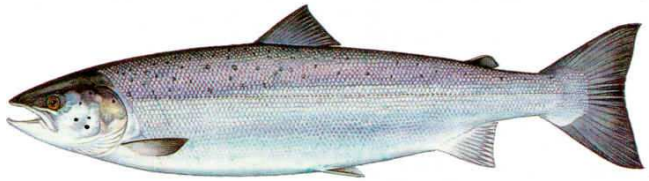
GROUNDWATER

& THE FUTURE OF SALMON



ON EARTH

Craig Orr, Watershed Watch

Fraser Assembly

Important Message About Water, Salmon, & **Us**

Fraser Assembly

Water = Wild Salmon in Our Future

Fraser Assembly

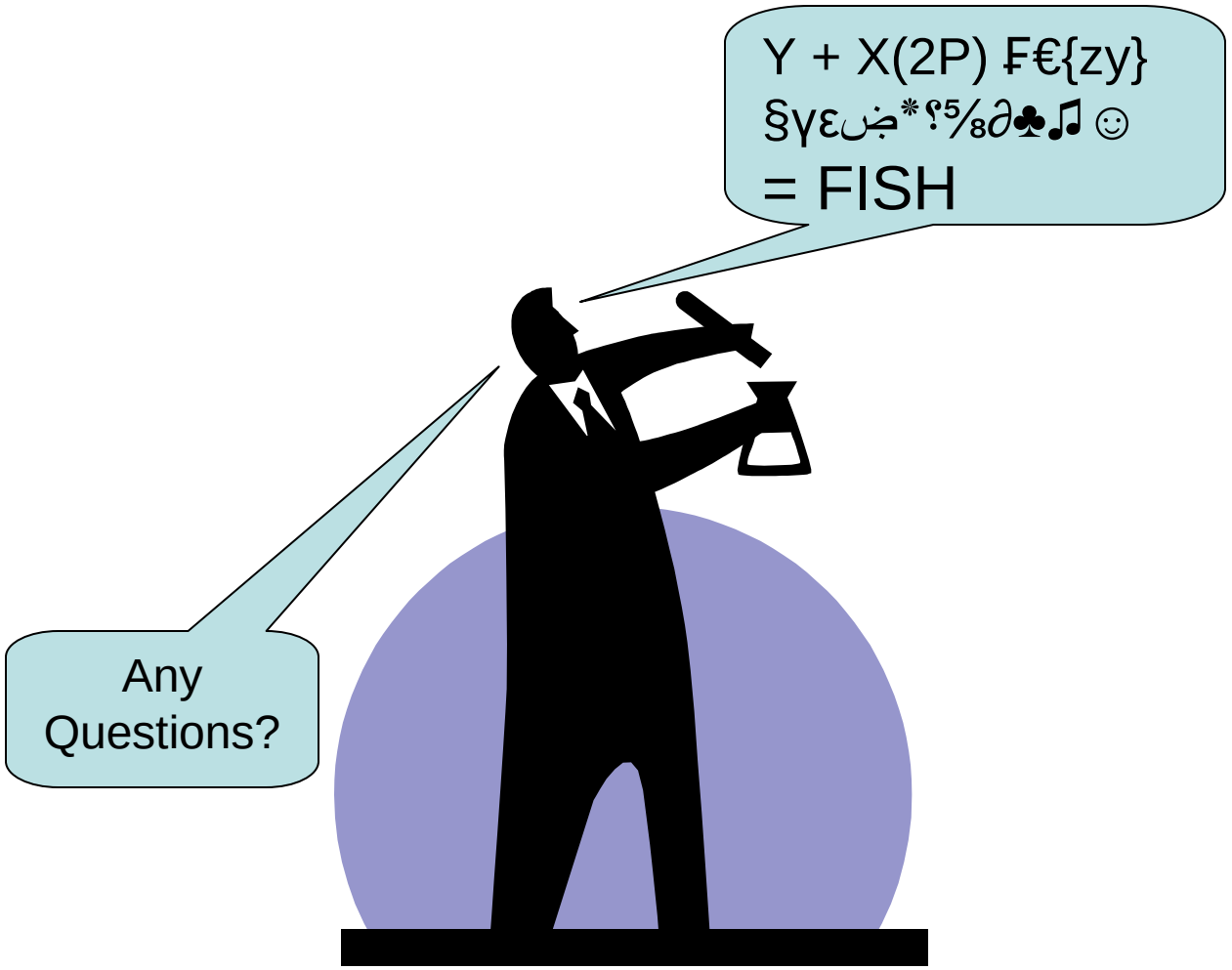
But so too is **$E = MC^2$**

Fraser Assembly

Factor **Resilience** into equation

Search for what
is enduring

Imparting Important Messages



Resilience Lessons

CREATOR

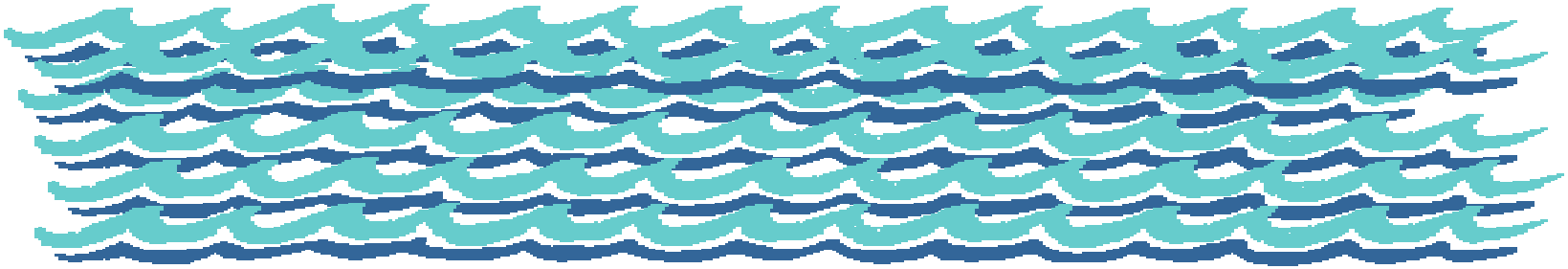
Go Even Bigger

What can we deduce about Creator’s grand scheme just by looking & logic?

Creator’s Inordinate Fondness

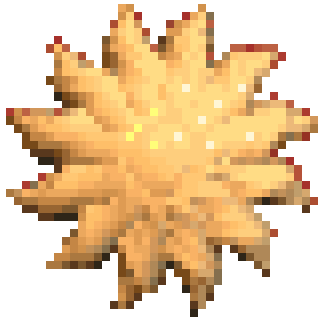
For Beetles…

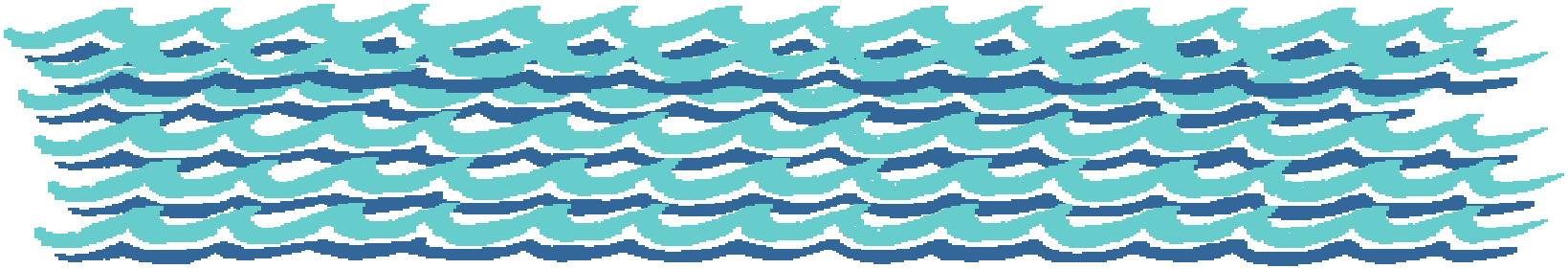
…and for

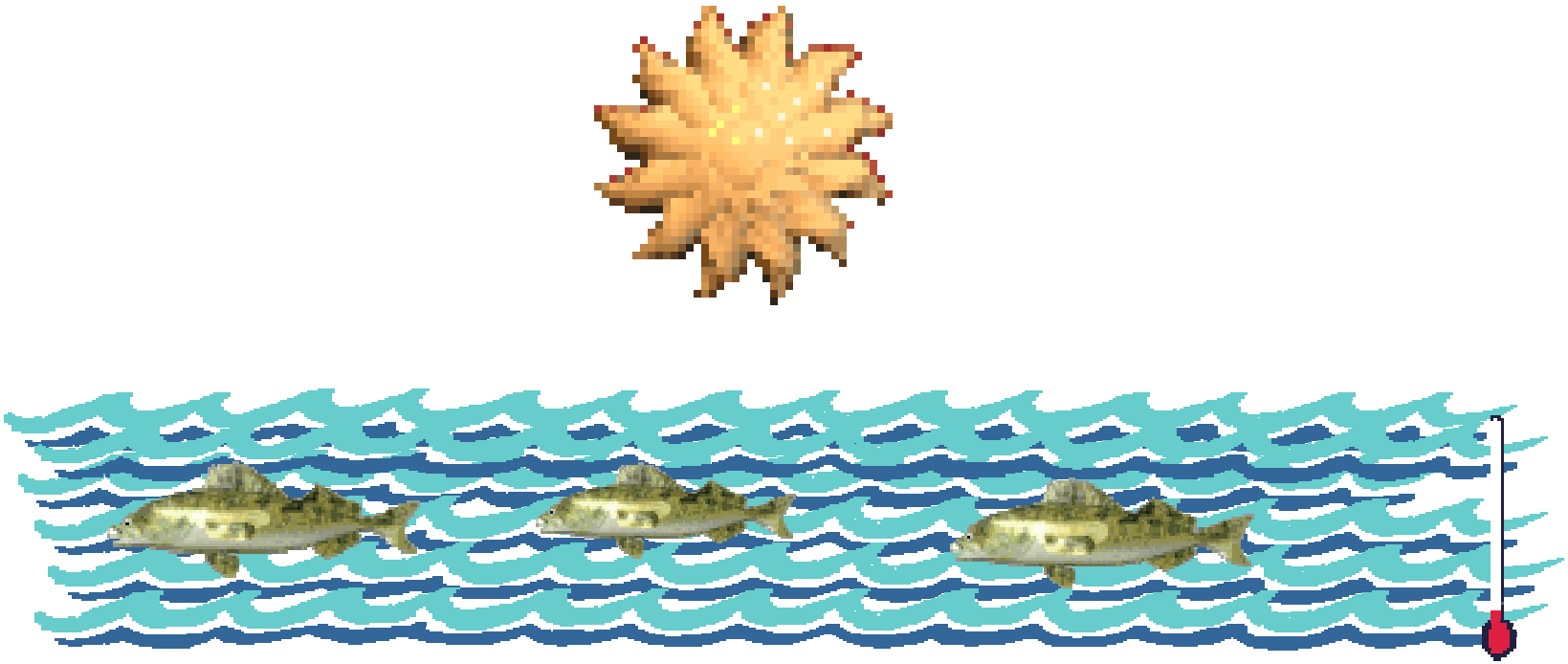


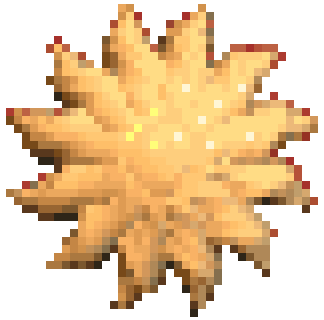
…rivers

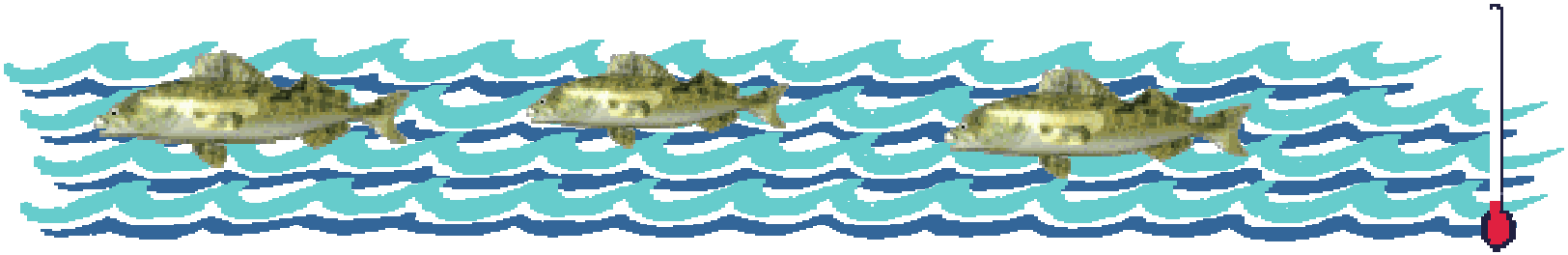
Maybe next?



