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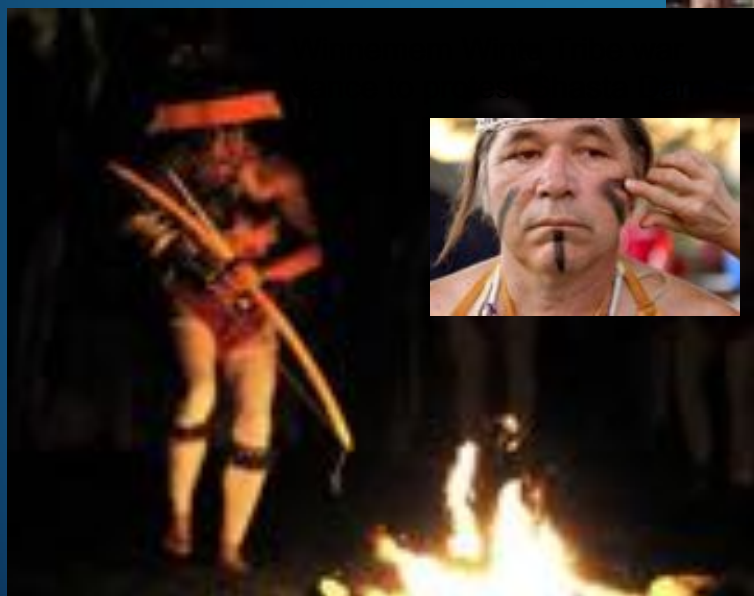


REMOVING BARRIERS

AND RESOLVING
CONFLICT



THE CONFLICT



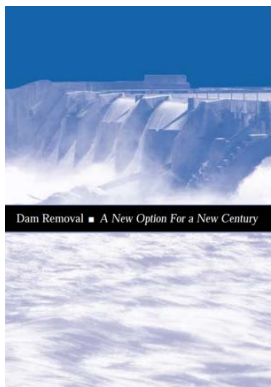
RESOLVING DIFFERENT PERSPECTIVES

Can be as easy as defining the terms

*Dam removal?
So you want to
remove Hoover
Dam? Why?*



*That small dam in
town is just rotting
in place and is a
safety hazard, we
should remove it!*



The Aspen Institute
A New Option for a
New Century (2000)



THE DECIDING FACTORS

to help prioritize successful restoration projects

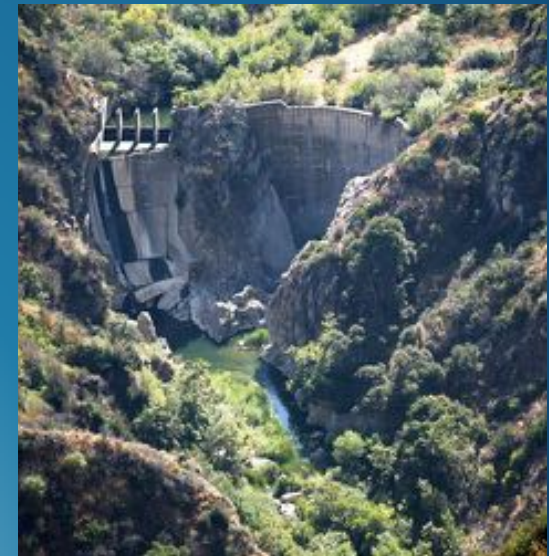
Typically Removed Due to:

- Dam Safety
- Liability
- Economic Issues (cost of maintenance)
- Environmental Concerns (i.e. connectivity/fish passage, water quality, restoration of natural fluvial functions)



Typically Retained Due to:

- Ownership
- Existing Uses
 - ✓ Water Supply
 - ✓ Hydroelectric
 - ✓ Flood Control
- Community Politics
- Aesthetics & Recreational
- Historic Issues
- Infrastructure
- Quantity of Sediment
- Quality of Sediment
- Scale of Project
- Funding Issues
- Sensitive Species & Conflicting Ecological Issues



SAFETY LIABILITY

Dam Retained



YORKVILLE DAM, IL
(19 deaths but dam repaired)



Lake Solitude Dam, NJ
(1 death, owner was denied right to remove dam)



SAFETY & LIABILITY

Dam Removed

Spoonville Dam, CT
(multiple deaths, involved the
white water boating community)



San Clemente Dam, CA
(earthquake proofing cost
too much)



Final Design: Princeton Hydro

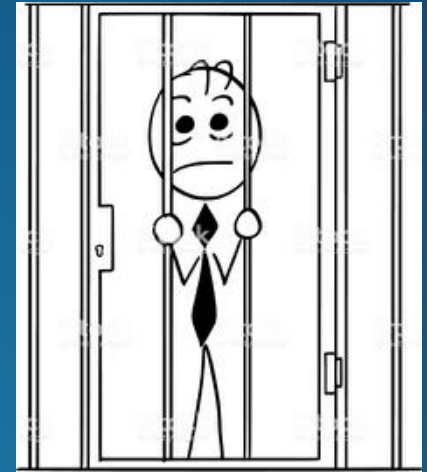


Final Design: Tetra Tech & Interfluve

OWNERSHIP

Dam Retained

Plume & Atwood Dam, CT



OWNERSHIP

Dam Removed



Pizzini Dam, CT

(utilized photo renderings to convince an absentee owner)



