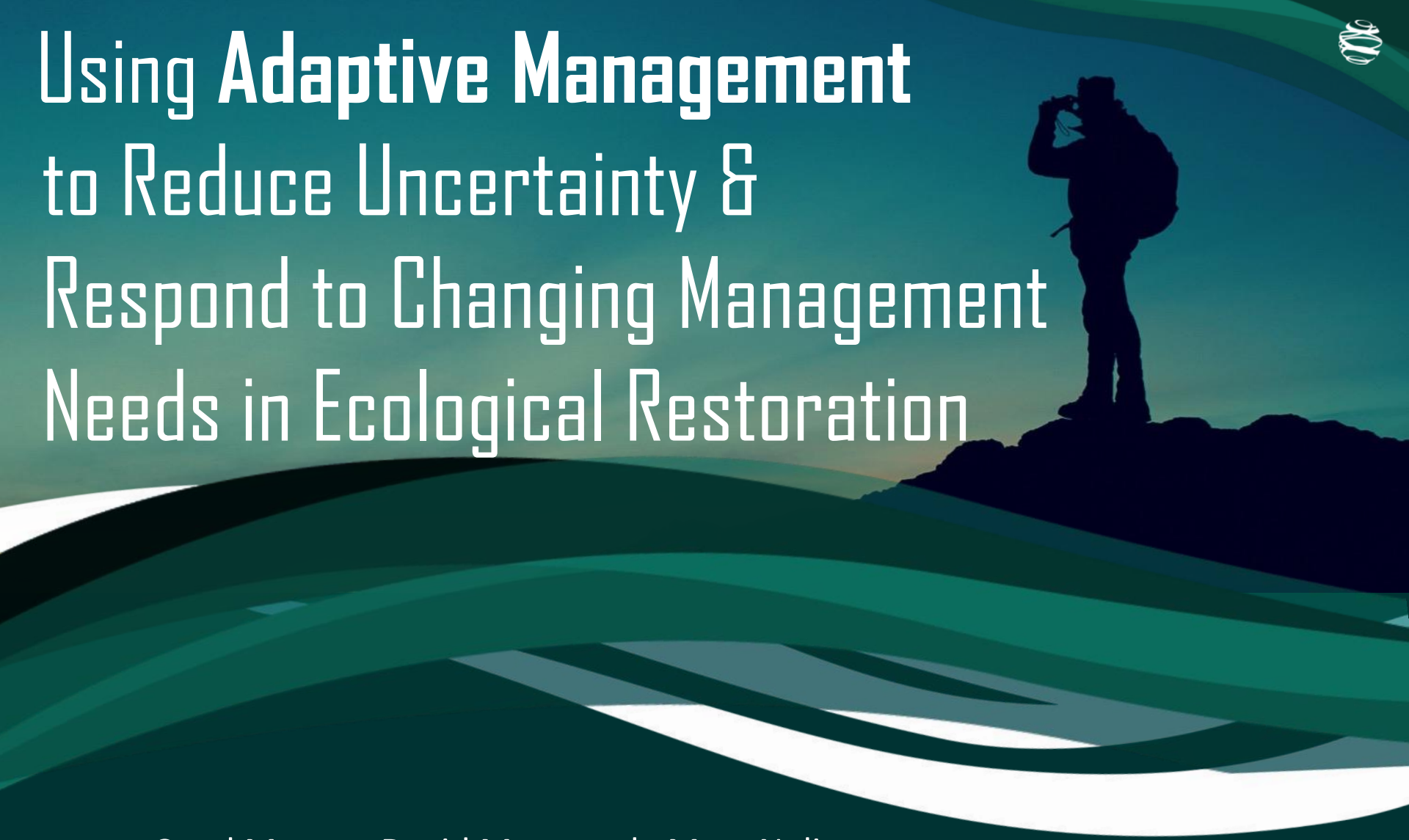
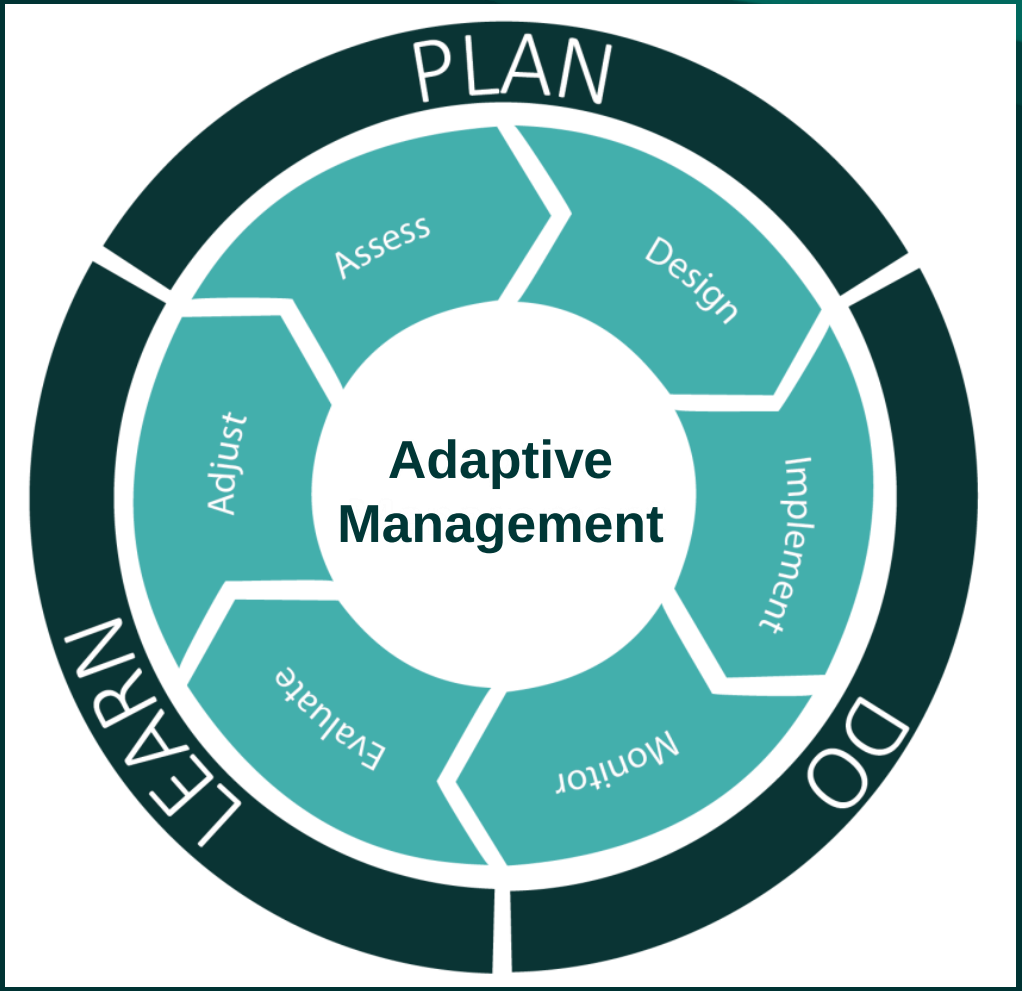
Using **Adaptive Management** to Reduce Uncertainty & Respond to Changing Management Needs in Ecological Restoration



