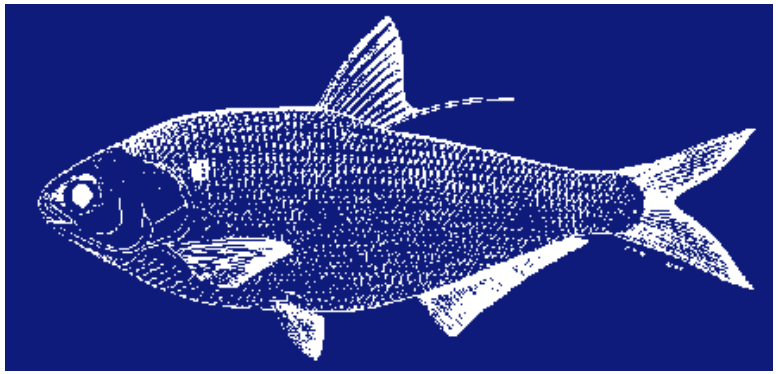
Clean Water Act Section 316(b) Fish Protection and Ecological Valuation

Interactions among law, science, government and industry

February 27, 2001



UCSD Science Studies

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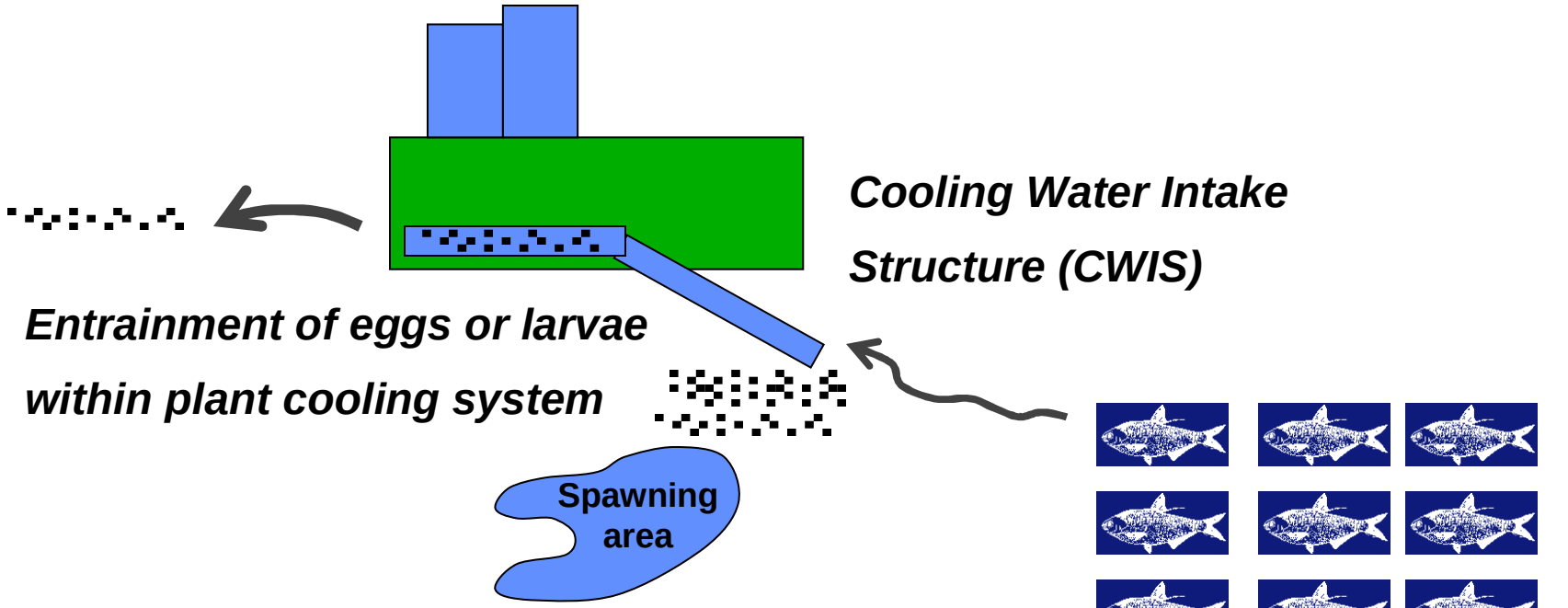
Policy and Decision Science

Topics

- How Section 316(b) of the Clean Water Act addresses some fish protection problems
- Proposals for 316(b) regulatory rules and decision-making
  - US Environmental Protection Agency's (EPA) proposals and electric power industry response
- Lessons from some 316(b) decisions
- Decision-theoretic and policy issues
  - Rules vs. guidelines and process in characterizing ecological change
  - Ecological valuation as a constructive process

316(b) is about fish "impingement" and "entrainment"



Section 316(b) of the 1972 Clean Water Act

Any standard established pursuant to section 301 [regulating effluent limitations] or section 306 [describing effluent performance standards] of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