Final Design: Wildman



Photo-rendering

DEVELOPING A COMMUNITY VISION

using photo renderings

Swanton Dam, VT



East Burke Dam, VT



Holmes Playground Dam, MA



Rendering by Wildman

Rendering by Wildman

Rendering by Wildman

EXISTING USE - HYDROELECTRIC

Dam Retained

Collinsville Dam, CT
(picturesque and have been
investigating hydro potential for
decades, with no real progress)



EXISTING USE - HYDROELECTRIC

Dam Removed

Edwards Dam, ME (record setting FERC relicensing – ecological benefits outweighed power benefits)

1999 – Edwards Dam removed

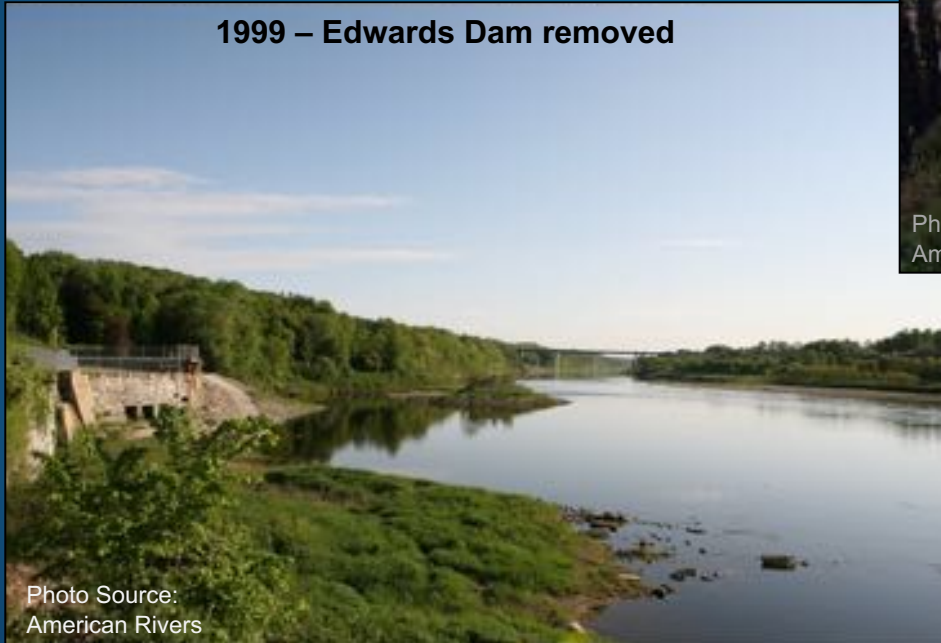


Photo Source:
American Rivers

1998 - Edwards Dam

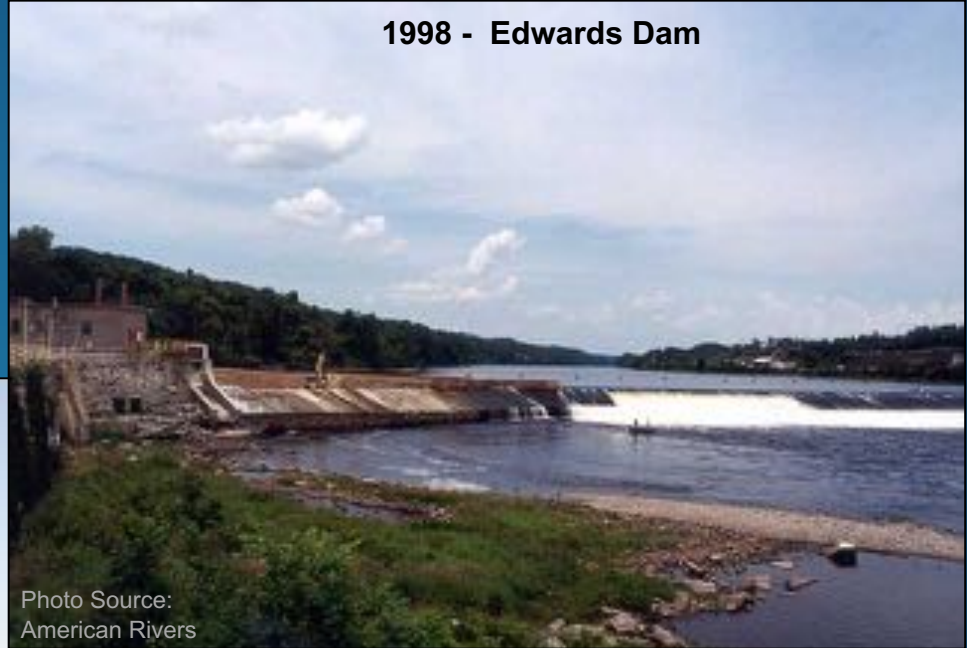


Photo Source:
American Rivers

Final Design: EPRO

1997: Edwards Dam marked the first time that FERC had ever denied an application for relicensing and set a precedent for FERC's authority to remove dams that pose greater harm than good. One year after removal in 1999 alewife returned by the millions for the first time in 160 years.