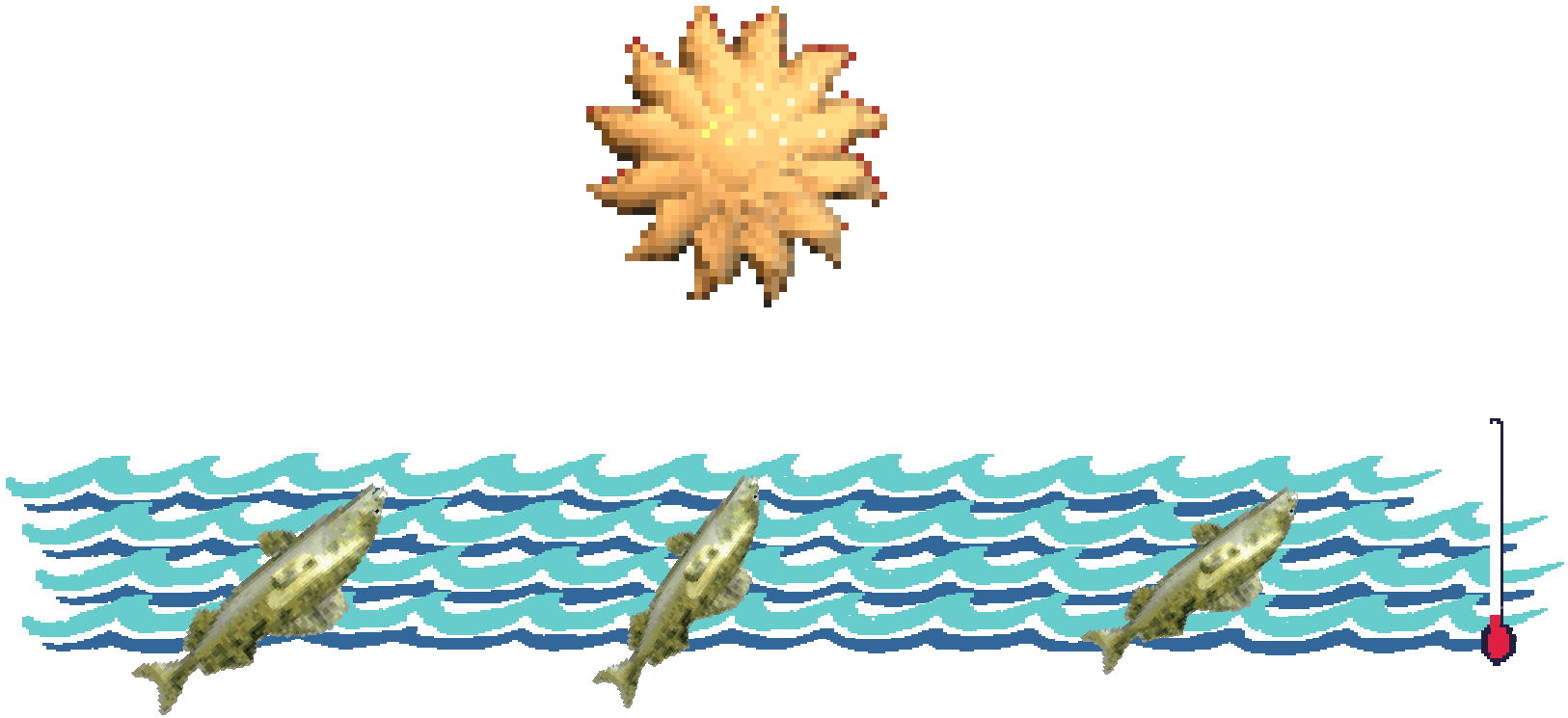






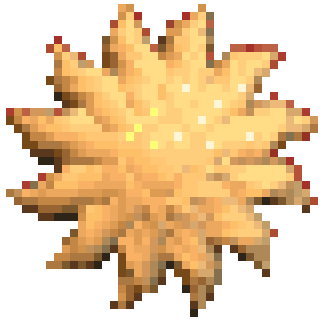


Challenges to the Grand Scheme

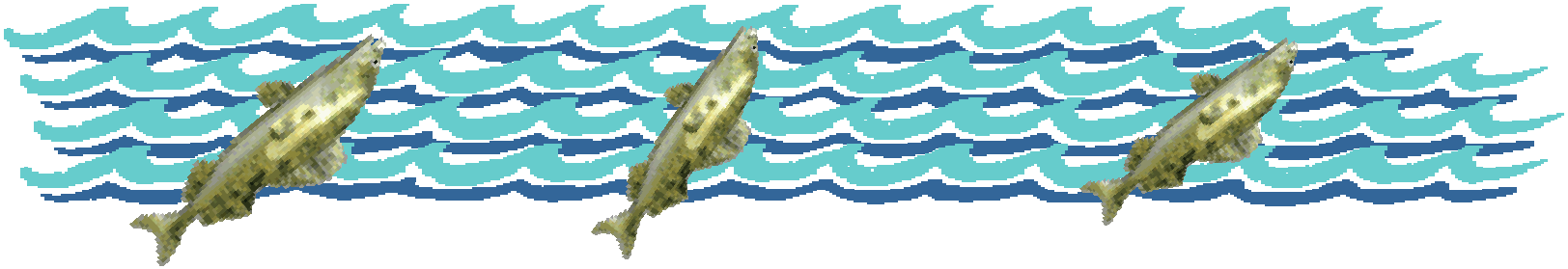


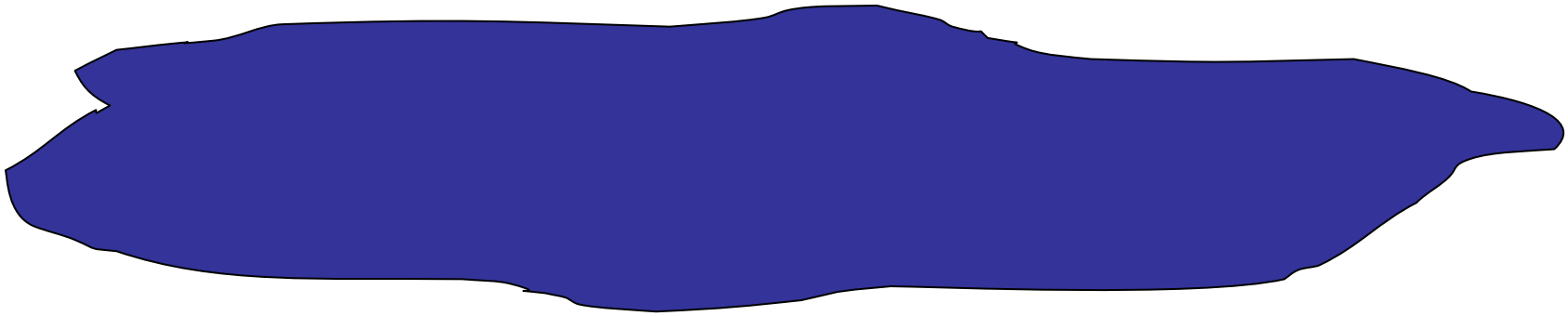
True Creator Genious

Rather simple yet elegant solution

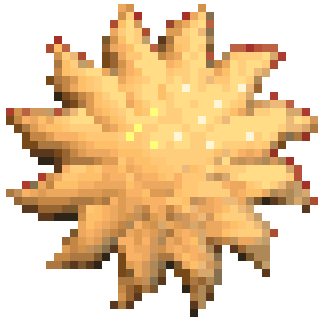


Add One Part for
Enduring System

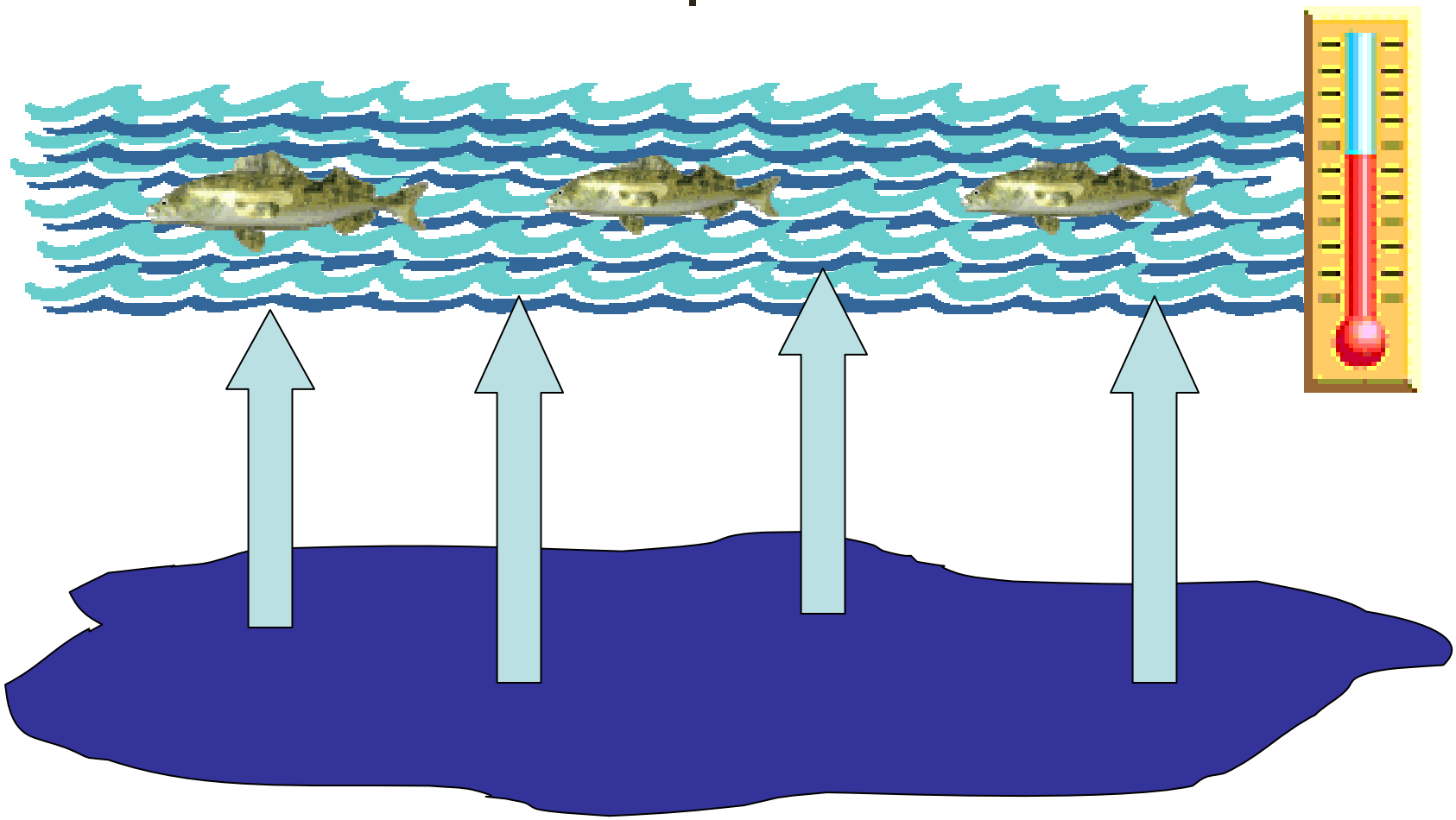




Stable & Resilient



Flow



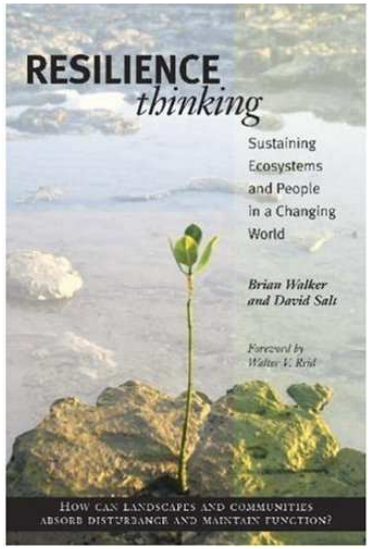
Added Bonus From Creator!

Groundwater provides buffer
from winter freezing

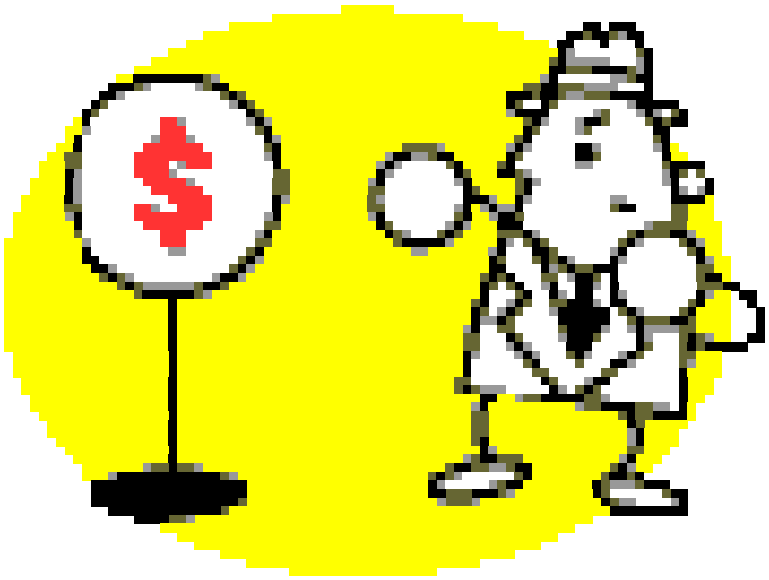
Equation Solved!

Groundwater = Wild Salmon

The Pulpit of the Church of Resilience



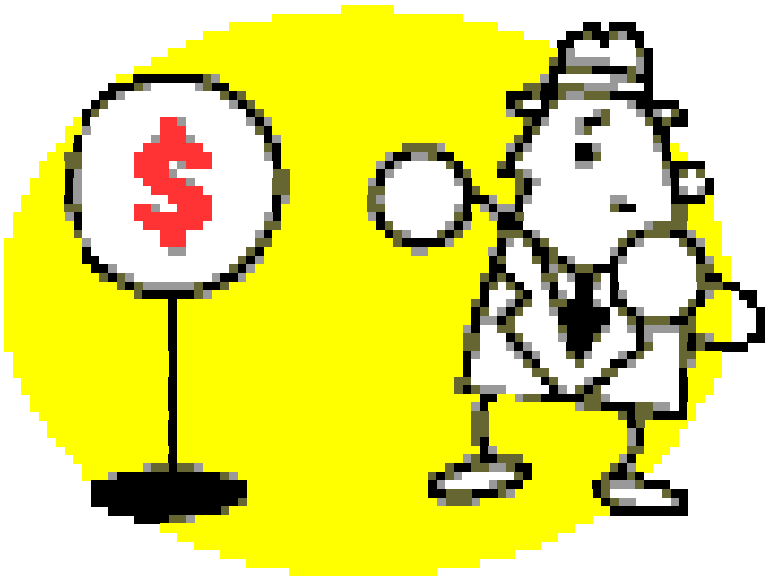
Resilience Is Simply…



The ability to **bounce back** from shock, disturbance, etc.

Resilience: Common Understanding

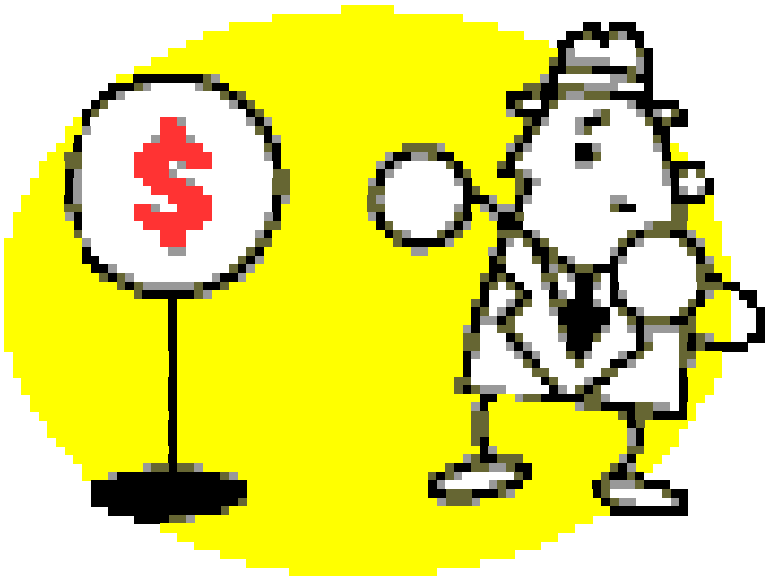
“He’s a resilient child.”



“It’s a resilient community.”

Resilient System Can:

Absorb disturbance



Still look & work the same!

Ability To Weather :

Disturbance

Crisis

Change

Outside Forces

Ability To:

Bounce Back

--At All

Ability To:

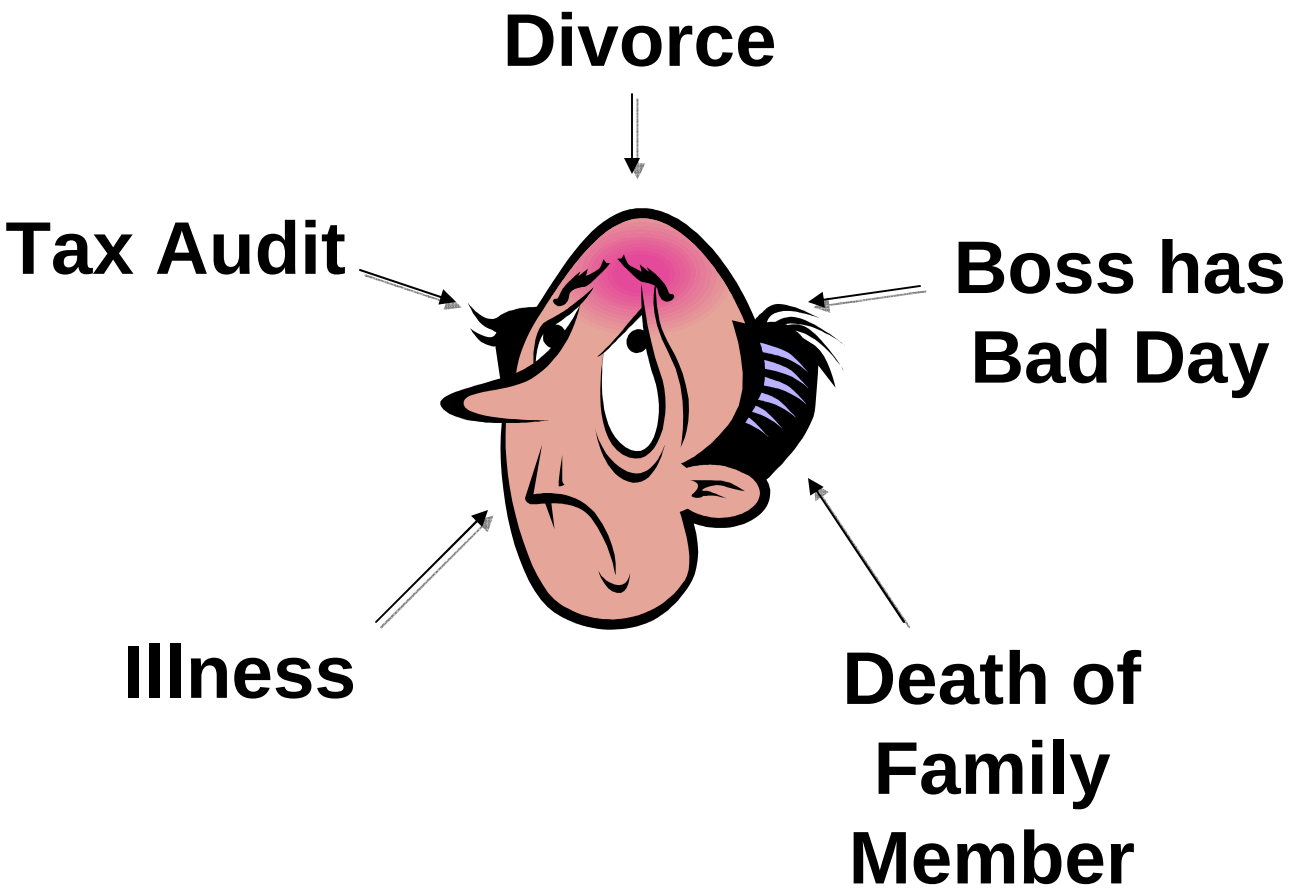
Avoid Crossing Into "Bad State"

Ability To:

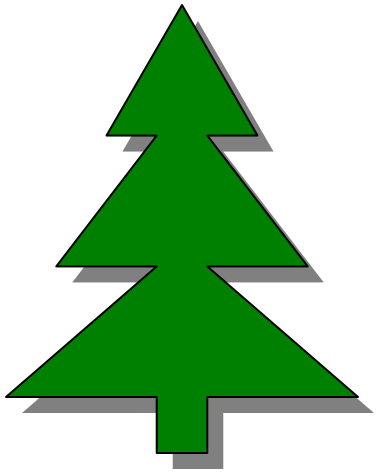
Or, as Devotees Chant...

