

Using Adaptive Management to Reduce Uncertainty & Respond to Changing Management Needs in Ecological Restoration



Carol Murray, David Marmorek, Marc Nelitz
ESSA Technologies Ltd.
February 14, 2018



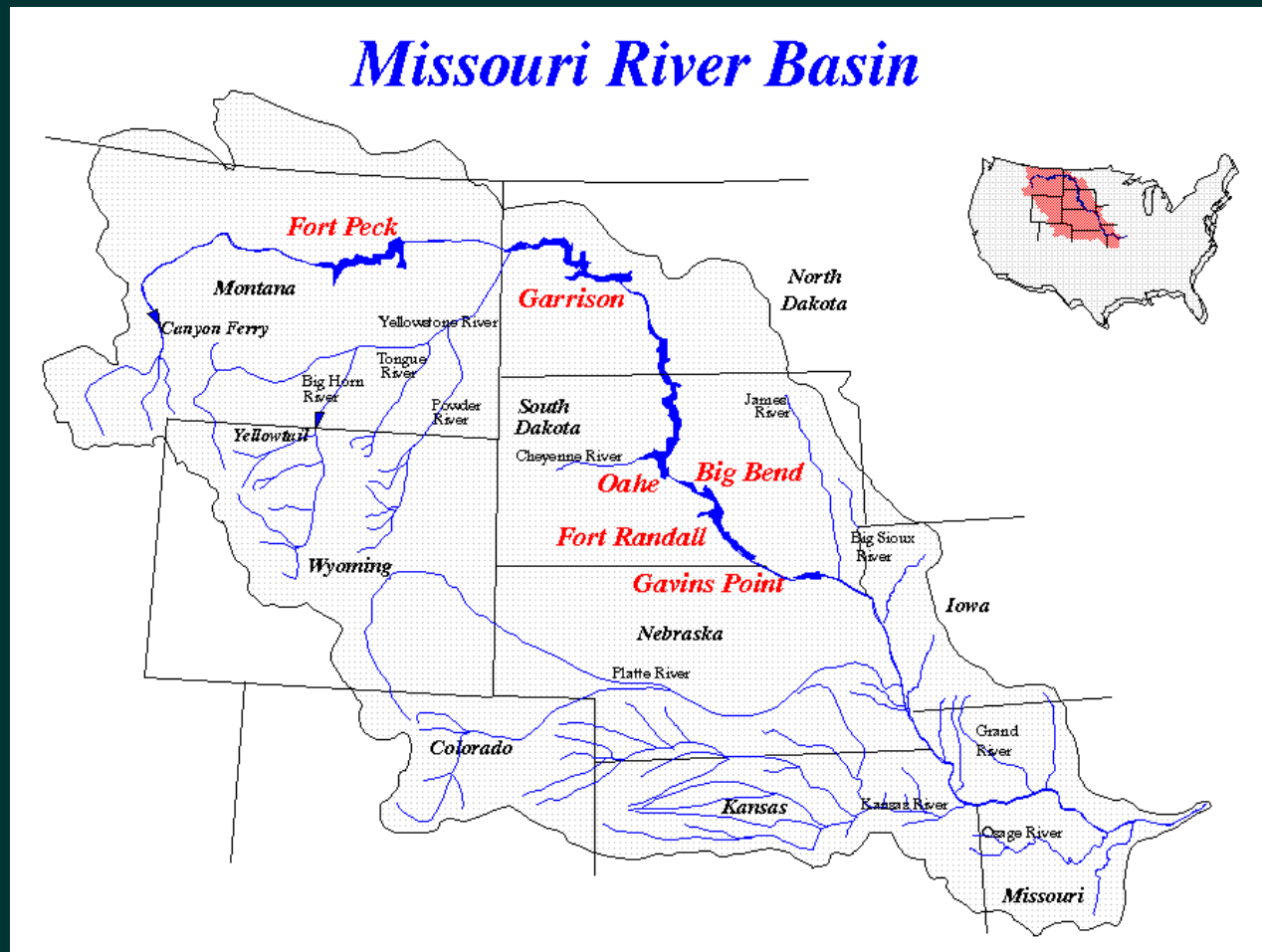
Why do AM?

- Unsure what actions will be effective
- Unsure of the necessary form, location or scale of actions
- Management resilience
- Social resilience

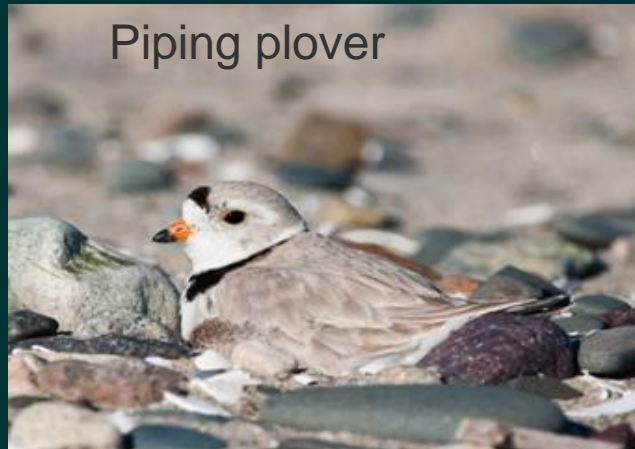


Presentation Outline

1. The restoration needs in the Missouri River
2. How they are using Adaptive Management
3. Lessons for using AM in other programs



