Overview of the Integrated Fisheries Restoration & Monitoring Plan for the Klamath

Chris Wheaton

Program Manager

Pacific States Marine Fisheries Commission

After the Klamath Basin Restoration Agreement (KBRA) Expired;

- KBRA Fisheries Program included concepts for fisheries restoration and monitoring plans
- FWS/NMFS and others still need a science plan to guide fisheries restoration and monitoring actions
- USFWS contracted with the PSMFC to oversee the development of the Plan. Working independently of the dam removal process, but the plan assumes that passage into the upper basin is provided

Overall Plan Vision

To advance the restoration and recovery of native fish species from the Klamath Basin headwaters to the Pacific Ocean, while improving flows, water quality, habitat and ecosystem processes.

Integrated Fisheries Restoration & Monitoring Plan (IFRMP): Five Phases

Synthesis Report

Completed Aug 15 2017

http://kbifrm.psmfc.org/

Formal Goals, Objectives & Core Performance Indicators

(Phase 2 / Task 1.2)

Target Dec 7 2018

We are here!

Clarify Restoration Priorities & Draft Monitoring Framework

(Phase 3)

Target Nov 2019

Draft Final Plan w Peer/Public Review, Integrated Tracking Inventory

(Phase 4)

Target Nov 2020

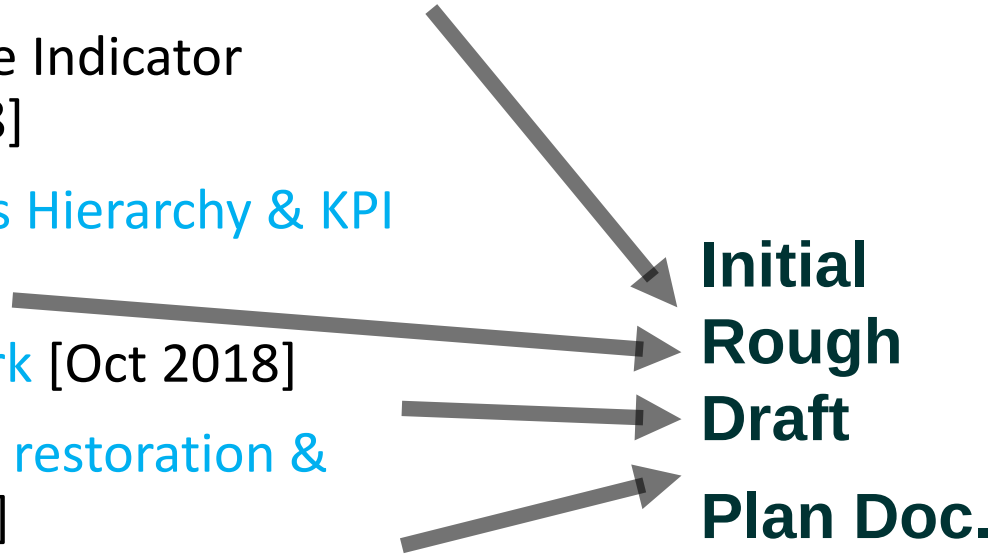
Plan Finalization, Annual AM Reporting Template, Final Scope Integrated Tracking Inventory

(Phase 5)

Target Dec 2021

Deliverable Timeline

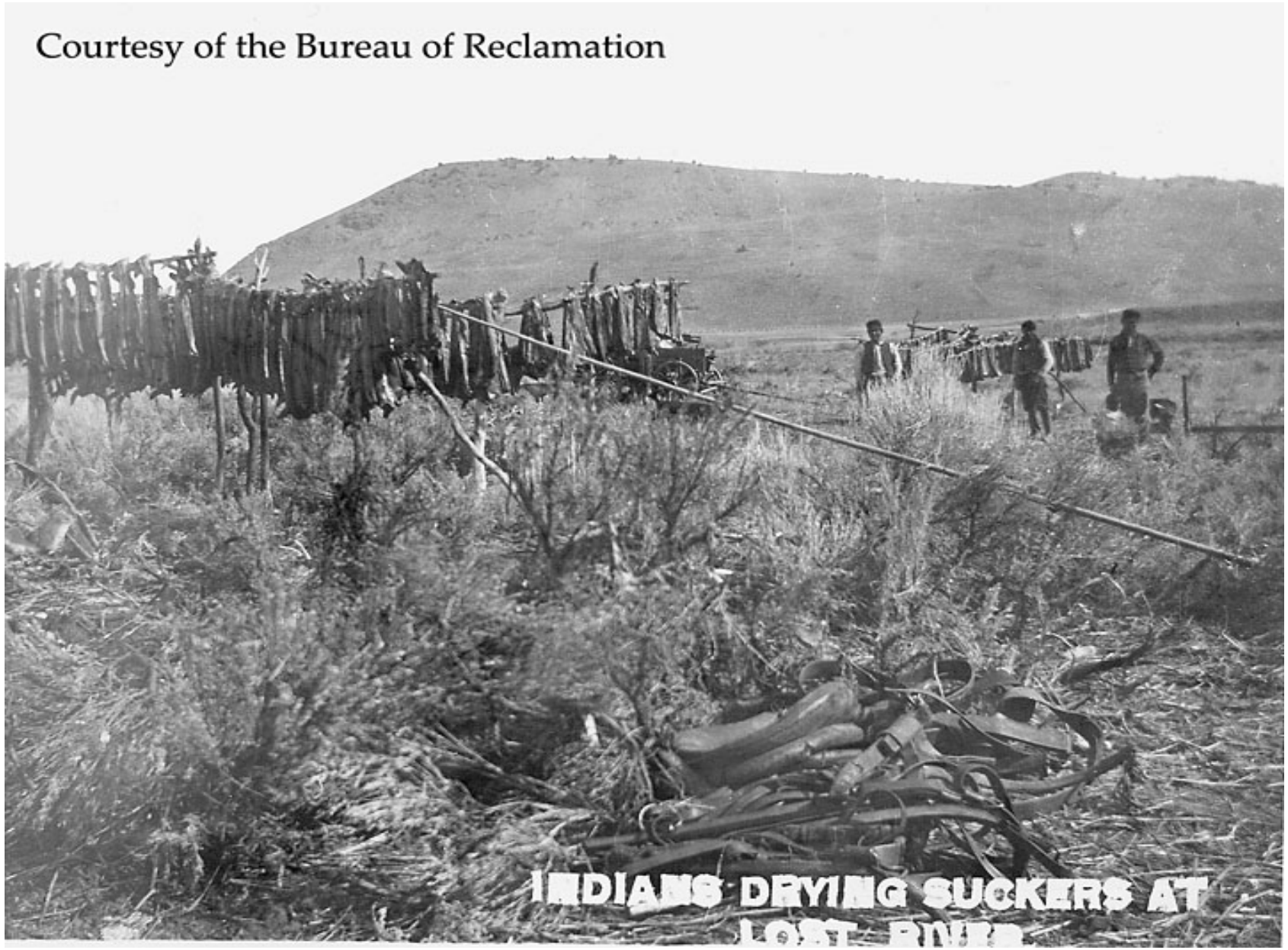
1. Plan Vision Pamphlet [Dec 2017]
2. Form Sub-regional Workgroups [Dec 2017]
3. Annotated Outline for Plan by Phase and Sub-region [March 2018]
4. Conceptual Model Workshop [March 2018]
5. Plan Conceptual Model Document [May 2018]
6. Objectives & Key Performance Indicator Workshop [July 10 & 11, 2018]
7. Plan phase-specific Objectives Hierarchy & KPI Document [Oct 2018]
8. Initial Prioritization Framework [Oct 2018]
9. Consolidated list of candidate restoration & monitoring actions [Oct 2018]



Goals of the Restoration & Monitoring Plan

Collaboratively produce a practical, science-based plan that will:

- Identify what is needed to restore Klamath Basin fisheries;
- Prioritize meaningful restoration actions & monitoring to help ensure these actions produce results;
- Recommend how R&M activities will be prioritized so agencies & partners will know how best to direct funding to yield most effective results
- Help the Service and other public agencies better understand how to sequence and prioritize restoration and monitoring actions


Courtesy of the Bureau of Reclamation
INDIANS DRYING SUCKERS AT

What the Plan Isn't …

- A regulatory tool
- An encyclopedia of every potential restoration & monitoring action in the basin
- Part of a negotiated settlement process, i.e., it is not the KBRA, KHSA, UKBCA or the KPFA
- Replacing existing partnerships and/or activities already underway in the Basin
- A synthesis of diverse perspectives on values or policy positions
- A dam removal decision process

Some Responses to Comments from the Survey

- We are starting at a basin-wide, broad scale. The overriding goal is to identify the most valuable basin-wide actions, and then move down to finer levels of resolution iteratively. As prioritization frameworks are solidified, we will work down from subregions towards subbasins and then specific watersheds. Plan development is supported and informed by the Sub-Regional Working Groups (SRWGs), who will help us identify the right scale
- The Plan identifies 10 focal species that we are contractually obligated to emphasize. However, this focal species approach should not be narrowly interpreted as "only these fish" or “only fish”. To the extent that restoration actions can be compellingly linked to improvements in habitat attributes and food web features for focal species there may indeed be actions that deliver a range of benefits to non-focal species
- Beyond fisheries values, there are numerous other beneficial uses and values associated with resources (such as water) in the Klamath basin. These may be related to human health, culture, economics, recreation, and other values. To the extent that these are impaired, we respect that these impairments represent a variety of other parallel concerns that are critically important for agencies, tribes and stakeholders in the Klamath Basin. However, elements that are not directly related to fisheries and fish habitats are outside the scope of the Plan
- Actions on private lands require willing collaboration, and this form of collaboration is to be encouraged. Without this collaboration, such projects are unlikely to rank highly during prioritization steps. The IFRMP will not identify specific private lands and landowners by name unless there is a prior agreement with the landowner to engage in that project (e.g., such as PacifiCorp and the Dam Removal project)
- We’re developing a multi-criteria scoring framework for the Service. They will decide who performs the scoring and how the results are disseminated. The specifics will be worked out in Phase 3 of the IFRMP development.

The headwaters of Upper Klamath Lake,. *(Chrysten Lambert/Trout Unlimited)*

Thank You All for Your Time and Commitment!

Mouth of the Klamath River, by Linda Tanner (2011), licenced under CC by 2.0.

Klamath Basin Integrated Fisheries Restoration and Monitoring Plan (IFRMP)

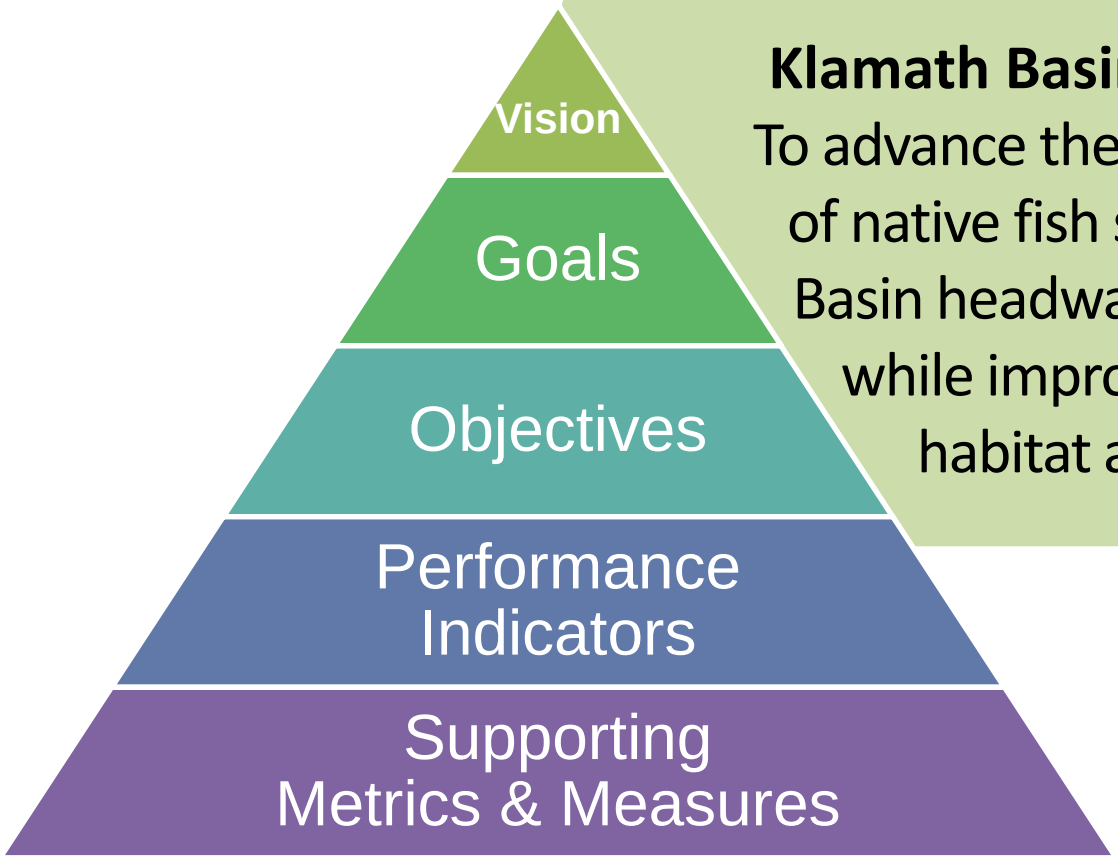
Goals, Objectives, and Performance Indicators