EXISTING USE - HYDROELECTRIC

Balanced Approach

Penobscot River, ME (Creative balancing of increased power generation and dam removals for ecological benefits)

Hydro Upgrades: Orono Dam from 2.78 to 6.52 MW & Stillwater Dam from 1.95 to 4.18 MW.

Bypass channel around Howland Dam

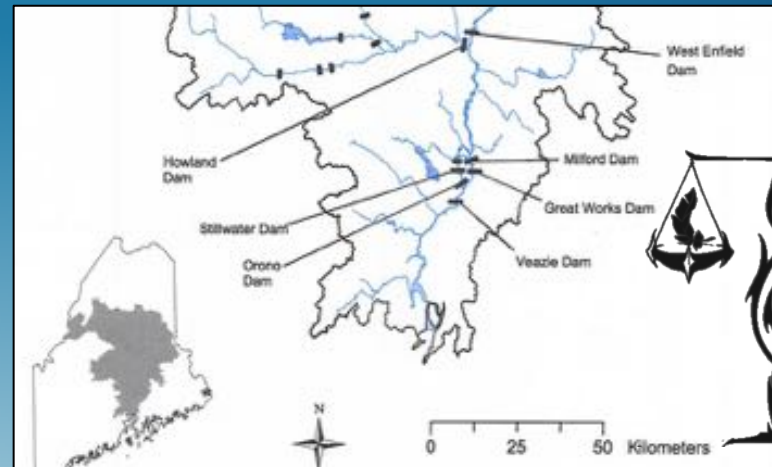
Veazie Dam Removal



Great Works Dam Removal



Photo Source:
TNC



EXISTING USE - HYDROELECTRIC

Alternatives

Hydro Kinetic Turbines



In-Conduit Turbines



<https://youtu.be/SFLCJvDj9xM>

EXISTING USE – WATER SUPPLY

Dam Retained

Goldsboro Dam, NC

- 9 MGD
- Proposed: Modify internal wet well pipe configuration



Barrier #1 Little Lehigh, PA

- 30 MGD
- Proposed: Screened in-channel intakes with air scouring system



Green River Water Supply Dam, MA

- 2.1 MGD
- Proposed: Gravity feed, bypassing sand filters; pre-treat elsewhere



Dam Failure



EXISTING USE – WATER SUPPLY

Dam Removed

Ballou Dam, MA

- 40,000 gal
- Proposed:
Underground
storage tank for
fire suppression



Final Design: MMI

Great Works , ME (alternate free flowing water intake)

- ~10 MGD
- Proposed:
alternate free
flowing water
intake



Final Design: MMI



EXISTING USE - FLOOD CONTROL

Dam Retained

Almost all flood control
dams are retained



EXISTING USE - FLOOD CONTROL

Alternative with a Dam



But flood control dams could easily be designed to pass 100% of normal flows and smaller storm events, and designed only to attenuate significant flood flows

EXISTING USE - FLOOD CONTROL

Alternative without a Dam

Attenuation through final configuration (partial removal) or vegetation



Charles River, MA - The Giant Sponge

- 1983 acquisition & protection of 17 natural valley storage areas
- **Totaling 8,103 acres**
- USACE estimate of annual flood control benefits at \$17 million/yr

Source: CIFMCG
Workshop 2006;
Comprehensive Floodplain
Management: Promoting
Wise Uses of Floodplains &
photos from the internet



COMMUNITY POLITICS

Dam Retained

Wiley Russell Dam, MA



Howland Dam, ME



COMMUNITY POLITICS

Dam Removed

Fort Halifax Dam, ME (economic justification)



West Winterport Dam, ME (extensive alternatives analysis, time & lawyers)



AESTHETICS & RECREATION

Dam Retained

Sweet Pond Dam, VT



Sennebec River, ME



Conceptual Design: Wildman
Final Design: URS



AESTHETICS & RECREATION

Dam Removed

Spoonville Dam, CT (worked with whitewater boaters)



Final Design: Princeton Hydro



Pawtuxet Dam, RI
(worked on envisioning
with community)



HISTORIC VALUE

Dam Retained

Heishman's
Mill Dam, PA



HISTORIC VALUE

Dam Removed

Kent Dam, OH
(kept portion of dam and created falling water aesthetic)



Town Brook
Dam, MA
(upfront study and documentation)



Final Design: MMI



INFRASTRUCTURE

Dam Retained

Tingue Dam,
CT



Final Design: MMI

Brave Station
Dam, PA



Mill Street
Dam, MA



INFRASTRUCTURE

Dam Removed

Anaconda & Union City Dams, CT (protected sewer line with sheet pile and concrete cap)



Final Design: MMI



Columbia Dam, PA
(saw cut & stabilized
rock riffle beneath
bridge capable of
passing fish)



Final Design: Princeton Hydro

QUANTITY OF SEDIMENT

Dam Retained

Rindge Dam, CA



Mad River Dam, CT (dam lowered)



Platts Mill Dam, CT
(partial width removal)



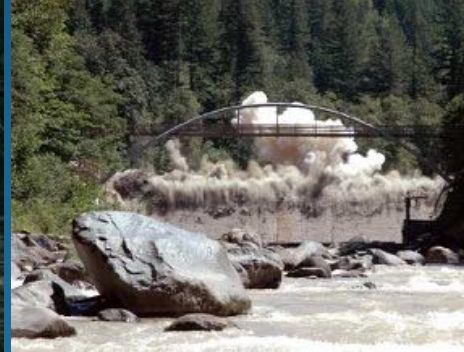
Final Design: MMI



QUANTITY OF SEDIMENT

Dam Removed

Marmot Dam, OR
(allowed large short term impact)



Final Design: PGE and Natl McDougall Co.