1. Restoration needs in the Missouri River



Piping plover



Interior least tern



Pallid sturgeon



MISSOURI RIVER
RECOVERY PROGRAM

Effects
Analysis
team leads:

Birds
Dr. Kate Buenau,
Pacific NW
National Labs

Pallid Sturgeon
Dr. Robert
Jacobson, USGS

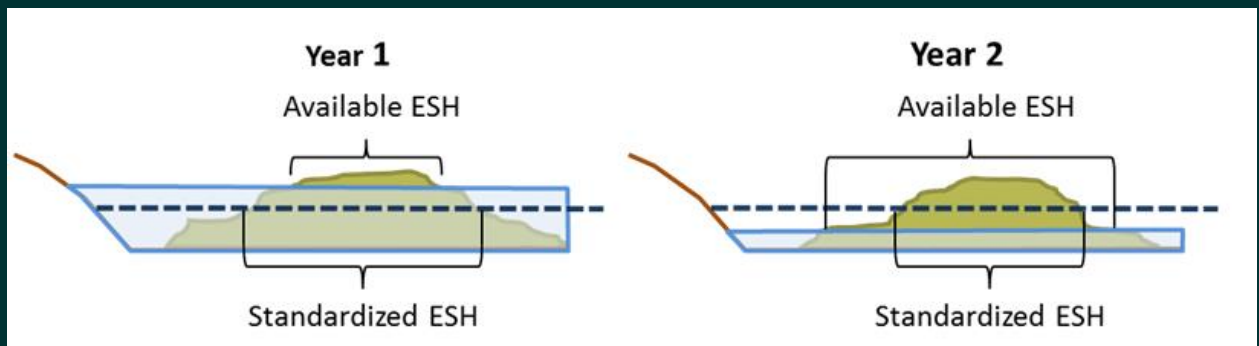
Hydrology,
Hydraulics,
Geomorphology
Dr. Craig
Fischenich,
USACE

What's up
with the terns
and plovers?



From MRRP ESH Fact Sheet

Figure 1. Emergent sandbar habitat. (Images: K. Buenau)



What's up with the Pallid sturgeon?



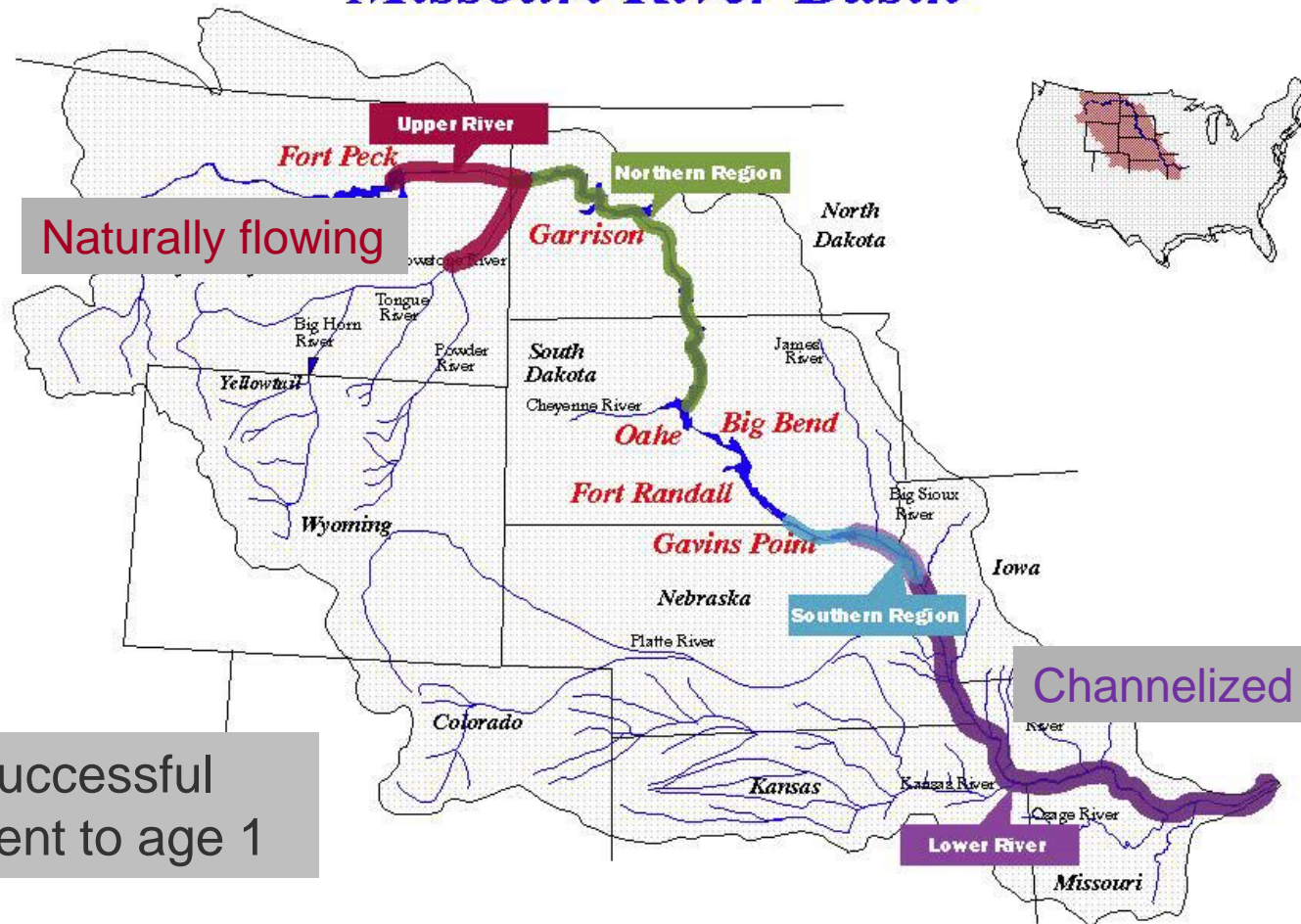
Base data from U.S. Geological Survey digital data, 1999
USA Contiguous Lambert Conformal Conic Projection