Natascia Tamburello

IFRMP Workshop, Klamath, CA, July 10 2018

ESSA

Basic Architecture of a Plan

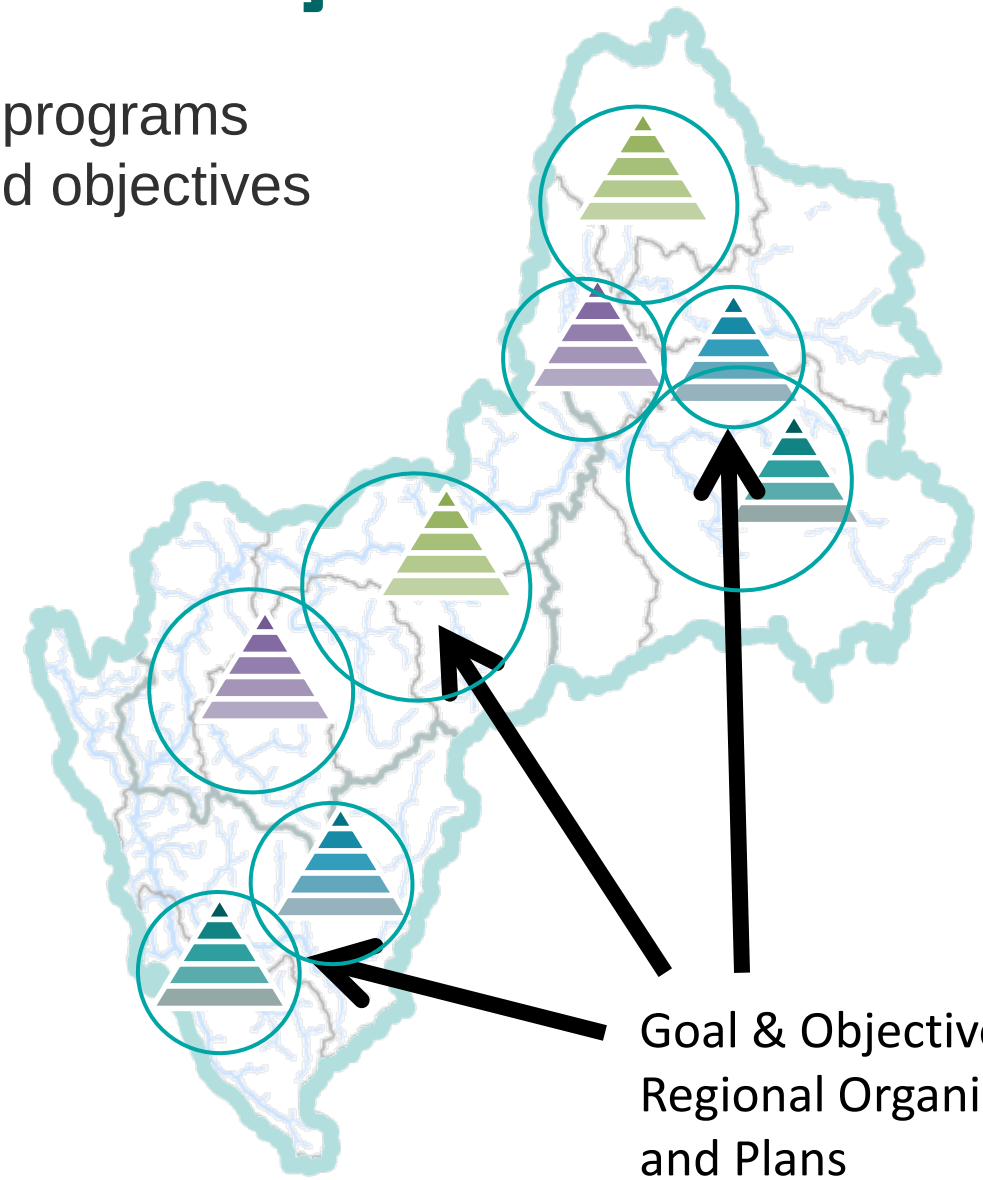


Klamath Basin IFRMP Overall Vision:
To advance the restoration and recovery of native fish species from the Klamath Basin headwaters to the Pacific Ocean, while improving flows, water quality, habitat and ecosystem processes.

1 Goals & Objectives

Scope of IFRMP Goals & Objectives

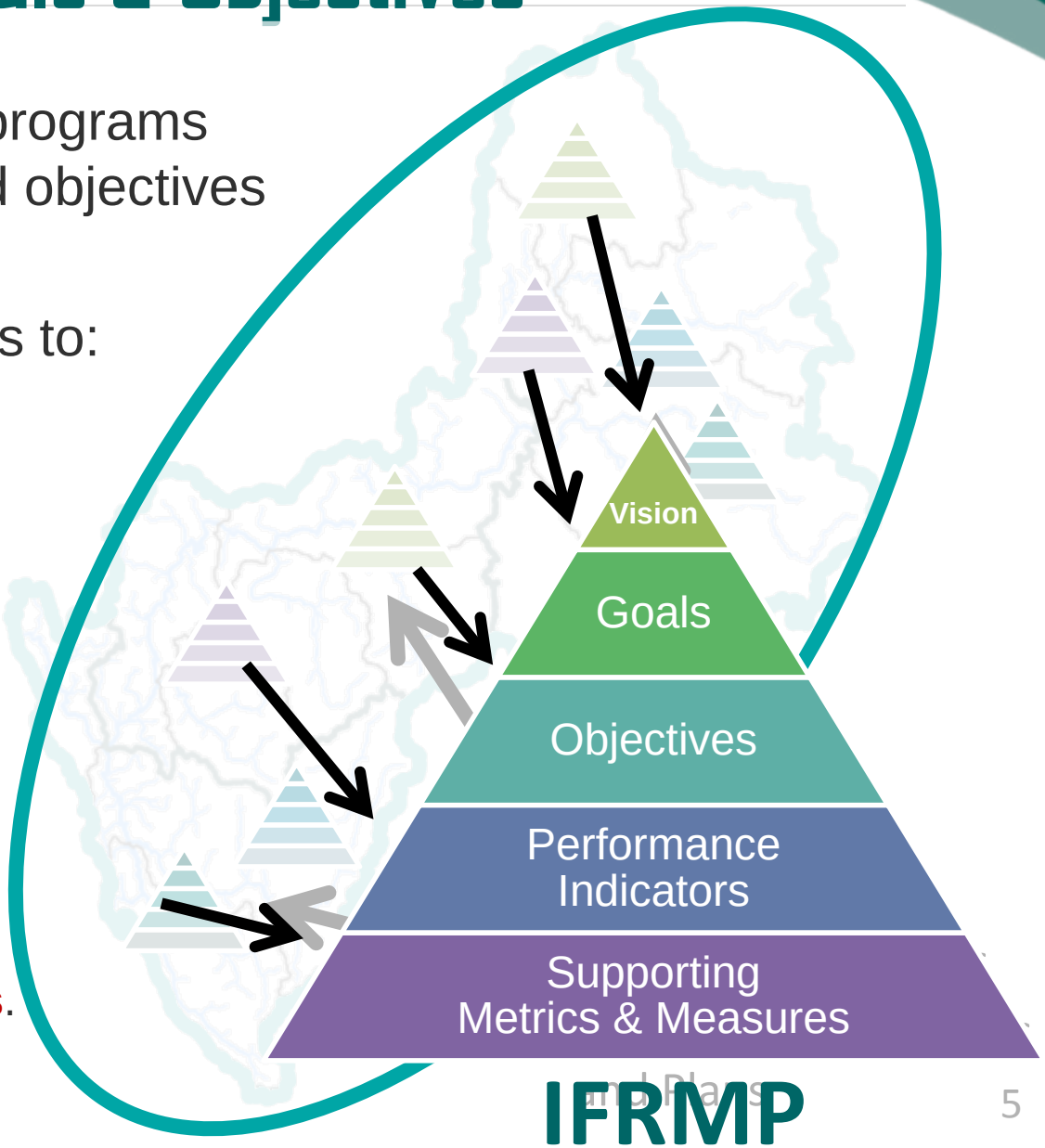
- Many regional plans & programs with their own goals and objectives



Scope of IFRMP Goals & Objectives

- Many regional plans & programs with their own goals and objectives

- Intention of the IFRMP is to:
  - Weave together G + Os of existing plans
  - Provide one set of G + Os for **whole-basin recovery at broader spatial scale**
  - and **NOT to "replace" G + Os of regional org or agency initiatives**.



Scope of IFRMP Goals & Objectives

- Ideally, our objectives will fit the criteria of SMART objectives.

Specific	Measurable	Attainable	Relevant	Time Based
Defines the direction of action by answering "What, how, why?"	Can be clearly tracked by some indicator.	Stands up to a "reality-check".	Directly tied to goals.	Includes timeframe, could be contextual (e.g., within 5 years of passage restored).

Scope of IFRMP Goals & Objectives

- Must also acknowledge **right level for detail** for region-wide restoration program-level objectives.
- Examples from similar plans →
- Some of the **very specific details** might be better suited to **regional action plans or specific projects**.

Revised Lost River Sucker and Shortnose Sucker Recovery Plan

RECOVERY GOAL, OBJECTIVES, AND CRITERIA

3. Recovery Goal

The ultimate goal of the recovery program is to arrest the decline and enhance Lost River sucker and shortnose sucker populations so that ESA protection is no longer necessary. To obtain this goal it is necessary to produce naturally self-sustaining populations, which possess healthy long-term demographic traits and trends.

4. Recovery Objectives

Based on the broad recovery strategy and current threats to the species the following objectives are identified (in no specific order):

a) Threat-based Objectives

i. Restore or enhance spawning and nursery habitat in Upper Klamath Lake and Clear Lake Reservoir systems.

ii. Reduce negative impacts of poor water quality

iii. Clarify and reduce the effects of non-native organisms on all life stages

iv. Reduce the loss of individuals to entrainment

v. Establish a redundancy and resiliency enhancement program

b) Demographic-based Objectives

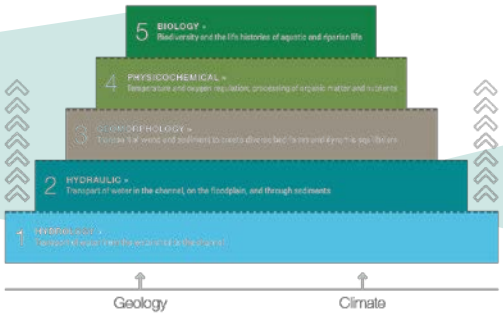
i. Maintain or increase larval production

ii. Increase juvenile survival and recruitment to spawning populations

iii. Protect existing and increase the number of recurring, successful spawning populations.

of these hatcheries are within the levels described in the respective HGMPs.

Objectives Hierarchy and Nested Actions

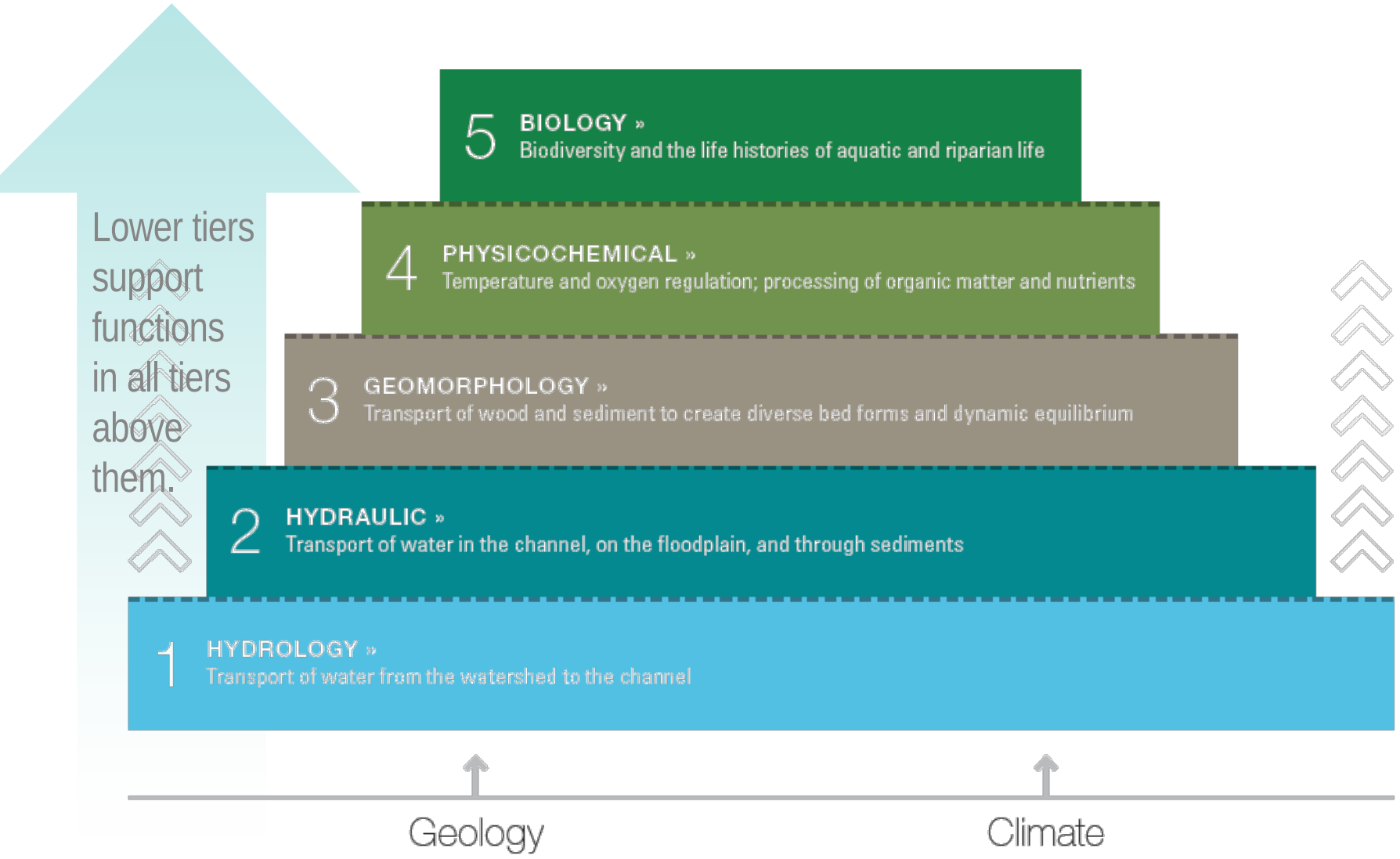


Action 1
Action 2
Action 3…

“Objectives” can be organized into a hierarchy that parallels the structure of the system being managed.

And for each specific objective, a series of actions that will make progress towards the objective.

Focus on FUNCTIONAL G+Os

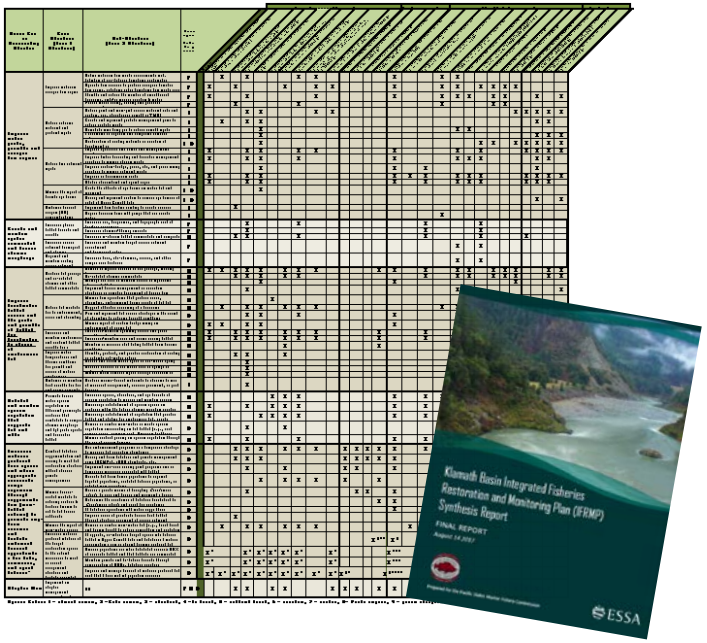


EPA 2012 - A Function-Based Framework for Stream Assessment & Restoration Projects

Draft G + O Hierarchy

- Reviewed goals and objectives from many existing plans
- Filtered to a smaller subset consistent with Fish Recovery Plans

REGIONAL RESTORATION PLANS & TMDLs



SPECIES RECOVERY PLANS

Table 1: Species Recovery Plans Consulted to Develop Basin-Wide Goals and Objectives

Species	Key Recovery Plans Consulted
Coho salmon	• NOAA NMFS. 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). National Marine Fisheries Service. Arcata, CA. 1841 pp. • California Department of Fish and Game. 2004. Recovery strategy for California coho salmon. Report to the California Fish and Game Commission. 594 pp. Copies/CDs available upon request from California Department of Fish and Game, Native Anadromous Fish and Watershed Branch, 1416 9th Street, Sacramento, CA 95814, or
Chinook salmon	• NONE (recovery outlines exist only for central California distinct population)
Steelhead	• McEwan, D. and T. A. Jackson. 1996. Steelhead restoration and management plan for California. California Department of Fish and Game. 246 pp. NOT RECENT (recent recovery outlines
Bull trout	• USFWS. 2015. Recovery Plan for the Prepared by U.S. Fish and Wildlife Ser • USFWS. 2015. Klamath River Recove 39 pp. Prepared by U.S. Fish and Wild • USFWS. 2002. Chapter 2, Klamath Ri (Salvelinus confluentus) Draft Recover
Redband trout	• Interior Redband Conservation Team *subsp.*) in the states of California, Ida
Suckers	• USFWS. 2012. Revised recovery plan fo *brevirostris*). U.S. Fish and Wildlife Service. Pacific Southwest Region. Sacramento, California. xvii + 122 pp.
Pacific lamprey	• USFWS. 2012. Conservation agreem Washington, Oregon, Idaho, and Cali • Goodman, D.H. and S.B. Reid. 2015. (*Entosphenus tridentatus*), California Arcata Fish and Wildlife Office, Arcata
Green sturgeon	• NONE (recovery plan exists only for s
Eulachon	• NOAA NMFS. 2016. Recovery Plan f West Coast Region, Protected Resou R, 97232. 120 pp.