Condit Dam, OR
(allowed large short term impact)



Final Design: PacifiCorp

San Clemente
Dam, CA
(bypass &
remove dam)



Final Design: Tetra Tech



QUALITY OF SEDIMENT

Dam Retained

Cumberland Dam, MD (dioxins)



QUALITY OF SEDIMENT

Dam Removed

Milltown
Dam, MO
(significant
sediment
removal and
confinement)



Final Design: River Design Group and Envirocon

Heminway Dam, CT (relocated and stabilize sediment on-site)



Final Design: Princeton Hydro



SCALE OF PROJECT

Dam Retained



Snake River Dams,
Pacific NW



Klamath Dams, CA

(initially retained but heading
toward removal now)



SCALE OF PROJECT

Dam Removed

Elwha Dam, WA
(many years of planning and patience; took care of impacts 1st)



Glen Canyon Dam, WA
(many years of planning and patience; took care of impacts 1st)



Birch Run Dam, PA (dewatered 1st)



FUNDING OF PROJECT

Dam Retained

American Brass Co. Dam, CT



Middle Street Dam, CT (had Federal Highway Funding – then lost it)



Final Design: Princeton Hydro

FUNDING OF PROJECT

Dam Removed

Naugatuck River Dams, CT (Special Environmental Projects Funding; i.e. mitigation)



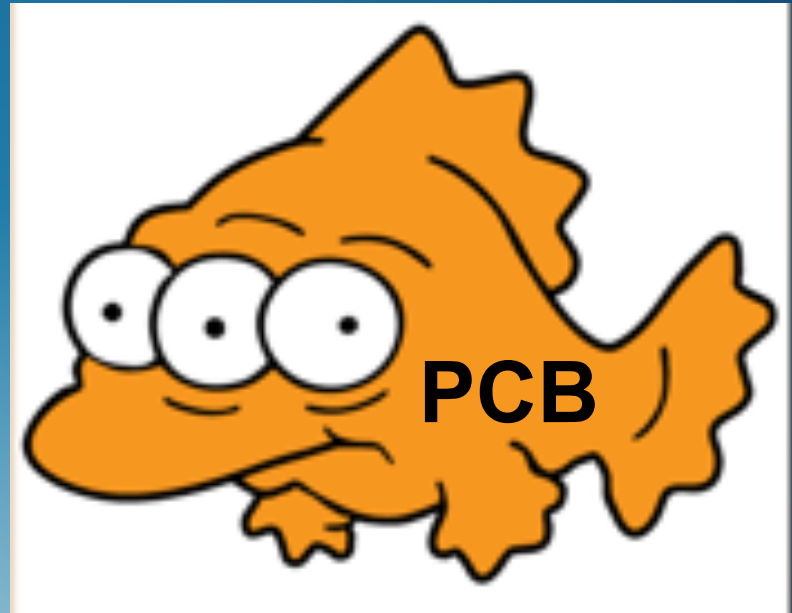
SENSITIVE OR INVASIVE SPECIES

Dam Retained

Many of 1st Barriers on the Great Lake
Tributaries, Midwest



Government Mill Dam # 6
E. Branch Housatonic River,
MA (lowest Crane Paper Dam)



SENSITIVE OR INVASIVE SPECIES

Dam Removed



Final Design: MMI

Cuddebackville Dam, NY
(Dwarf Wedge Mussels – locate & relocate)



Carpenters Dam, CT (Wood
Turtles – studied and developed
construction protection plan)