Historical and contemporary range defined by
U.S. Fish and Wildlife Service, 2008



Missouri River Basin



lack of successful
recruitment to age 1

Prepared in cooperation with the Missouri River Recovery Program

Missouri River *Scaphirhynchus albus* (Pallid Sturgeon) Effects Analysis—Integrative Report 2016



Eggs

Developing embryo (~5-7 days)

Free embryo (~8-12 days)

Exogenously feeding larvae and age-0
(to June 1)

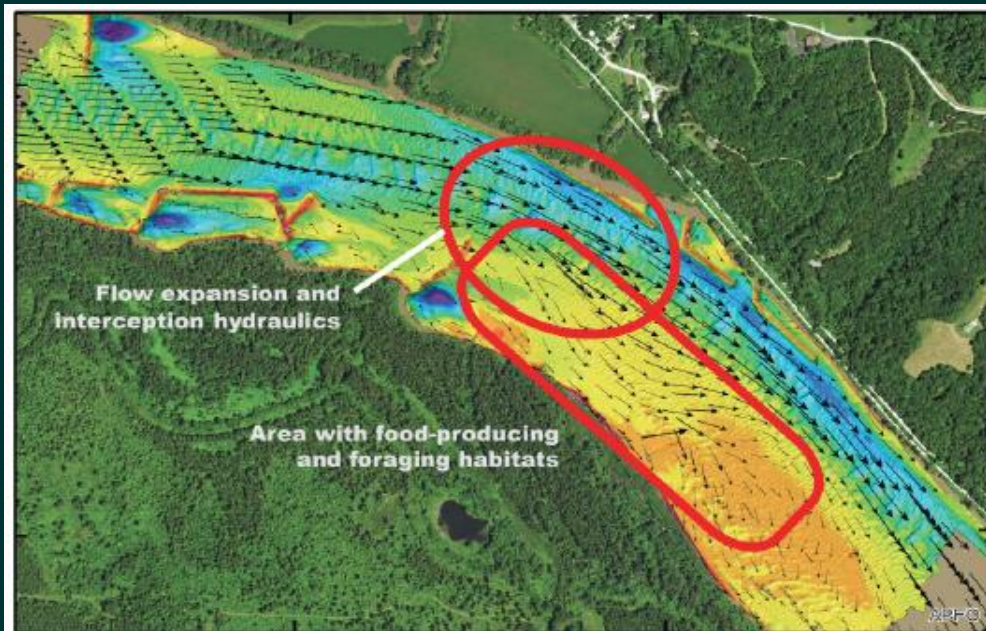
Juvenile (age 1-9)

Scientific Investigations Report 2016–5064



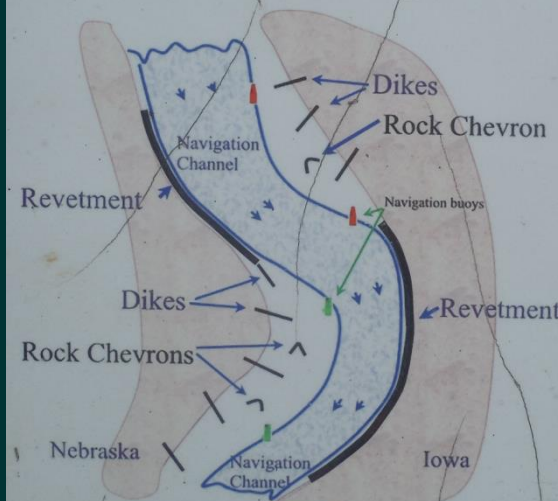
Upper River

Lower River



NOTICE:

TYPICAL CHANNEL CONFIGURATION



Underwater rock dikes and chevrons located on the inside river bends are dangerous boating hazards.

Use extreme caution when boating through these areas.

Speeds greater than 5mph should only be done in the navigation channel.



Objectives:

Avoid jeopardizing the continued existence of these species from USACE actions on the Missouri R.



- Maintain current geographic distribution (river, reservoirs)
- Maintain a population of piping plovers with a modeled 95% probability that at least 50 individuals will persist for at least 50 years in both the Northern and Southern Regions.