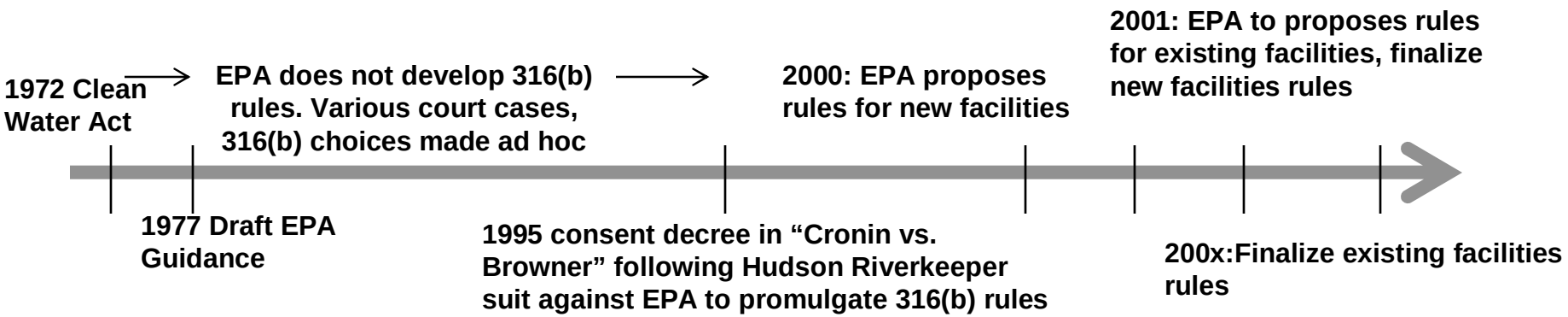
Some key terms

Any standard established pursuant to section 301 [regulating effluent limitations] or section 306 [describing effluent performance standards] of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

Technology criteria

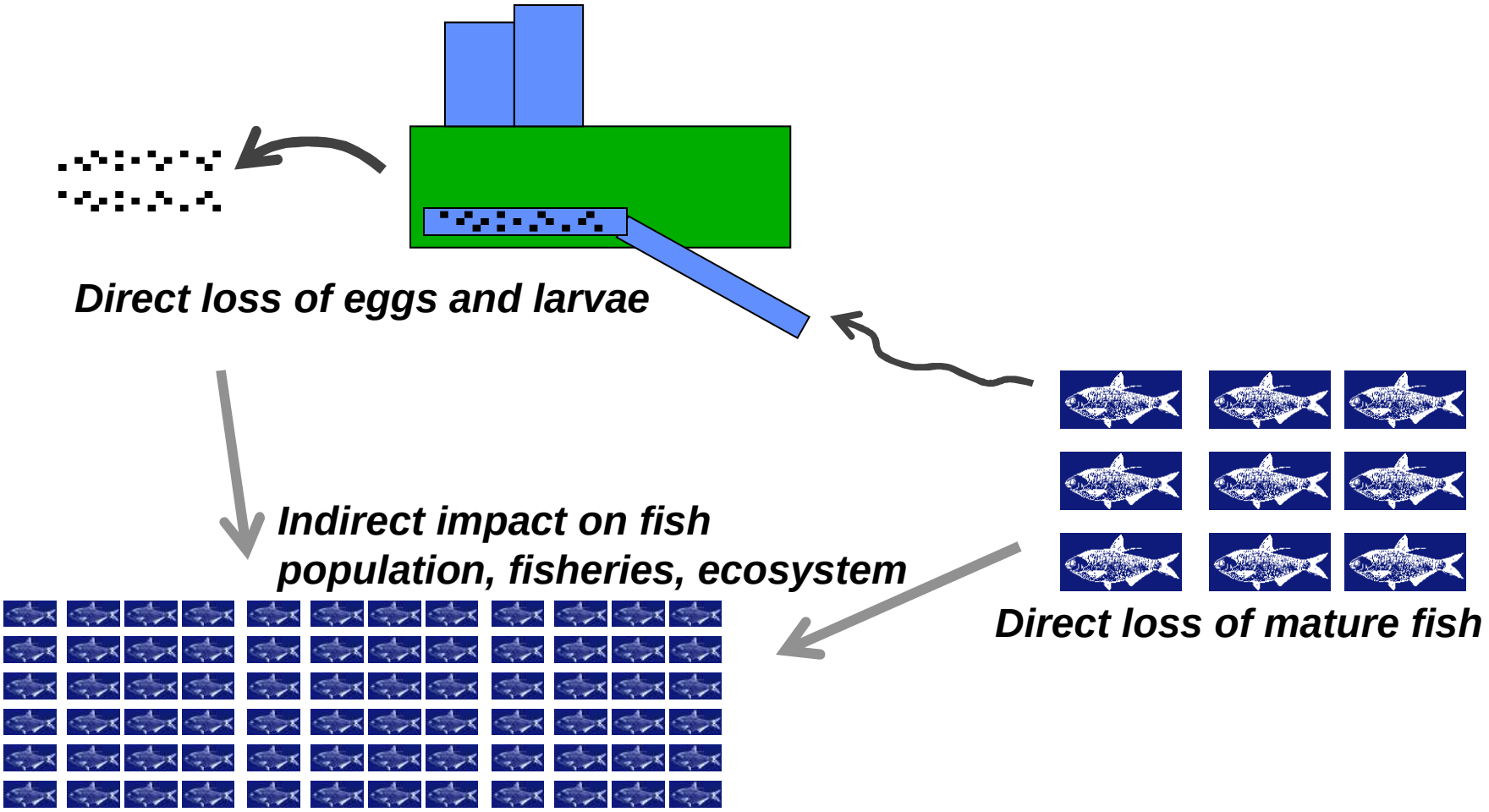
Not further defined

For decades 316(b) has been in limbo. . .