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

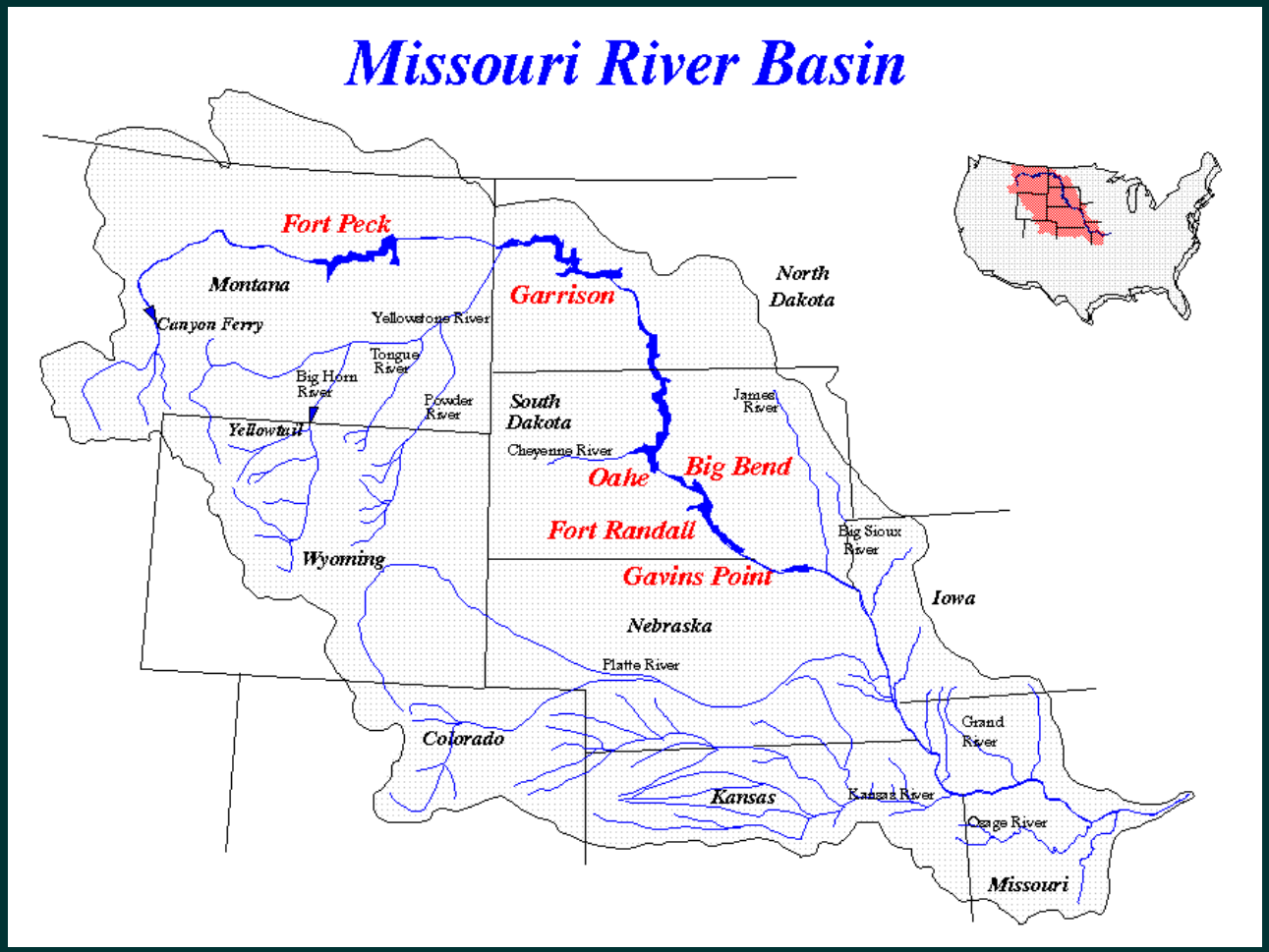


Why do AM?

