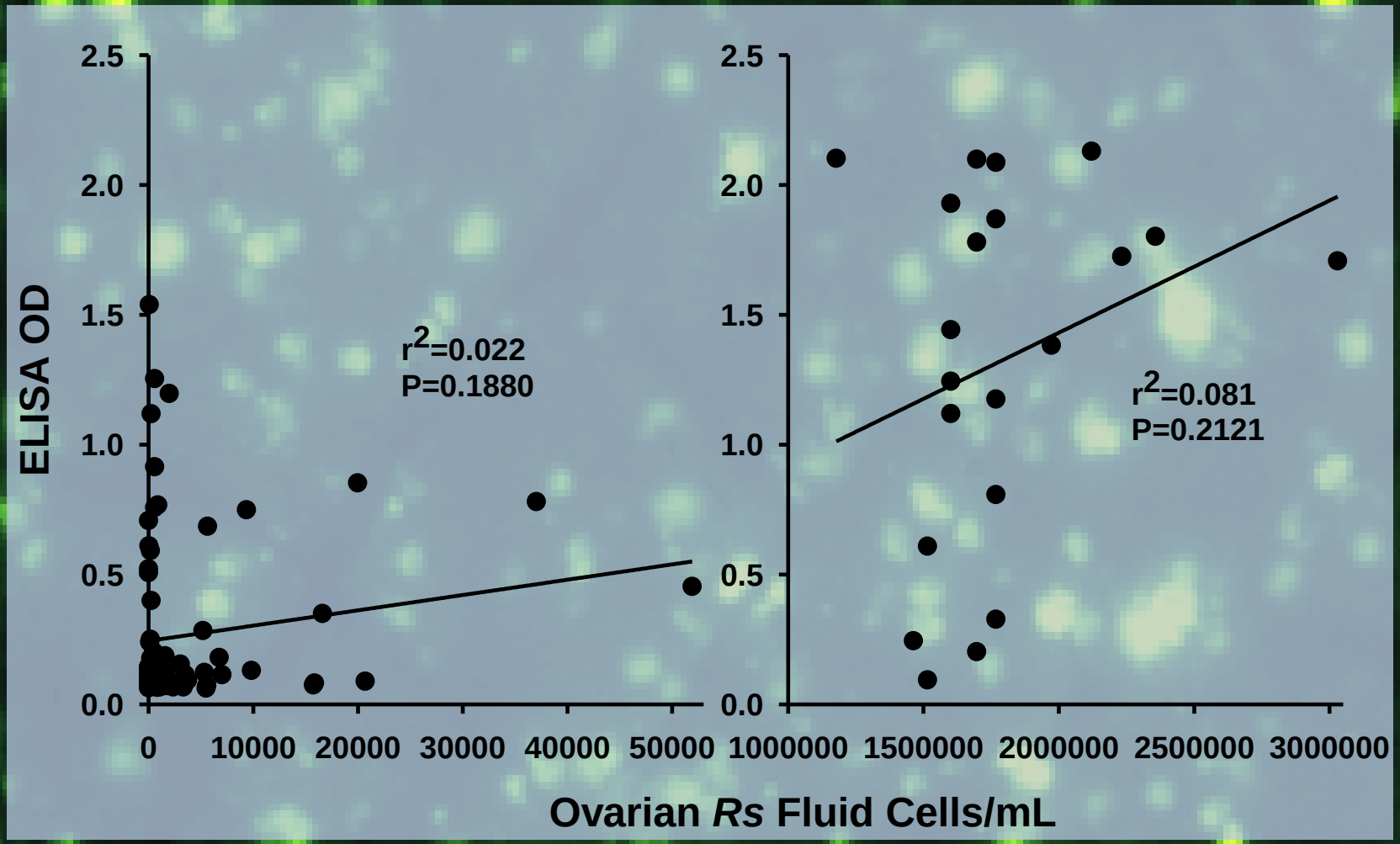