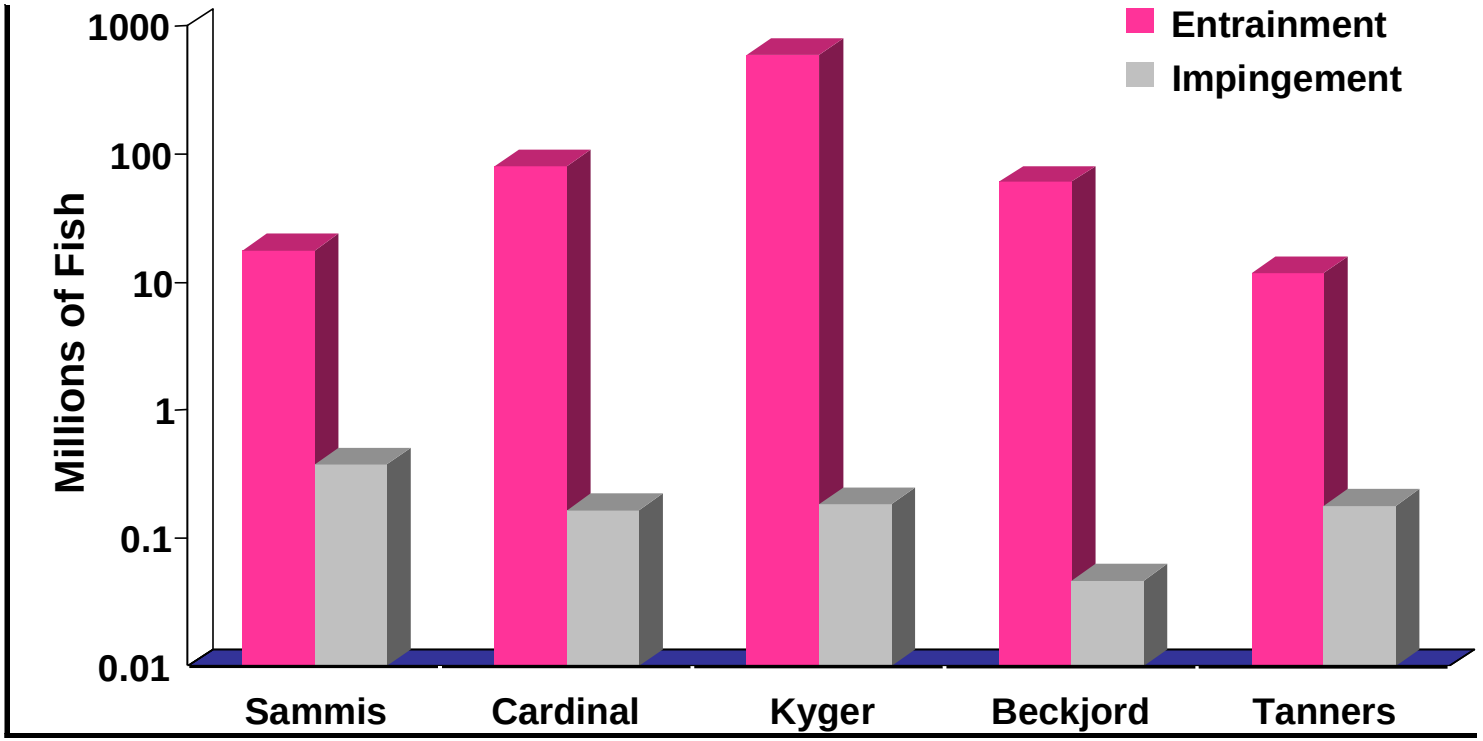


(An "existing" facility is in operation and may have to retrofit to address 316(b). For a "new" facility, 316(b) considerations would be designed in from the start.)