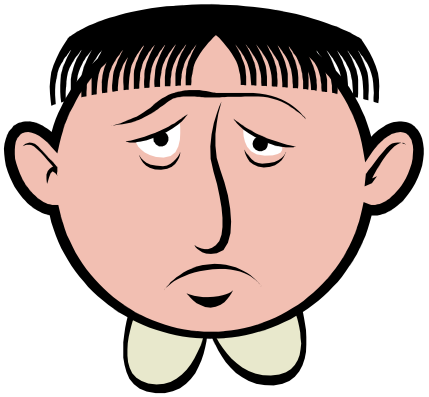
A Degraded State

Bounce back? Or Go Over The Edge?



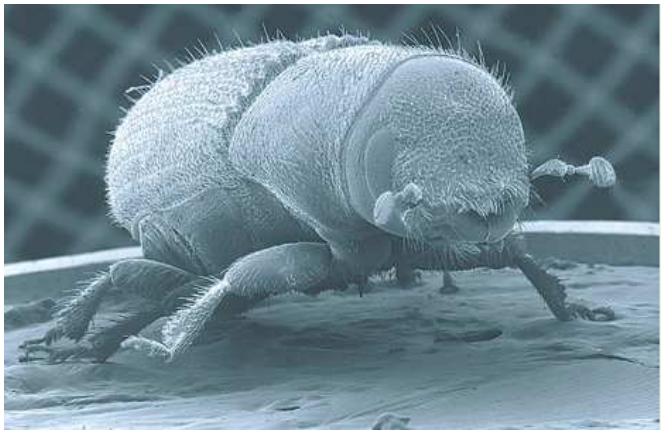
Church Encourages Mix of Systems



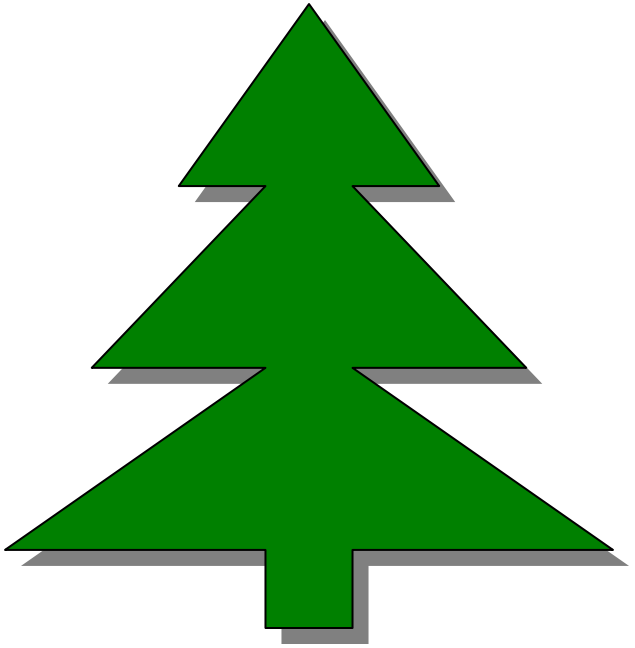


Teachings All Around Us

Beetle Damage: Past a Tipping Point?

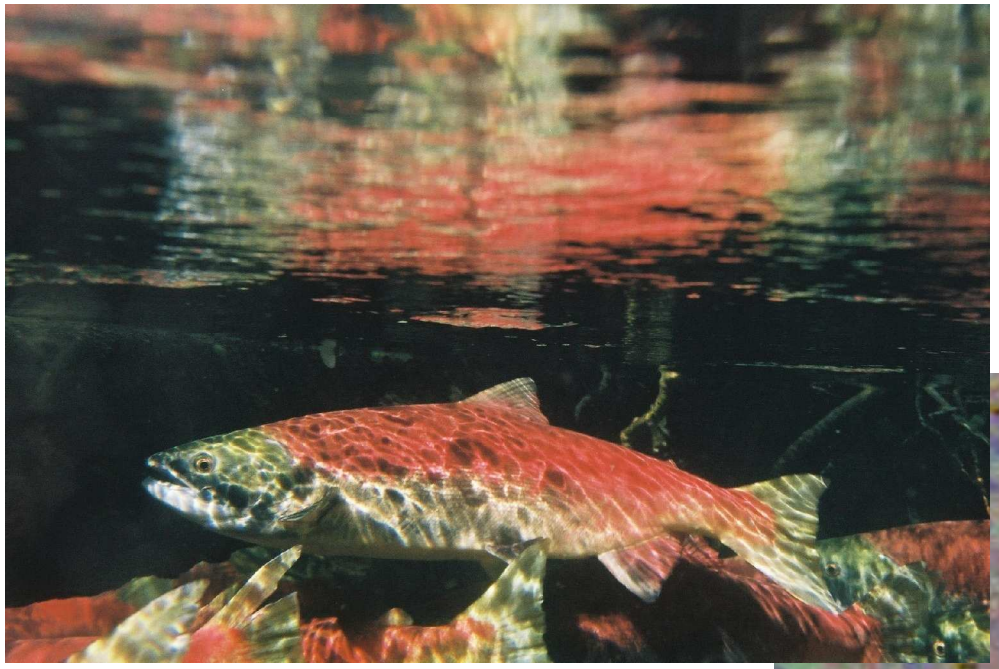


+



Same Form & Function?
…or Degraded State?

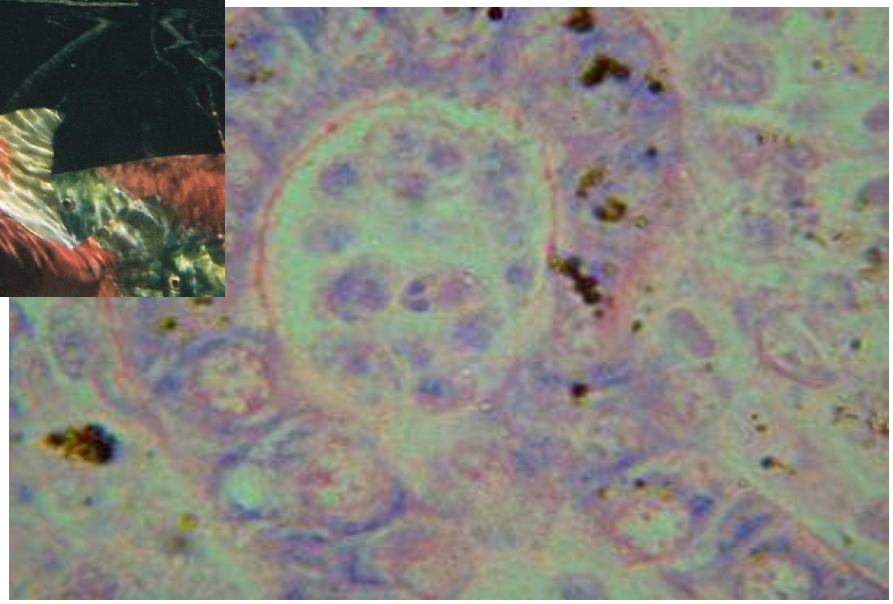
Sockeye: Crossing Into a Bad State



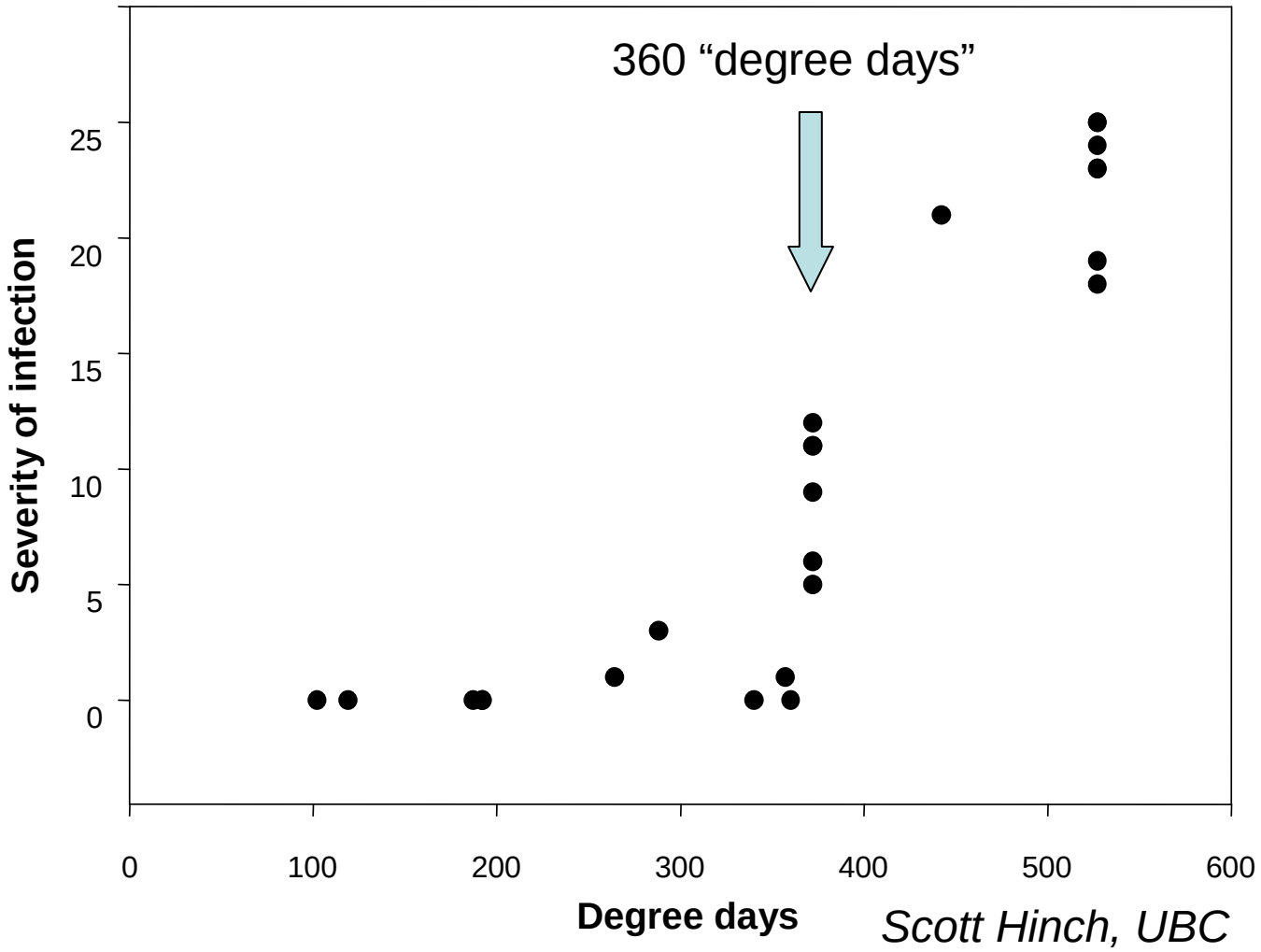
Elan Park

T^{o} stress

Simon Jones



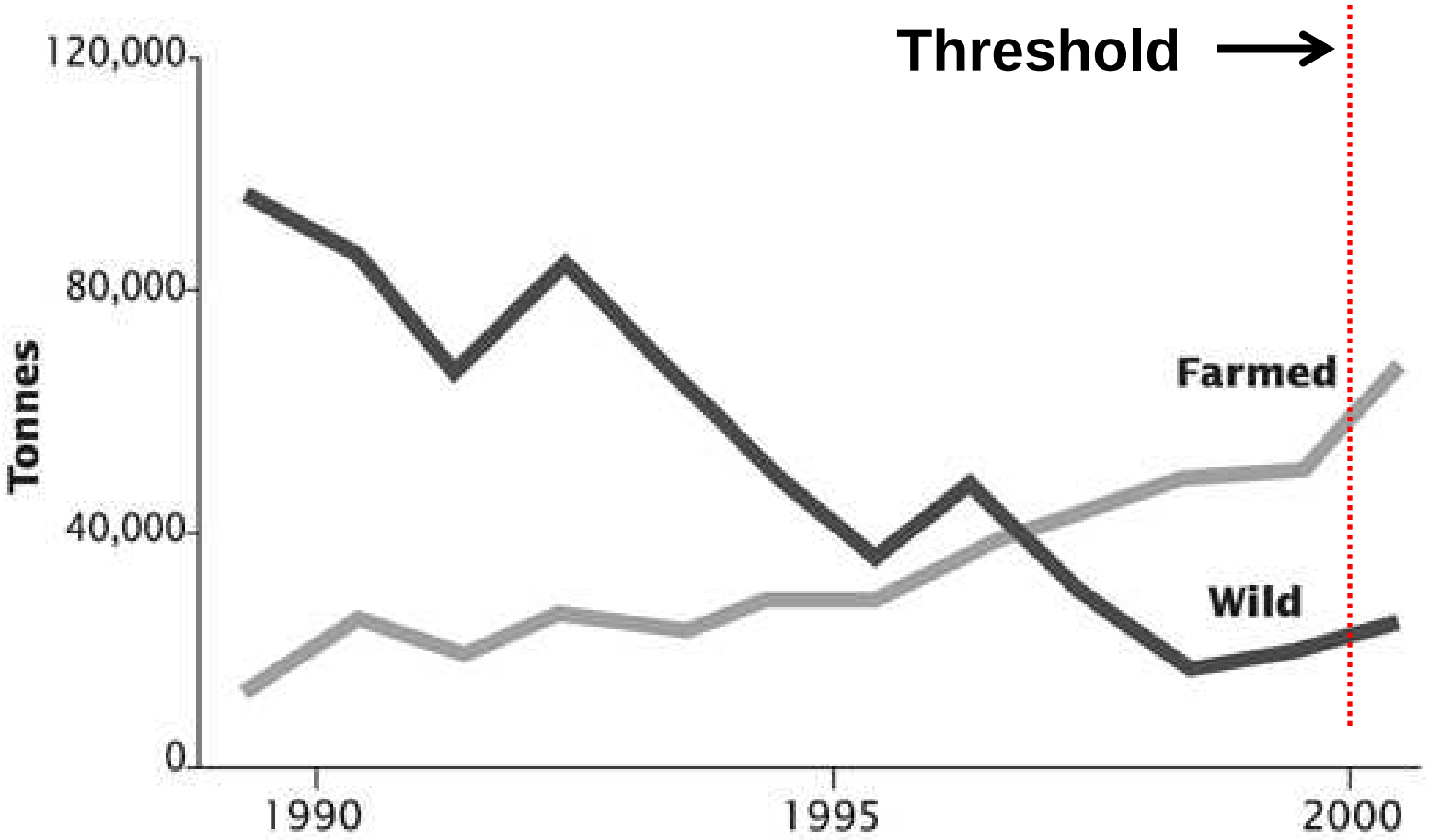
Threshold for parasite “activation”



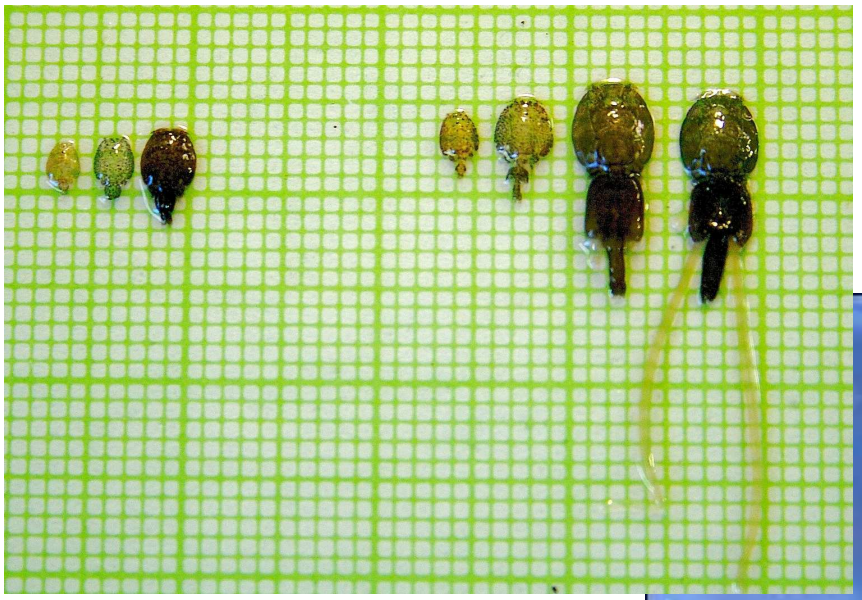
Salmon Farms & Ecosystem States

700,000 Atlantics = 465 Asian Bull Elephants

A Sea Lice Tipping Point?