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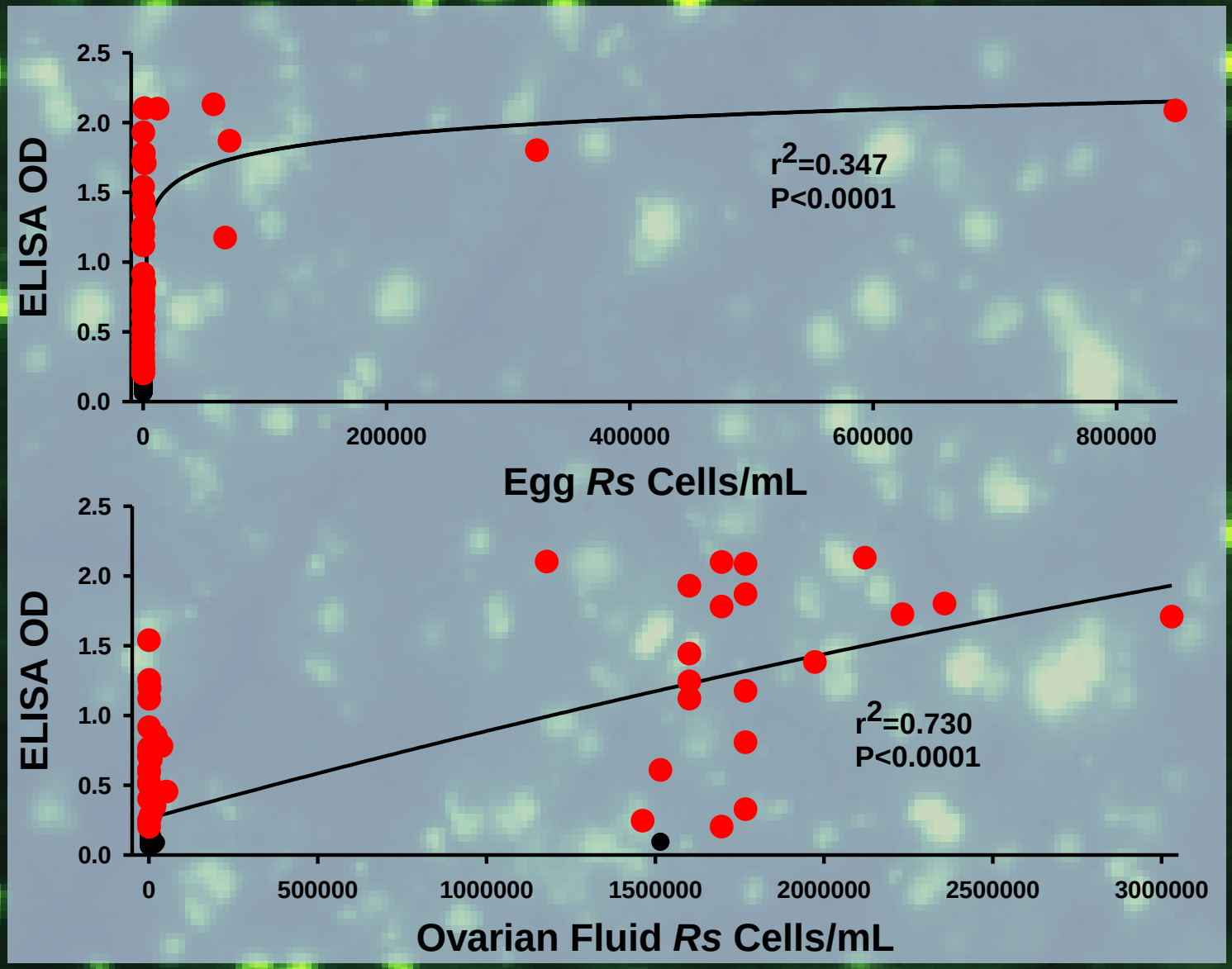