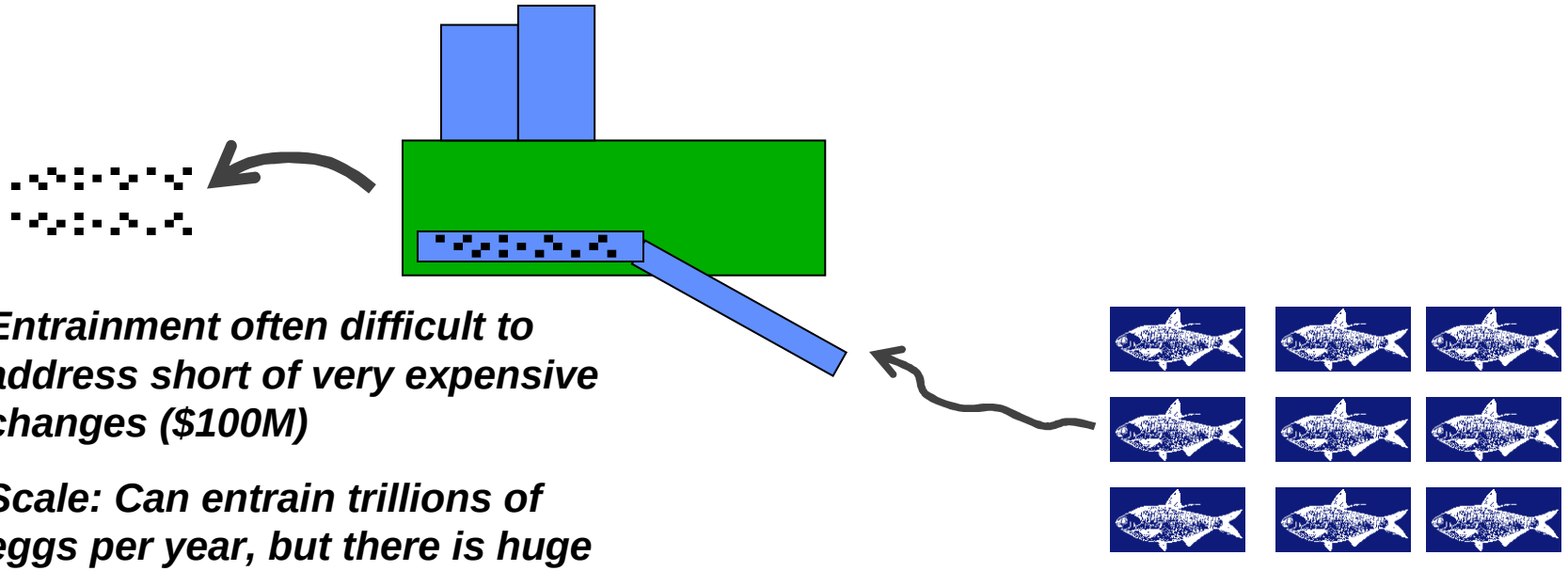
What might an "Adverse Environmental Impact" (AEI) be?



An example of numbers from the Ohio River



Complicating factors 1: entrainment vs. impingement

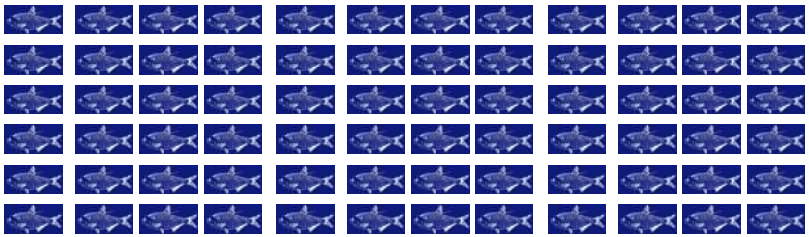


- ***Entrainment often difficult to address short of very expensive changes ($100M)***
- ***Scale: Can entrain trillions of eggs per year, but there is huge natural mortality of larvae and eggs "anyway" (e.g. 90%+),***
- ***Fish population or ecosystem productivity loss hard to estimate***

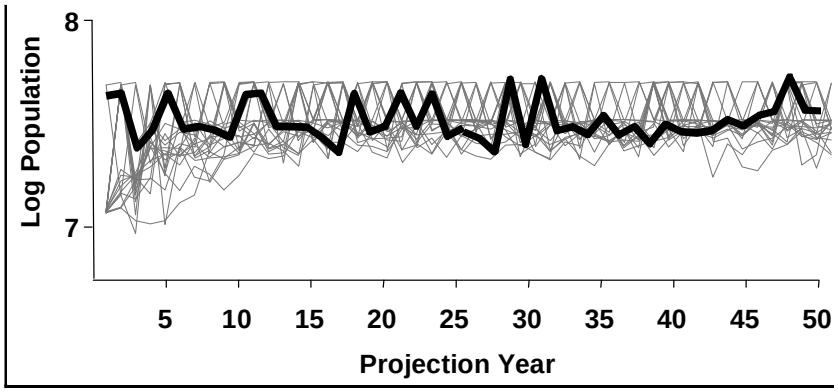
- ***Impingement often easier to address, but not always***
- ***Not framed for power industry as "resource extraction" as is fishing***
- ***Usually smaller take than a fishery***

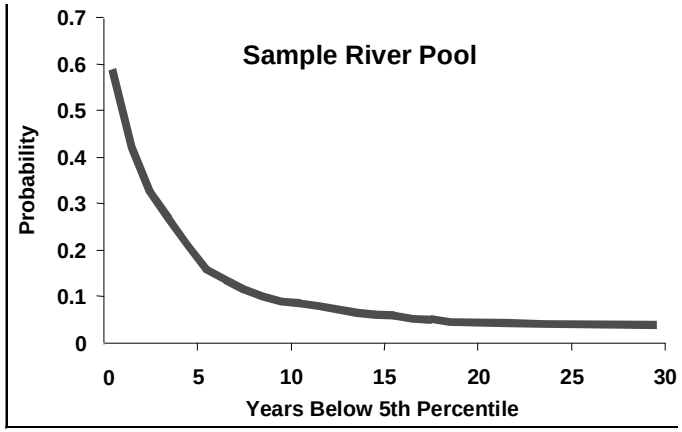
Complicating factors 2: What should be valued?