- Increase recruitment to age 1
- Maintain or increase numbers as an interim measure until sufficient and sustained natural recruitment occurs



Must meet species needs as well as “human considerations”

- 1) Navigation
- 2) Irrigation
- 3) Flood Control
- 4) Fish and Wildlife
- 5) Recreation
- 6) Water Quality
- 7) Water Supply
- 8) Agriculture
- 9) Conservation Districts
- 10) Waterway Industries
- 11) Major Tributaries
- 12) Thermal Power
- 13) Hydro power
- 14) At large/other interests, e.g. cultural and historic preservation
- 15) Local Government
- 16) Environmental/conservation organizations



ERDC/EL TR-16-DRAFT

Environmental Laboratory



US Army Corps
of Engineers®
Engineer Research and
Development Center

Draft Version 6 Science and Adaptive Management Plan

Missouri River Recovery Program

Draft/Pre-decisional/For Review and Comment

December 2016



Draft Document for Review

Missouri River Recovery Program (MRRP) AM Plan

Lead agencies:
US Army Corps of Engineers
US Fish and Wildlife Service

Draft Version 6

Science and Adaptive Management Plan

Missouri River Recovery Program

J. Craig Fischenich

Environmental Laboratory
U.S. Army Engineer Research and Development
Center
3909 Halls Ferry Rd
Vicksburg, MS 39180

Kate E. Buenau

Marine Science Laboratory
Pacific Northwest National Laboratory
U.S. Department of Energy
1529 W. Sequim Bay Rd
Sequim, WA 98382

Joseph L. Bonneau and Craig A. Fleming

U.S. Army Corps of Engineers
Omaha District
Gavins Point Project Office
Yankton, SD 57078

David R. Marmorek, Marc A. Nelitz,
Carol L. Murray and Brian O. Ma

ESSA
600 - 2695 Granville Street
Vancouver, BC Canada V6H 3H4

Graham Long

Compass Resource Management Ltd
210 - 111 Water Street
Vancouver, BC Canada V6B 1A7

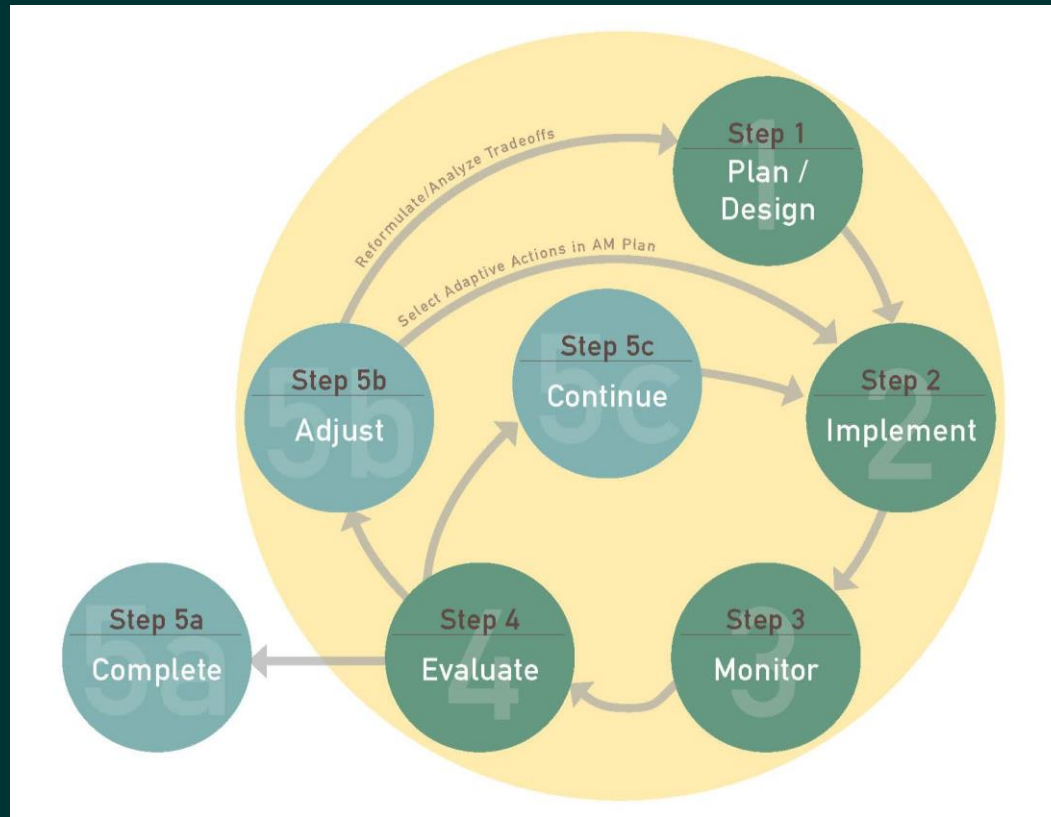
Carl J. Schwarz

Department of Statistics and Actuarial Science,
Simon Fraser University
8888 University Drive
Burnaby, BC Canada V5A 1S6

2. How MRRP is using Adaptive Management



*What does
“using AM”
look like?*



Subset
for this
talk

- a) Uncertainties, hypothesis-testing
- b) Decisions
- c) Governance
- d) Communication & Reporting

Management Uncertainties for Plovers and Terns

- a) **Uncertainties, hypothesis-testing**
- b) Decisions
- c) Governance
- d) Communication & Reporting



Interior Least Tern



Piping Plover



ESH Construction at river mile 795



Vegetation removal

- Best way to create habitat?
- Maintain existing habitat vs creating new habitat?
- Improve existing habitat vs “ “ “ ?
- Contribution of population protection actions?