Draft G + O Hierarchy

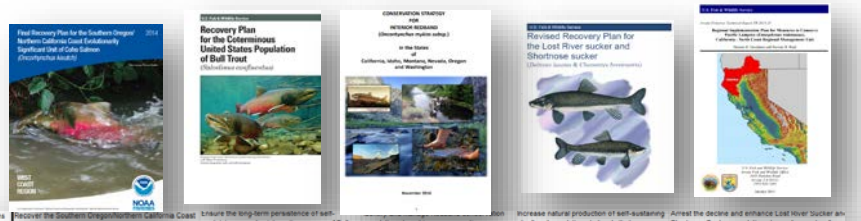
Whole-Basin Scale Nested Goals	Whole-Basin Nested Core Objectives
Fish Populations **1. Prevent further declines of Klamath fish populations and produce naturally self-sustaining populations with healthy demographic traits and trends that exceed escapement objectives to provide harvest opportunities.**	1.1 Increase juvenile production 1.2 Increase juvenile survival and recruitment to spawning populations 1.3 Increase overall population abundance and productivity 1.4 Maintain or increase life history and genetic diversity 1.5 Expand spatial distributions
Fisheries Actions **2. Regulate harvest to support achievement of goal #1.**	2.1 Improve management and regulations/enforcem[illegible]f harvest, bycatch and poaching of naturally produced fish such that populations do not de[illegible] and [illegible] recover
Biological Interactions (BI) **3. Support goal #1 by reducing biotic interactions (ecological, genetic) that could have negative effects on native fish populations**	3.1 Conduct hatchery supple[illegible]uction[illegible]g [illegible]e-intro[illegible]tion (as needed) to meet fish restoration objectives without gen[illegible]g adv[illegible]ompetitiv[illegible]enetic [illegible]nsequences for native fish 3.2 Minimize dis[illegible]ciate[illegible]ortality [illegible]cing ve[illegible] and fa[illegible]s known to lead to fish disease outbreaks 3.3 Redu[illegible]pacts of exc[illegible]spec[illegible]n native [illegible] 3.4 [illegible]ace[illegible]ac[illegible]pred[illegible]nat[illegible]sh
Habitat (H) **4. Support goal #1 by improving freshwater ha[illegible]t access for fish and the quality and quantity of habitat used by all freshwater life stages**	4.1 [illegible]re f[illegible]ass[illegible]ge an[illegible]e-[illegible]sh ch[illegible]. and other habitat connectivity 4.2 [illegible]or[illegible]val[illegible]m,[illegible]ures [illegible]ther local water quality conditions for fish growth and survival 4.3 [illegible]n[illegible]nd [illegible]aint[illegible]d availability 4.4 R[illegible]sh mo[illegible]ue to entrainment, scour, stranding 4.5 Enhance and maintain habitats for all freshwater life stages of resident and anadromous fish
Fluvial Geomorphic Processes (FG) **5. Support goal #1 by creating and maintaining spatially connected and diverse channel and floodplain morphologies**	5.1 [illegible]ease and maintain coarse sediment recruitment and transport processes 5.2 Increase channel and floodplain dynamics, stability and interconnectivity 5.3 Promote establishment of diverse riparian and wetland vegetation that contributes to complex channel and floodplain morphologies
Watershed Inputs (WI) **6. Support goal #1 by improving water quality, quantity, and ecological flow regimes**	6.1 Improve instream ecological flow regimes for the Klamath River mainstem and tributary streams 6.2 Reduce fine sediment inputs 6.3 Reduce external nutrient and pollutant inputs 6.4 Minimize the impact of harmful algae blooms

Draft G + O Hierarchy

Whole-Basin Scale Nested Goals	Whole-Basin Nested Core Objectives
Fish Populations	1.1 Increase juvenile production
1. Prevent further declines of Klamath fish populations and produc	1.2 Increase juvenile survival and recruitment to spawning populations
populations with heal	
trends that exceed es	
provide harvest oppo	
Fisheries Actior	
2. Regulate harvest t	
goal #1.	
Biological Intera	
3. Support goal #1 by	
(ecological, genetic)	
effects on native fish	
Habitat (H)	
4. Support goal #1 by	
access for fish and th	
habitat used by all fr	
Fluvial Geomor	
5. Support goal #1 by	
spatially connected a	
floodplain morpholo	
Watershed Inpu	
6. Support goal #1 by	
quantity, and ecological	
	6.3 Reduce external nutrient and pollutant inputs
	6.4 Minimize the impact of harmful algae blooms

Crosswalked for Quick Comparison

IFRMP



Initial Survey Feedback

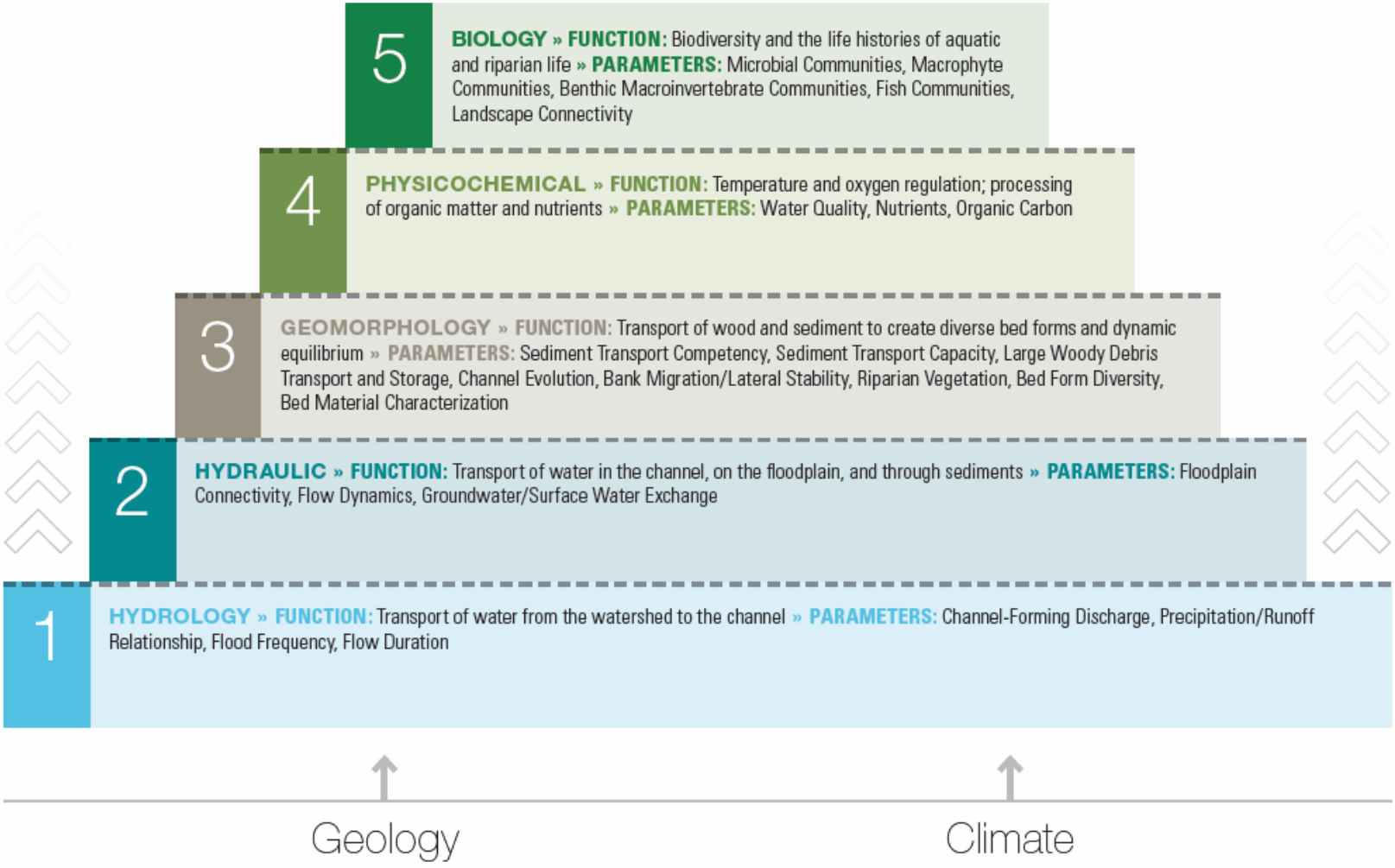
- ~12/19 respondents to this question were satisfied with the breadth and coverage of draft G & Os (others skipped).

- Common concerns among other respondents included:

  - Specific species not listed, might imply hierarchy is salmonid-centric.
  - Objectives not sufficiently specific (i.e., specific actions in specific places, like addressing WQ in UKL).
  - Some objectives should be more prominent or appear at a higher level as their own goal (e.g., water quality).
  - Socioeconomic objectives other than fisheries are not represented.

2 Performance Indicators

From Objectives to Indicators



EPA 2012 - A Function-Based Framework for Stream Assessment & Restoration Projects

Examples of Performance Indicators

Type of Indicator	Habitat		Fish Population	
	Action Effectiveness	*Sub-region & Basin-wide Status/Trends*	*Action Effectiveness*	*Sub-region & Basin-wide Status/Trends*
Qualitative or Proxy indicators	Ratings for specific types of created habitat features: poor, fair, good, etc. Qualita passag	# reported dewatering events in each sub-region # farms implementing practices to reduce	Observations of fish presence in areas of restored access (Y/N) Observations of	# streams in sub-region X with local observations of species Y Qualitative statements of ation trends e.g., pparent increase".
Quantitative indicators	% of sa with ac permea restora % area site X n criteria habitat % redu load in trib X following mitigation actions % time reach Y meets temperature targets	Upper Klamath meeting temperature targets during August index period	per female in tribs w restoration vs controls	ation abundance # naturally ners) ners per spawner its per spawner rtionate Natural nce (PNI), proportion hatchery influence (pHOS)

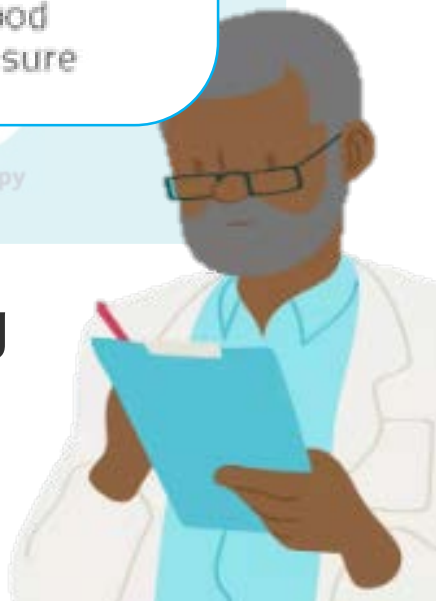
- But we **can't measure everything**.
- Maintaining **Core PIs** over time (through budget fluctuations) is essential for adaptive management

What is a "Core" Performance Indicator?

DIAGNOSTIC INDICATORS →Candidate Performance Indicators

VITAL SIGNS →<u>Core</u> Performance Indicators (CPIs)

- The <u>most critical</u> indicators to keep monitoring regularly, even when resources are limited, to reliably track overall system status.



Guidance for Converging to Core PIs

No

Relevant to Management: Is this the **best indicator to assessing progress towards a Level 2 objective** in objectives hierarchy* and / or **refining restoration strategy and actions**?

* Table 2 in briefing document

Yes

No

Feasible: Can indicator be **feasibly monitored**, providing unambiguous and cost-effective information for decisions?

Yes

No

Foundational: Would loss of this indicator from monitoring program severely impact Klamath restoration strategy?

Yes

Supplemental Indicator
(may be monitored)

Core PI
(must be monitored)

3 Workshop Activities

WORKSHOP ACTIVITY

Topics Under This Theme

Timeslot	Activity
Day 1 - PM	
Day 2 - AM	
Day 2 - PM	

WORKSHOP ACTIVITY

Topics Under This Theme

Timeslot	Activity
Day 1 - PM	
Day 2 - AM	
Day 2 - PM	terim formance Indicators (drawing on refs provided).

- NOT a "one and done" process.
- ITERATIVE, can return to earlier topics on Day 2 as understanding develops.
- All products to be further refined in SRWG Meetings & Oct Peer-Review Process.

Over to Darcy for more on Monitoring…

4 Workshop Instructions

WORKSHOP ACTIVITY

Day 1 PM – Lightning Round on Objectives & CPIs

1. **Feedback on Goals & Objectives hierarchy** (further suggestions, revisions).

2. **Choosing top Core Performance Indicators** for Objectives from list of candidates to feed Day 2 monitoring activities.

What will it look like?

WORKSHOP ACTIVITY

Day 1 PM – G & Os

1. Feedback on Goals & Objectives hierarchy

Initial Suggestions on "Tier 2" Objectives?