Loss of individual fish?



Probabilistic reduction below some threshold in a varying population?





And more complicating factors 3 . . .

Water body type

- Impacted rivers, productive estuaries, managed reservoirs, marine environments, Great Lakes

Other industry issues

- Nuclear plants often focus of 316(b) challenges; new plant siting; Hudson River contamination and Riverkeeper history

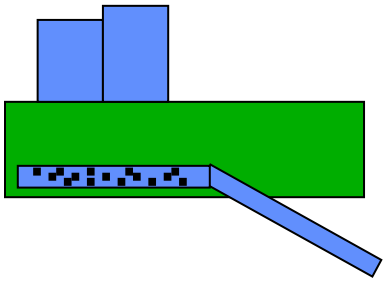
Unclear how serious US EPA considers the risk

- CWIS problems not identified as significant water risk, e.g. compared to non-point source runoff, sewage overflows; no clear horrendous examples

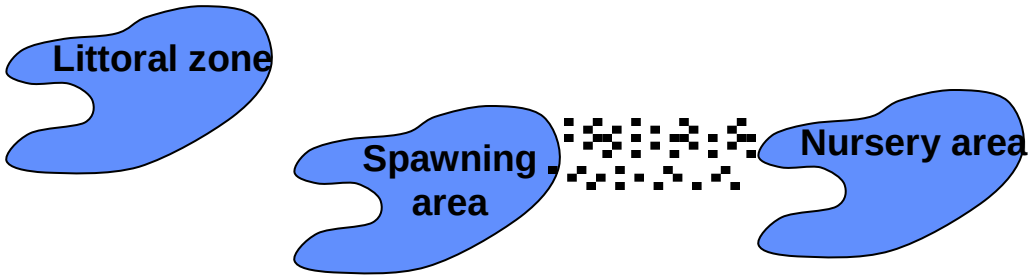
Messy regulatory history

- No actual rule codified for decades
- 1995 court order following Hudson River Riverkeeper suit

Suggested technological, a priori "adverse environmental impact" standards, or simplified metrics as regulatory tools

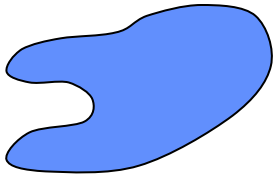


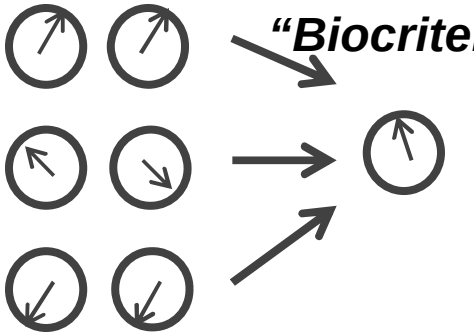
Limitations on CWIS water velocities



Generic characterizations of "biologically sensitive" areas

Water body health with / without CWIS= ?

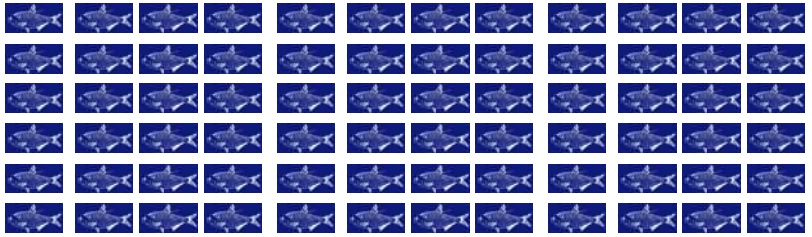




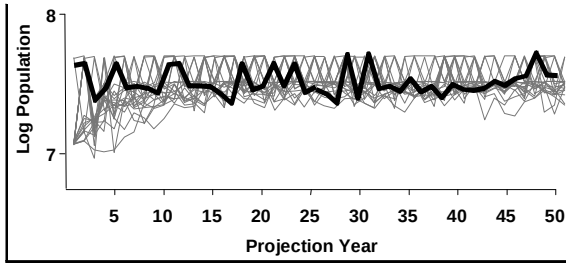
"Biocriteria"

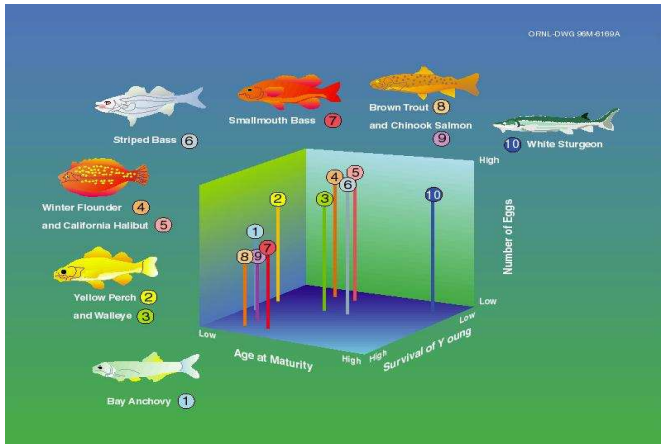
Risk- and science-based response to proxy regulatory rules

What is the CWIS impact on relevant fish populations or ecosystem as a whole?