- 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

Effects Analysis team leads:

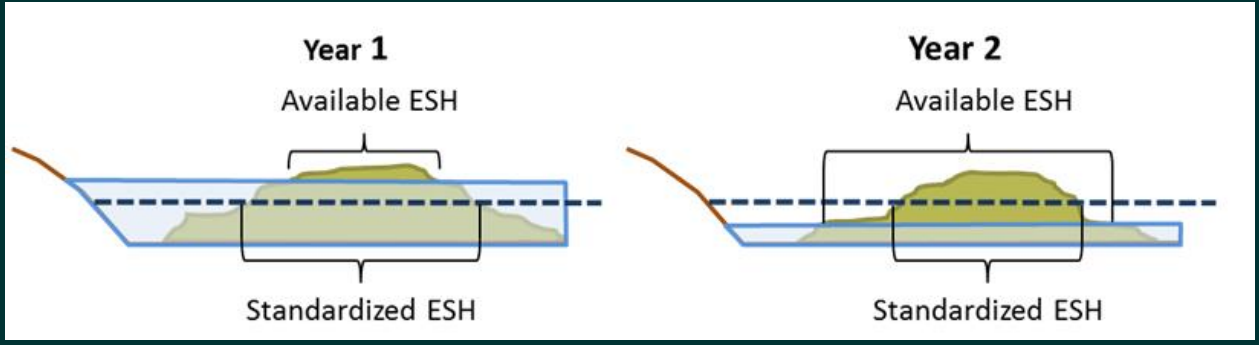
Birds
Dr. Kate Buenau, Pacific NW National Labs

Pallid Sturgeon
Dr. Robert Jacobson, USGS

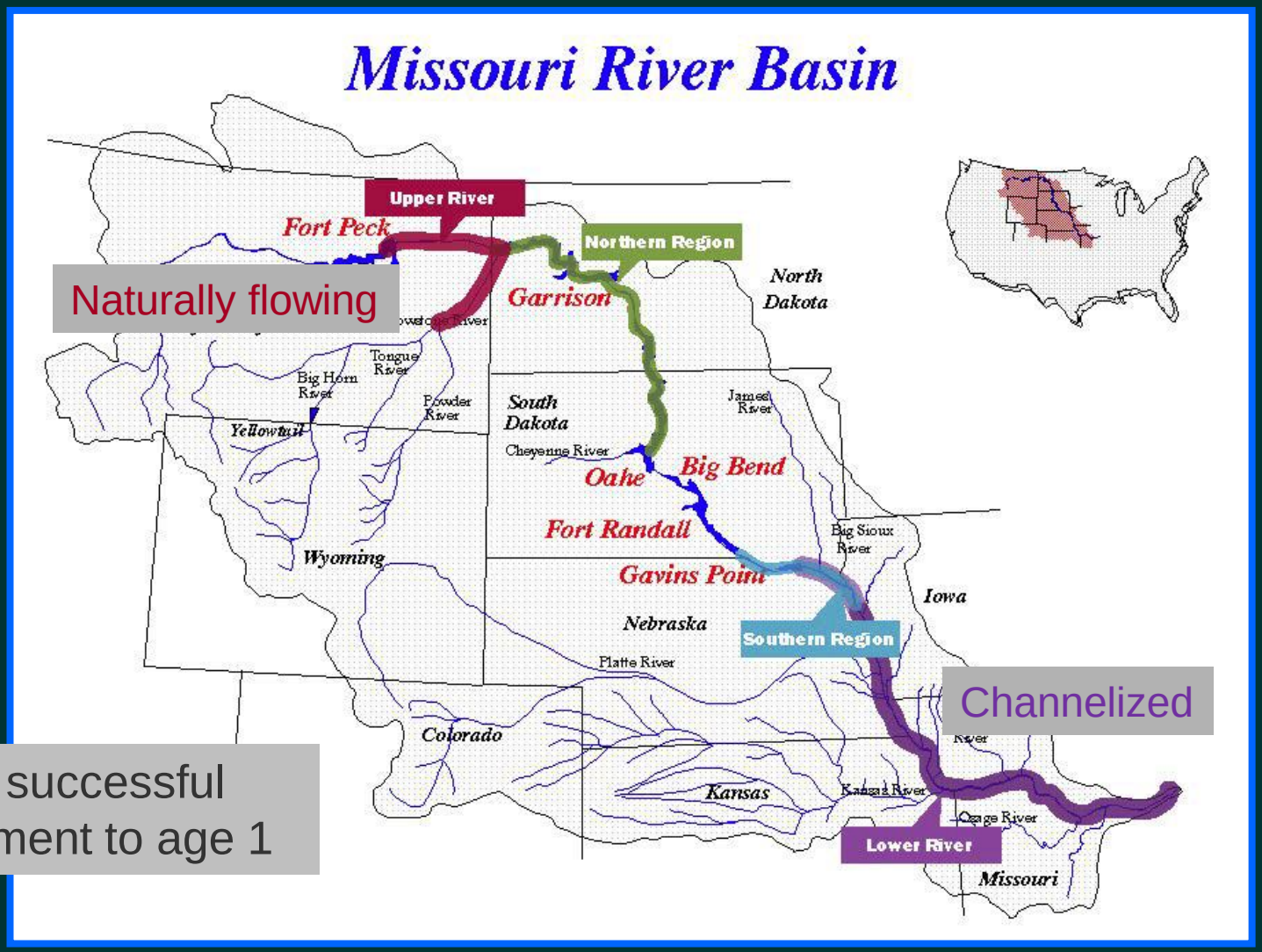
Hydrology, Hydraulics, Geomorphology
Dr. Craig Fischenich, USACE