Whole-Basin Scale Nested Goals	Whole-Basin Nested Core Objectives
Fish Populations **1. Prevent further declines of Klamath fish populations and produce naturally self-sustaining populations with healthy demographic traits and trends that exceed escapement objectives to provide harvest opportunities.**	1.1 Increase juvenile production 1.2 Increase juvenile survival and recruitment to spawning populations 1.3 Increase overall population abundance and productivity 1.4 Maintain or increase life history and genetic diversity 1.5 Expand spatial distributions
Fisheries Actions **2. Regulate harvest to support achievement of goal #1.**	2.1 Improve management and regulations/enforcement of harvest, bycatch and poaching of naturally produced fish such that populations do not decline and can recover
Biological Interactions (BI) **3. Support goal #1 by reducing biotic interactions (ecological, genetic) that could have negative effects on native fish populations**	3.1 Conduct hatchery supplementation, rearing and re-introduction (as needed) to meet fish restoration objectives without generating adverse competitive or genetic consequences for native fish 3.2 Minimize disease-related mortality by reducing vectors and factors known to lead to fish disease outbreaks 3.3 Reduce impacts of exotic fish species on native fish 3.4 Reduce impacts of predation on native fish
Habitat (H) **4. Support goal #1 by improving freshwater habitat access for fish and the quality and quantity of habitat used by all freshwater life stages**	4.1 Restore fish passage and re-establish channel and other habitat connectivity 4.2 Improve water temperatures and other local water quality conditions [illegible] survival 4.3 Enhance and maintain food availability 4.4 Reduce fish mortality due to entrainment, scour, stranding [illegible]d maintain habitats for all freshwater life stages of resident and anadromous fish
Fluvial Geomorphic Processes (FG) **5. Support goal #1 by creating and maintaining spatially connected and diverse channel and floodplain morphologies**	[illegible] maintain coarse sediment recruitment and transport processes 5.2 Increase channel and floodplain dynamics, stability and interconnectivity 5.3 Promote establishment of diverse riparian and wetland vegetation that contributes to complex channel and floodplain morphologies
Watershed Inputs (WI)	6.1 Improve instream ecological flow regimes for [illegible]er mainstem and tributary streams

REMOVE

←ADD "on O2, pH, PO4…to meet TMDLs…"

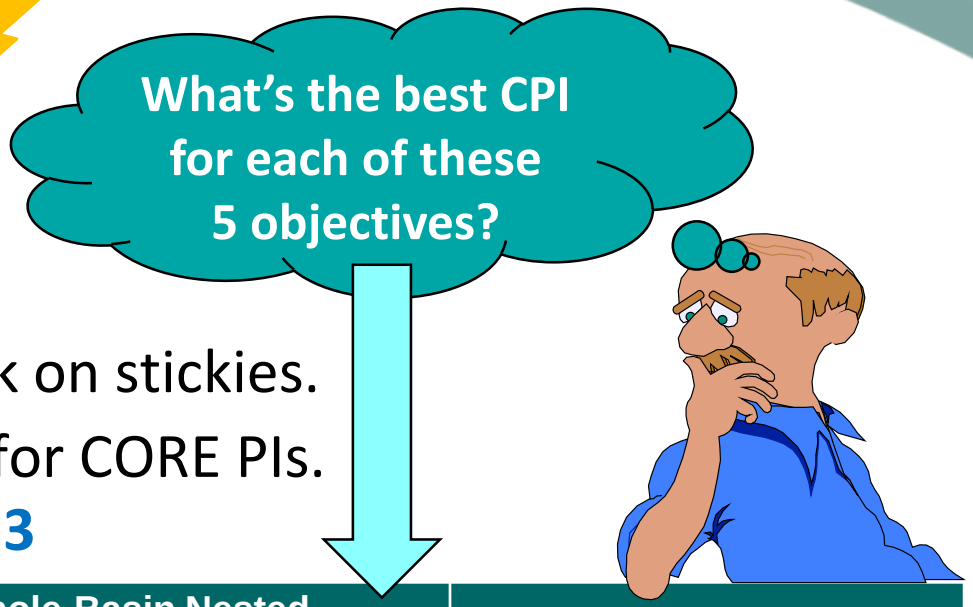
L3 L3 L3

4 . 6 Suggested new objective X…

↑ "fringe"

WORKSHOP ACTIVITY

Day 1 PM - CPIs



2. Choosing top Core Performance Indicators

- Everyone add their top pick on stickies.
- Each group votes on picks for CORE PIs.

Group 1 **Group 2** **Group 3**

Whole-Basin Scale Nested Goals	Whole-Basin Nested Core Objectives	Candidate Core PIs
Habitat (H) **4. Support goal #1 by improving freshwater habitat access for fish and the quality and quantity of habitat used by all freshwater life stages**	4.1 Restore fish passage and re-establish channel and other habitat connectivity	
	4.2 Improve water temperatures and other local water quality conditions for fish growth and survival	
	4.3 Enhance and maintain food availability	
	4.4 Reduce fish mortality due to entrainment, scour, stranding	
	4.5 Enhance and maintain habitats for all freshwater life stages of resident and anadromous fish	

WORKSHOP ACTIVITY

Day 2 AM – Revisit G&Os / CPIs, Forge Ahead on Actions

1. **Feedback on Goals & Objectives hierarchy** (further suggestions, revisions).

2. **Choosing top Core Performance Indicators** for Objectives from list of candidates to feed Day 2 monitoring activities.

Are we satisfied with these? Further discussion needed?

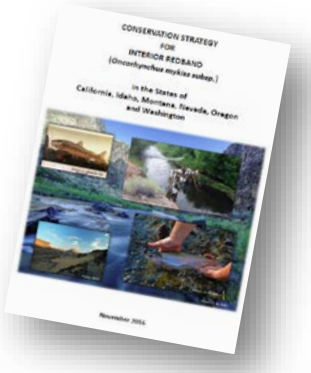
WORKSHOP ACTIVITY

Day 2 AM – Revisit G&Os / CPIs, Forge Ahead on Actions

3. **Proposing specific "highest-benefit" actions** for Objectives.

What does this mean?

Ex. From Redband Trout Conservation Strategy



Goal: Improve instream and riparian habitat to support all life stages of Redband in the sub-basin.

Objective: Restore riparian vegetation and ecological function with focused efforts in the North Fork Sprague River, South Fork Sprague River, and Upper Sycan watersheds.

Action Item: Riparian fencing and planting of native species along Fishhole Creek, Fivemile Creek, Meryl Creek and the lower 10 miles of the South Fork Sprague River.

Action Item: Riparian restoration along the North Fork Sprague River and Upper Sycan River and tributaries on lands administered by the US Forest Service.

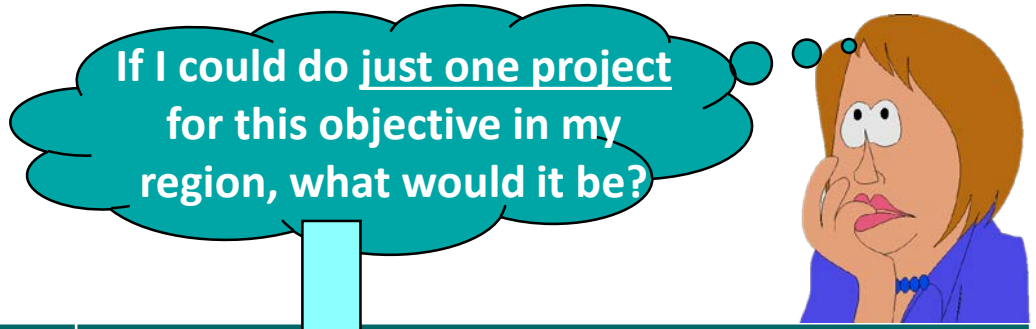
Action Item: Levee removal to restore floodplain connectivity along with riparian fencing and planting along the mainstem Sprague River.

WORKSHOP ACTIVITY

Day 2 AM – Revisit G&Os / CPIs, Forge Ahead on Actions

3. Proposing specific "highest-benefit" actions for Objectives.

- Everyone add their **top action** on stickies **for each Obj**.
- Group to discuss distribution and **gaps** – are they real or circumstantial? Why?



Whole-Basin Scale Nested Goals	Whole-Basin Nested Core Objectives	High-Benefit Actions			
		KRE	LKR	MUK	UKL
Habitat (H) **4. Support goal #1 by improving freshwater habitat access for fish and the quality and quantity of habitat used by all freshwater life stages**	4.1 Restore fish passage and re-establish channel and other habitat connectivity		Action	Action Action	Action
	4.2 Improve water temperatures and other local water quality conditions for fish growth and survival		Action	Action	Action Action Action
	4.3 Enhance and maintain food availability		Action	Action Action	?
	4.4 Reduce fish mortality due to entrainment, scour, stranding		?	?	Action
	4.5 Enhance and maintain				

WORKSHOP ACTIVITY

Day 2 PM – Revisit Prior Steps, Forge Ahead on Thresholds

1. **Feedback on Goals & Objectives hierarchy** (further suggestions, revisions).
2. **Choosing top Core Performance Indicators** for Objectives from list of candidates to feed Day 2 monitoring activities.
3. **Proposing specific "highest-impact" actions** for Objectives.

Are we satisfied with these? Further discussion needed?

WORKSHOP ACTIVITY

Day 2 PM – Revisit

4. **If** satisfied with input or
benchmarks or suitab
Indicators (drawing on

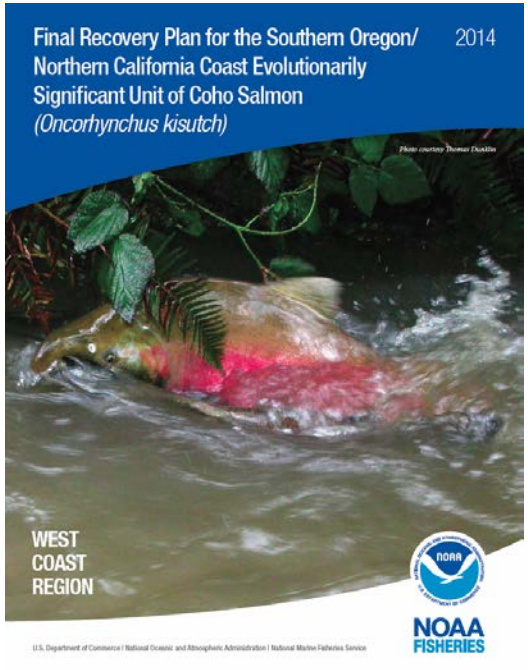


Table 4-6. Indicators of aquatic habitat suitability for coho salmon habitat, to used to rate applicable stresse and determine if stresses are rated "medium" or "low". Adapted from Kier Associates and NMFS (2008).

Stress	Indicators	Good	Very Good
Lack of Floodplain and Channel Structure	Pool Depths	3-3.3 ft	>3.3 ft.
	Pool Frequency (length)	41-50%	>50
	Pool Frequency (area)	21-35%	>35%
	D50 (median particle size)	51-60 & 95-110 mm	60-95 mm
	LWD (key pieces[1]/100 m)	2-3	>3
	LWD <20 ft. wide[2]	54-84 pieces[3]/mi	>85 pieces[3]/mi
	LWD 20-30 ft. wide[2]	37-64 pieces[3]/mi	>65 pieces[3]/mi
	LWD >30 ft. wide[2]	34-60 pieces[3]/mi	>60 pieces[3]/mi
Altered Sediment Supply	% Sand <6.4mm (wet)	15-25%	<15%
	% Sand <6.4mm (dry)	12.9-21.5%	<12.9%
	% Fines <1mm (wet)	12-15%	<12%
	% Fines <1mm (dry)	8.9-11.1%	<8.9%
	V Star (V*)	0.15 - 0.21	<0.15
	Silt/Sand Surface (% riffle area)	12-15%	<12%
	Turbidity (FNU)[4]	120-360 hrs > 25 FNU	<120 hrs >25 FNU
	Embeddedness (%)	25-30	<25
Impaired Water Quality	pH (annual maximum)	8.25-8.5	<8.25
	D.O. (COLD) (mg/l 7-DAMin)	6.6-7.0 mg/l	>7.0 mg/L
	D.O. (SPAWN) (mg/l 7-DAMin)	10.1-11 mg/l	>11.0 mg/l
	Temperature (MWMT[5])	16-17 °C	<16 °C
	Aq Macroinverts (EPT)	19-25	>25
	Aq Macroinverts (Richness)	31-40	>40
	Aq Macroinverts (B-IBI)	60.1-80	>80
Degraded Riparian Forest Conditions	Canopy Cover (% shade)	71-80%	>80%
	Canopy Type (% Open + Hardwood)	20-30%	<20%
	Riparian Condition (conifers >36" dbh / 1000ft for 100 ft wide buffer)	125.1-200	>200
Disease	*Ceratonova shasta*	No greater than 10% mortality of sentinel coho salmon juveniles at Beaver Creek confluence in the Klamath River during May and June	

WORKSHOP ACTIVITY

Day 2 PM – Revisit Prior Steps, Forge Ahead on Thresholds

CPIs from Day 1/2	Good Status	Fair Status	Poor Status
CPI	< X N. Tamburello	~ X N. Tamburello	> X N. Tamburello
CPI			
CPI			