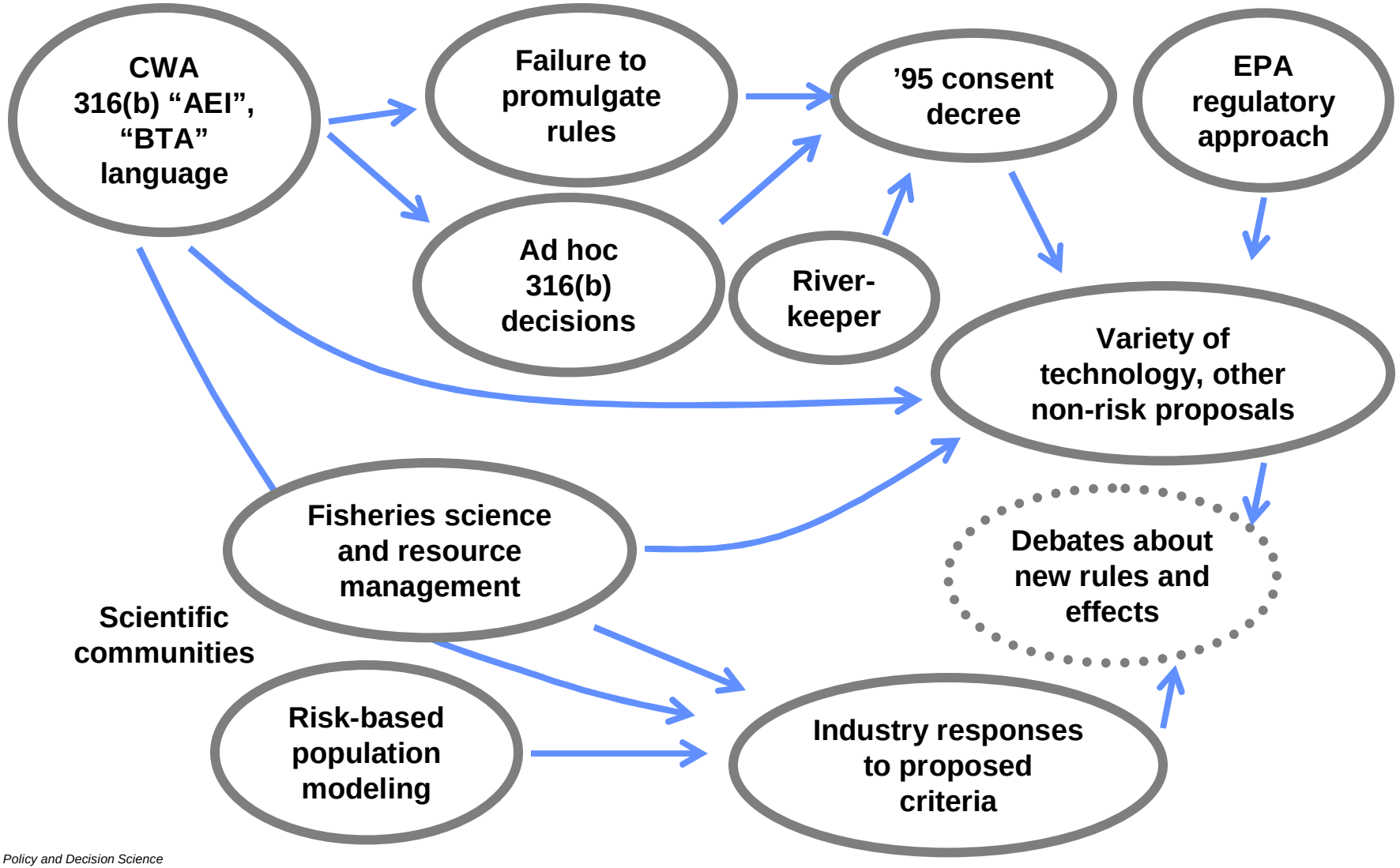
What are causal models of fish life history, population variability, and population change?





Effort versus accuracy is the driving tradeoff. Proxies are heuristics to simplify these site-specific theories and models.

Some of the interactions within 316(b) regulatory activity



From the Utility Water Act Group's (UWAG) response to EPA's proposed new source rule (2000)

In line with the above principles, UWAG recommends that "adverse environmental impact" be defined as follows:

> Adverse environmental impact is a reduction in one or more representative indicator species that (1) creates an unacceptable risk to the population's ability to sustain itself, to support reasonably anticipated commercial or recreational harvests, or to perform its normal ecological function and (2) is attributable to the operation of the cooling water intake structure.

Because this definition is drawn from scientific principles fundamental to natural resource management, it can be interpreted using the same concepts and analytical techniques used by fisheries scientists and resource managers. . . The proposed definition turns on "unacceptable risk." What risk is "unacceptable" is a function of a number of biological and social factors, which must be managed through a scientific risk assessment and risk management process.

Breaking the code. . .Specific rules or a risk paradigm?

Value judgment with uncertainty
Suggests possible threshold(s)

Individual fish not a concern

In line with the above principles, UWAG recommends that "adverse environmental impact" be defined as follows:

Multiple social values

> Adverse environmental impact is a reduction in one or more representative indicator species that (1) creates an unacceptable risk to the population's ability to sustain itself, to support reasonably anticipated commercial or recreational harvests, or to perform its normal ecological function and (2) is attributable to the operation of the cooling water intake structure.