What's up with the terns and plovers?

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



What's up with the Pallid sturgeon?



lack of successful recruitment to age 1

Eggs

Developing embryo (~5-7 days)

Free embryo (~8-12 days)

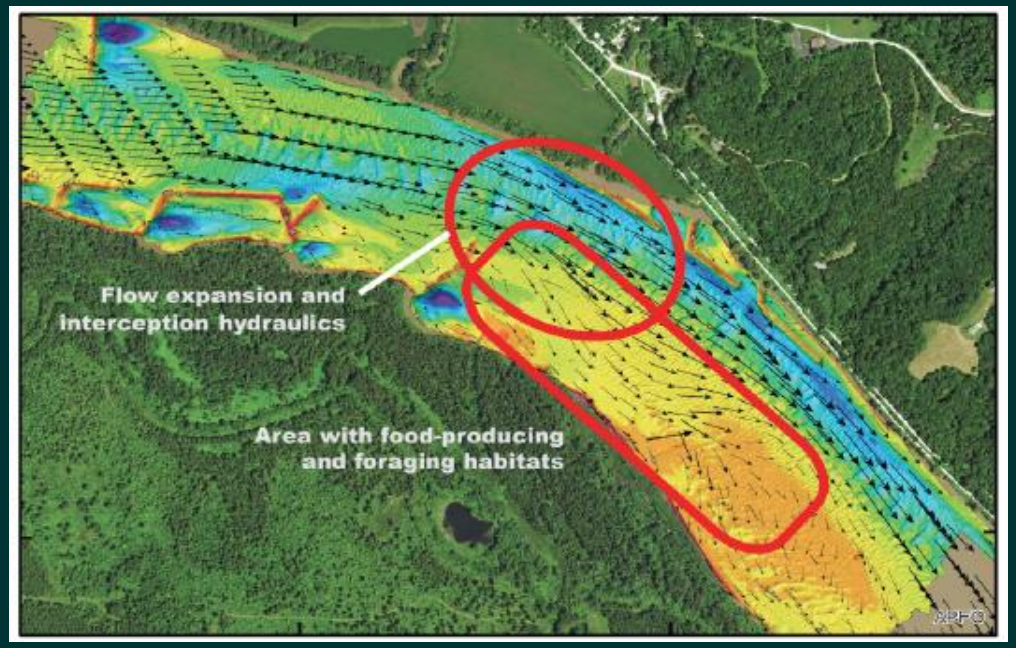
Exogenously feeding larvae and age-0 (to June 1)

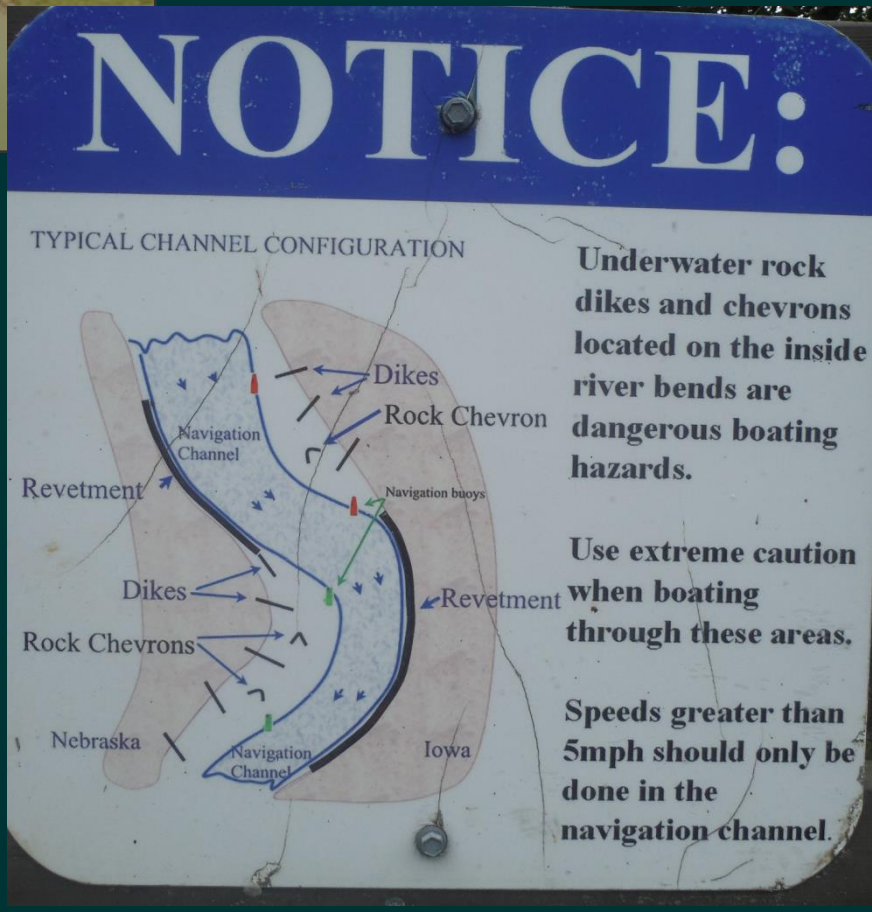
Juvenile (age 1-9)