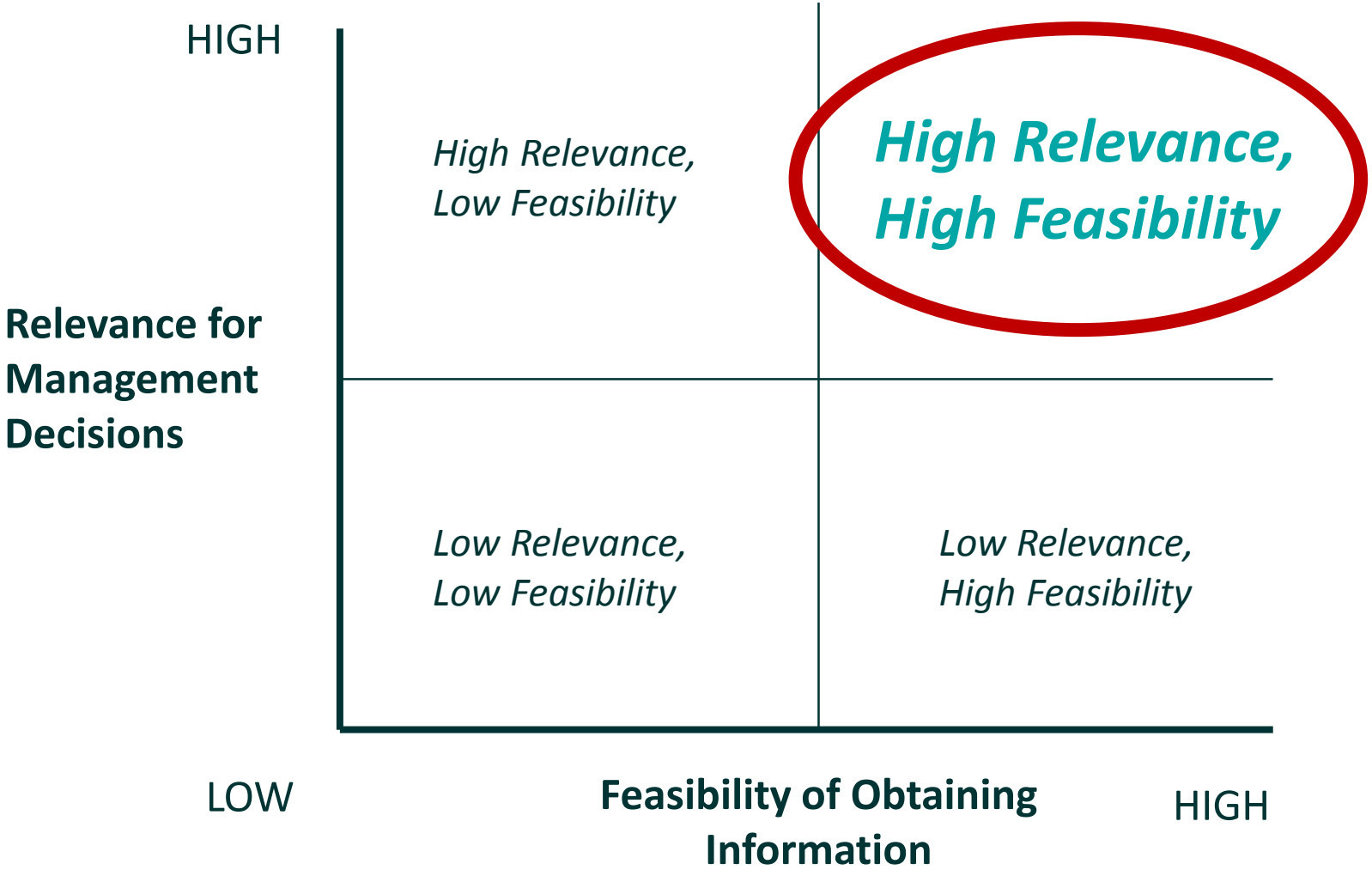
Include Value, Your Name, Reference

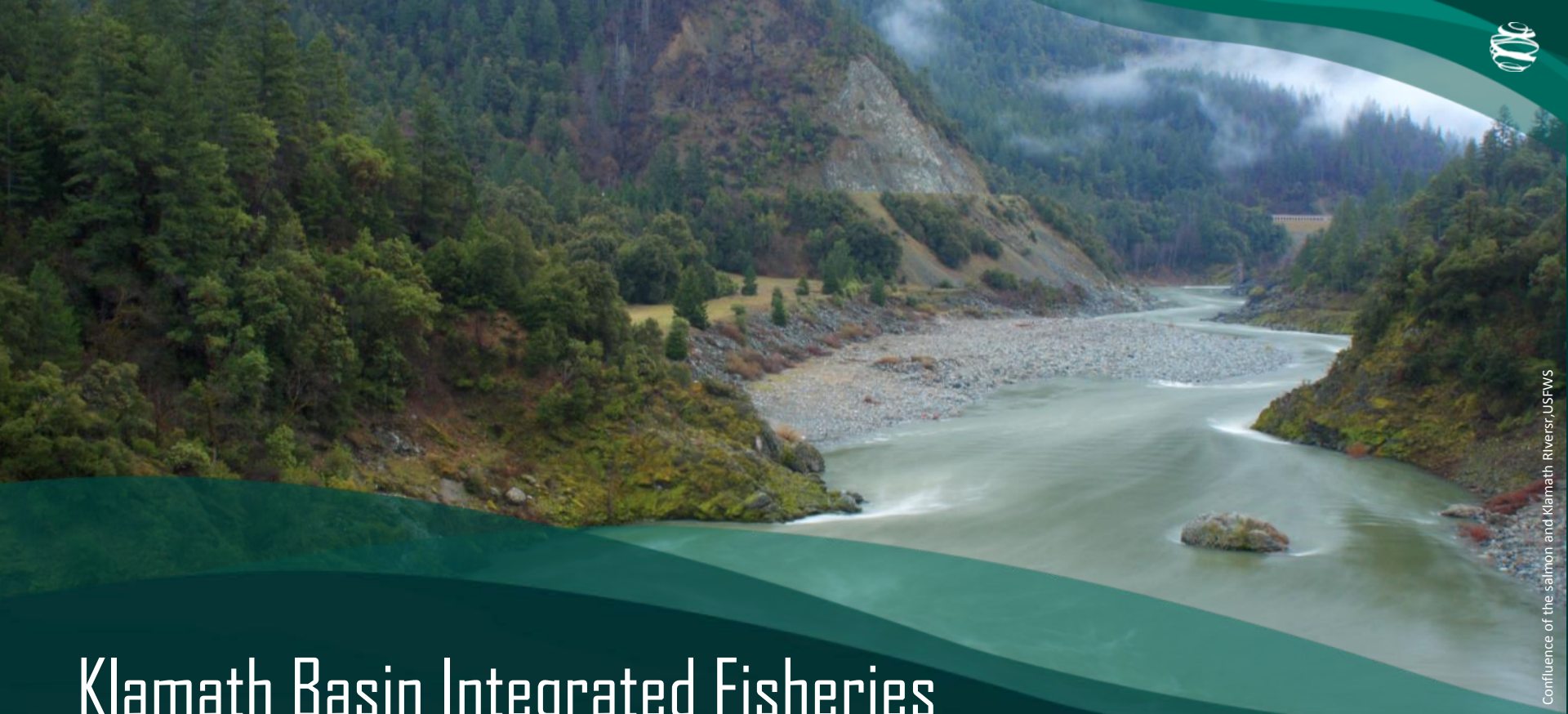
General Ideas

- Diff. thresholds for each species
- CPI X should use qualitative thresholds, etc.

Reserves

What is a "Core" Performance Indicator?





Confluence of the salmon and Klamath Rivers,USFWS

Klamath Basin Integrated Fisheries Restoration and Monitoring Plan

Monitoring Framework Development

Darcy Pickard

IFRMP Workshop, Klamath, CA, July 10 2018

ESSA

Outline

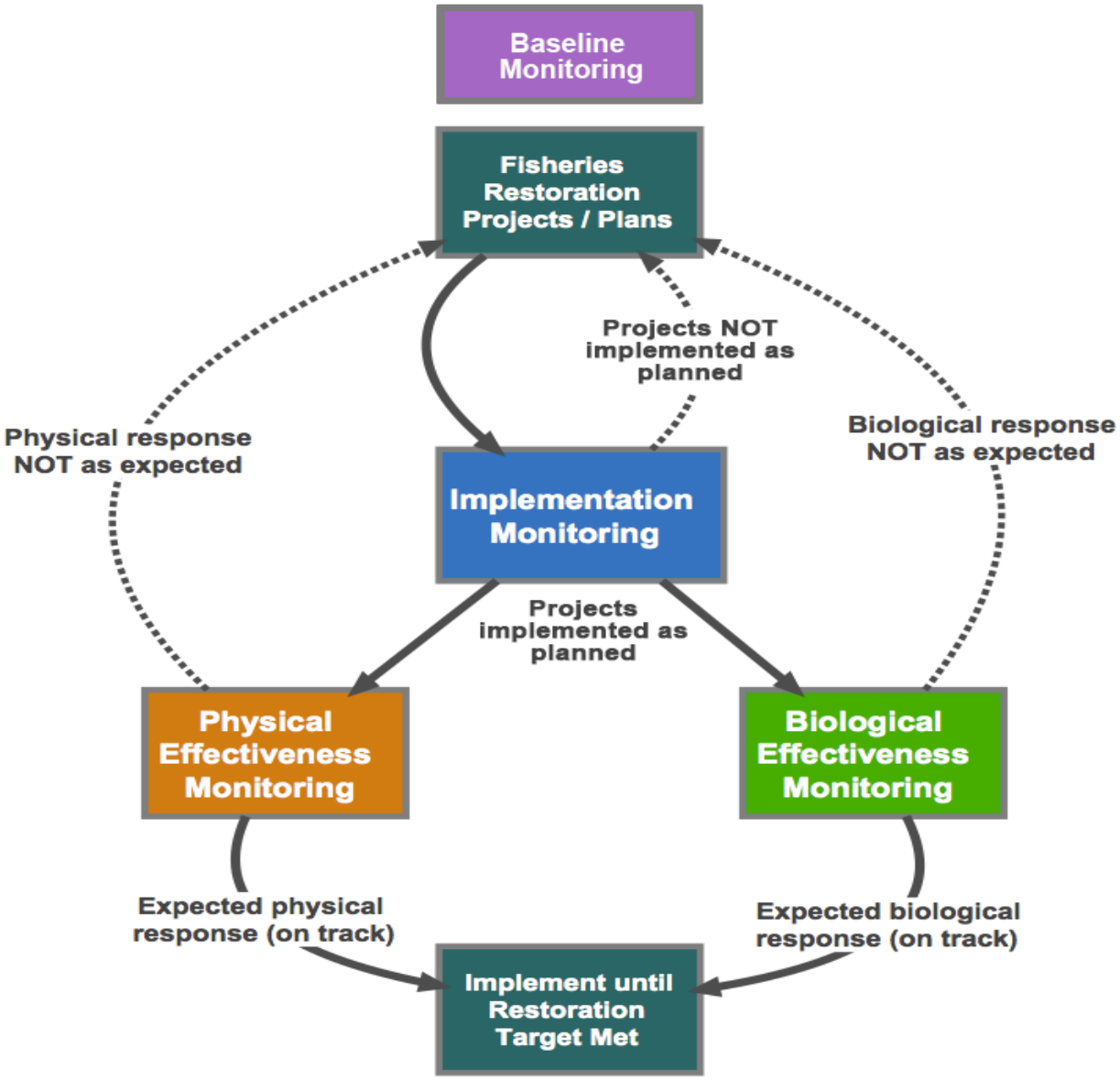
- Monitoring framework
  - Types of monitoring
  - Monitoring design components
  - Thoughts on prioritization
  - Phases of development
- What is different about the IFRMP?
- Current monitoring
- Workshop task process

→ Goal of this presentation is to establish a common understanding, setting the stage for workshop conversations

Types of monitoring

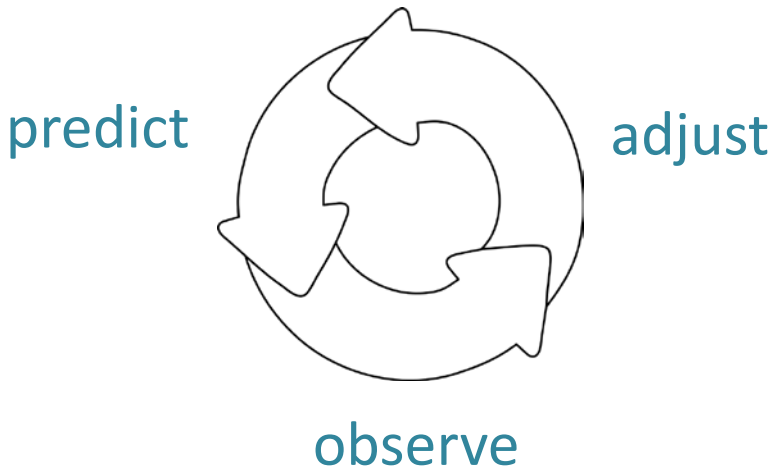
- Status and Trends Monitoring
  - Long-term
  - Consistent approach (indicators, methods, effort)
- Action Effectiveness Monitoring
  - Shorter term, focused questions
  - Approach may change over time
  - Sample design is tied to management action in question

Effectiveness monitoring



Adaptive management approach to Action effectiveness monitoring

- What type of monitoring and how much effort is needed will change over time
  - Detailed abundance surveys aren't necessary until evidence of recolonization
  - High water events might be required to trigger some physical responses

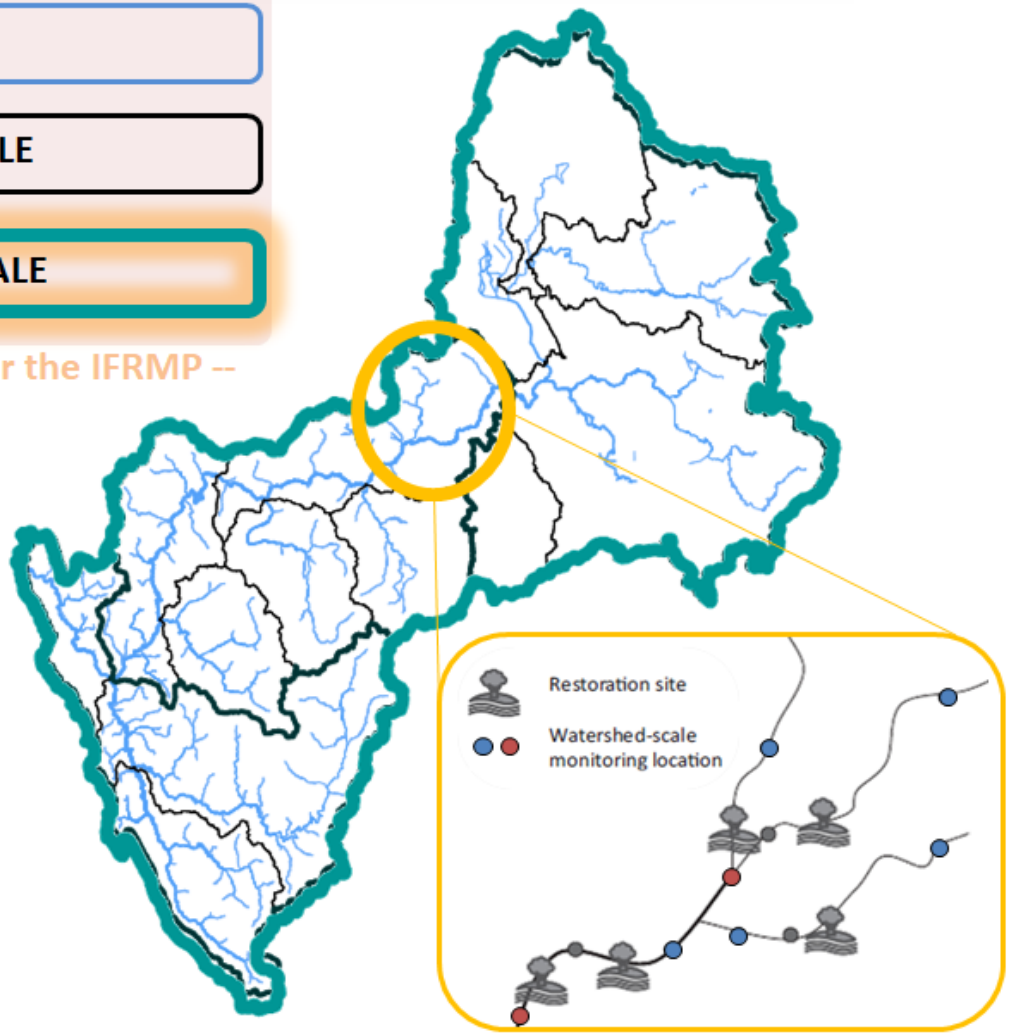


➢ Develop a flexible monitoring design that anticipates and directly responds to observed changes

Relevance to IFRMP

Status and Trends	Action Effectiveness
LOCAL SCALE	
SUB-BASIN SCALE	
BASIN-WIDE SCALE	