Pass the Threshold, Pay the Price

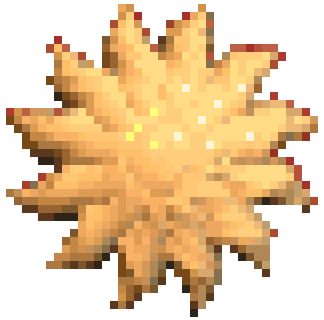


Lots of farmed fish
Lots of Lice

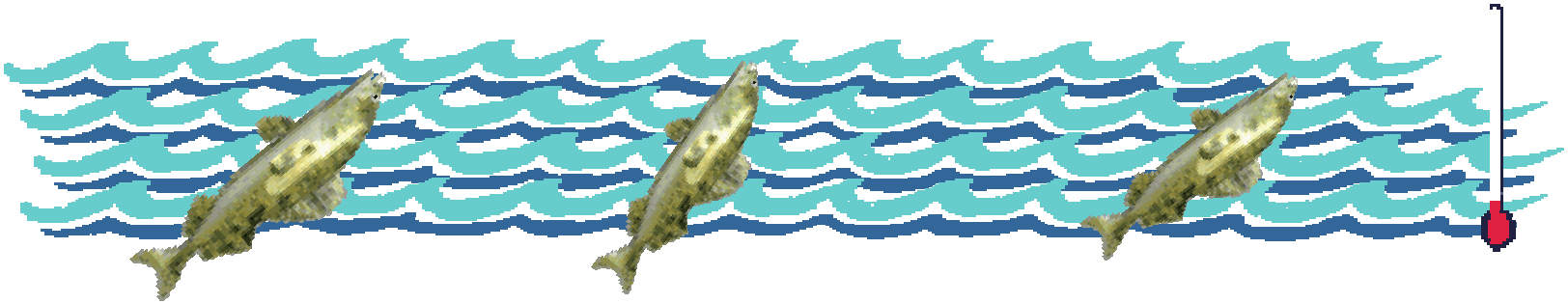
Few farmed fish
Few Lice

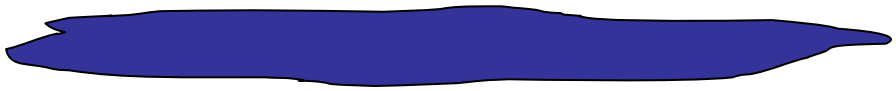
What do we Really Know?

ATTRACTION



Climate Change

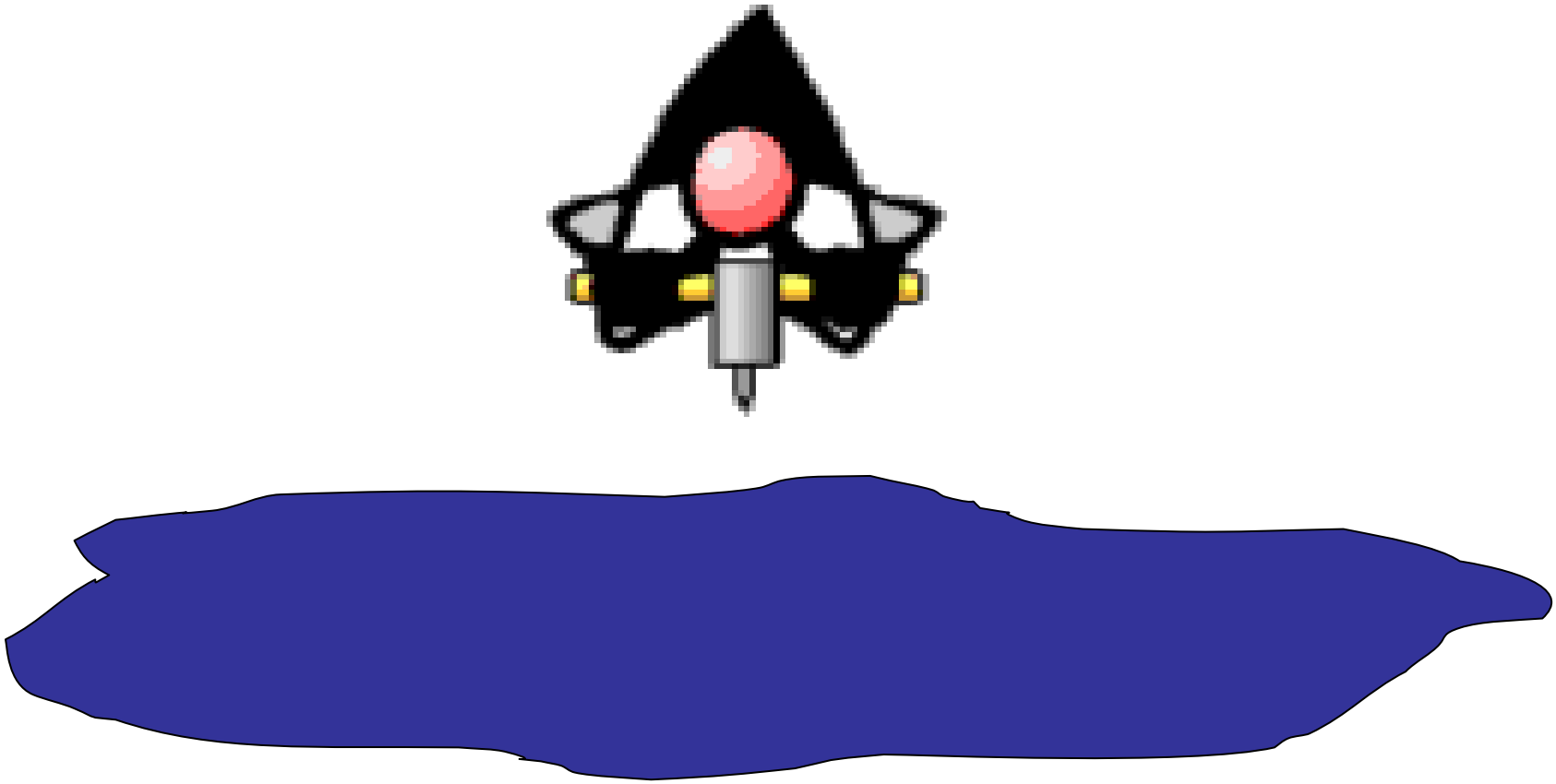




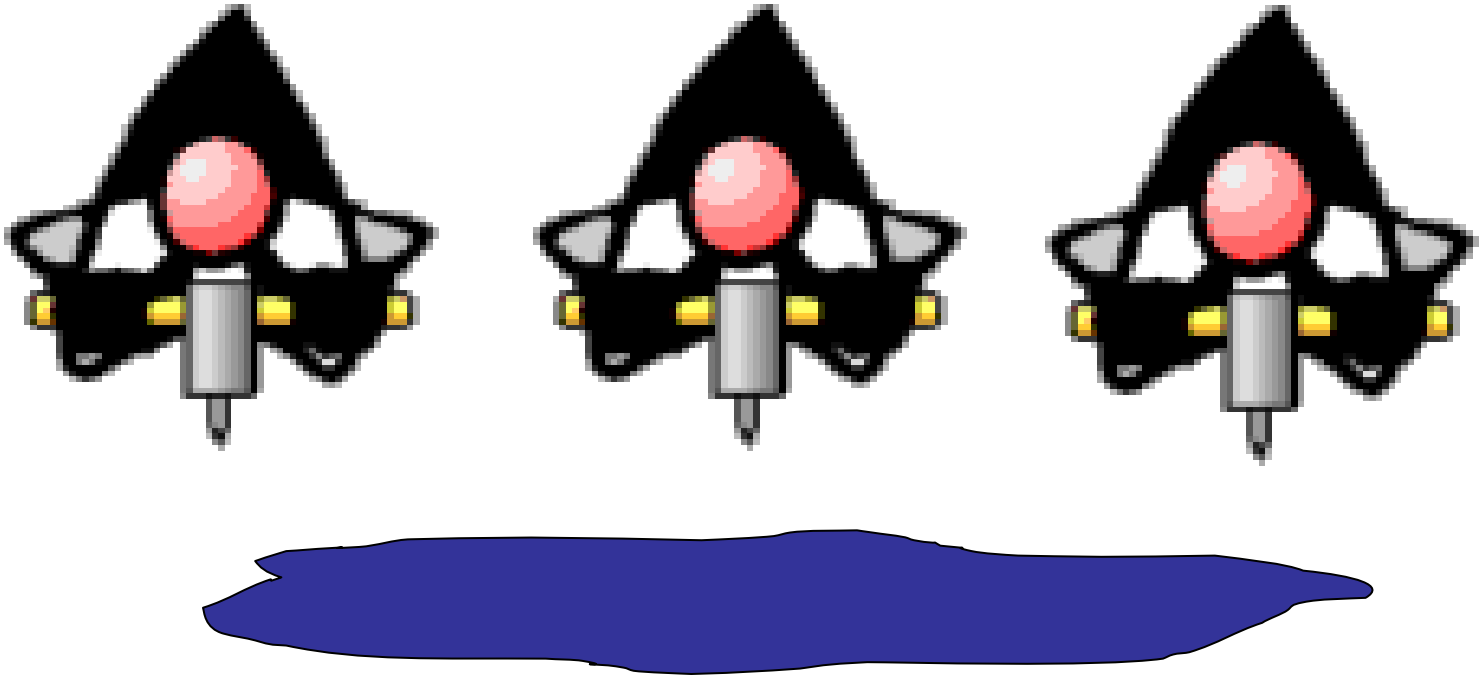
Heading Toward Bad State

Our case is weakened by inadequate information on **groundwater**

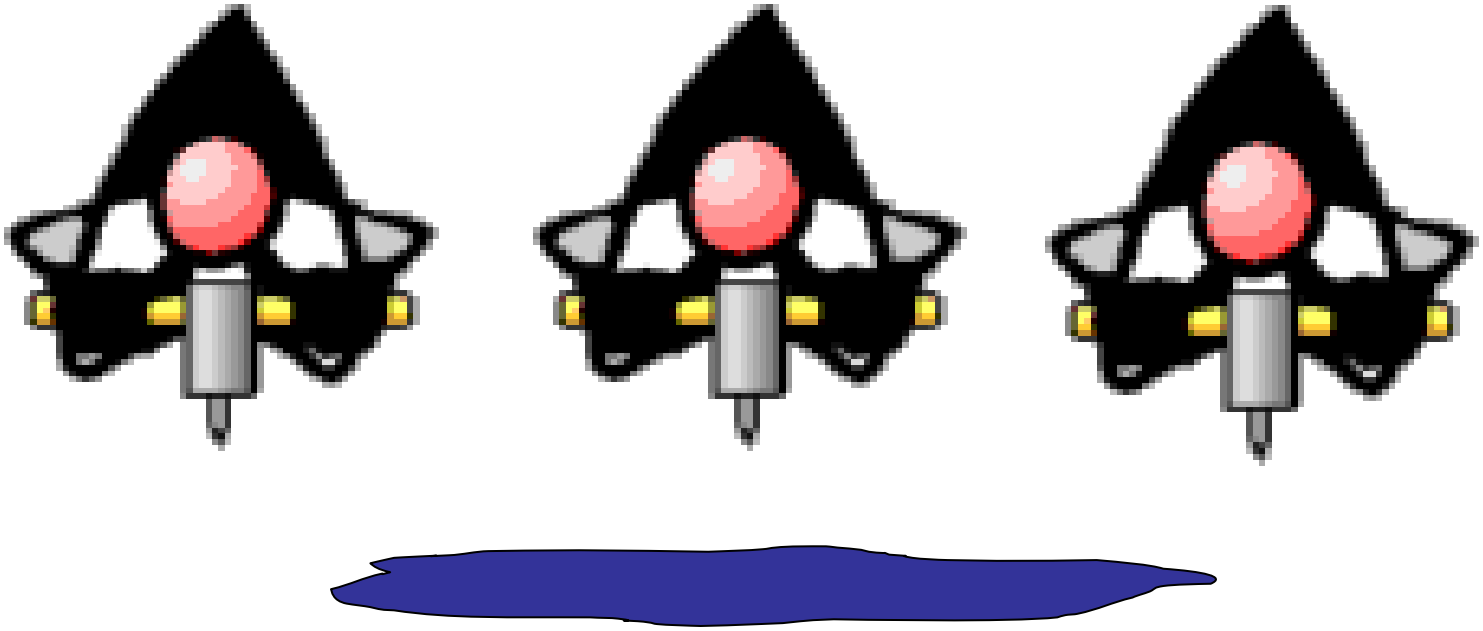
Huge Questions About Disturbance



How Much Is Too Much?



Maintain Form and Function?

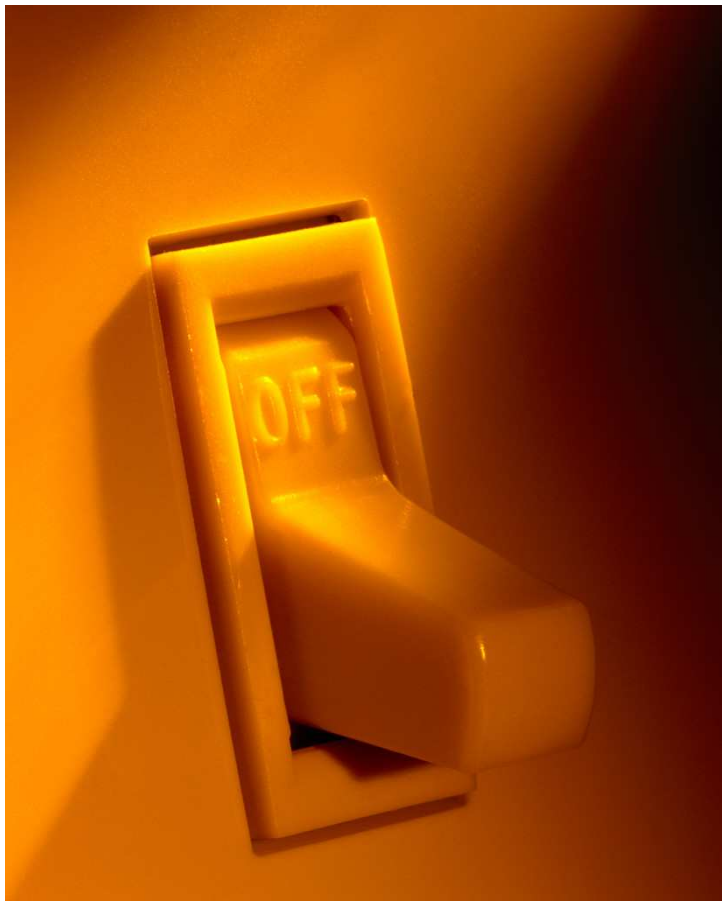


Paradise Lost?