+ hypotheses
for each

Big Questions for Pallid Sturgeon

- a) **Uncertainties, hypothesis-testing**
- b) Decisions
- c) Governance
- d) Communication & Reporting



BQ 1 – Spawning Cues: Can spring pulsed flows from Fort Peck synchronize reproductive fish, increase chances of reproduction and recruitment?



BQ 2 – Food and Forage: Can naturalization of the flow regime from Fort Peck contribute to increased food production, foraging habitat, and survival of age-0 sturgeon?

BQ 3 – Temperature Control: Can water-temperature manipulations at Fort Peck contribute significantly to increased chance of reproduction and recruitment?



BQ 4 – Sediment Augmentation: Can sediment bypass at Fort Peck contribute significantly to increased chance of reproduction and recruitment?

BQ 5 – Drift Dynamics: Can combinations of flow manipulation from Fort Peck, drawdown of Lake Sakakawea, and fish passage at Intake Dam on the Yellowstone River increase probability of successful dispersal of free embryos and retention of exogenously feeding larvae?



BQ 6 – Population Augmentation. Can population augmentation (stocking) processes be enhanced to increase survival and genetic fitness of stocked fish?

BQ 1 – Spawning Cues: Can spring pulsed flows synchronize reproductive fish, increase chances of reproduction and recruitment?



BQ 2 – Temperature Control: Can water-temperature manipulations at Fort Randall and/or Gavins Point contribute significantly to increased chance of reproduction and recruitment?

BQ 3 – Food and Forage: Can naturalization of the flow regime or channel reconfiguration (alone or in combination) contribute to increased food production, foraging habitat, and survival of age-0 sturgeon?



BQ 4 – Drift Dynamics: Can naturalization of the flow regime or channel reconfiguration (alone or in combination) contribute to decreased direct mortality and increased interception of free embryos into supporting habitats?

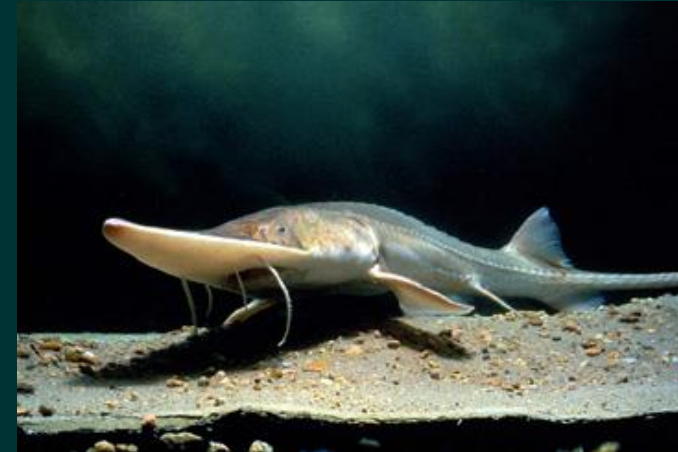


BQ 5: Spawning Habitat. Can channel reconfiguration and spawning substrate construction increase probability of survival of eggs through fertilization, incubation, and hatch?



BQ 6: Population Augmentation. Can population augmentation (stocking) processes be enhanced to increase survival and genetic fitness of stocked fish?