Causal account required

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For example, cost , impact on fisheries, ecosystem

"Process" vs. a priori rule

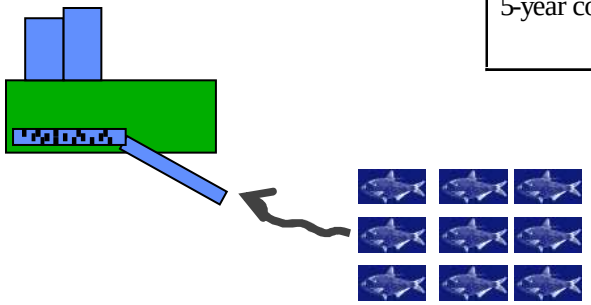
Should play by same rules as fisheries

Decision-making at Chalk Point in the 1980s (1)

- **Background: Collapse of striped bass population due to overfishing in Chesapeake Bay, fishing moratorium**
- **Maryland had codified American Fisheries Society fish values into State implementation of Clean Water Act Section 316(b)**
- **Successful implementation of barrier net to reduce impingement (but not entrainment)**

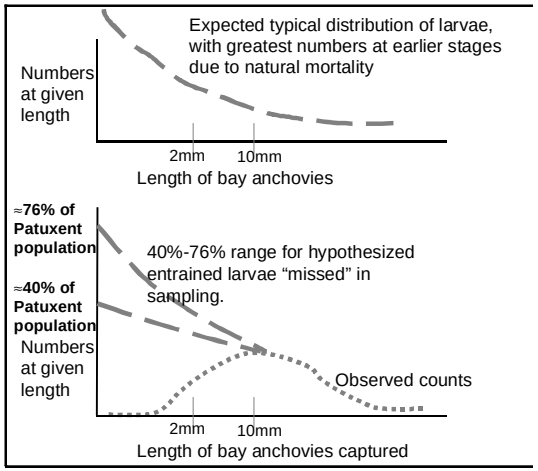
Chalk Point Impingement Valuation Based on AFS Values

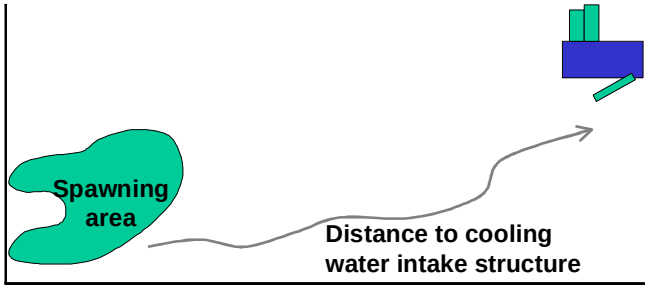
Before deployment of barrier nets	Annual estimated count	Valuation		After deployment of barrier nets	Annual estimated count	Valuation
Atlantic menhaden	1,347,490	$85,094		Atlantic menhaden	144,558	$11,751
Spot	647,016	$211,864		Atlantic silverside	14,159	$182
Hogchoker	192,926	$12,562		Clingfish	12,129	$91
White perch	41,910	$26,602		Weakfish	17,336	$3,592
Total fish	2,368,324			Hogchoker	19,019	$389
Blue crab	1,948,132	$662,312		White perch	10,459	$1,853
Total fish and crab	4,316,456	$1,023,514		Total fish	267,368	$21,992
Cost adjusted for crab impingement survival		$455,912		Blue crab	164,738	$6,437
5-year cost		$2,280,000		Total fish and crab	432,106	$28,430
				5-year cost		$142,150

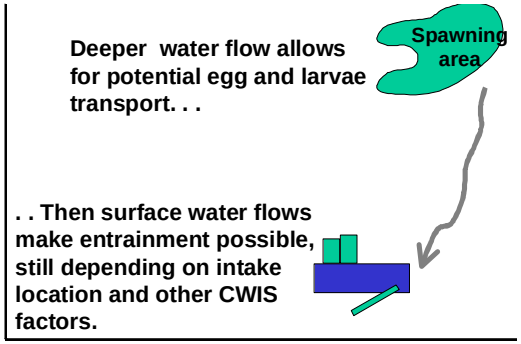


Decision-making at Chalk Point in the 1980s (2)

- **Sequence of conjectures and refutations over entrainment of bay anchovy as forage fish for striped bass**
- **Internal concern: expensive cooling tower prospect**
- **Successful pilot striped bass stocking program**
- **Agree on stocking program "enhancement" project to mitigate entrainment**
- ***Question: What limits the mitigation project investment level, which could be as high as you like?***







Another valuation example: Elkhorn Slough (2000)

Two two new operating units proposed for existing plant on productive estuary on Monterey Bay, part of fast-track modernization strategy