©Stephen V. Silluzio 2004



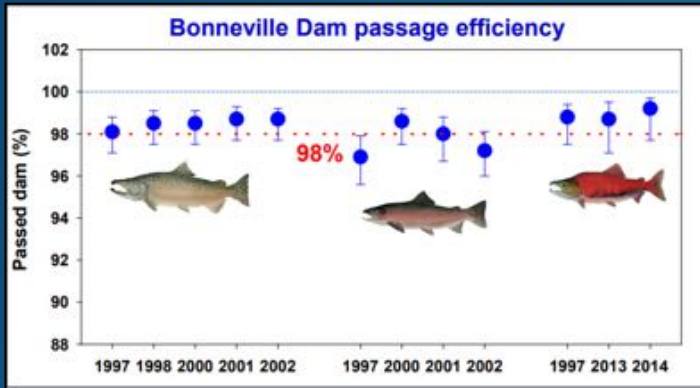
Final Design: Princeton Hydro



EFFECTIVE FISH PASSAGE

Dam Retained

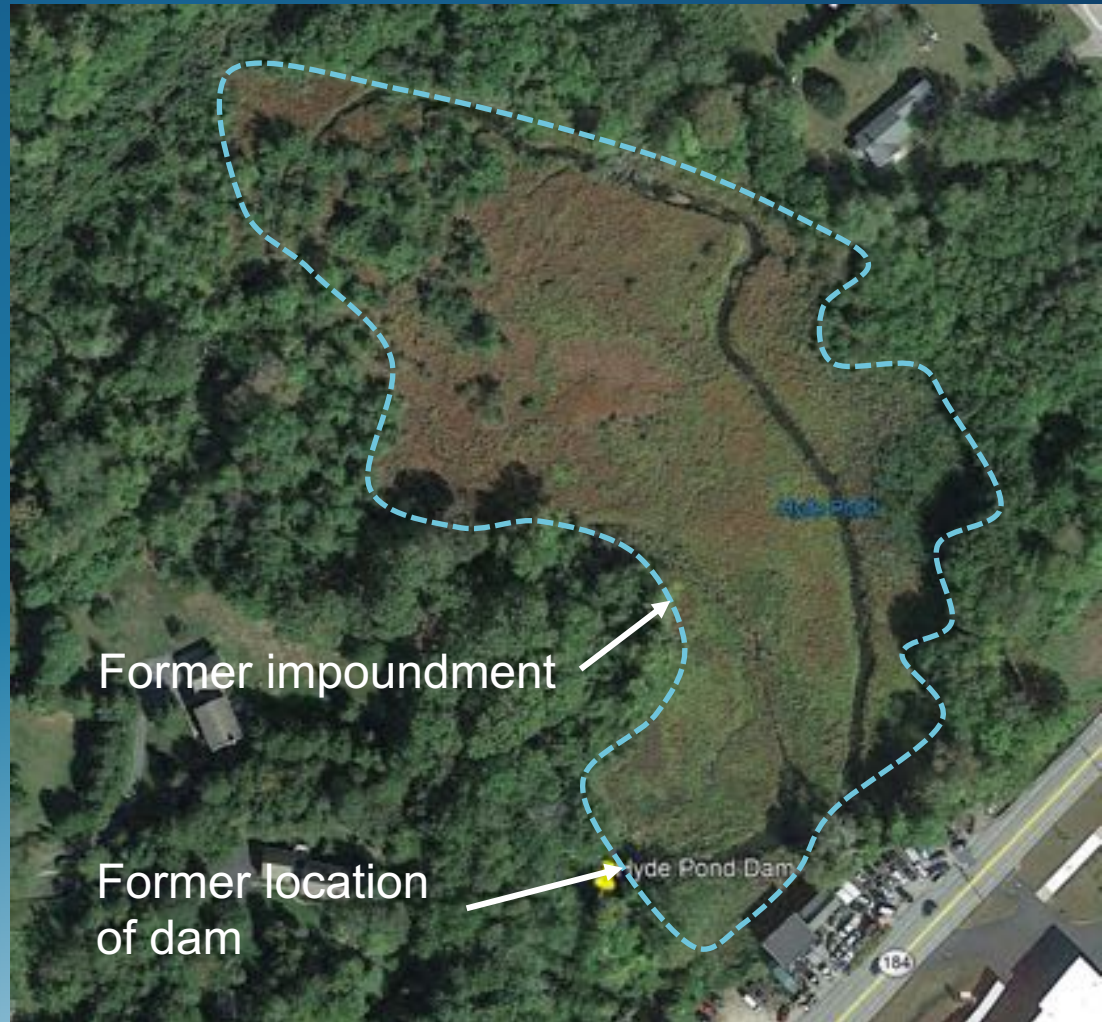
Bonneville Dam, WA / OR (few species, salmon centric, strong swimmers & jumpers)