Upper River



Lower River

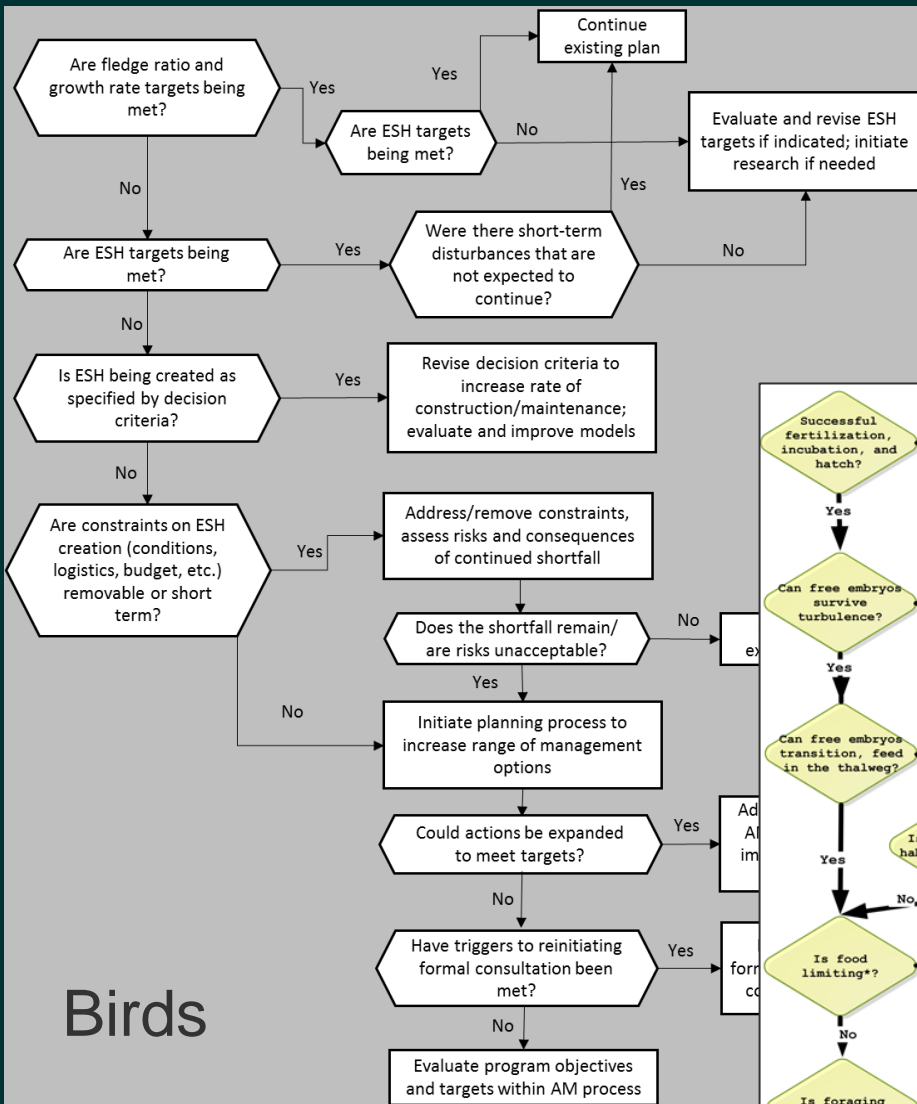
+ hypotheses
for each BQ



Pallid Sturgeon Framework (incremental approach)

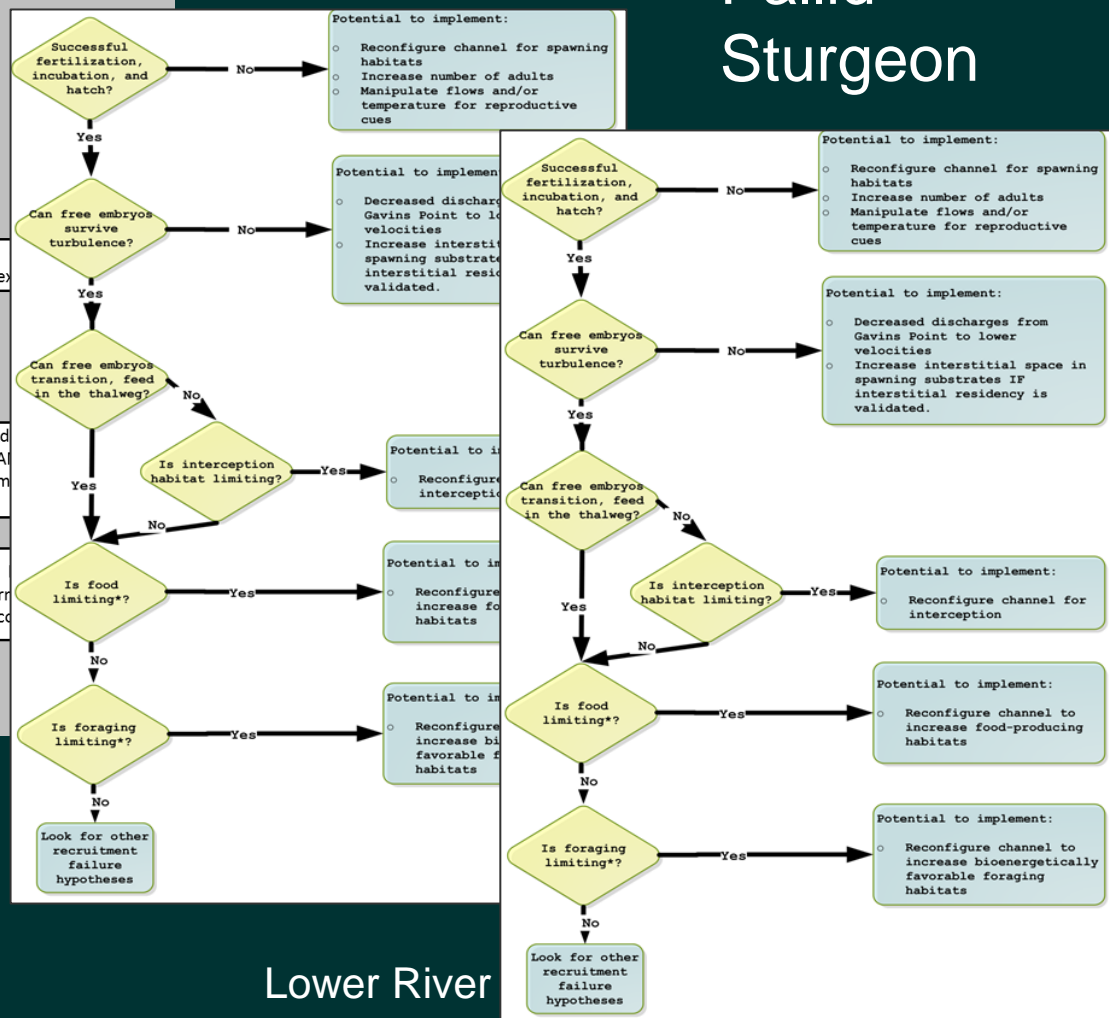
Level 1: Research	Population Level Biological Response <u>IS NOT Expected</u>	Studies without changes to the system (Laboratory studies or field studies under ambient conditions)
Level 2: In-river Testing		Implementation of actions at a level sufficient to expect a measurable biological, behavioral, or physiological response in pallid sturgeon, surrogate species, or related habitat response.
Level 3: Scaled Implementation	Population Level Biological Response <u>IS Expected</u>	In terms of reproduction, numbers, or distribution, initial implementation should occur at a level sufficient to expect a meaningful population response progressing to implementation at levels which result in improvements in the population. The range of actions within this level is not expected to achieve full success (i.e. Level 4).
Level 4: Ultimate Required Scale of Implementation		Implementation to the ultimate level required to remove as a limiting factor.