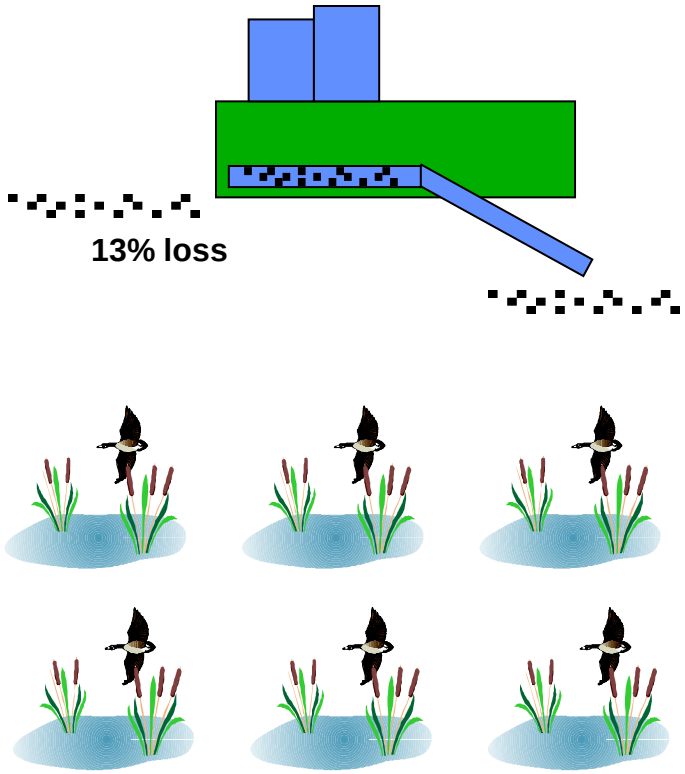
No significant impingement

Entrainment loss estimated as 13% of slough larvae and eggs

Power company proposed no fish population loss

Biologists countered with purely ecological “trophic” impact

How to value and get closure on the decision?



From larval and egg entrainment to dollars

Start with estimate of 13% entrainment

Consider as "equivalent" to similar loss of wetlands around the slough

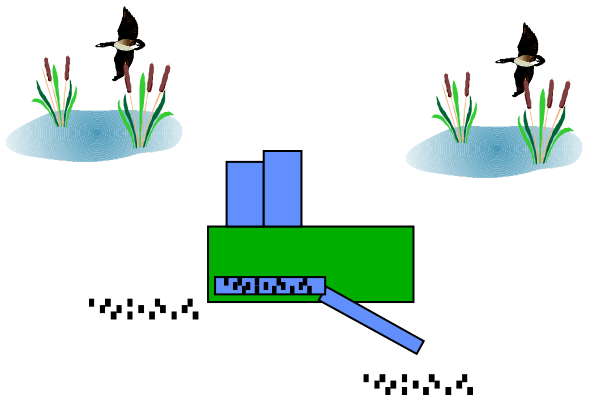
Calculate 13% of slough surface area = 13% x 3000 acres = ~390 acres

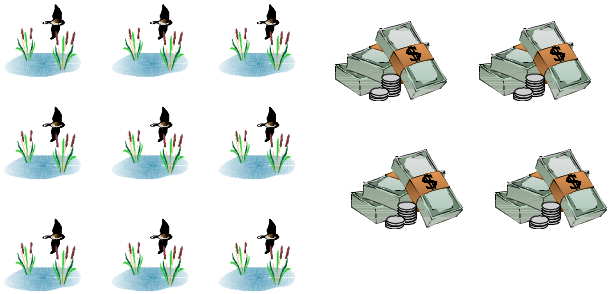
Obtain per acre estimates of wetland construction costs in California

Adjust down per acre wetland construction cost to ~$12K-$18K / acre

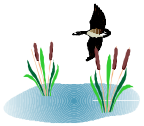
Calculate valuation of ~ $6.5M

But, no wetlands planned. Instead, use to reduce local pollution to slough, obtain easements, etc.





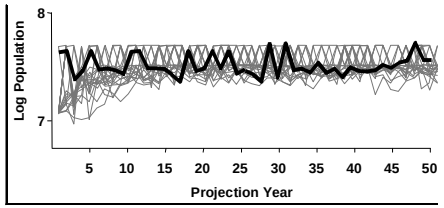
Conjectured dynamic for some 316(b) decisions



Formulate contextual valuation of water body

- Estuary
- Marine
- Impacted water body
- Managed reservoir

Estimate fish populations or ecosystem changes



Formulate rough bound on "just" cost

- Plant size, history
- Water body type, condition
- Perceptions of impact

Construct site-specific $ valuation of fish impact

Develop mitigation with investment "budget" tied to valuation

Screen alternatives at "extreme" costs, see what else possible

Some speculations about 316(b)

It's much about bounded rationality and simplifying choices. . .

- **Technology and other proxy standards vs. risk-based approaches = regulatory heuristics vs. site-specific study and valuation**

. . .But ecological science and valuations are often site-specific

- **Ecological variability makes it implausible to formulate useful technology-based or a priori AEI standards**
- **Still can be useful heuristics and and "one-sided" criteria**
- **Ecological valuations may often be locally constructed**

Political economy of fairness at work

- **Mitigation options with investment budget set by ecological valuation, other local considerations**

Plus larger forces. . .

- **Difficulty of studying fish populations + probably overall low true concern + equity with fisheries + new EPA administrator + perceived energy needs and energy competition → ?**