Or stark reminder we have
thresholds coming out of our **wazoos?**

A World of Thresholds

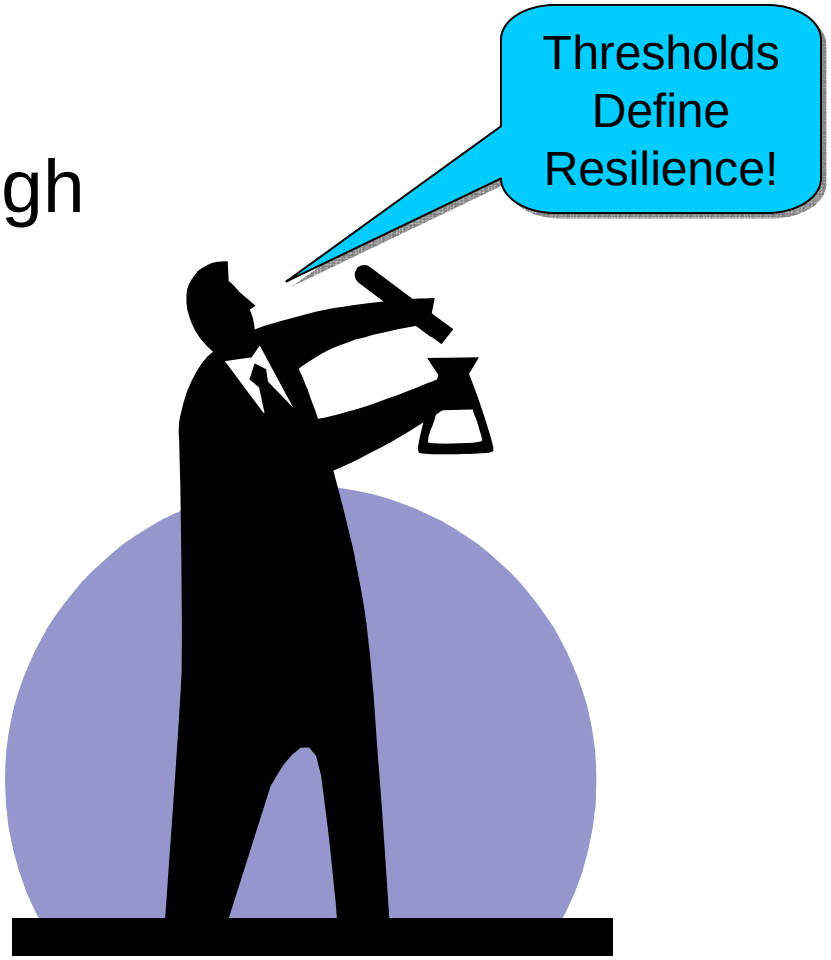
Some simple



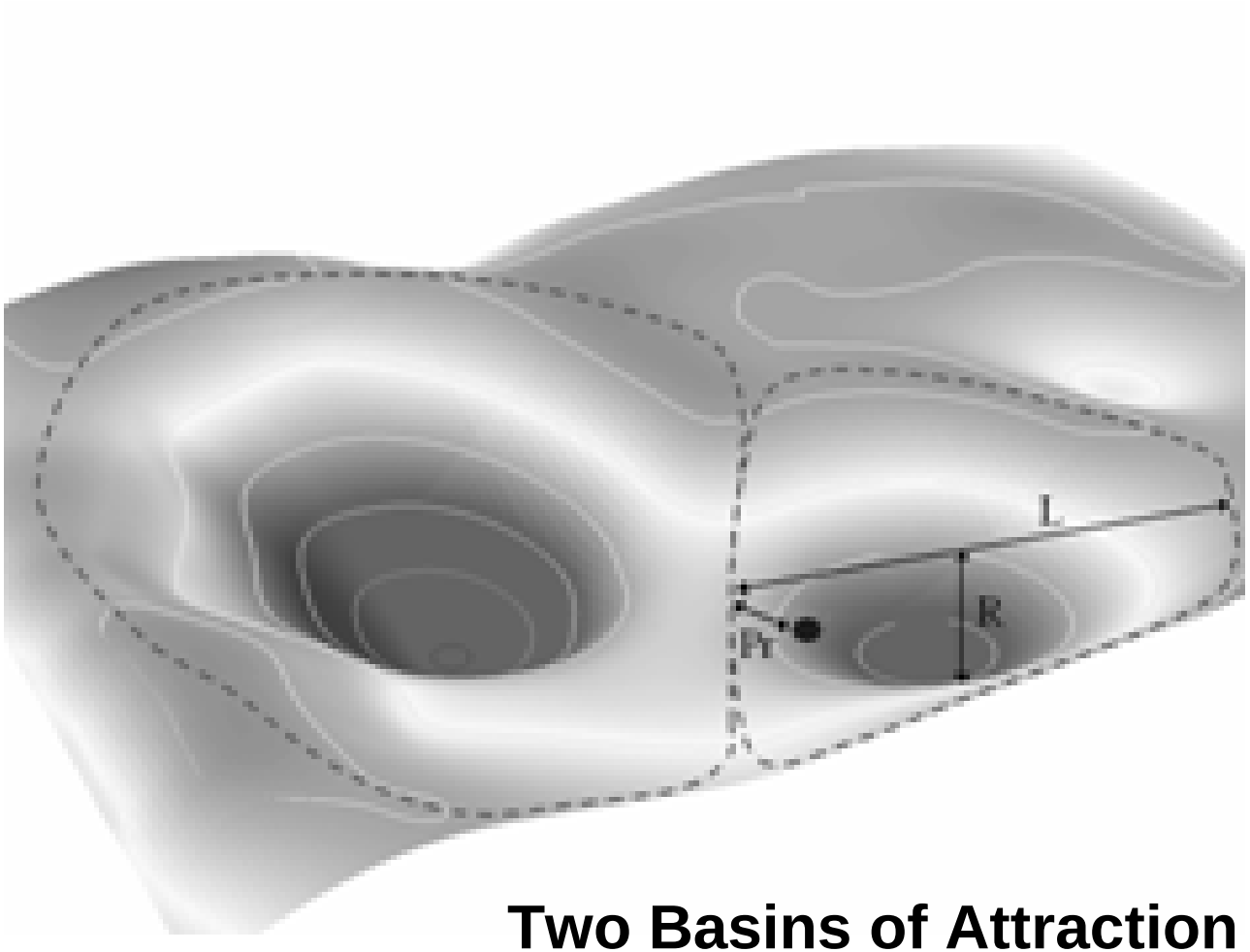
Others of life-changing importance

Again With the Church Doctrines

Preaching Through Cartoons

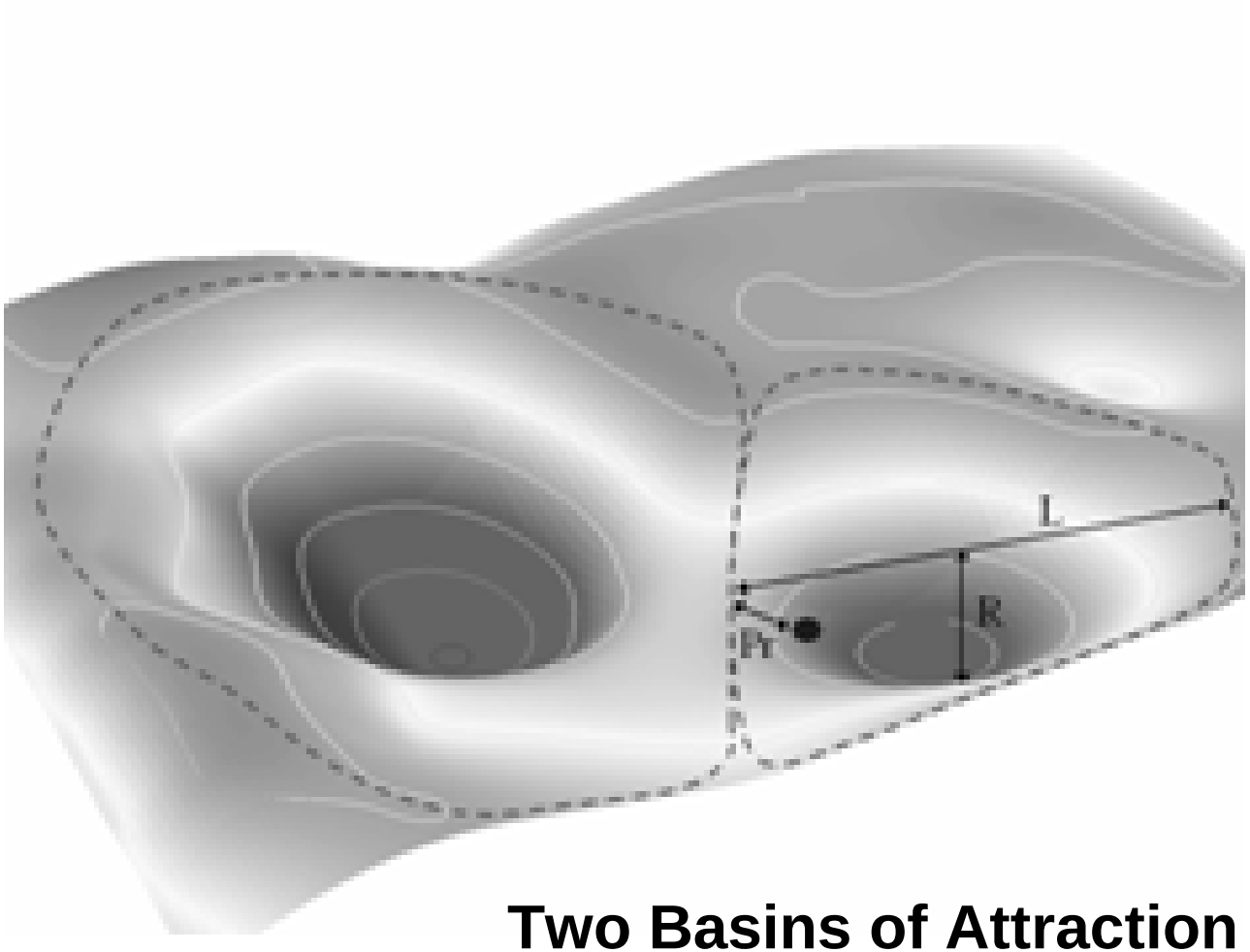


Your Basic System



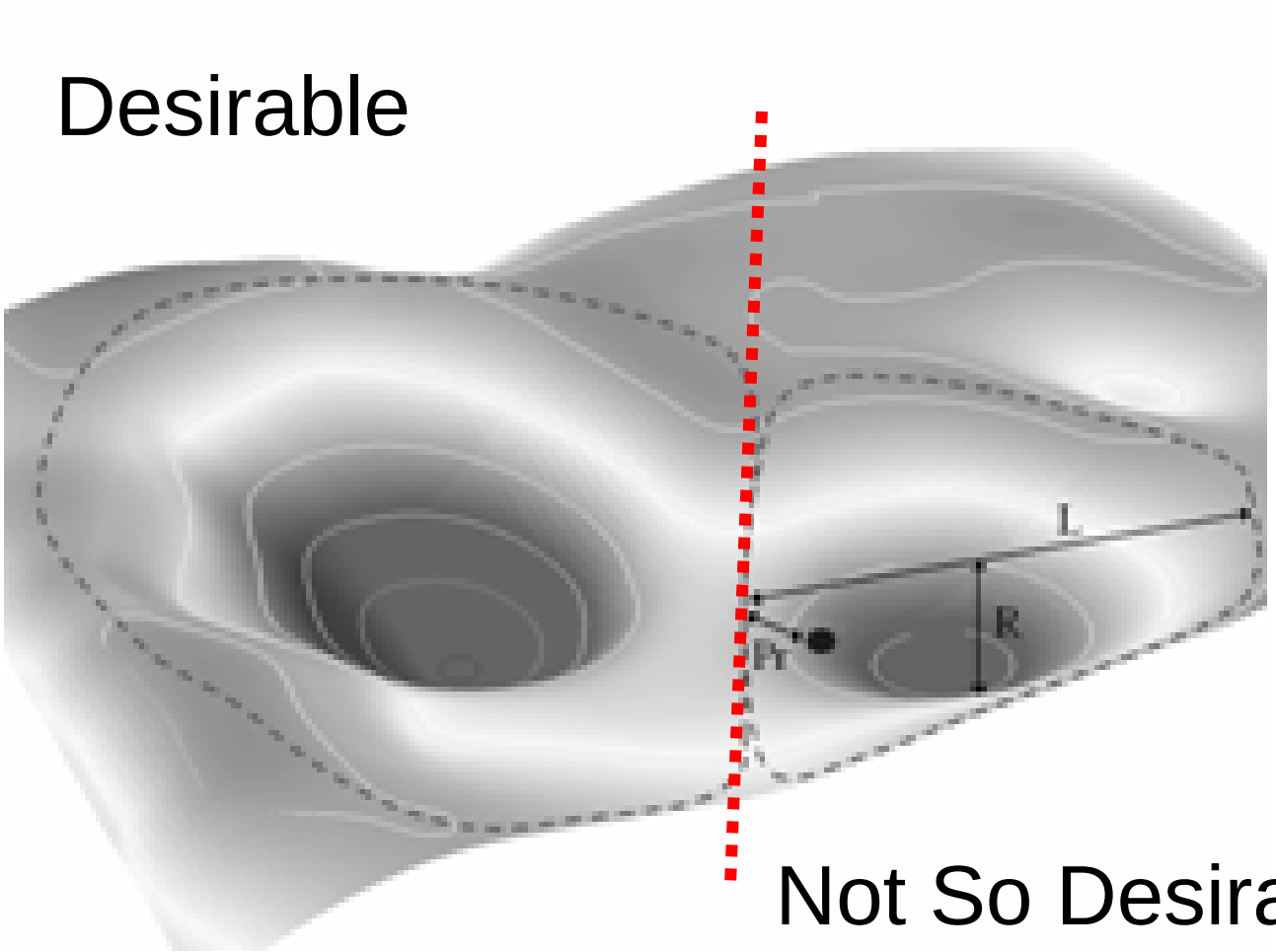
Two Basins of Attraction
Two Stable States