-- Focus of monitoring under the IFRMP --



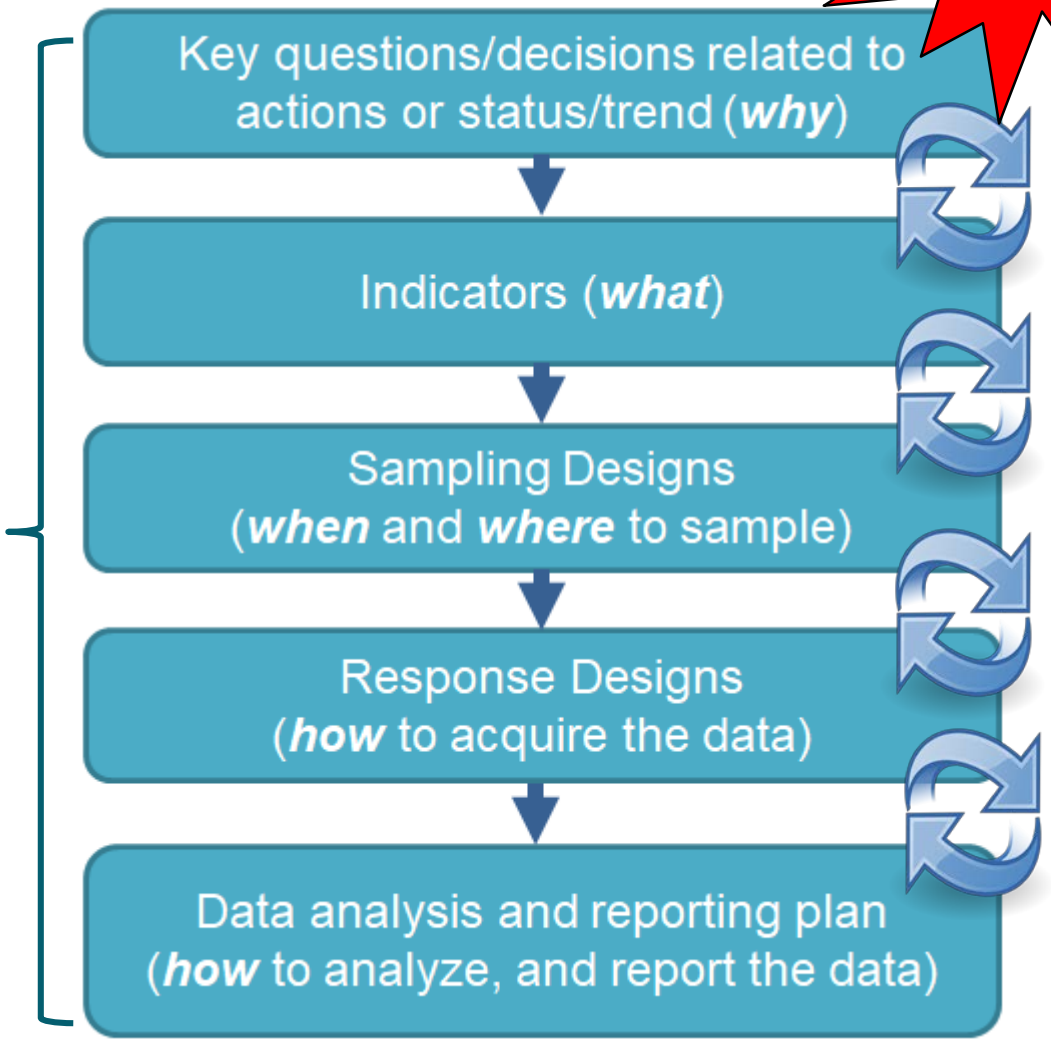
Questions or comments?

Monitoring Framework - components

many:man

→ this is an **iterative** process and there are **dependencies** among all steps

Who?



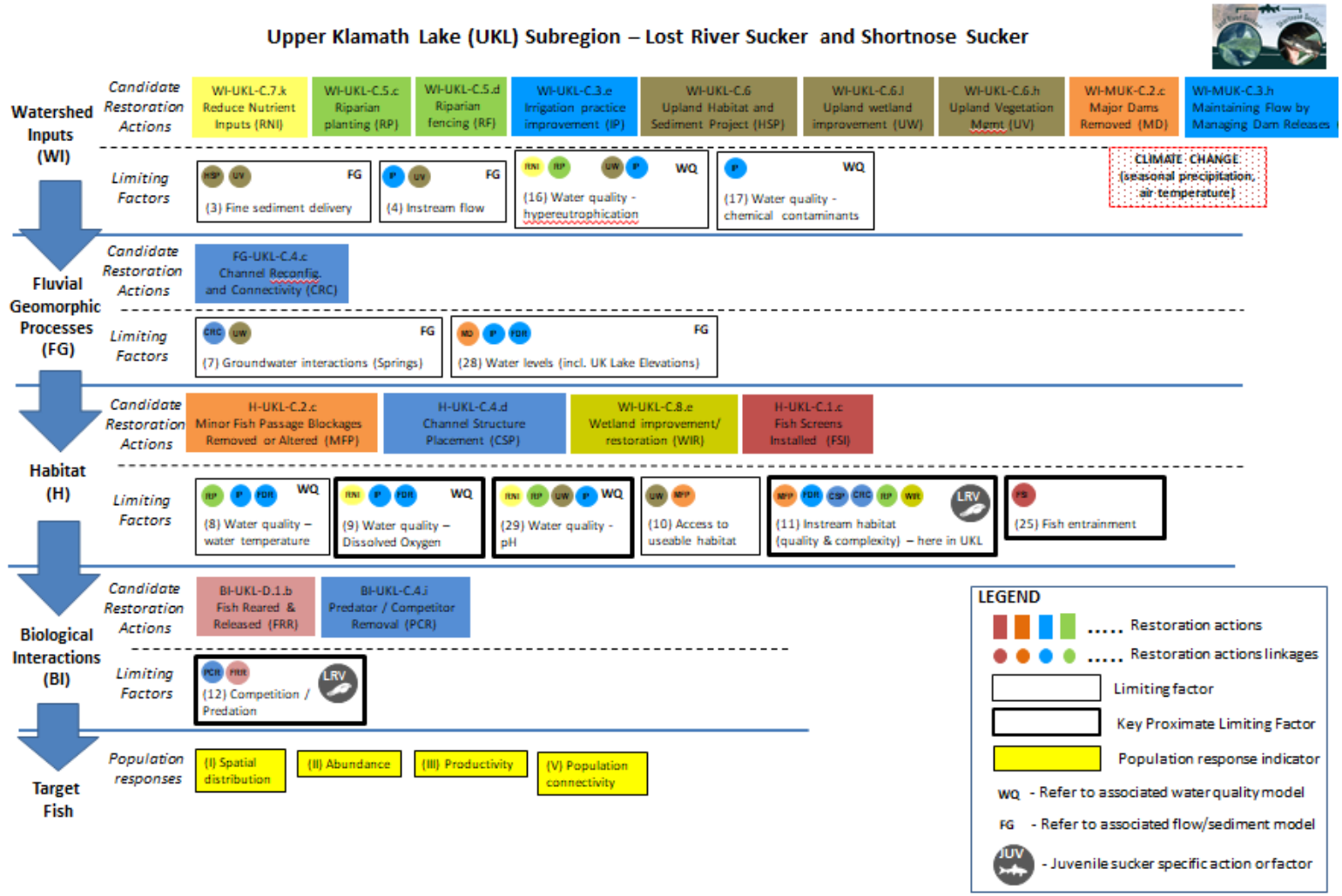
→**80:20 rule**
start at the top and work down but once you start to get bogged down, move to the next step and iterate back later.

Key Questions or Management Decisions (Why)

- Why do we need the information? How does it relate to the IFRMP goals?
- How will the data be used? How 'good' does it need to be?
- Provides insight on all the other components of monitoring design

→ A poorly defined problem is one of the most common failures of monitoring programs

Indicator Selection (What)



Indicator Selection (What)

Informs multiple indicators or questions

Too rigid: Need to keep open mind to allow for new insights

Category	Criteria
Science	**Scientifically valid** ★
	Reflects Indigenous or Traditional Knowledge
	Benchmark(s) exists for indicator (e.g., poor, fair, good) ★
Management (Why)	**Relevant to policy or management decisions** – assess progress towards objectives, refine restoration strategy ★
	Reflects community concerns (e.g., food security, health)
Analytical	**Sensitive to change** ★
	Small signal to noise ratio
	Widely used across agencies and locations
Data	Supporting data available, meets database requirements
	Time series data available
Feasibility	Technically feasible to sample, measure, process, analyze.
	Cost effective data collection ★

Accessibility of data?

Add data quality

→ Focus of breakout group discussions

Sample Design (Where and When)

- Target population
- Sample unit
- Sample frame
- Stratification
- Sampling scheme
- Sample effort
- Timing & frequency

Response Design (How)

What are the options and how do they compare in terms of:

- Cost
- Feasibility
- Spatial coverage
- Sample unit
- Precision
- Established protocols

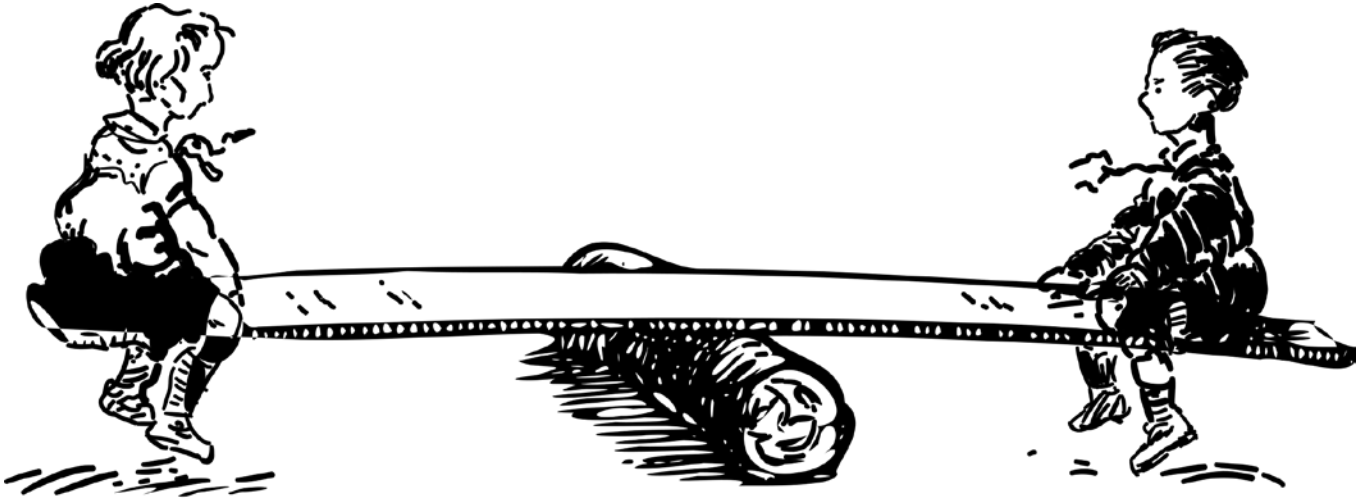
Are there new or emerging methods that should be considered?

Data Analysis and Reporting Plan (How)

- Identify how you intend to use the information
  - Trend over time? How to estimate?
  - Comparison between locations?
  - Comparison to a target or threshold?
- Identify how you intend to manage the data and report the information
- Identify responsibilities

Questions or comments?

Restoration vs. Monitoring

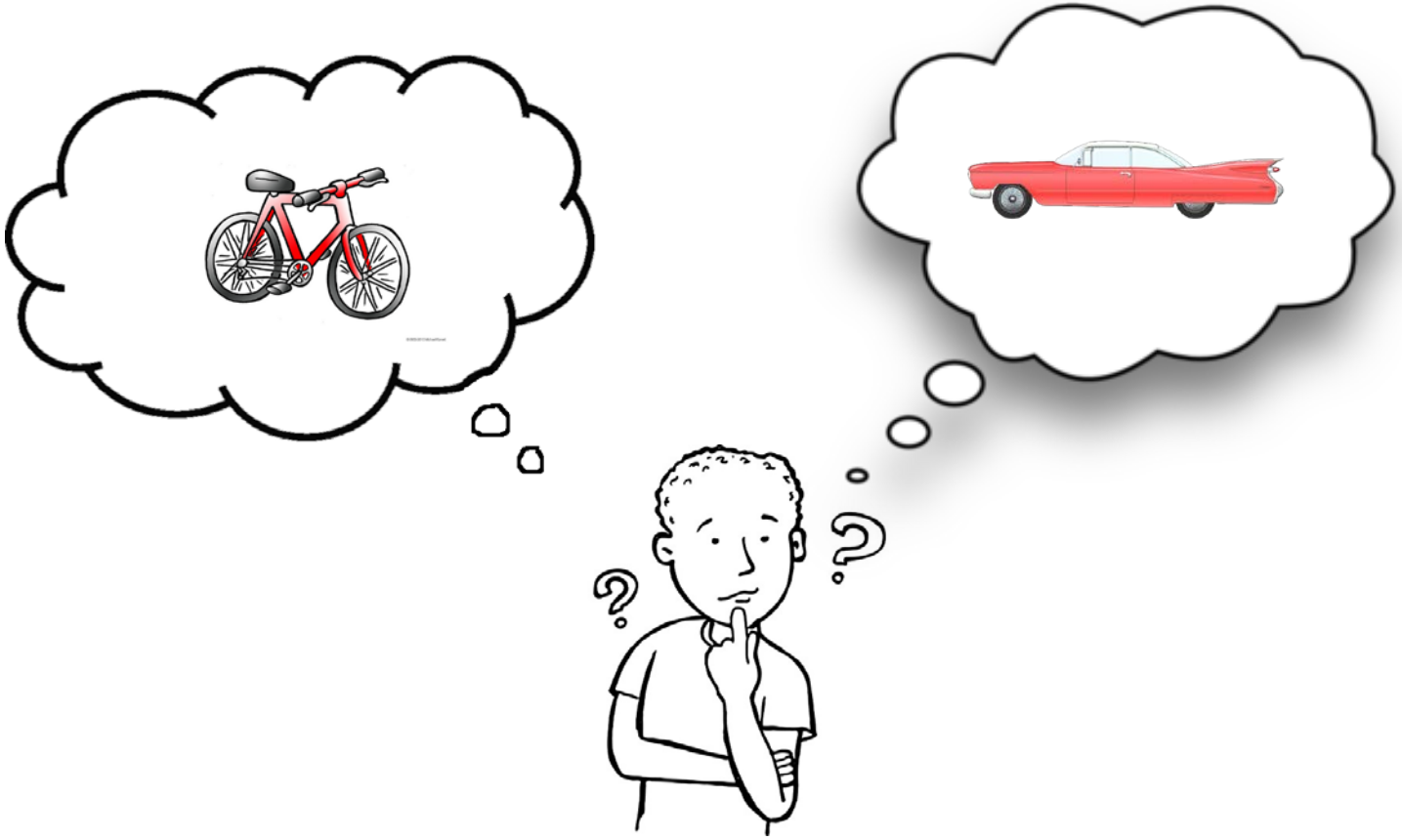


Restoration

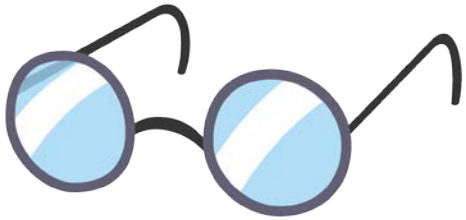
Monitoring

→ **Efficiency is important**

How much is enough?