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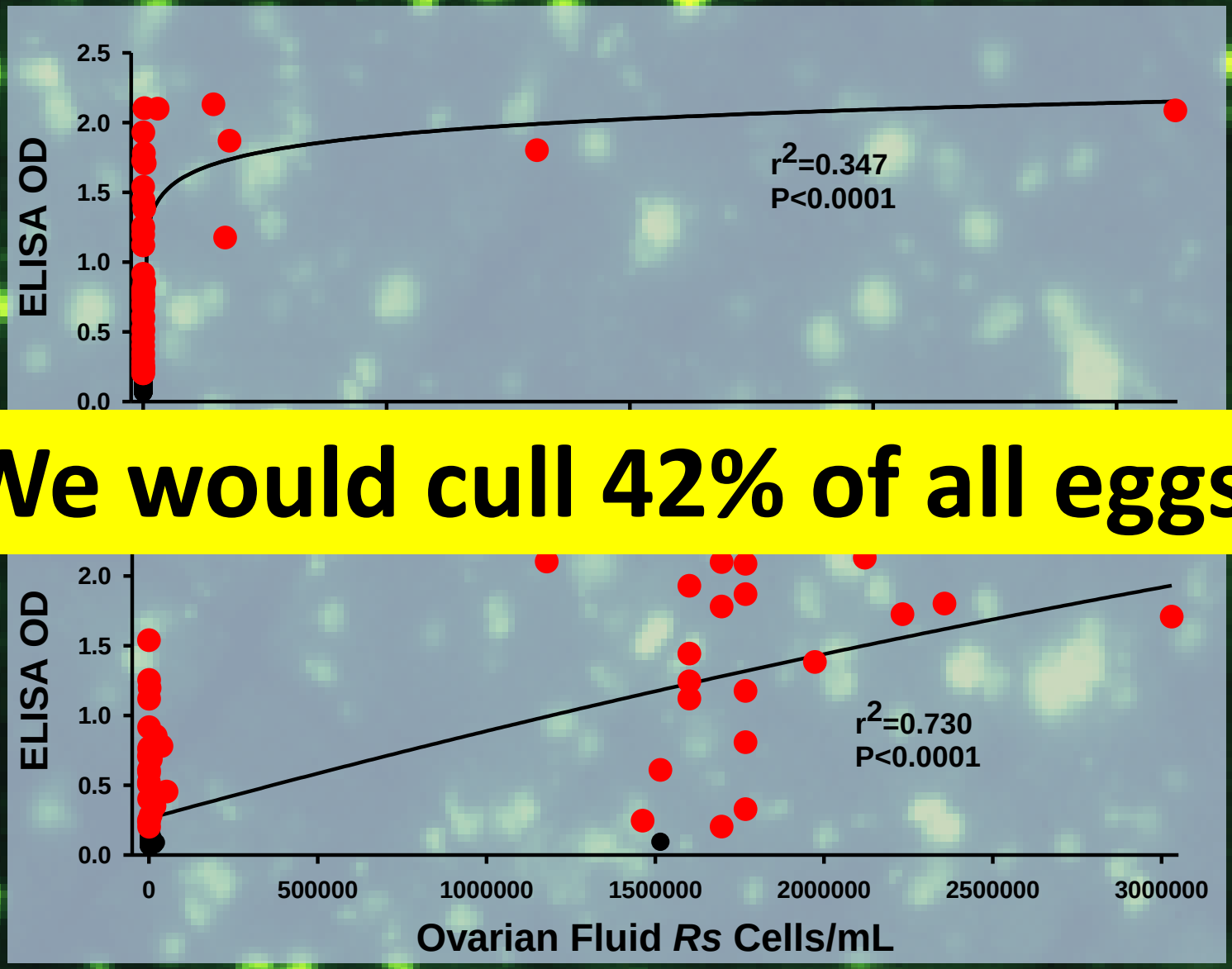

We would cull 42% of all eggs.