Your Neigbourhood

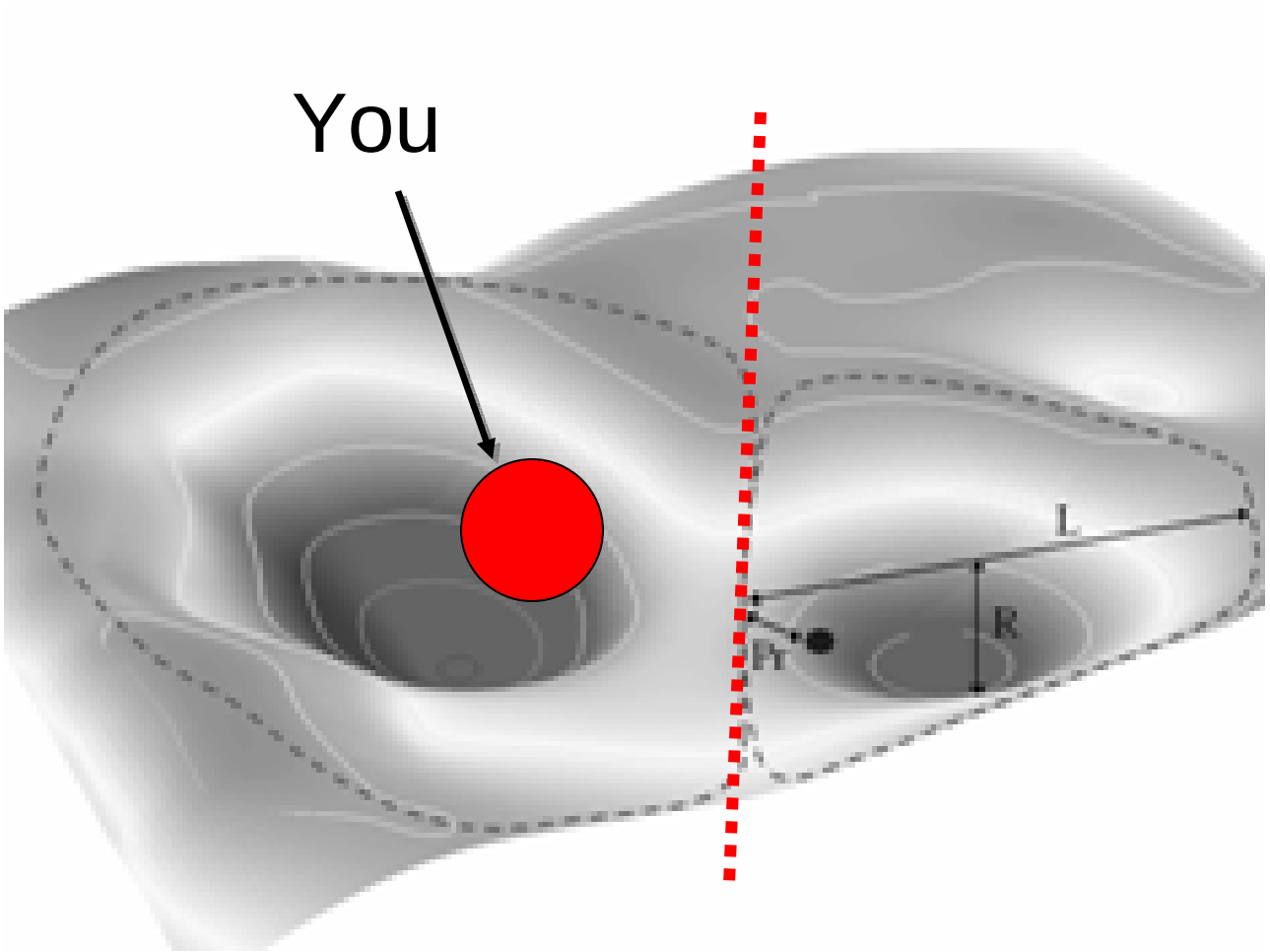


Two Basins of Attraction
Or Stable States

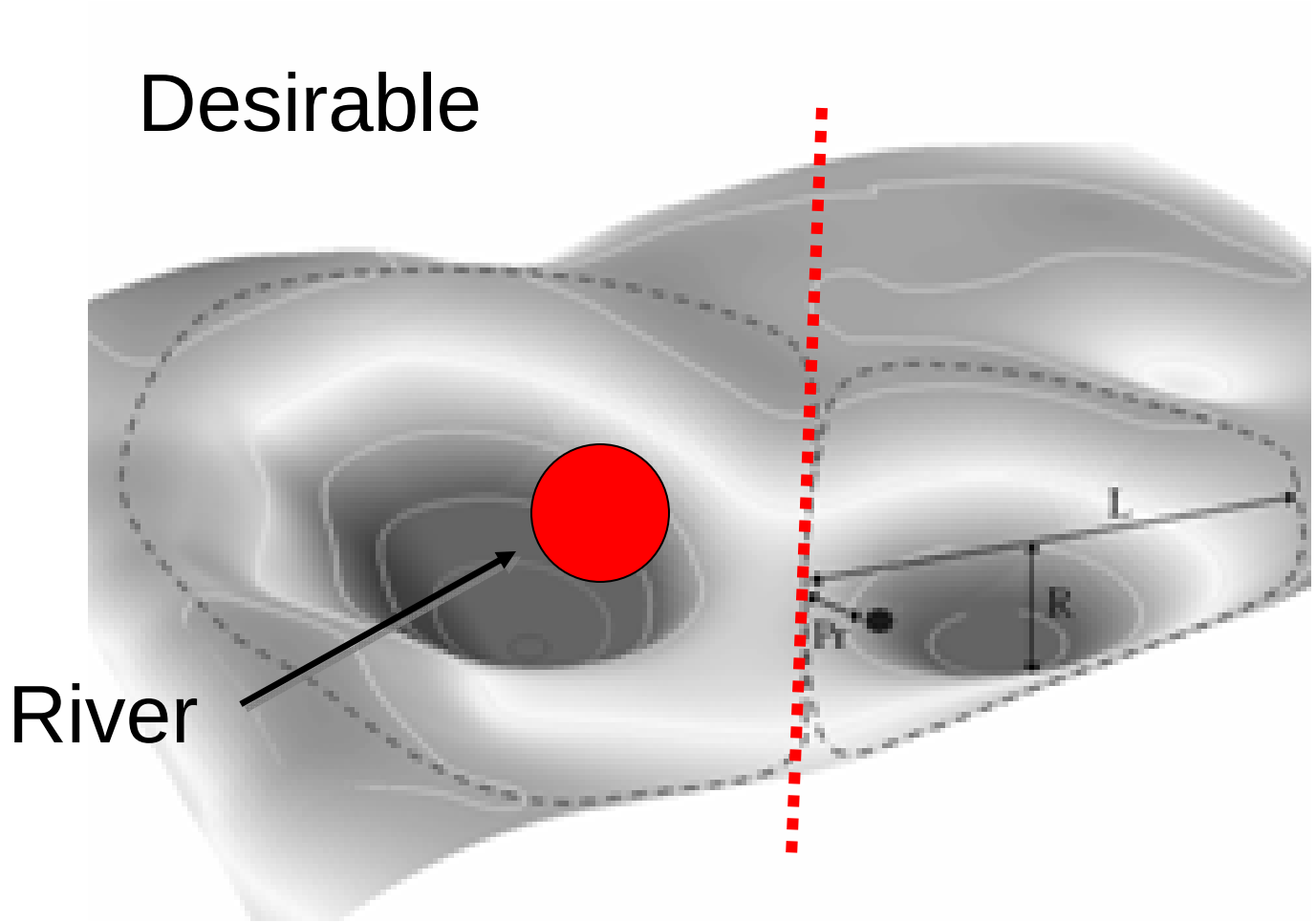
Separated by Threshold



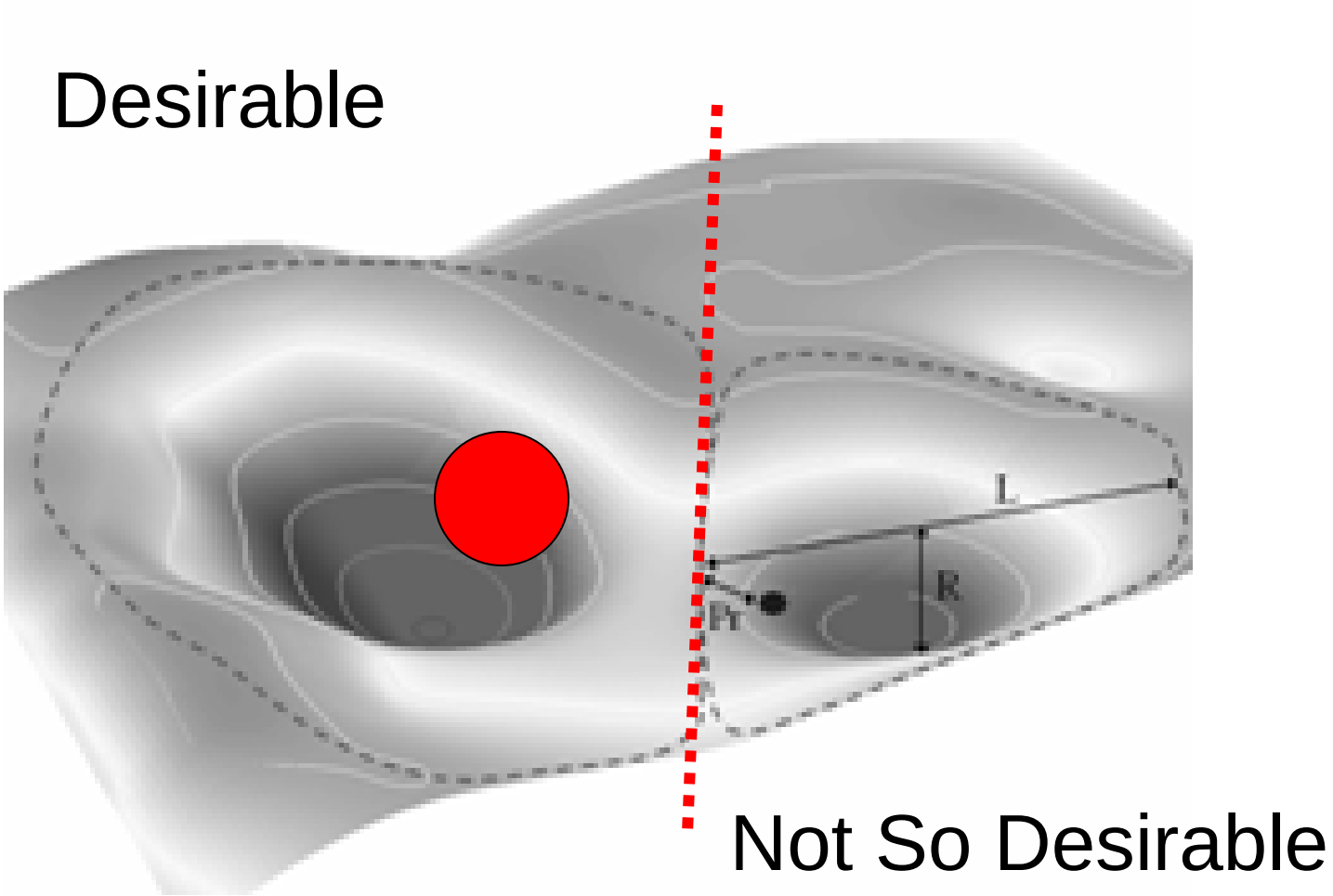
Socio-economic System



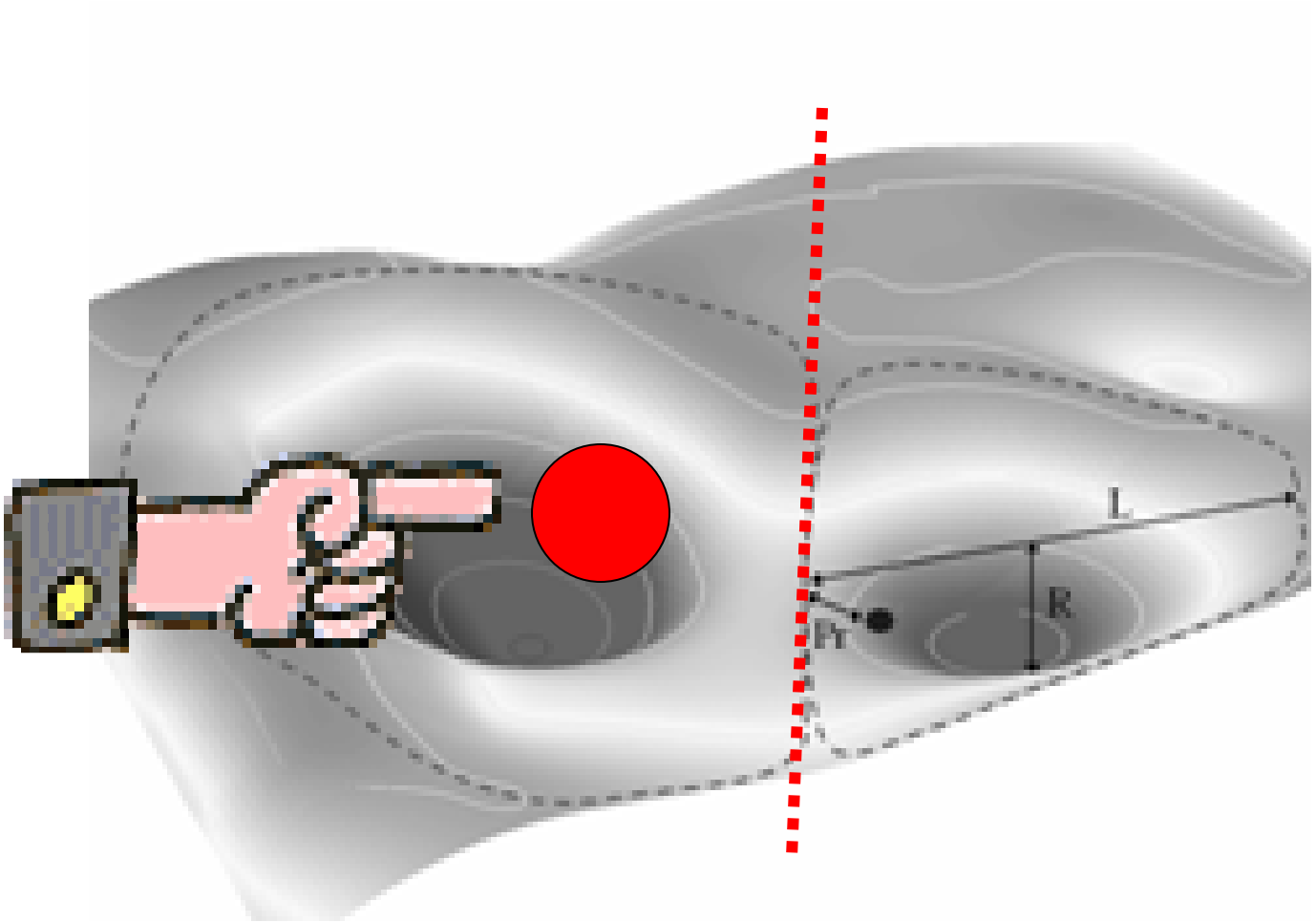
Ecosystem



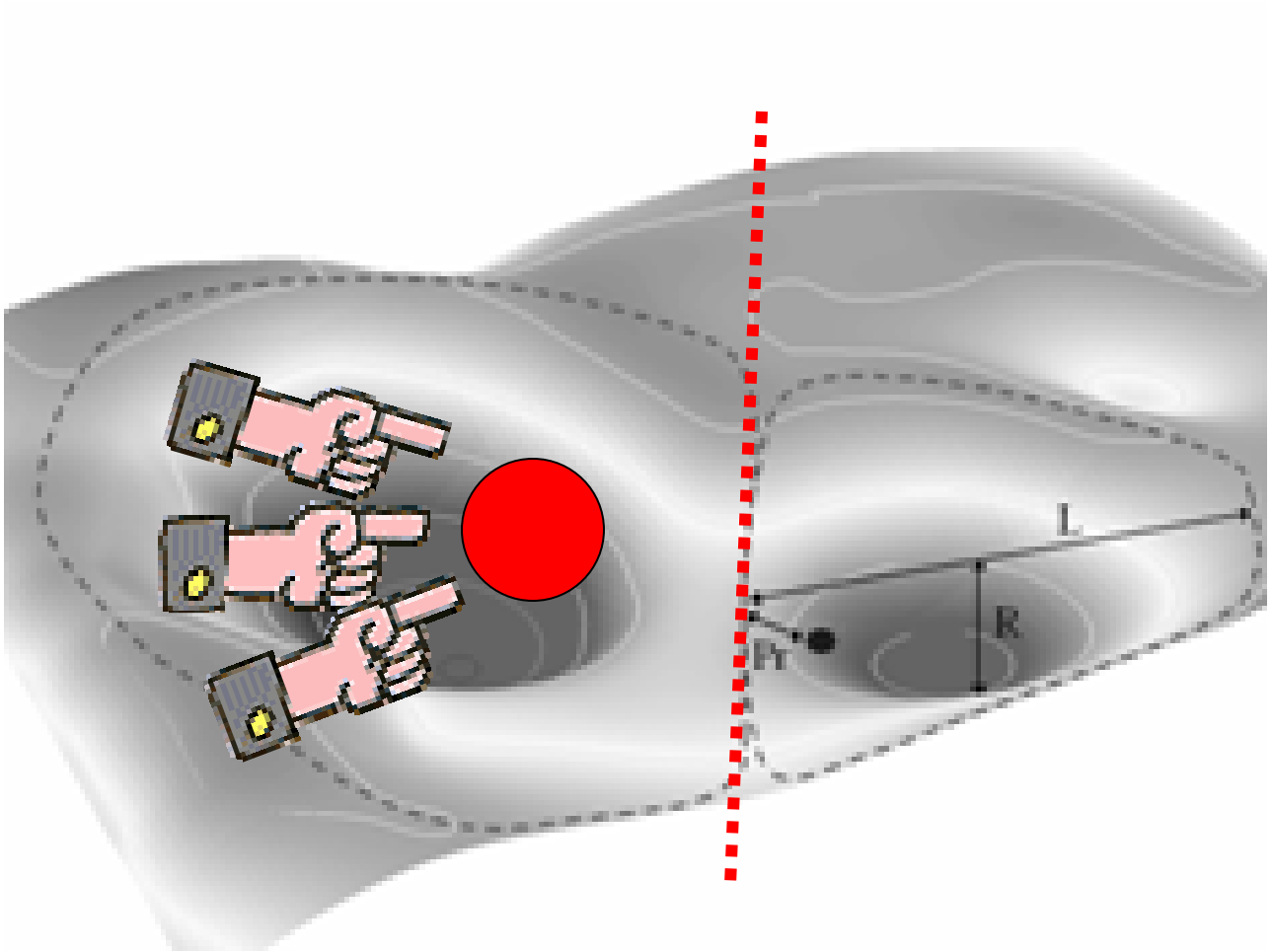