Monitoring Prioritization Lenses

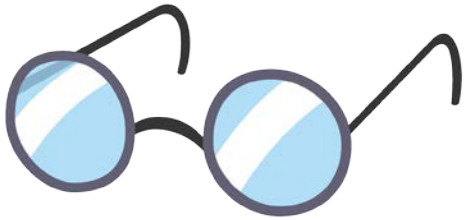


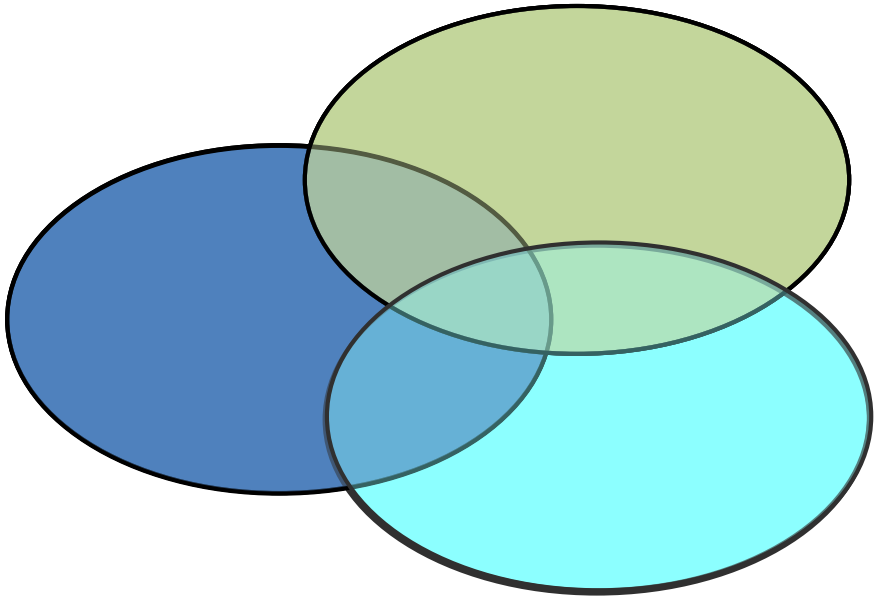
Indicator suitability

Degree of **uncertainty**

Questions by **monitoring activity**

Monitoring Prioritization Lenses





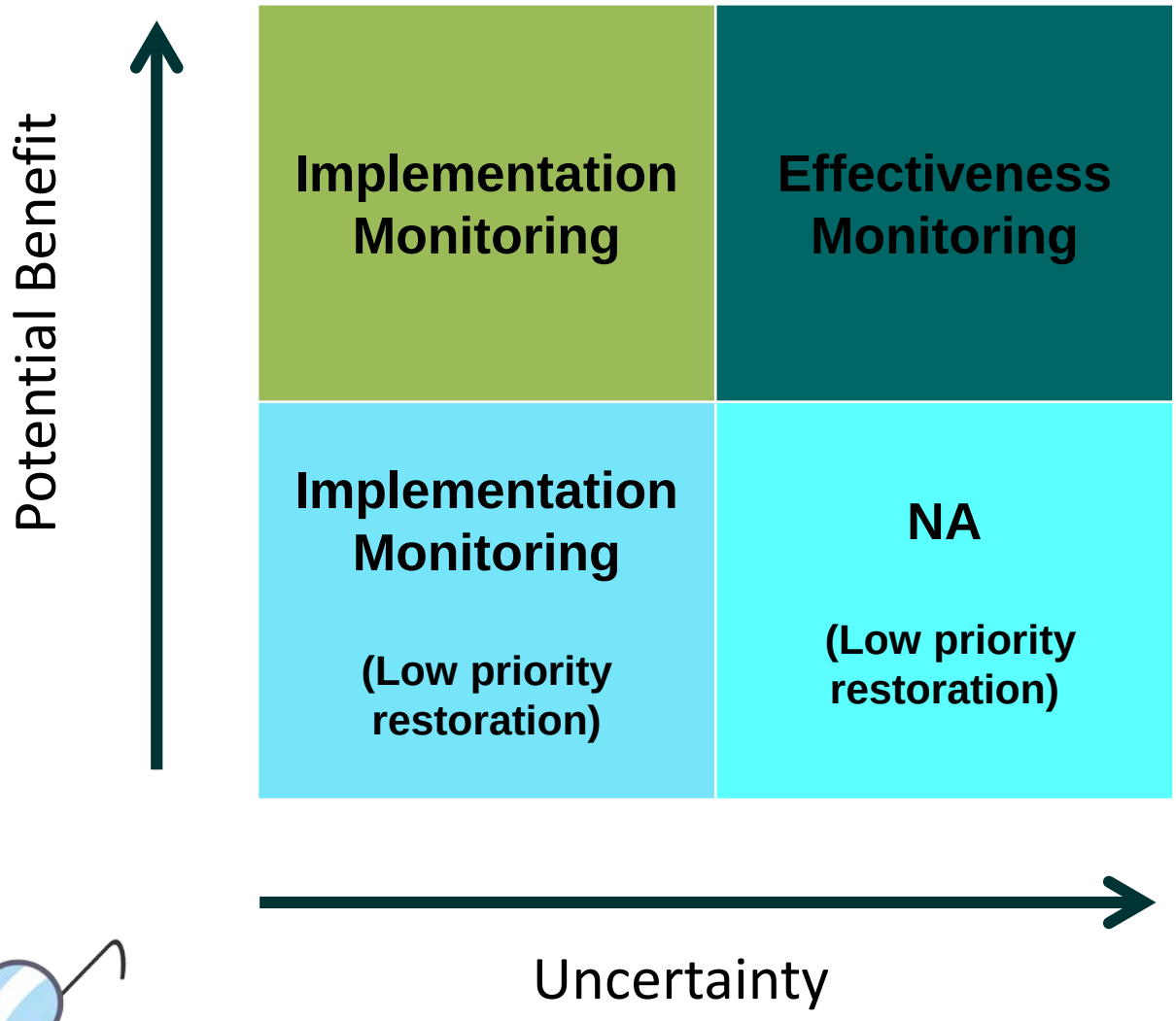
Indicator Suitability

Candidate Performance Indicators

Selection Criteria

Core Performance Indicators

Degree of uncertainty wrt restoration?



Activity by question matrix

Monitoring activity	E.1 IRCs		E.2 SWH		E.3 Spawning habitat projects				E.4 Level 2 spawning flows				E.5 Translocation / passage at Intake				
	Q1	Q2	Q1	Q2	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q5
Age-0 population sampling	X		X					X				X				X	X
Physical monitoring of food producing and foraging habitat		X		X													
Plankton net surveys and genetic analysis								X				X				X	X
Radio tagging, genetic analysis of motivated adults						X	X		X	X	X		X	X	X		
Passive telemetry network (and/or aerial surveys)						X			X	X			X	X			
Mobile tracking by boat						X	X			X	X			X	X		
Physical monitoring of spawning habitats					X										X		
DIDSON acoustic video						X	X			X	X				X		
3D telemetry						X	X								X		
Adult capture (e.g., trammel net) to assess size of aggregation or confirm spawning (ultrasound or pre/post weight)							X			X	X				X		
Macro-scale in-river monitoring									X	X	?	?		X			
Experimental release of reproductively ready hatchery primed but natural origin sturgeon						X	X										
Acoustic Doppler Current Profiler (ADCP) at Intake													X				
Experimental release of hatchery free-embryos above Intake Diversion Dam																	X

→ Monitoring activities which inform more than one question may be prioritized

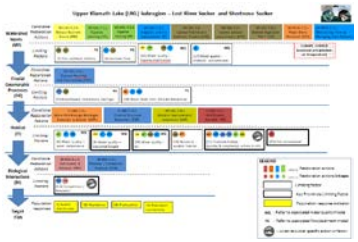
Questions or comments?

Monitoring Framework Phases

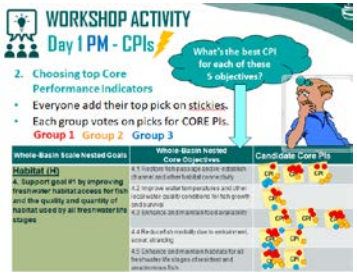
- Phase 2: (Fall 2018)
  - Initial scoping of monitoring framework
- Phase 3: (Dec 2018-Nov 2019)
  - Developing the monitoring framework
  - Address baseline monitoring gaps
- Phase 4: (2020)
  - Apply and prioritize monitoring activities
  - Scope integrated tracking inventory
  - Major peer & public review
- Phase 5 (2021)
  - Final technical review
  - Complete integrated tracking inventory
  - AM reporting framework

Monitoring Framework – **Phase 2** Status

Key questions/decisions related to actions or status/trend (***why***)



Indicators (***what***)



Road test template July 10-11

Sampling Designs (***when*** and ***where*** to sample)

Response Designs (***how*** to acquire the data)

Data analysis and reporting plan (***how*** to analyze, and report the data)

→ Later phase


Questions or comments?

Outline

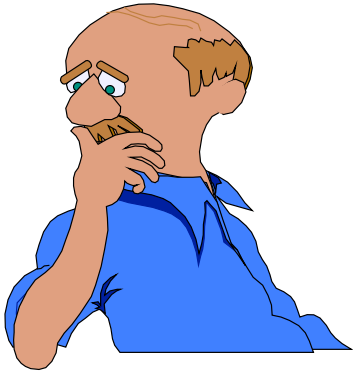
- Monitoring framework
  - Types of monitoring
  - Monitoring design components
  - Thoughts on prioritization
  - Phases of development
- **What is different about the IFRMP?**
- Current monitoring
- Workshop task process

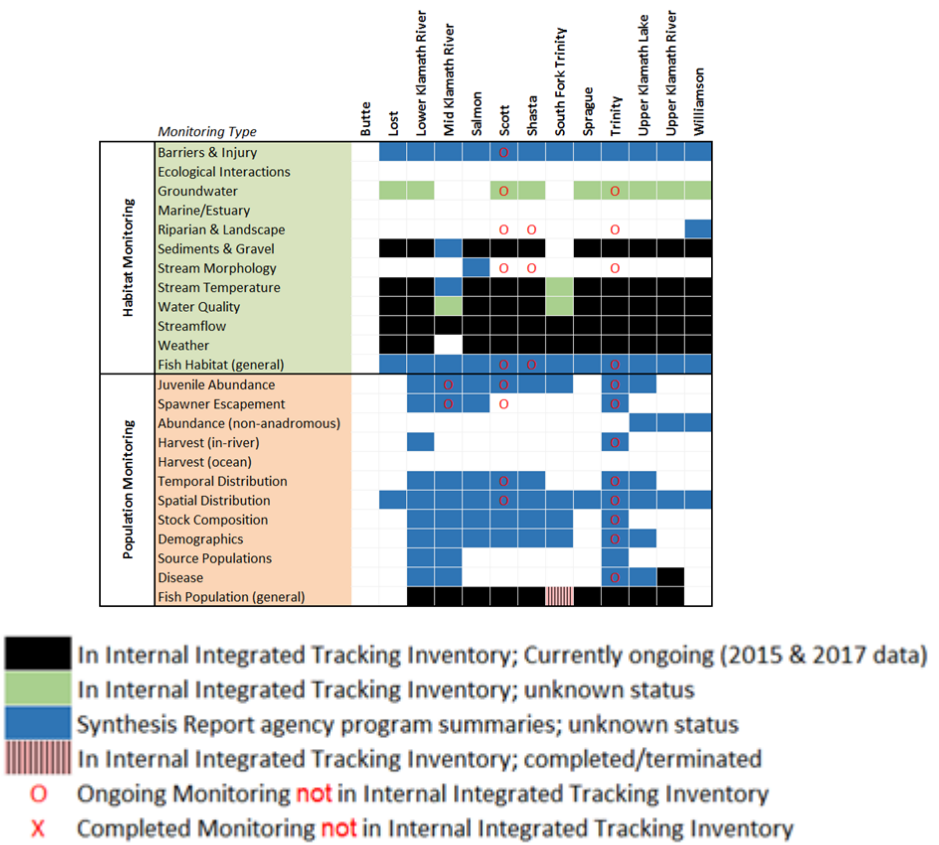
→ Goal of this presentation is to establish a common understanding, setting the stage for workshop conversations

Approach

Gaps = [Needs] – [Current Monitoring]

Key Questions for IFRMP?





In Internal Integrated Tracking Inventory; Currently ongoing (2015 & 2017 data)

In Internal Integrated Tracking Inventory; unknown status

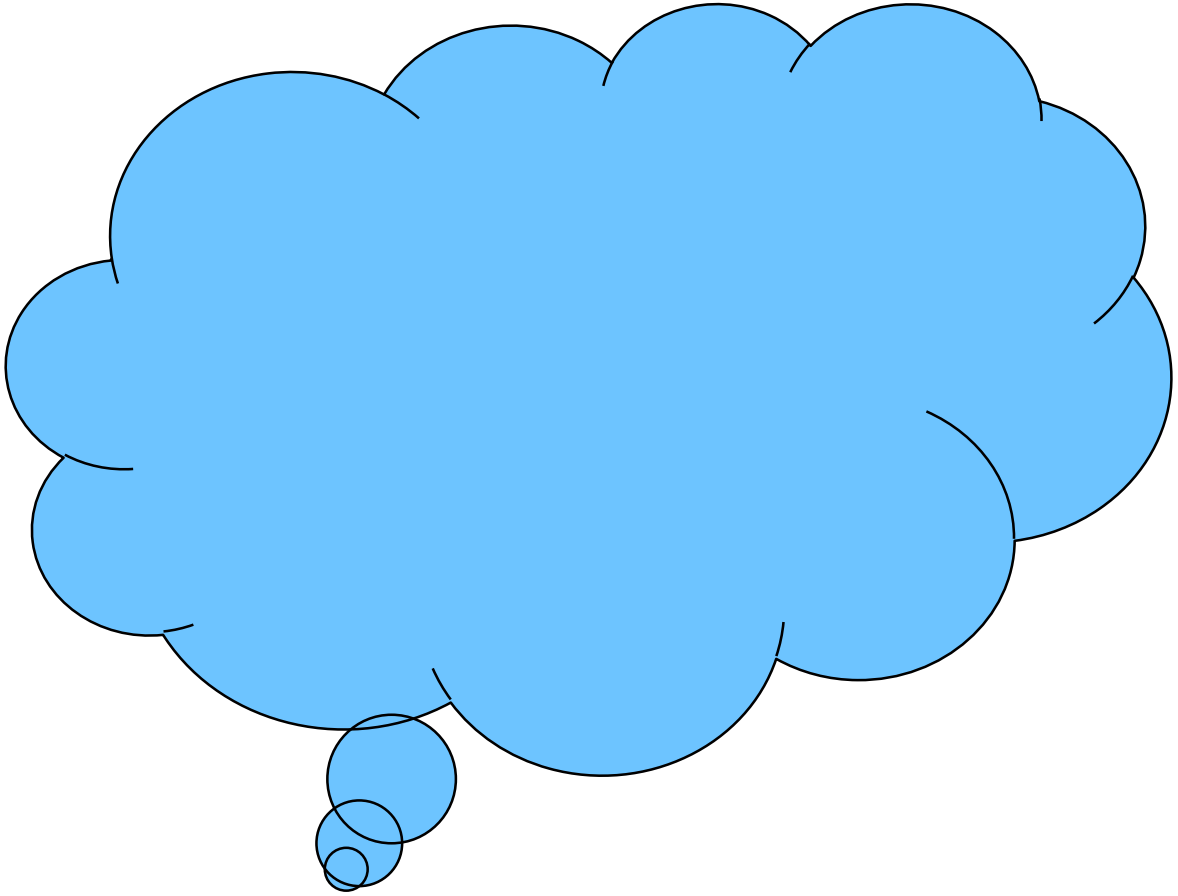
Synthesis Report agency program summaries; unknown status

In Internal Integrated Tracking Inventory; completed/terminated

O Ongoing Monitoring not in Internal Integrated Tracking Inventory

X Completed Monitoring not in Internal Integrated Tracking Inventory

How does the IFRMP differ?