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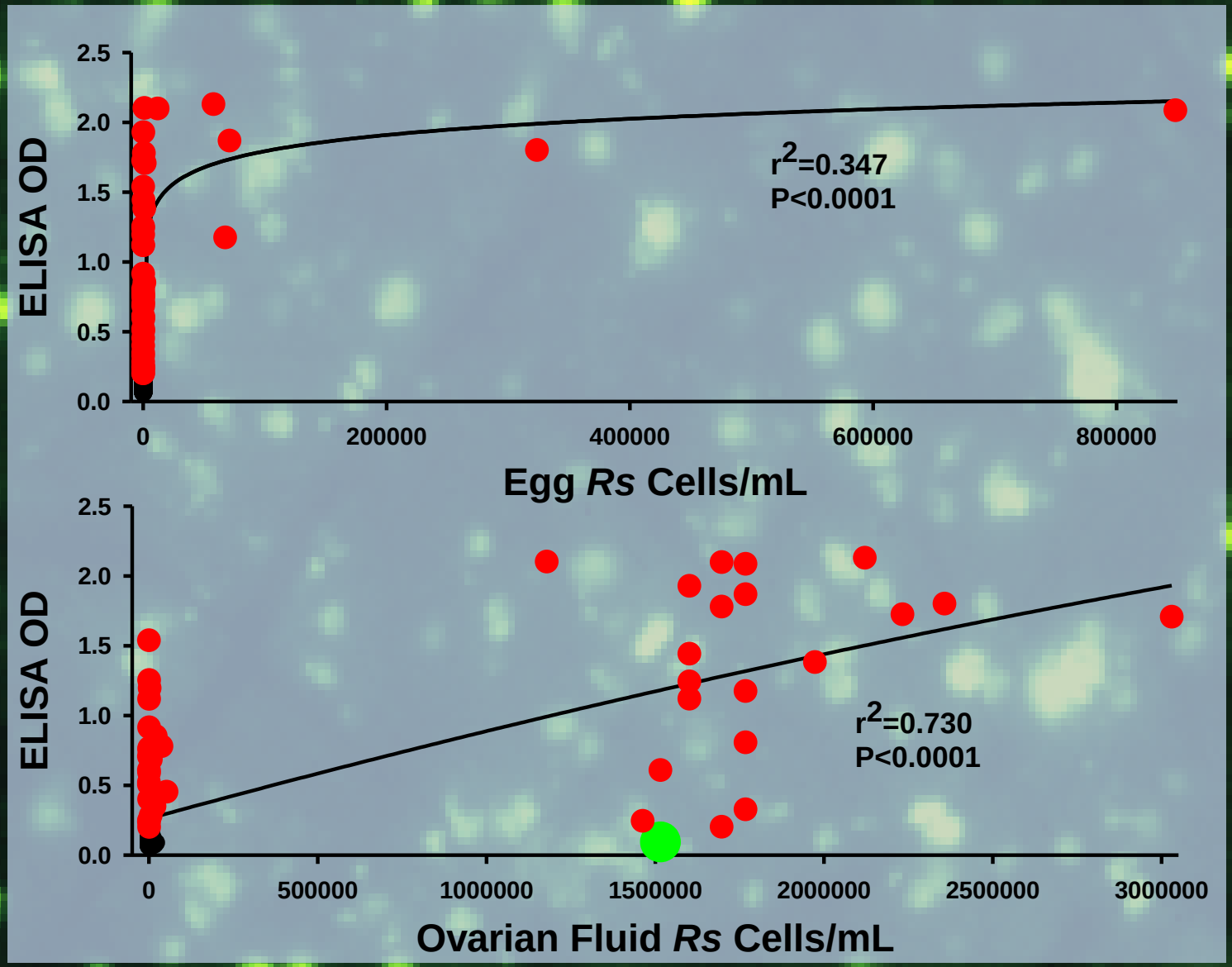