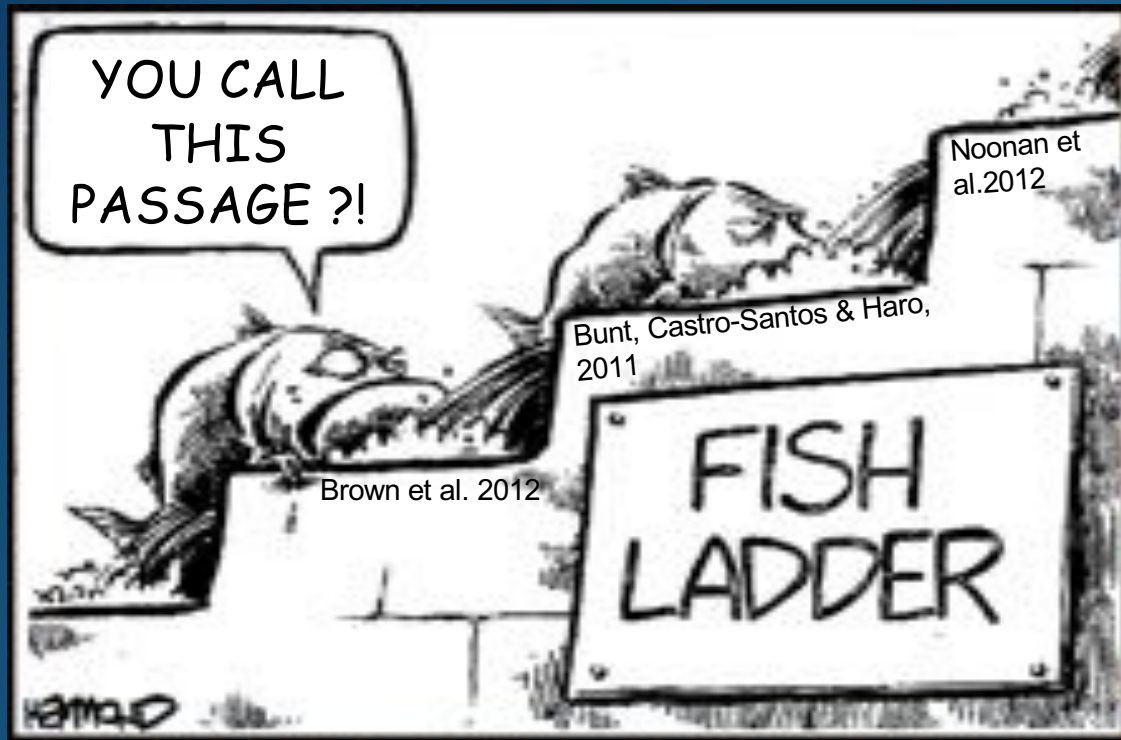
INEFFECTIVE FISH PASSAGE

Dam Removed

Hyde Pond Dam, CT



FISH PASSAGE EFFECTIVENESS



Brown et al. 2012: “It may be time to admit failure of fish passage and hatchery-based restoration programs and acknowledge that significant diadromous species restoration is not possible without dam removals.”

Bunt et al. 2011: Assessed 19 studies “The vast majority of fishway structures do not effectively mitigate the effects of barriers...”

Structure type	Total efficiency (%)
Pool-and-weir	43
Vertical-slot	44
Denil	62
Nature-like	43
Total	44

Noonan et al. 2012: “Low overall efficiency of passage indicated that most facilities need to be improved to mitigate habitat fragmentation...”