Jacobson, R.B., Annis, M.L., Colvin, M.E., James, D.A., Welker, T.L., and Parsley, M.J., 2016, Missouri River *Scaphirhynchus albus* (pallid sturgeon) effects analysis—Integrative report 2016: U.S. Geological Survey Scientific Investigations Report 2016–5064, 154 p., http://dx.doi.org/10.3133/sir20165064.

Upper River

Lower River





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.

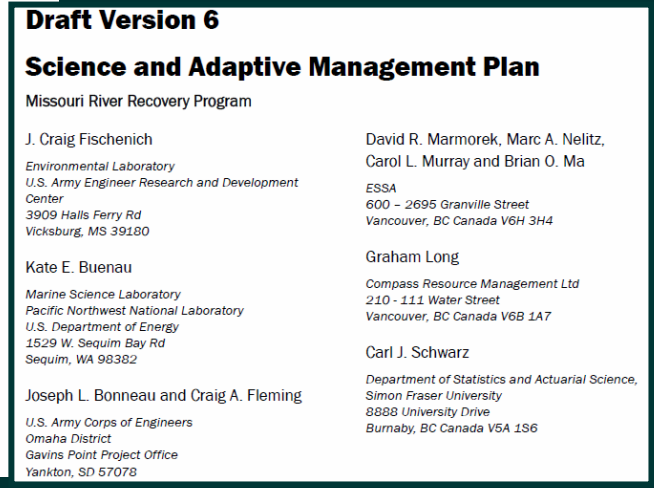
- Increase recruitment to age 1
- Maintain or increase numbers as an interim measure until sufficient and sustained natural recruitment occurs

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

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

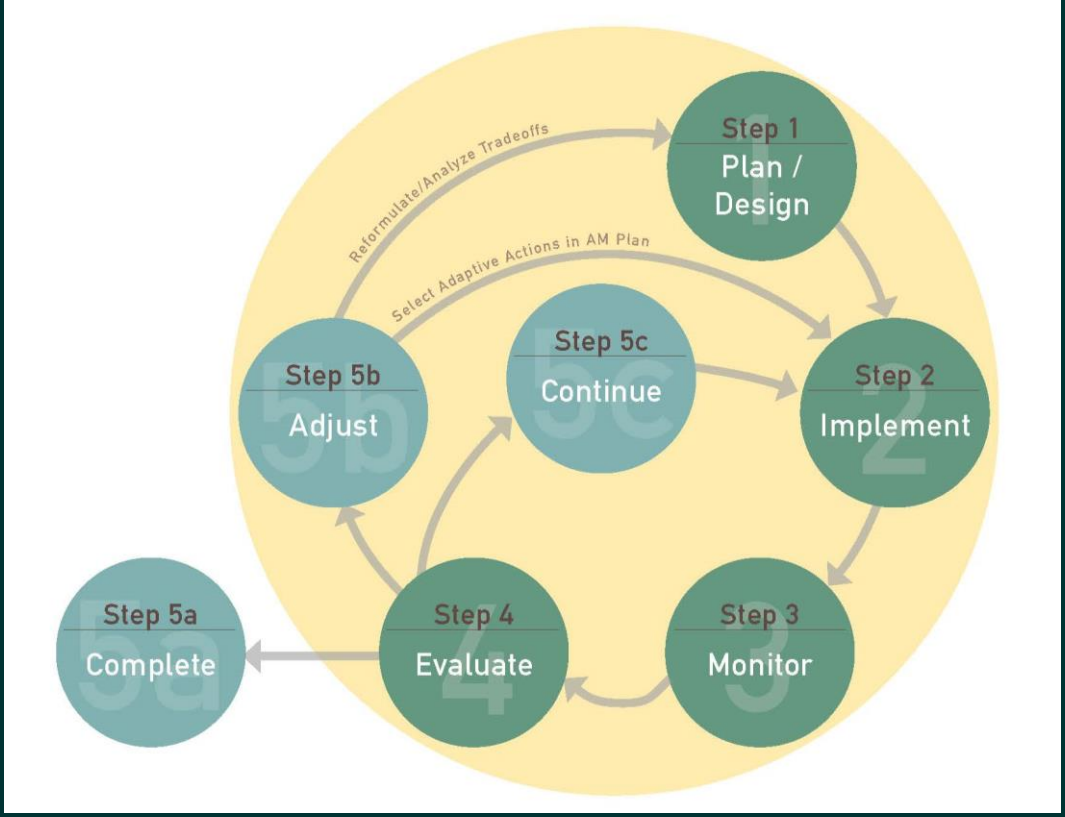
Compass Resource Management Ltd
210 - 111 Water Street
Vancouver, BC Canada V6B 1A7

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

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

Images are from http://moriverrecovery.usace.army.mil

Big Questions for Pallid Sturgeon

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?