- Uncertainties, hypothesis-testing
- Decisions**
- Governance
- Communication & Reporting



Upper River

Pallid Sturgeon



Lower River

Decision Trees

Many participants / interests

- a) Uncertainties, hypothesis-testing
- b) Decisions
- c) **Governance**
- d) Communication & Reporting



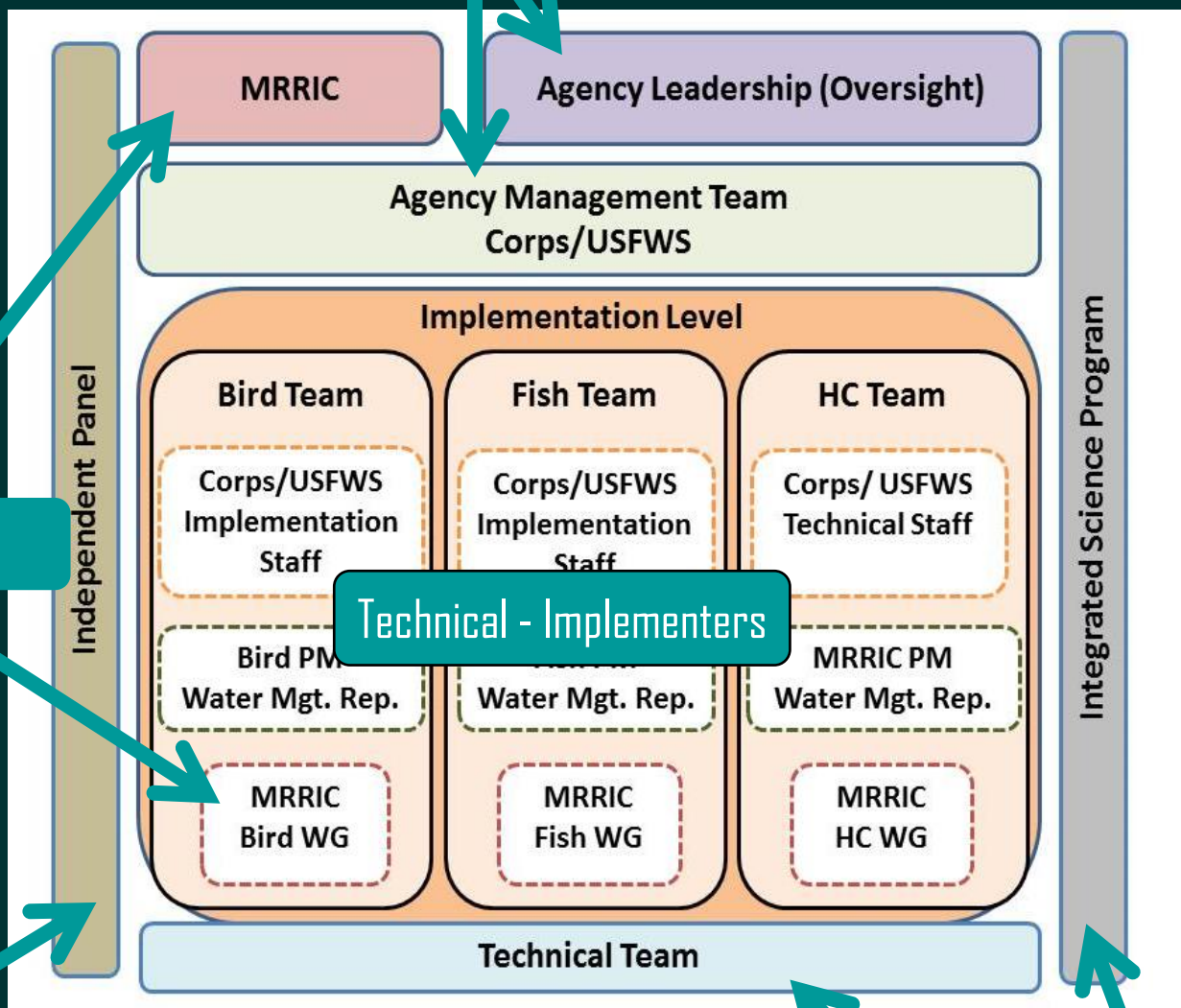
- **Missouri River Recovery Implementation Committee**
- **29 stakeholder members representing 16 stakeholder interests x 2 reps / interest**
- **15 federal government agencies**
- **8 state agencies**
- **29 Tribes**