Resilience: Distance from Threshold



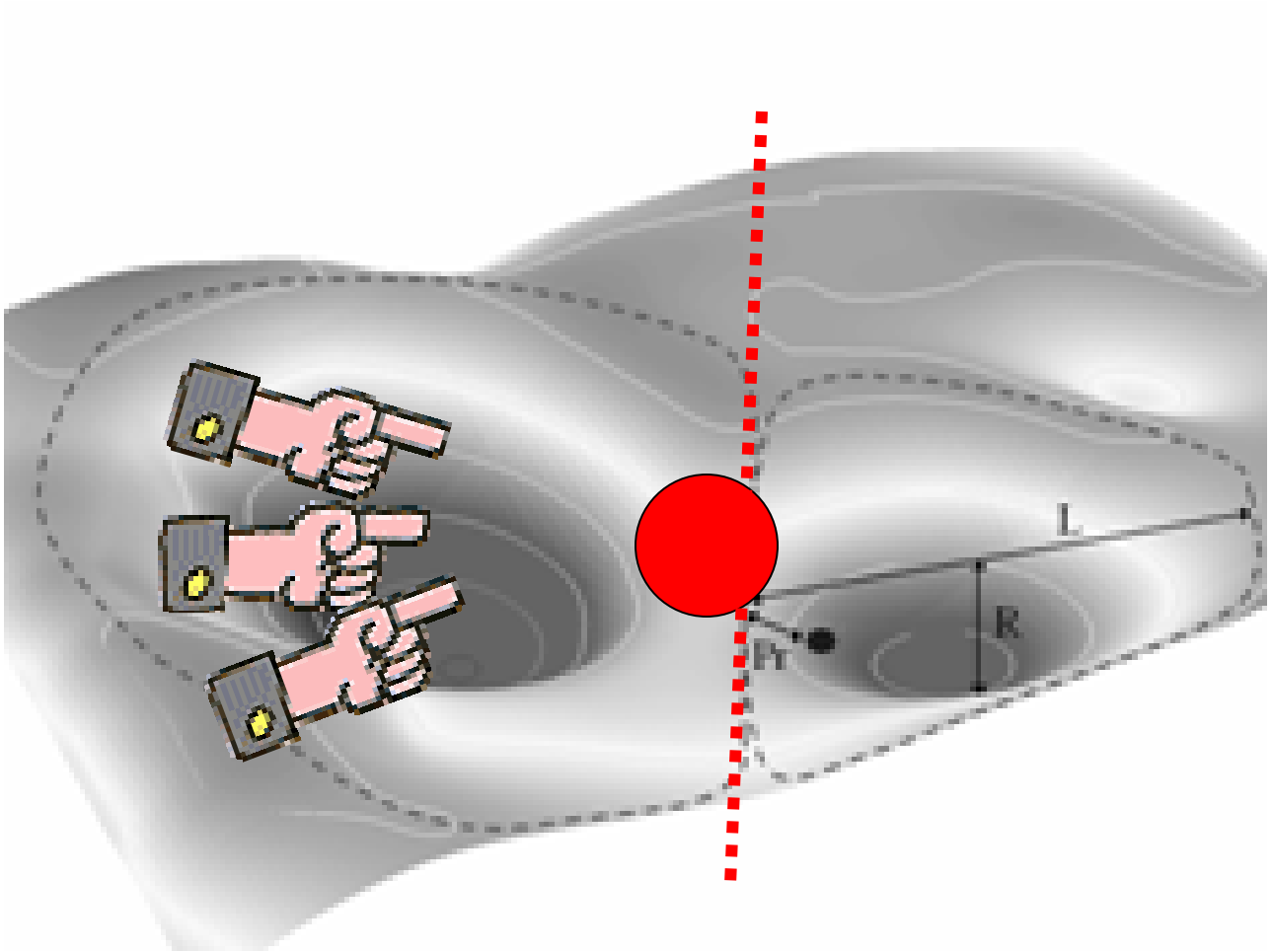
Disturbance: Pushes Toward Threshold



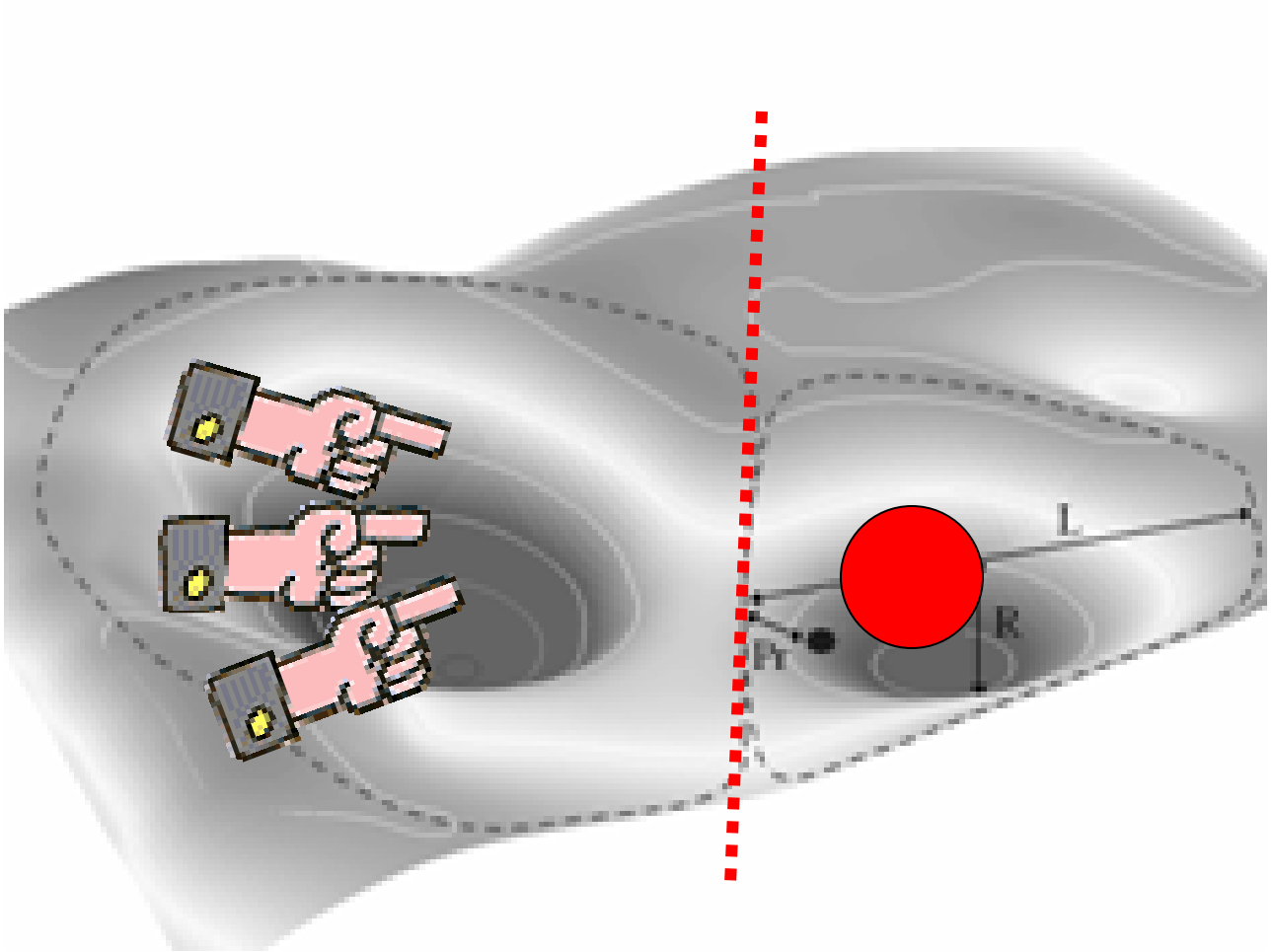
Many Smaller Pushes: Same Effect



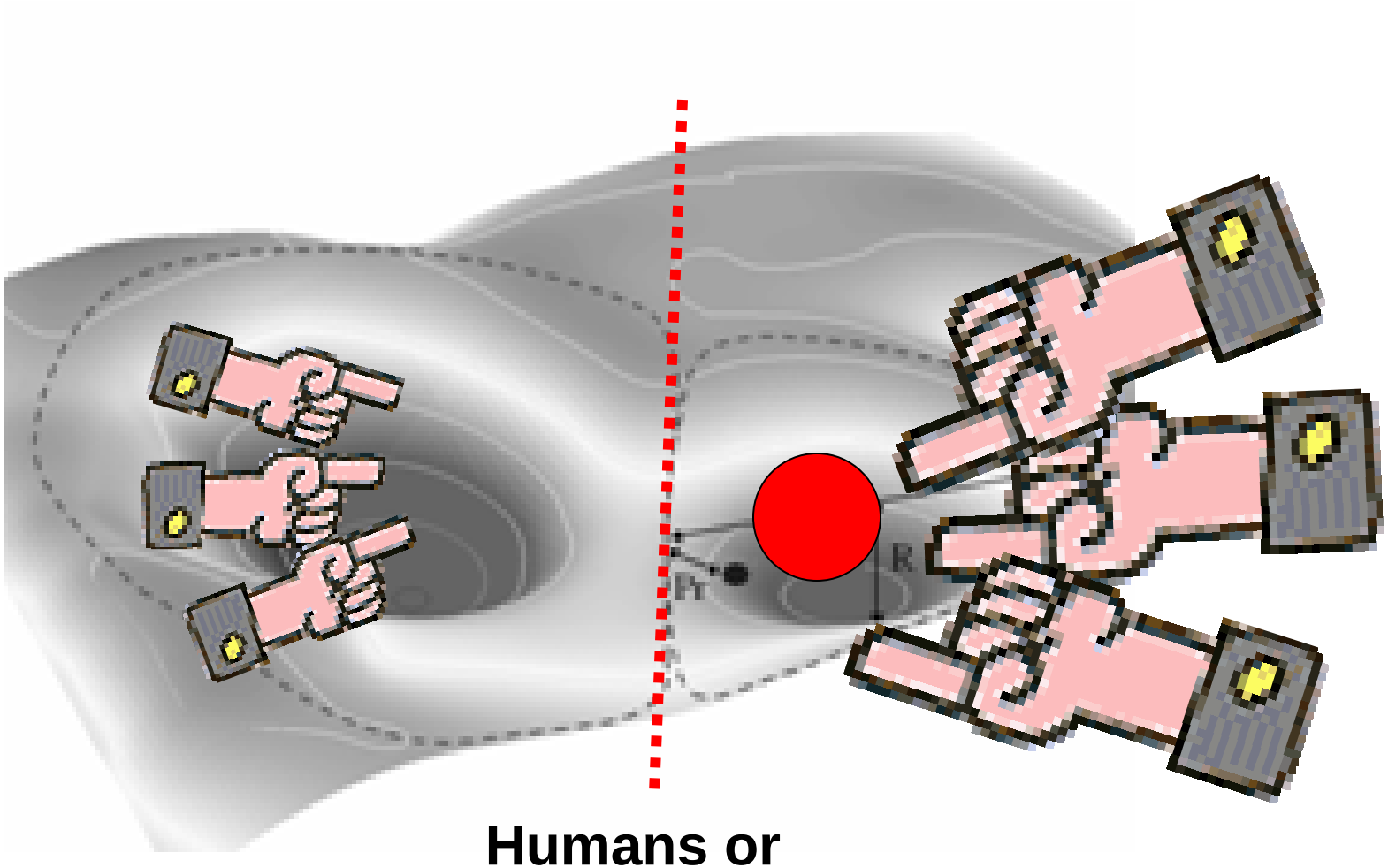
Many Smaller Pushes: Same Effect



System in New “Basin of Attraction”



Much Harder to “Get Back”