FISH PASSAGE EFFECTIVENESS



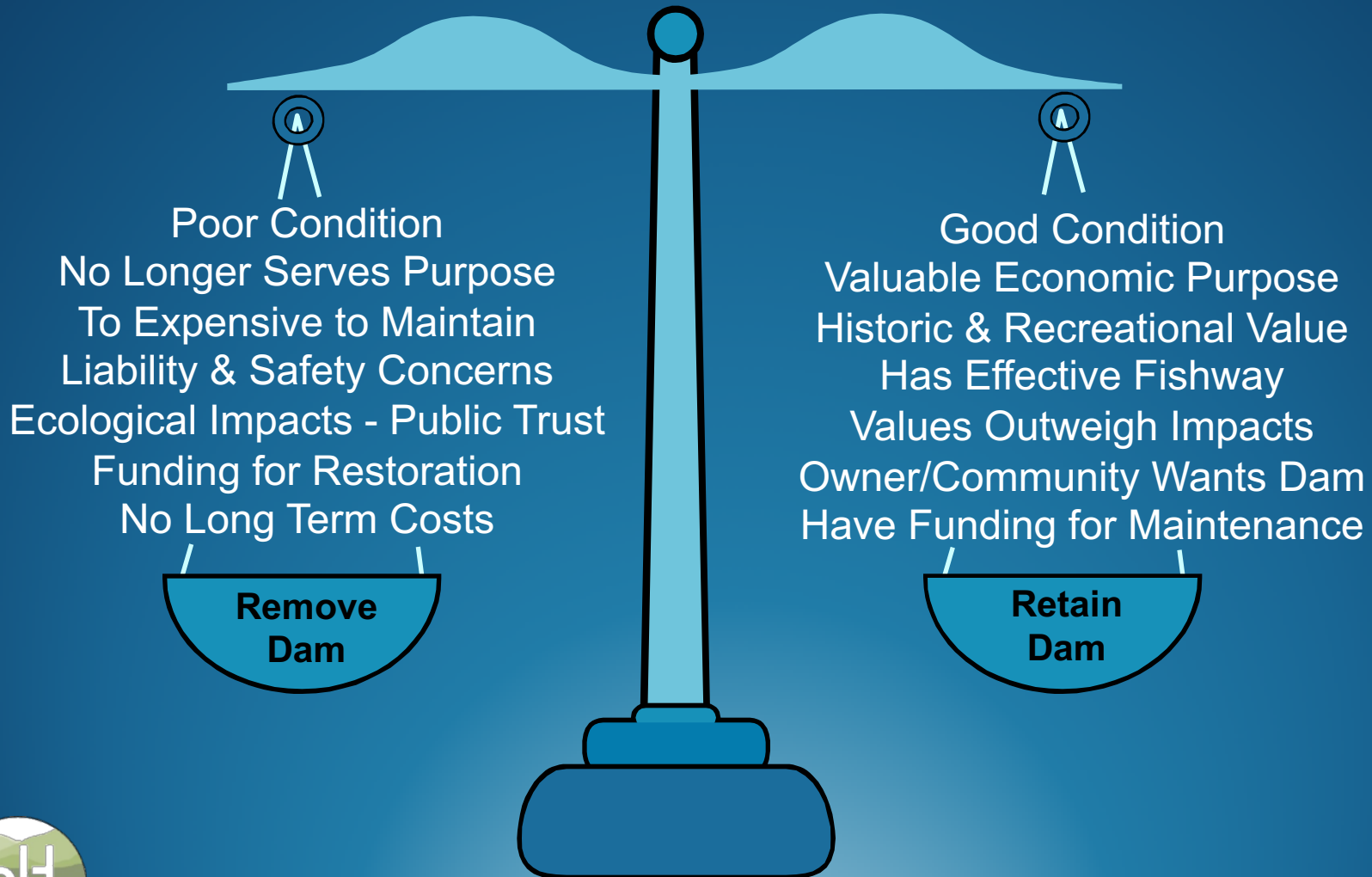
What we think we are getting



What we are actually getting

CONFLICT RESOLUTION

The Balancing Act



WHAT ACTIONS CAN BE TAKEN

Prioritize limited ecological restoration resources and funding by:

1. Identify critical issues/potential barriers with stakeholder input early on

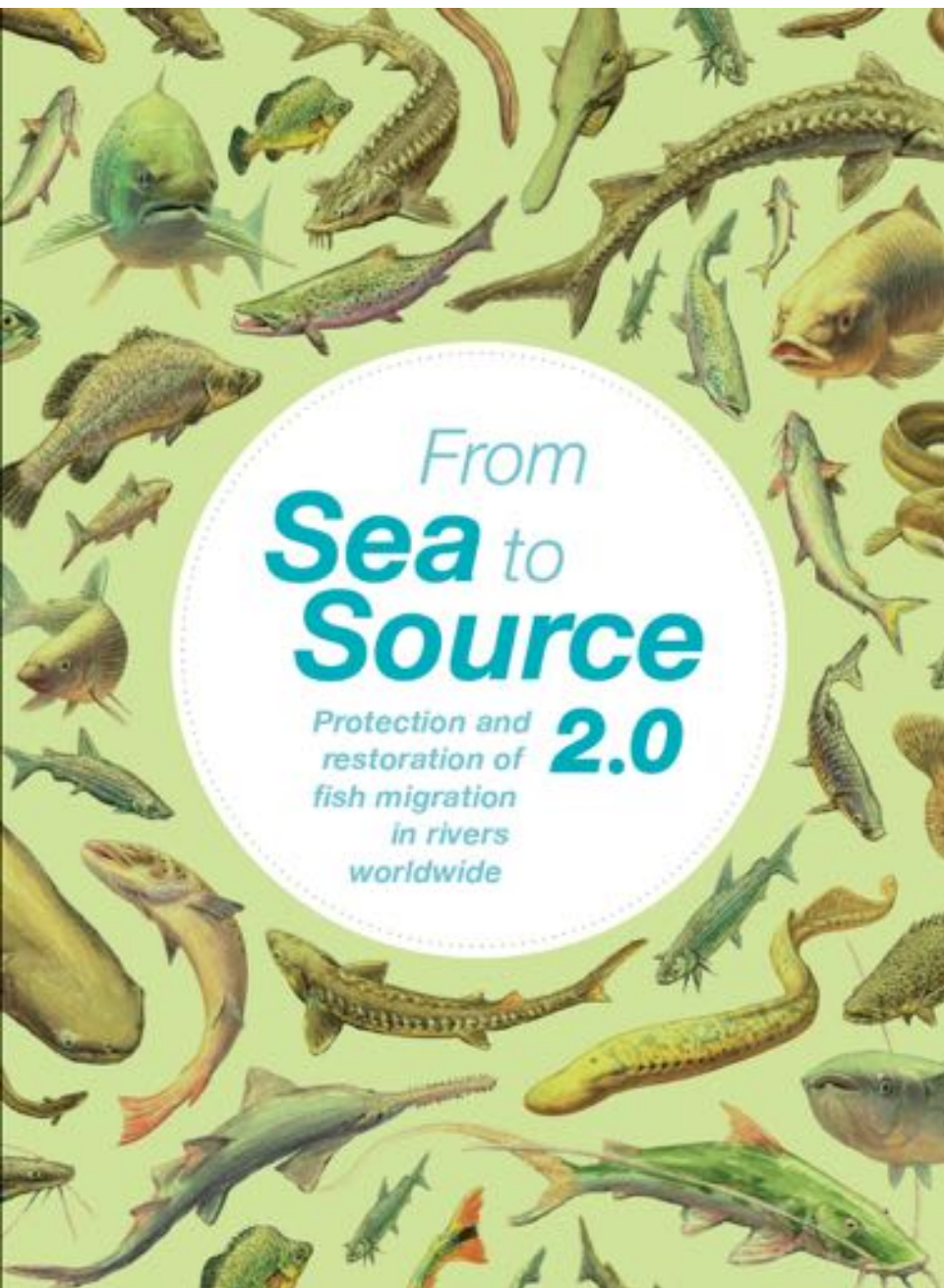
LOTS OF DATA AVAILABLE IF YOU DIG DEEP

- Past dam inspections
- FEMA – Flood Insurance Studies
- Inundation Hazard Mapping
- Aerial or ortho photographs
- USGS mapping, gauge data for flow & sediment
- Geological mapping
- EPA watershed mapping & info
- GIS data
- Past plans of dam, site, or nearby construction
- Topographic mapping & LIDAR
- Sanborn Fire Insurance mapping
- Utility information (town, state, cal-before-you-dig)
- Web pages for local boating
- Permit applications
- Old reports (environmental, historic, engineering, planning, state studies, etc.)
- Photographs and Drawings
- Historic records & maps
- Federal Energy Regulatory Commission reports
- State rare & endangered species mapping
- Tax assessors mapping
- Wetland mapping
- Fisheries data
- Stream data
- Watershed, aquifer, env. hazard mapping
- Flood Reports
- Pre-Dam Photographs, Drawings, or Surveys
- Reservoir Drawdown Photographs
- Barrier Inventories