Novel Strategies – Lab Methods for Vertical Transmission

	Kidney		Skein		Ovarian Fluid
Fish	ELISA OD	qPCR	ELISA OD	qPCR	mFAT (cells/mL)
17	0.25	20	0.06	59	642
7	0.07	172	0.055	274	386
14	0.136	44	0.053	26	992
6	0.109	836	0.055	540	441
16	0.071	65	0.059	528	1255
1	0.1	56	0.057	939	4630
4	0.31	168	0.06	237	7889
10	1.094	517	0.07	9,331	20000
13	0.859	68	0.148	19	47842
12	0.451	167	0.071	159	84553
18	1.157	128,793	0.116	295	882
11	0.317	37	0.345	199,008	315
15	0.819	5,374	0.186	275,265	50709
5	1.489	1,487,069	0.661	382,536	93480
9	1.865	35,345	0.975	4,878,049	1000000
2	1.214	597,701	1.482	17,158,806	200000
3	2.29	30,431,034	2.083	31,976,857	1000000
8	1.414	279,138	1.728	193,587,417	1000000
Minimum	0.07	20	0.053	19	315
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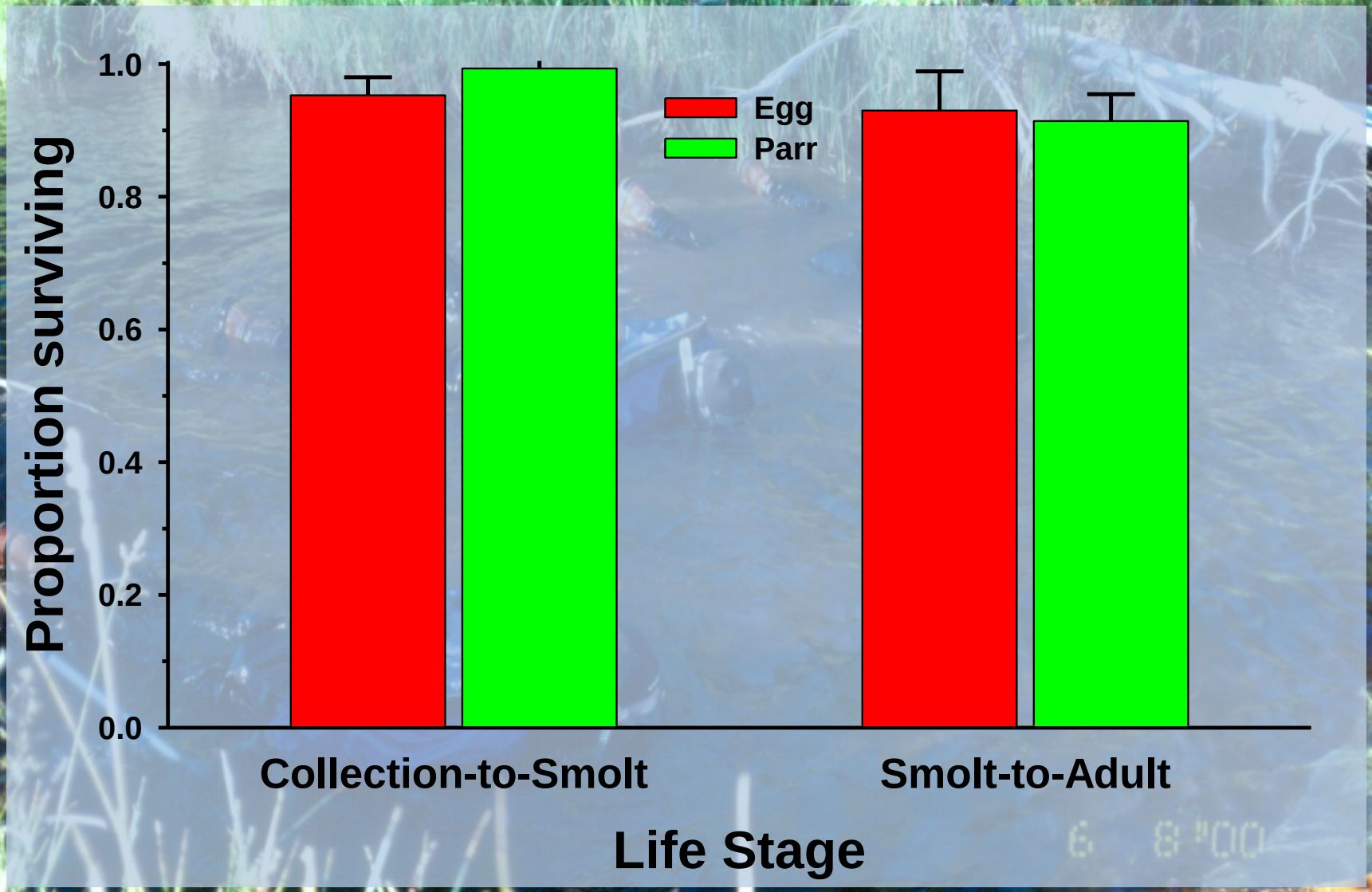
Novel Strategies – Eggs vs. Parr