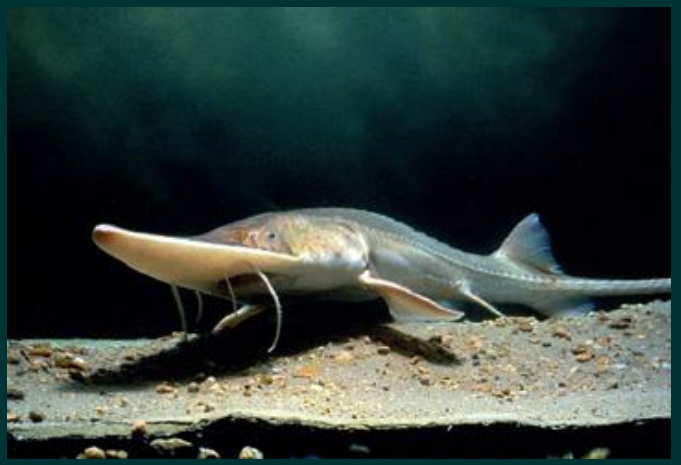
BQ 3 – Temperature Control: Can water-temperature manipulations at Fort Peck contribute significantly to increased chance of reproduction and recruitment?

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?

Upper River



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?

Lower River

+ hypotheses
for each BQ

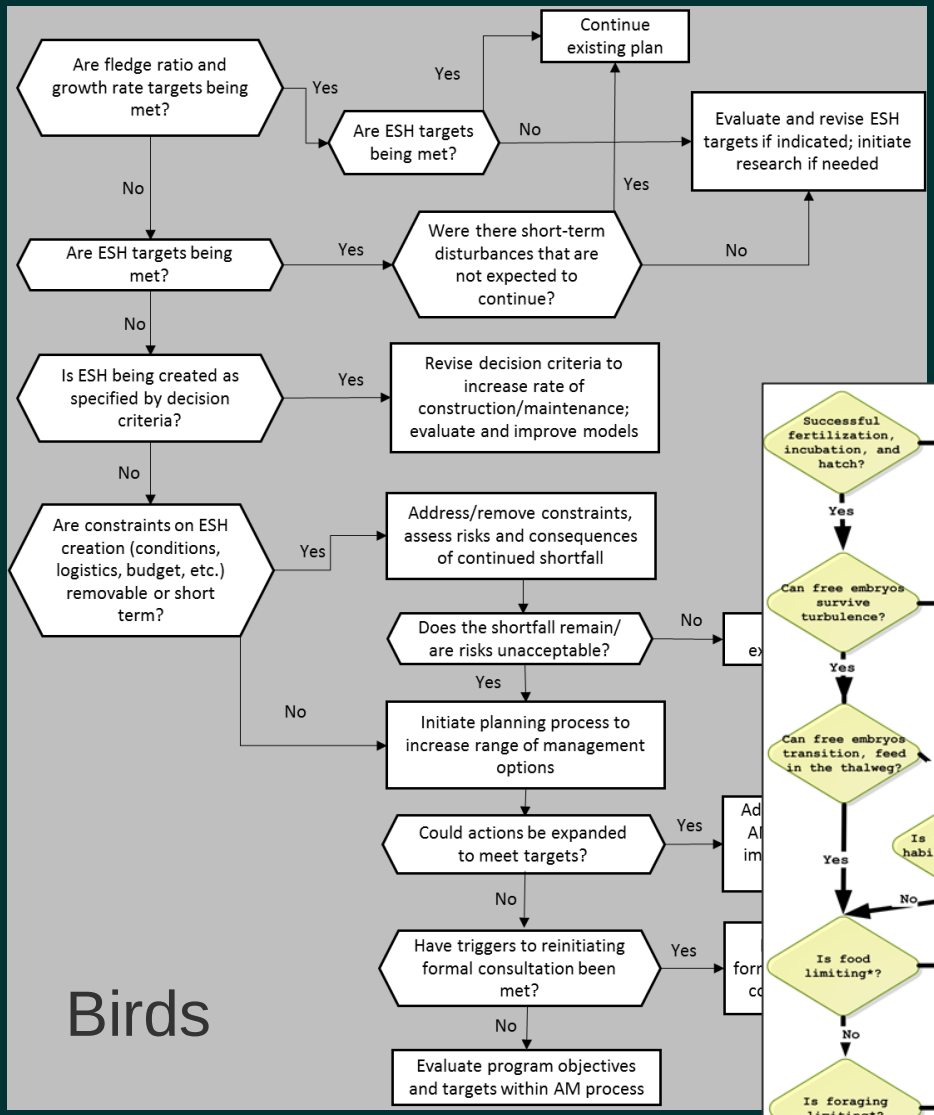
Pallid Sturgeon Framework (incremental approach)

Level 1: Research	Population Level Biological Response IS NOT Expected	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 IS Expected	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.