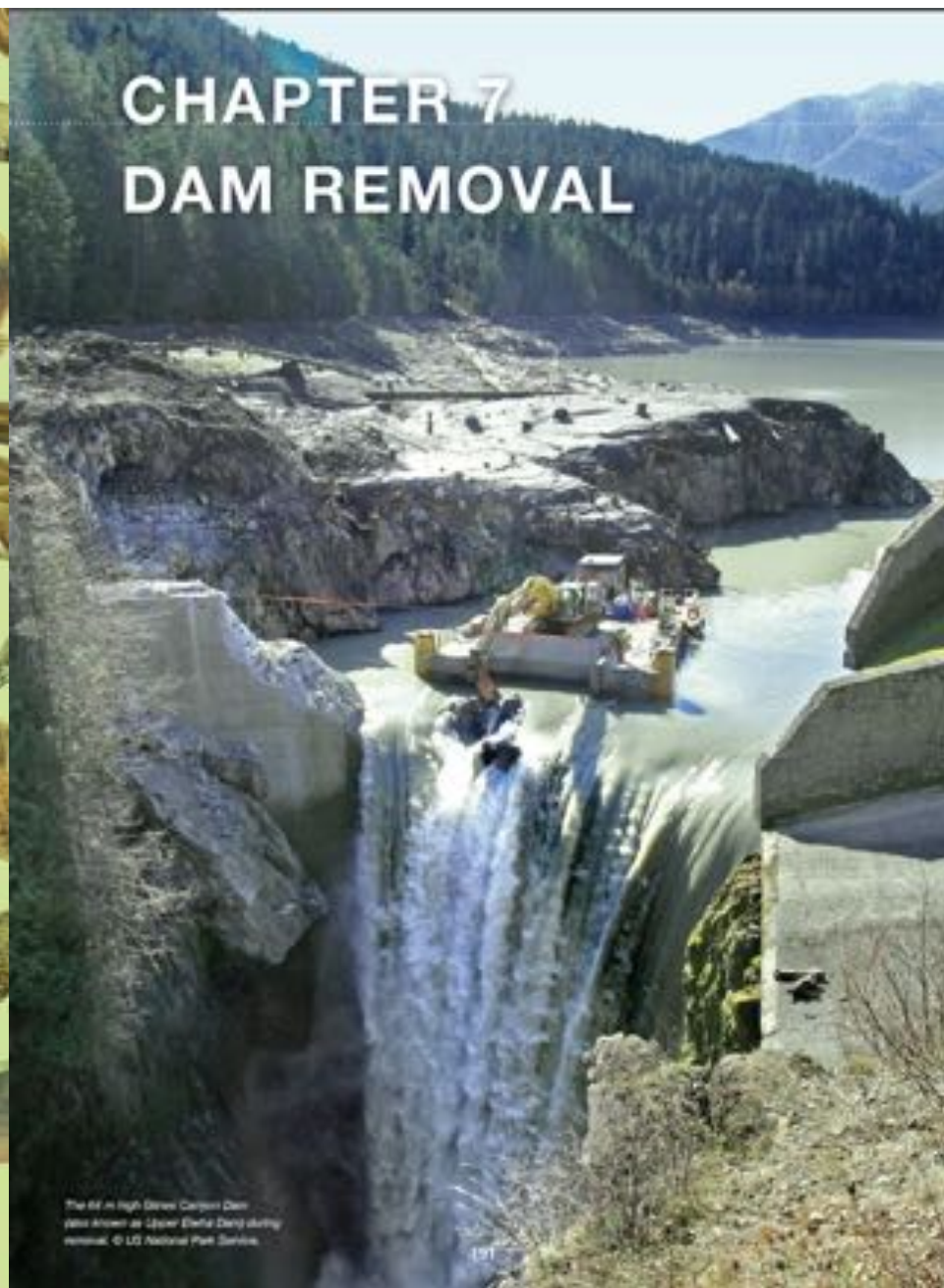
WHAT ACTIONS CAN BE TAKEN

Prioritize limited ecological restoration resources and funding by:

1. Identify critical issues/potential barriers with stakeholder input early on
2. Determine if they really are “barriers” or if creative solutions can be found
3. Design project with regional regulatory requirements in mind
4. Adopt an adaptive management approach incorporating monitoring if possible



CHAPTER 7 DAM REMOVAL



The 61 m high Silver Canyon Dam (also known as Upper Elwha Dam) during removal. © US National Park Service.

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Thank You!

Now you're ready to go out and find the best opportunities for a successful restoration project!



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