- a) Uncertainties, hypothesis-testing
- b) Decisions
- c) **Governance**
- d) Communication & Reporting



Managers



Stakeholders

Independent
Science Reviewers

Technical - Scientists

Generic roles in AM Projects

- a) Uncertainties, hypothesis-testing
- b) Decisions
- c) **Governance**
- d) Communication & Reporting



Managers



Technical - Implementers



Technical - Scientists



Stakeholders



Independent
Science Reviewers





US Army Corps
of Engineers
Engineer Research and
Development Center

Draft Version 6

Science and Adaptive Management Plan

Missouri River Recovery Program

Draft/Pre-decisional/For Review and Comment

December 2016



Draft Document for Review

Missouri River Recovery Program



Annual Adaptive Management Report for
2017

DRAFT

Prepared by the MRRP Science and Adaptive Management
Technical Team

- a) Uncertainties, hypothesis-testing
- b) Decisions
- c) Governance
- d) **Communication & Reporting**



AM Plan – guiding doc

- CEMs
- Objectives
- Management questions, hypotheses
- Metrics
- Management actions
- Science activities
- Governance structure and processes

AM Report – annual update on actions / learning

- Conditions that year
- Status & trends
- Update on management actions
- Update on science activities
- Results, management implications
- How HCs were considered

Draft AM
Report

AM
Wrkshp

Final AM
Report

Update
Strat. Plan

AM actions

Science
Meetings

Write AM Report

3. Lessons for Other Programs



*How to do AM
in other
places /
programs?*

Some Key Characteristics of Adaptive Management

a) Uncertainties, hypothesis-testing

Be explicit

Proceed Incrementally

b) Decisions

Decision points, decision criteria; opportunities, constraints
What do decision-makers need to know?

c) Governance

Look outside the science box – include all 5 roles
Don't ignore this – it matters! (and takes time)

d) Communication & reporting

Separate AM Plan from AM Reports; regularly update the Plan
If you think you are doing too much, you probably have it about right



- You're unsure what actions will be effective

Resources are limited – ineffective actions waste time, \$

Balance 2 risks: risk of not implementing actions that might have helped, & implementing ones that don't help

- You're unsure of the necessary scale, location or form of actions

- Scaling up from research to larger scale efforts is a cost-effective approach

- **Management resilience**

Management Qs → science-based structure, + good governance → adaptation of management plans / actions

Focusing science on Qs managers have, which can change

- **Social resilience**

Social license, broad engagement, scientific credibility

Considering what stakeholders care about, which can change

MISSOURI RIVER RECOVERY PROGRAM



Home **Management Plan** Effects Analysis BiOp Efforts/Actions MRRIC Tribal Basin Explorer

Search MRRP

Overview Events In The News River History Did You Know Documents Maps Links Contact Us

MISSOURI RIVER RECOVERY PROGRAM



Missouri River Recovery Program (MRRP)

What is it?

It is an effort to replace lost habitat and avoid a finding of jeopardy to threatened and endangered species (pallid sturgeon, least tern and piping plover) resulting from U.S. Army

Pallid Sturgeon

[Pallid sturgeon](#) numbers began declining over 100 years ago, and it was listed as an endangered species in 1990. Engineered changes to the river have changed habitat and the fish community. Understanding which factors are suppressing pallid sturgeon numbers and what actions can be taken to benefit pallid sturgeon is a current focus of management efforts on the Missouri River. The Corps funds federal and state partner agencies to raise pallid sturgeon in fish hatcheries and stock them into the Missouri River as one way to begin to improve sturgeon numbers. The Corps and partner agencies also monitor the fish's numbers along the river, including looking for naturally-produced pallid sturgeon.



Interior Least Tern and Piping Plover

The [least tern and piping plover](#) are shore birds that nest along the banks of, and on

Connect with MRRP



What's New

Table of Contents:

- MRRP holds AM Workshop
- MRRIC 2017 Annual Report
- Sandbar Habitat input due
- Biological Assessment Available
- Corps incorporating EIS comments
- Draft MRRMP-EIS Available
- MRRMP-EIS Fact Sheets
- 2015 MRRP Annual Report
- EIS-NEPA Factsheet
- Basin Balancer Game
- Public Lands and Regulations

MRRP holds AM Workshop

The Missouri River Recovery Program held an Adaptive Management Workshop

MRRP Adaptive Management Plan Technical Team:

- Kate Buenau, Pacific Northwest National Laboratory
- Craig Fischenich, U.S. Army Engineer Research and Development Centre
- Robb Jacobson, U.S. Geological Survey
- Graham Long, Compass Resource Management Ltd.
- David Marmorek, ESSA Technologies Ltd.

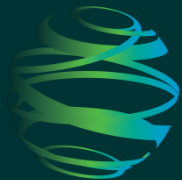
<http://moriverrecovery.usace.army.mil>



Thank you!

www.essa.com

cmurray@essa.com



It starts with a mindset