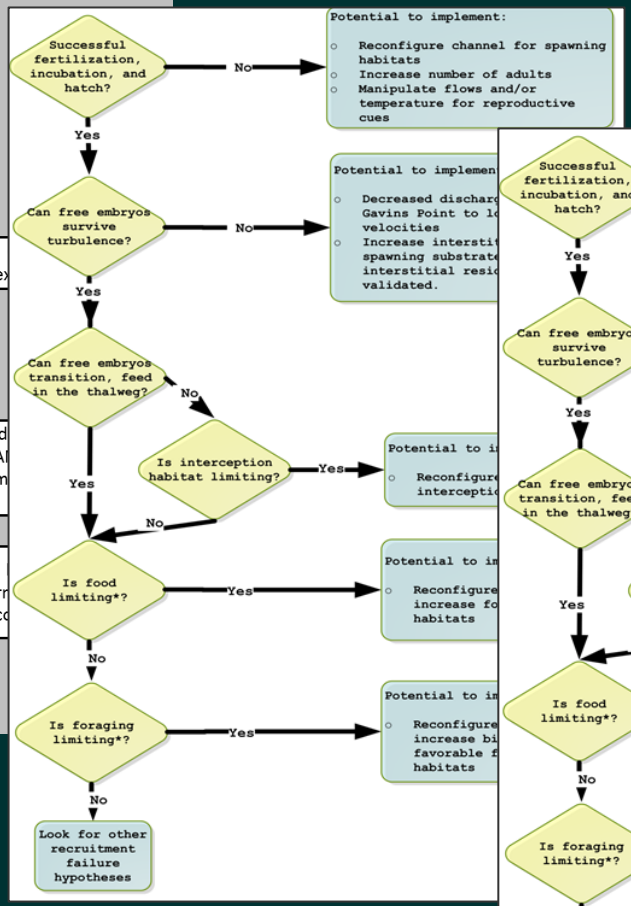
a) Uncertainties, hypothesis-testing
b) **Decisions**
c) Governance
d) Communication & Reporting