Humans or Ecosystems

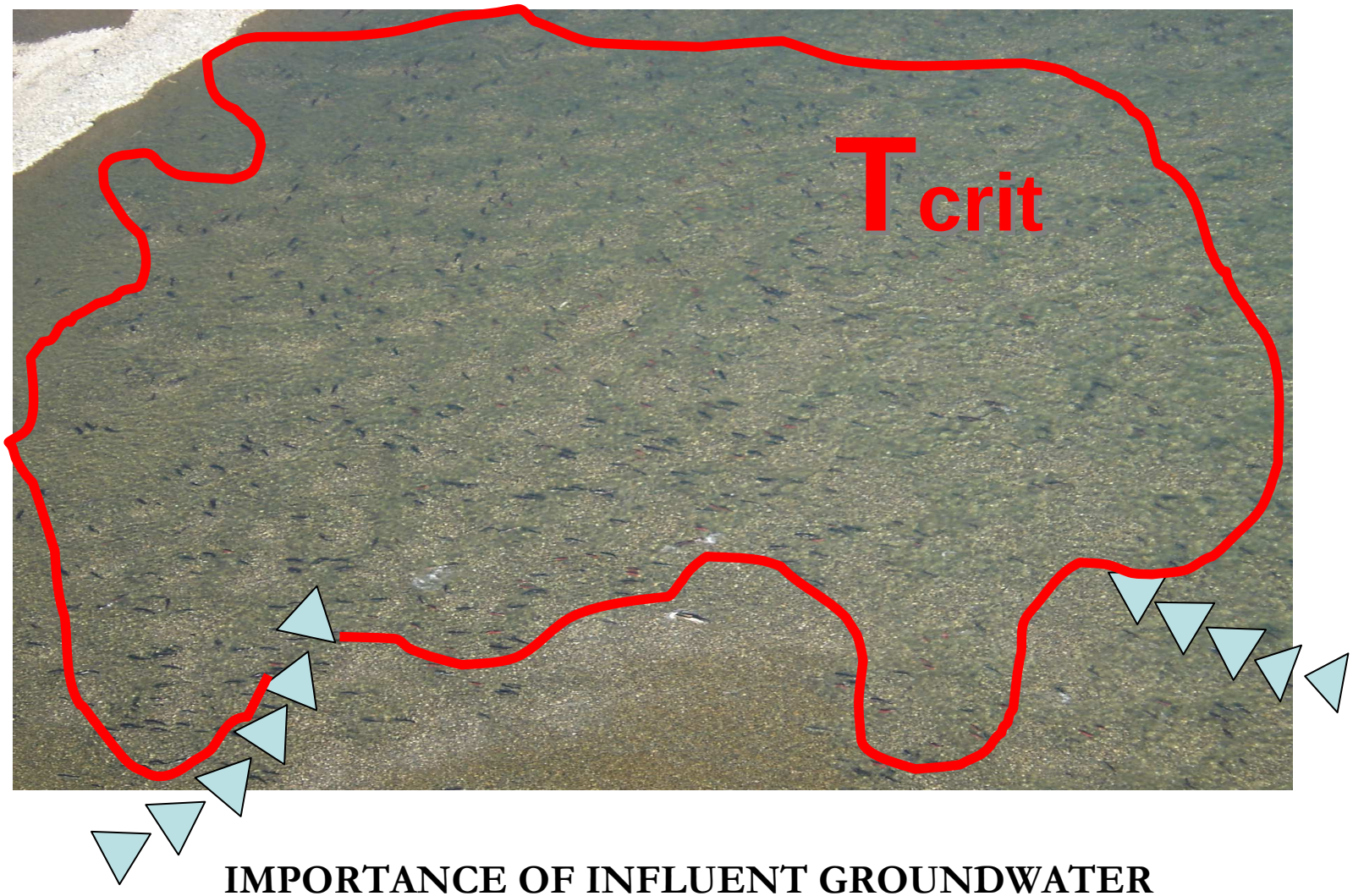
Salmon Bedrooms: Living on the Edge

How much do we *really* know about
Resilience & **Critical Thresholds?**

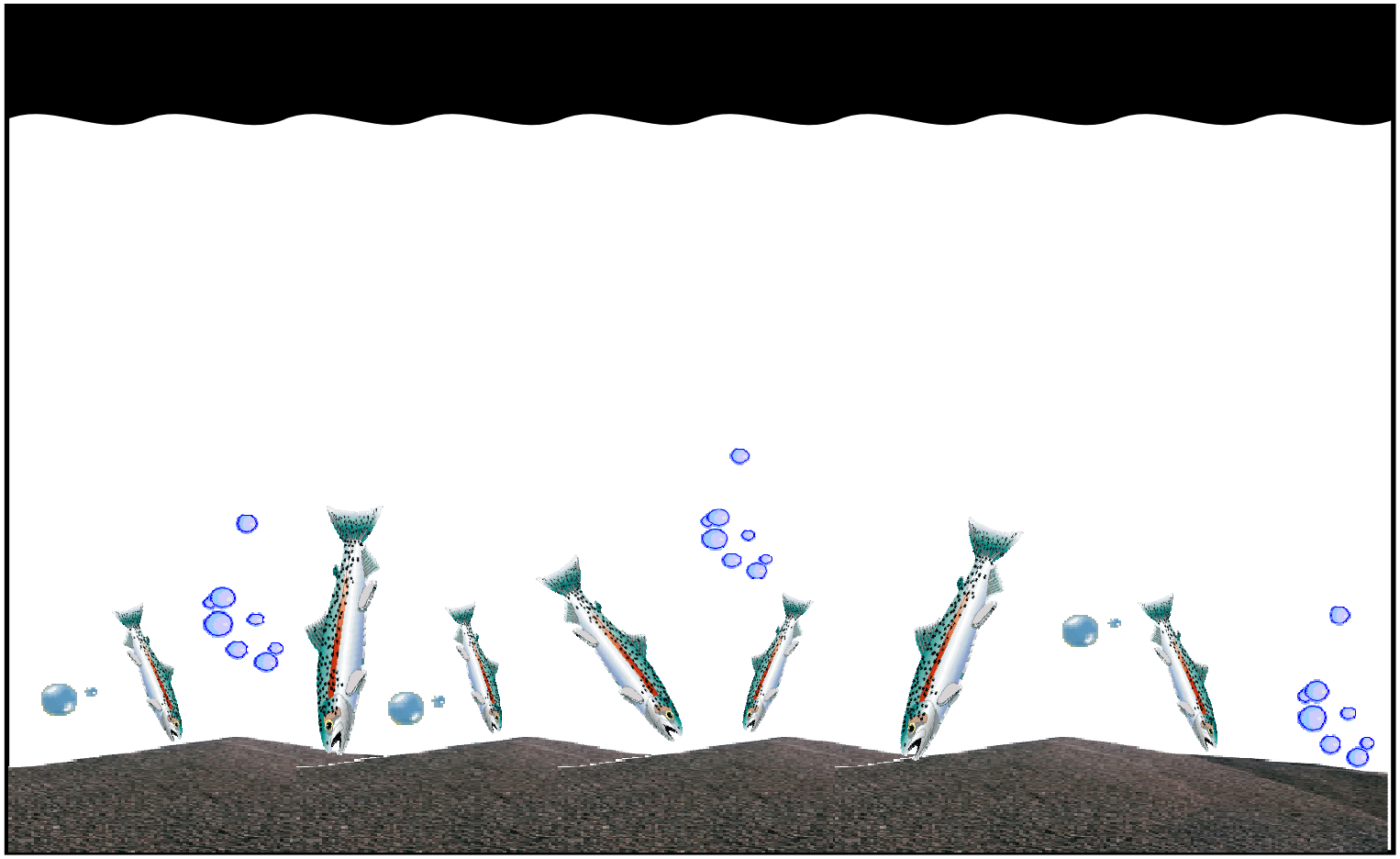
Know Little, Worry a Lot

NICOLA RIVER CHINOOK

Way to Push Back From Critical Threshold

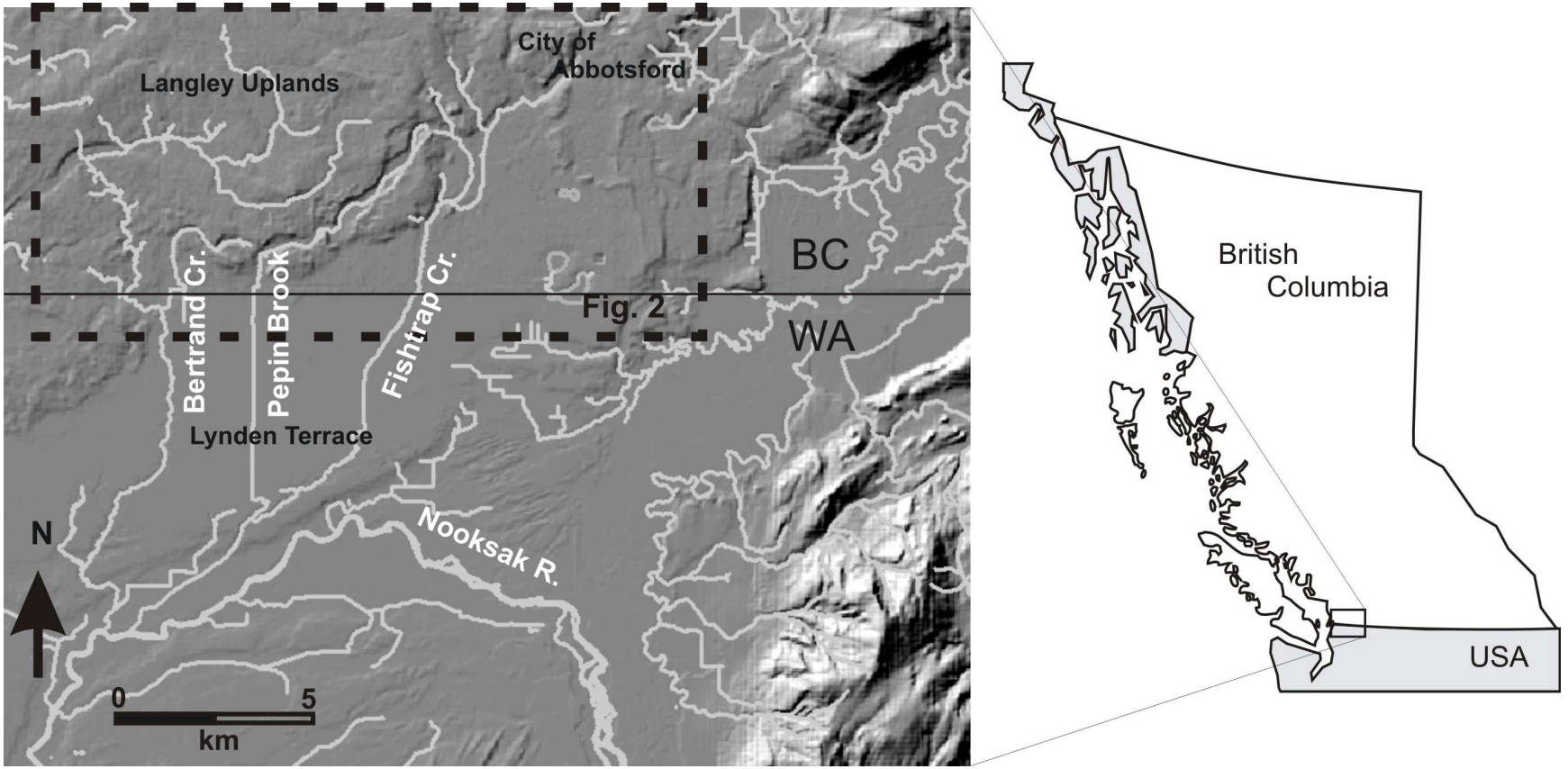


Secwepemc-led Groundwater Study



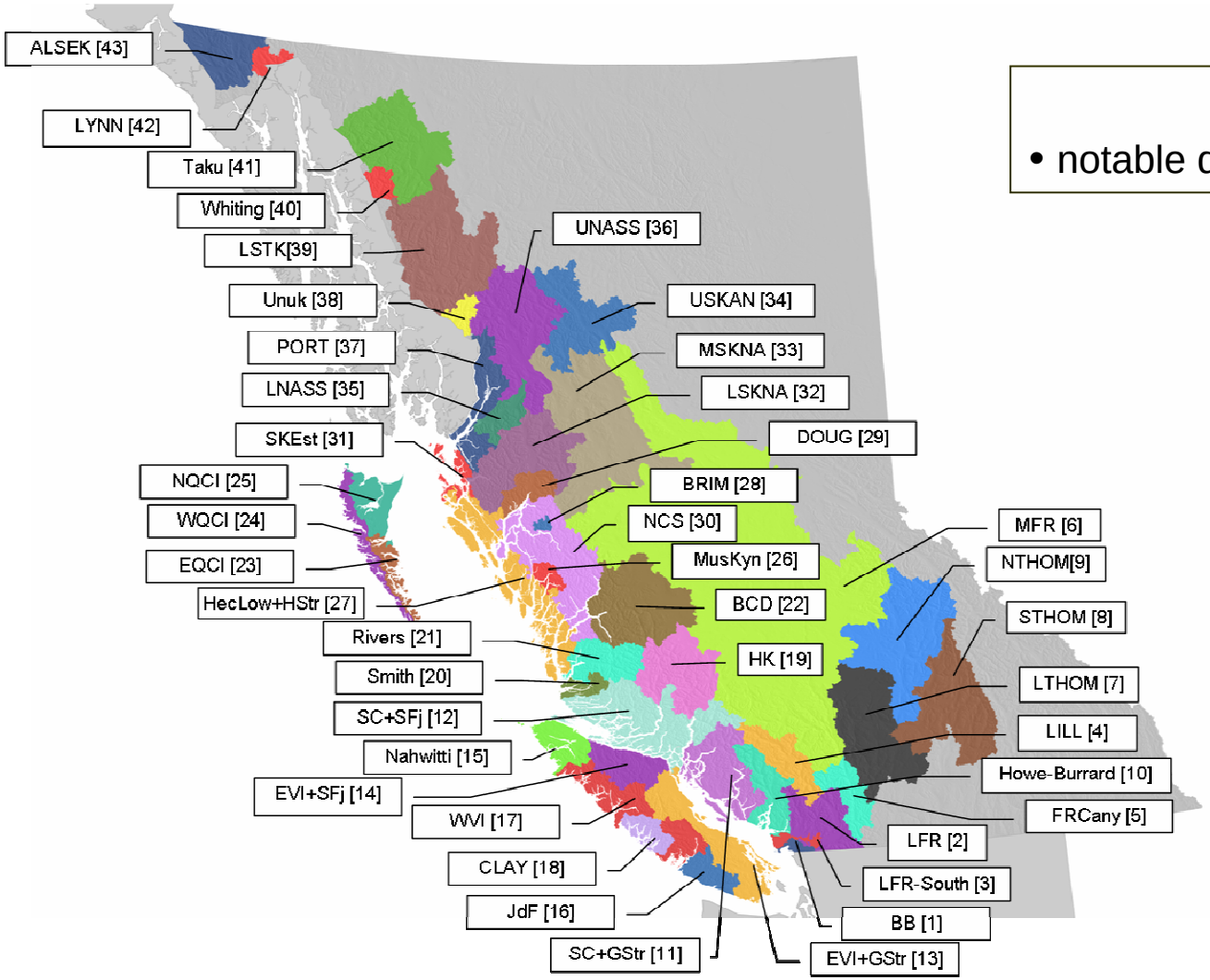
LIVING ON THE EDGE: THERMALLY-CHALLENGED SALMON

Climate and Resiliency Wake-up Call



Watershed Watch-SFU Fraser Salmon and Watersheds Project

Coho CUs in Pacific/Yukon



43 CUs

- notable diversity: WVI, CC, NC

WSP

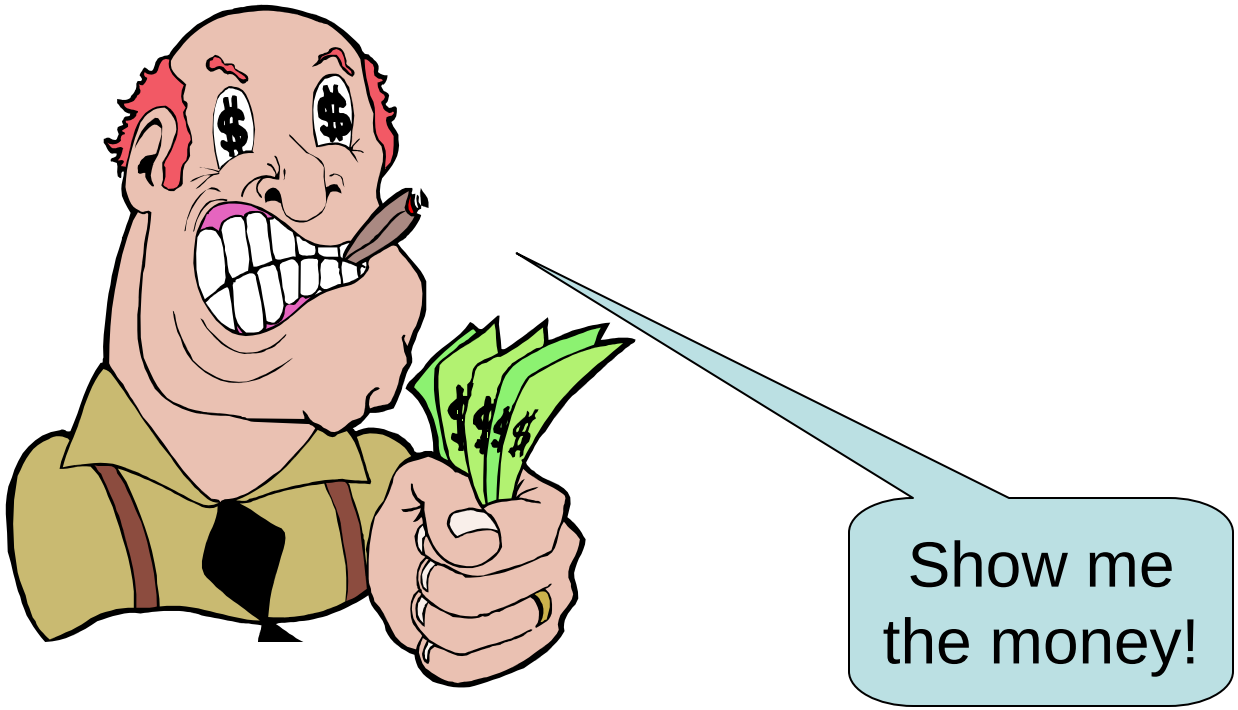
In Summary, Resilient Systems Have…

Capacity to change as the world changes, while still maintaining function

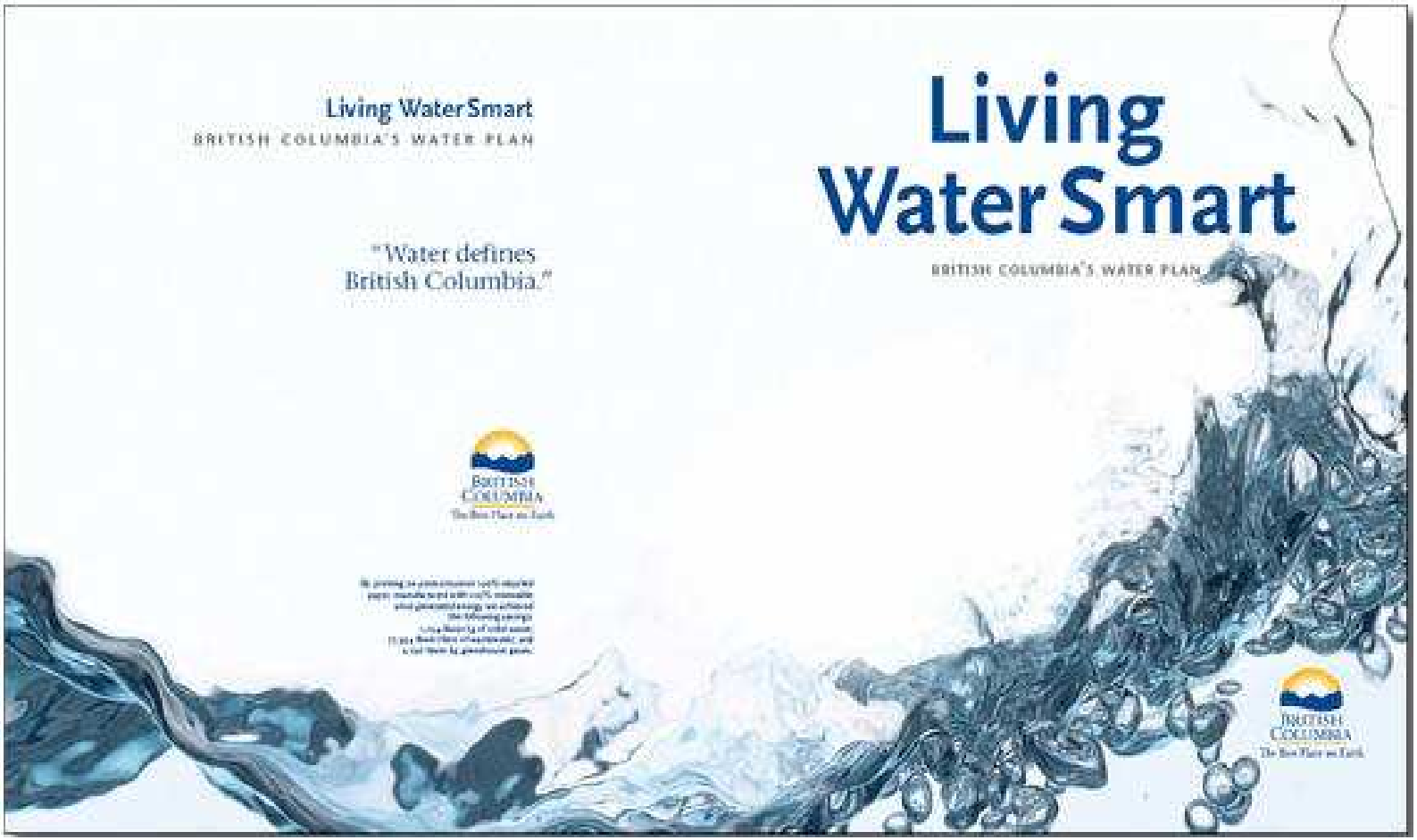
Key To Sustainability

Lies in **enhancing the resilience** of socio-economic systems, not in ‘optimizing’ isolated parts of system.

Humans & Critical Thresholds



Is Anyone Accountable?



Government To Modernize Water Laws:

Ensure adequate stream flows, ecosystem health, more community involvement, and **protection of groundwater**

Stigma of apologies

Can We Avoid the Ultimate
Degraded State?

Please Help. Preach Resilience.

Watershed Watch Salmon Society

Watching Out for BC's Wild Salmon

www.watershed-watch.org

wwss@telus.net

Katrina's Rules of Order

Table 2. Average run size for sockeye stocks or timing groups and the probabilities of achieving specified run sizes.

		Mean Run Size		Probability of Achieving Specified Run Sizes[a]				
Sockeye stock or timing group	Forecast model[b]	All cycles	2006 cycle	0.1	0.25	0.5	0.75	0.9
Early Stuart	fry	**362,000**	**129,000**	**175,000**	**124,000**	**84,000**	**55,000**	**38,000**
Early Summer		**492,000**	**586,000**	**4,545,000**	**2,412,000**	**1,303,000**	**721,000**	**435,000**
Bowron	Ricker-pi	35,000	21,000	85,000	54,000	34,000	22,000	15,000
Fennell[f]	TSA	25,000	13,000	692,000	140,000	24,000	4,000	1,000
Gates[g]	power	58,000	21,000	50,000	31,000	20,000	11,000	7,000
Nadina	fry	82,000	24,000	94,000	54,000	29,000	16,000	9,000
Pitt	power	67,000	56,000	292,000	194,000	124,000	75,000	51,000
Raft	power	29,000	14,000	172,000	109,000	71,000	43,000	28,000
Scotch	R1C	49,000	119,000	567,000	319,000	168,000	89,000	50,000
Seymour	Ricker-cyc	147,000	318,000	1,039,000	656,000	393,000	253,000	166,000
Misc[d]	R/S	-	-	1,553,630	854,554	439,831	208,412	108,115
Summer		**4,669,000**	**3,943,000**	**23,240,000**	**13,052,000**	**7,158,000**	**4,020,000**	**2,484,000**
Chilko	smolt-esc	1,636,000	1,597,000	3,110,000	2,257,000	1,689,000	1,215,000	932,000
Late Stuart	R1C	686,000	305,000	2,017,000	803,000	288,000	104,000	41,000
Quesnel[h]	R1C	1,824,000	1,538,000	16,786,000	9,104,000	4,613,000	2,338,000	1,268,000
Stellako	R1C	523,000	503,000	1,327,000	888,000	568,000	363,000	243,000
Late		**3,196,000**	**8,143,000**	**28,586,000**	**16,314,000**	**8,812,000**	**4,734,000**	**2,726,000**
Cultus	smolt-jack	28,000	28,000	18,000	11,000	5,800	3,000	1,000
Harrison[i]	TSA	35,000	45,000	184,000	90,000	41,000	19,000	9,000
Late Shuswap[j]	RAC	2,206,000	6,745,000	21,605,000	12,359,000	6,644,000	3,572,000	2,043,000
Portage	Ricker	52,000	80,000	269,000	134,000	67,000	34,000	18,000
Weaver	fry	384,000	594,000	1,117,000	656,000	411,000	259,000	175,000
Birkenhead	power	491,000	651,000	1,120,000	713,000	433,000	274,000	183,000
Misc Shuswap[e]	R/S	-	-	3,819,395	2,100,807	1,081,266	512,352	265,786
Misc. non-Shuswap[e]	R/S	-	-	454,052	249,745	128,542	60,909	31,597
TOTAL		8,719,000	**12,801,000**	**56,546,000**	**31,902,000**	**17,357,000**	**9,530,000**	**5,683,000**

[a] probability that the actual run size will exceed the specified projection [b] see text for model descriptions
[c] 1970-2004 mean [d] unforecasted miscellaneous Early Summer stocks [e] unforecasted miscellaneous Late stocks