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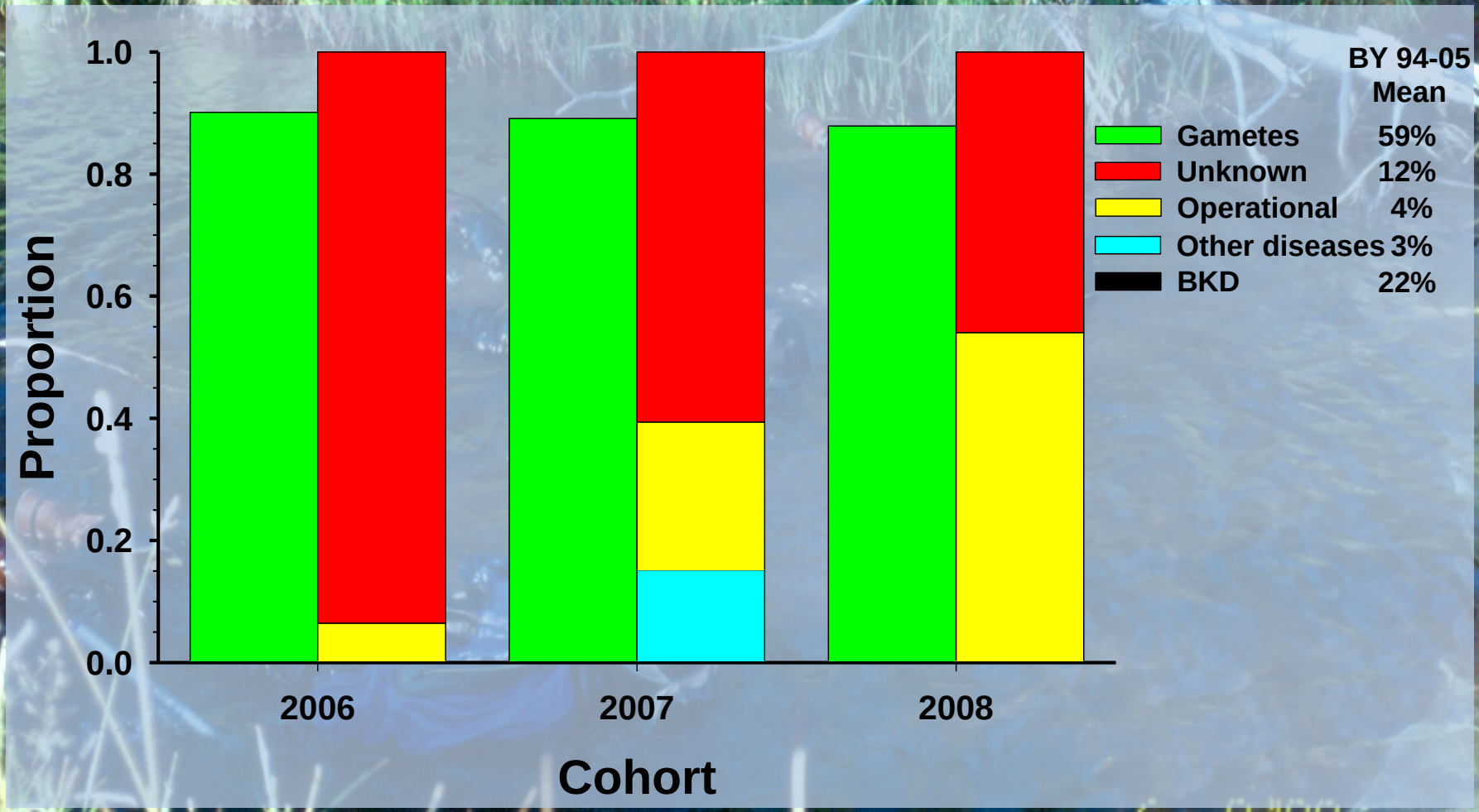

Conclusions

- Bacterial kidney disease was the worst disease in the Captive Broodstock Program.
  - Killed a mean of 22% of the CBS.
  - Killed up to 80% (90% of females) of a stock and cohort (BY 2002 GR).
- Tumors resulted in the deaths of 34% of the BY 2000 GR.
  - 22% of females (BKD killed 68%).
- No other disease killed more than 1% of the total CBS.
- Fungus deaths were nearly all maturing salmon.
- BKD vaccines were not effective.

Recommendations

- Use dorsal sinus injections.
- Use Azithromycin, if possible.
- Replace ELISA for culling determinations.
  - Find a method that is quick and directly measures Rs infection of eggs.
  - Test new methods from spawn through smolting of offspring (or even return of adults).
- Collect the Captive Broodstock early.
  - Presmolt rearing should be slow to reduce precocious maturation.
  - If eggs, incubate in cold water.

TRADITION

JUST BECAUSE YOU'VE ALWAYS DONE IT THAT WAY
DOESN'T MEAN IT'S NOT INCREDIBLY STUPID.

RISKS

If You Never Try Anything New,
You'll Miss Out on Many of Life's Great Disappointments.

Acknowledgements

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