Decision Trees

Birds



Upper River



Pallid Sturgeon

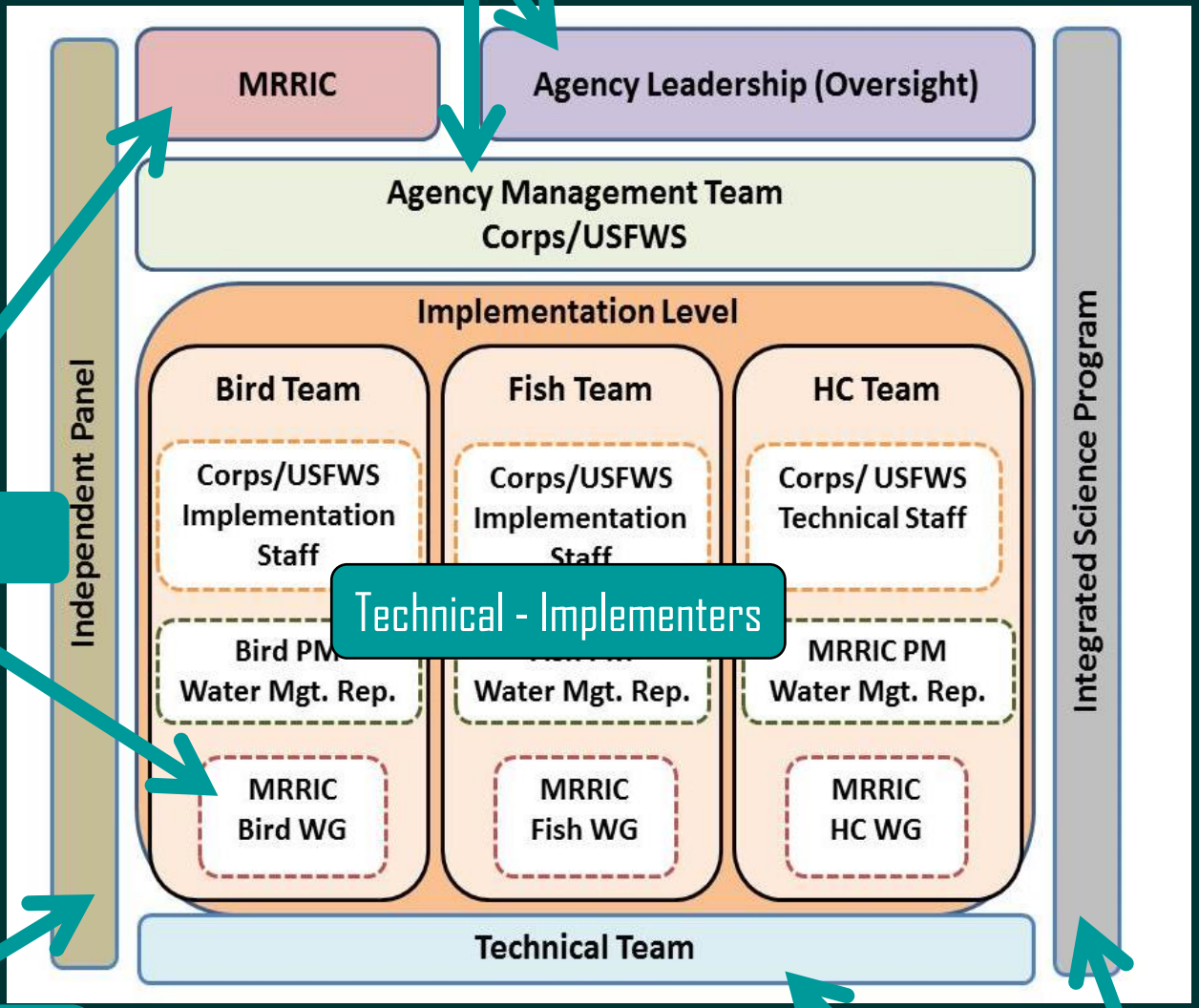
Lower River

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



Generic roles in AM Projects

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

Managers

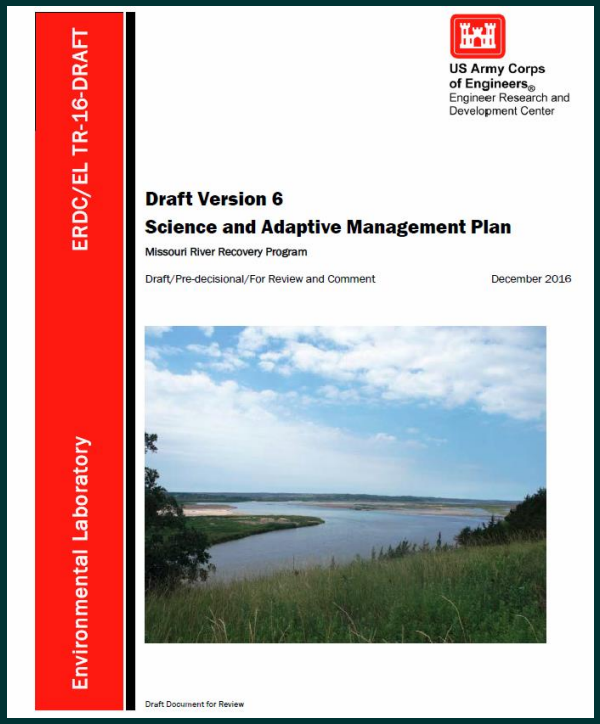
Technical - Implementers

Technical - Scientists

Stakeholders

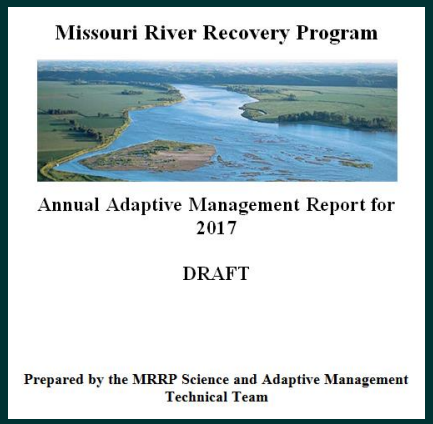
Independent Science Reviewers

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
Jan
Dec

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

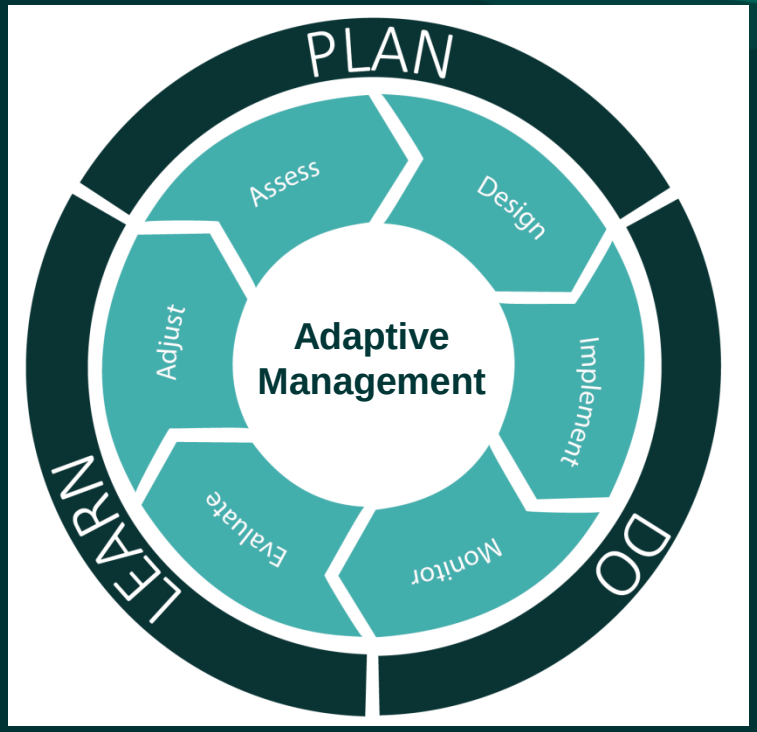
- Separate AM Plan from AM Reports; regularly update the Plan
- If you think you are doing too much, you probably have it about right

- 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

http://moriverrecovery.usace.army.mil

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.



Thank you!

www.essa.com

cmurray@essa.com

It starts with a mindset