How does the IFRMP differ?

Basin-wide

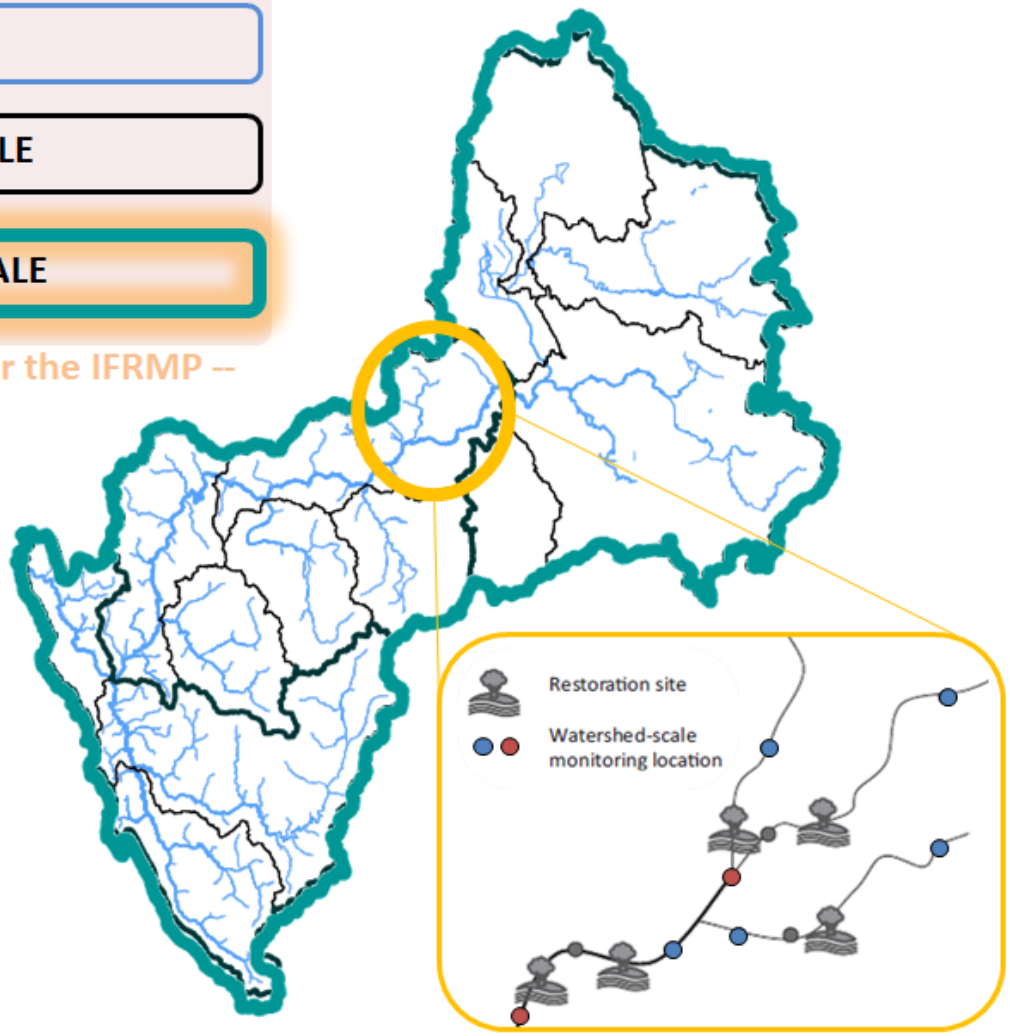
Integrative

Restored Fish Passage

Relevance to IFRMP

Status and Trends	Action Effectiveness
LOCAL SCALE	
SUB-BASIN SCALE	
BASIN-WIDE SCALE	

-- Focus of monitoring under the IFRMP --



Basin-wide Questions– survey results

- Having considered the objectives hierarchy, what are the **"Top 3" key basin-wide monitoring questions** from your perspective?

-- See handout for full responses

Survey results: by the numbers

- 15 people, 43 proposed questions
- Types of monitoring
  - 14 Action Effectiveness
  - 22 Status and Trends
  - 9 research questions
- Habitat (22), Population (11), Both (9)
- Basin-wide (31), Upper or Lower focus (10)
- Focus on Dam removal (10)
- Salmonids (7), Suckers (4), Lamprey (1)

Survey results: themes

- Adult fish abundance & distribution
- Fish passage
- Juvenile fish (limiting factors)
- Productivity, survival, condition, growth
- Suckers in upper Klamath Lake

Survey results: themes

- Habitat [instream]
- Water quality
- Water quantity, Baseflow
- Landscape condition
- Sediment
- Nutrient delivery
- Climate change (riparian restoration; refugia)
- Temperature

Discussion

Monitoring if dams are removed

- Direct habitat effects
  - Channel redevelopment
  - Changing water quality

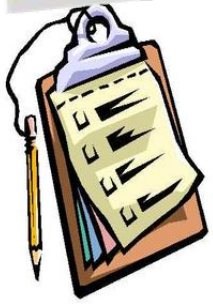
& quantity

& sediment

- Distribution and abundance of fish
  - Reintroduction of native anadromous species
  - Unintended introductions of non-native species

& non-

Less interest in this question than the others



Disease dynamics

Approach

TABLE 2. Existing status of sediment supply and migration barriers in the Elwha and Quinault Rivers. The Elwha River is divided into sections by two dams. Δ = change.

	Sediment Supply		Barriers to Migration	
Reach	Current conditions	Post dam removal Δ	Current conditions	Post dam removal fish community Δ
Lower Elwha	Unnatural	Yes	Yes[1]	No
Middle Elwha	Unnatural	Yes	Yes[1]	Yes
Upper Elwha	Natural	No	Yes[2]	Yes
Quinault	Natural	No	No	No

Expected changes

Preliminary monitoring vision

TABLE 5. Candidate ecosystem monitoring parameters that could be collected before, during, and after dam removal in the Elwha River. Reach scale includes newly opened and pre-dam removal reaches.

Parameter	Scale	Statistics	Technique	Frequency	Sampling Scheme
Habitat response to release of stored reservoir sediment	Reach/watershed	Mean Variance Rate of change	Gravel mapping	Annual	Stratified and including index reaches and annual randomly located sites
	Reach/watershed	Mean Variance Rate of change	Embeddedness	Annual before and every 3 yrs following dam removal	Every 10th habitat sampled
	Reach/watershed	Mean Variance Rate of change	Sub-surface sediment sampling	Same as above	Stratified and including index reaches and randomly located sites
	Reach/watershed	Mean Variance Rate of change	Census of pool depths	Annual	Stratified and including index reaches and randomly located sites
Reservoir reach recovery as forest recolonize exposed reservoir sediments	Reach	Mean Variance Rate of change	see list above	Annual	Complete census

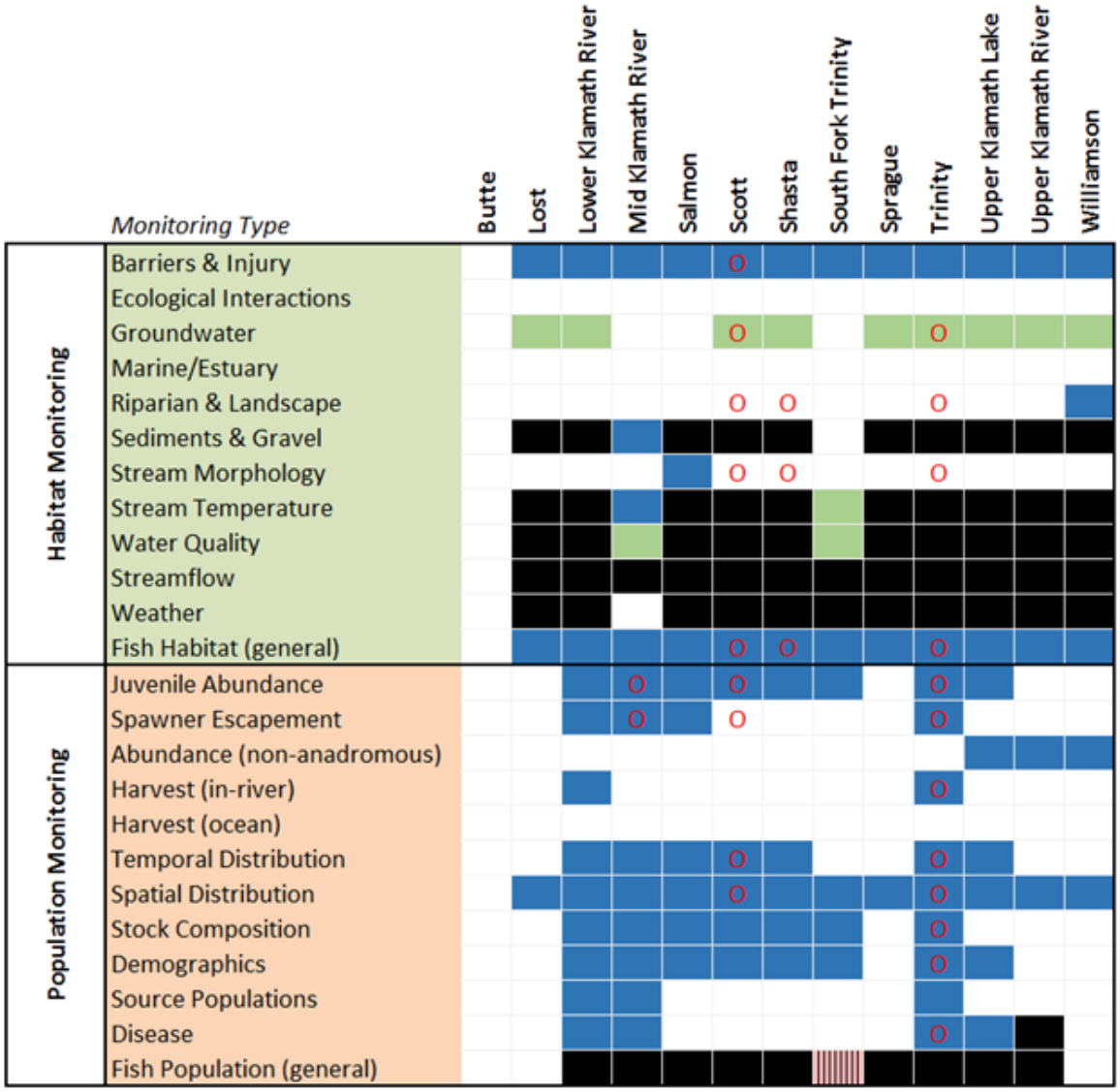
McHenry and Pess 2008

Outline

- Monitoring framework
  - Types of monitoring
  - Monitoring design components
  - Thoughts on prioritization
  - Phases of development
- What is different about the IFRMP?
- **Current monitoring**
- Workshop task process

Summary of current monitoring across the Klamath Basin

- ESSA's Integrated Tracking Inventory currently has monitoring metadata from 36 Klamath agencies/projects



In Internal Integrated Tracking Inventory; Currently ongoing (2015 & 2017 data)
In Internal Integrated Tracking Inventory; unknown status
Synthesis Report agency program summaries; unknown status
In Internal Integrated Tracking Inventory; completed/terminated
O Ongoing Monitoring not in Internal Integrated Tracking Inventory
X Completed Monitoring not in Internal Integrated Tracking Inventory

*Legend is organized in order of priority for shading used in cells

Current Monitoring – survey results

Based on your knowledge of monitoring efforts in the basin, are there particular elements of current monitoring that you think are being

- **DONE WELL**
- **DEFICIENT**

for habitat and/or population monitoring, for particular focal fish species, and/or for particular areas of the Basin?

Current Monitoring – Done Well

- WQ in Upper Basin & Shasta
- Fall Chinook
- Escapement data for salmonids
- Juvenile salmon smolt out-migration
- Endangered suckers (adults & juveniles) in Upper Klamath Lake (e.g. USGS PIT tag network)
- Habitat restoration in Upper Klamath Lake
- Disease in lower Basin
- Water temperature monitoring – good (but way overdone across basin)
- Implementation data across restoration projects (but data often not readily available)

Current Monitoring – Deficiencies

- Integration & coordination of monitoring data across agencies
- Scott River – sediment & water temperature
- Steelhead and coho
- Spatial distribution of all species
- Wintertime & event-based assessments of nutrient loads
- Carbon quality and sources
- Juvenile salmon distribution & survival
- Flow regimes in Klamath R. & tributaries
- Fish loss to unscreened diversions

Current Monitoring – Deficiencies

- Fish passage at Keno & Link dams
- No lower river monitoring station for juvenile and adult salmon (or other species)
- Funding for WQ monitoring

Workshop Activities

WORKSHOP ACTIVITY

Topics Under This Theme

Timeslot	Activity
Day 1 - PM	Current monitoring: Provide feedback on the draft summary and confirm any gaps. Clarify if and how data are currently used. Monitoring framework: structure, role, candidate monitoring questions.
Day 2 - AM	Identify critical gaps by comparing needs to current status. For a subset of core performance indicators populate the monitoring framework template.
Day 2 - PM	Dams out or other high priority restoration: each group will pick one monitoring question and populate the monitoring framework template.

Confluence of the salmon and Klamath Riverst,USFWS

Klamath Basin Integrated Fisheries Restoration and Monitoring Plan

Introduction to Concepts for Prioritizing Restoration Actions

*David Marmorek and Clint Alexander

July 10 2018

1 Prioritization Concepts

KBRA era (2010):

"Funding for restoration projects [in the] Upper Basin settlement agreement and the Klamath Agreements of 2010 is approximately $545 million, a significant reduction from the original cost of the Klamath Agreements, which was estimated to cost $1 billion."

IFRMP and Prioritization

Prioritization (def.)

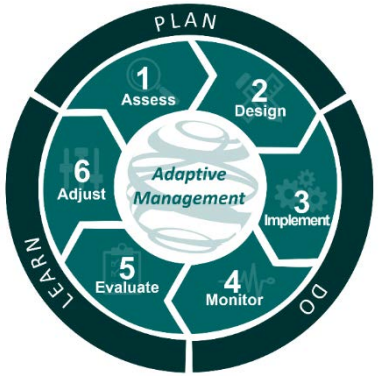
A prioritization framework provides a **systematic**, **repeatable** and **transparent** rationale for making restoration action decisions given *limited funding, capacity and time* (Beechie et al. 2008, Roni et al. 2013).

IFRMP and Prioritization

Prioritization (def.)

Helps clarify decision-making process for **funding agencies**, **proposal reviewers**, **project proponents.**

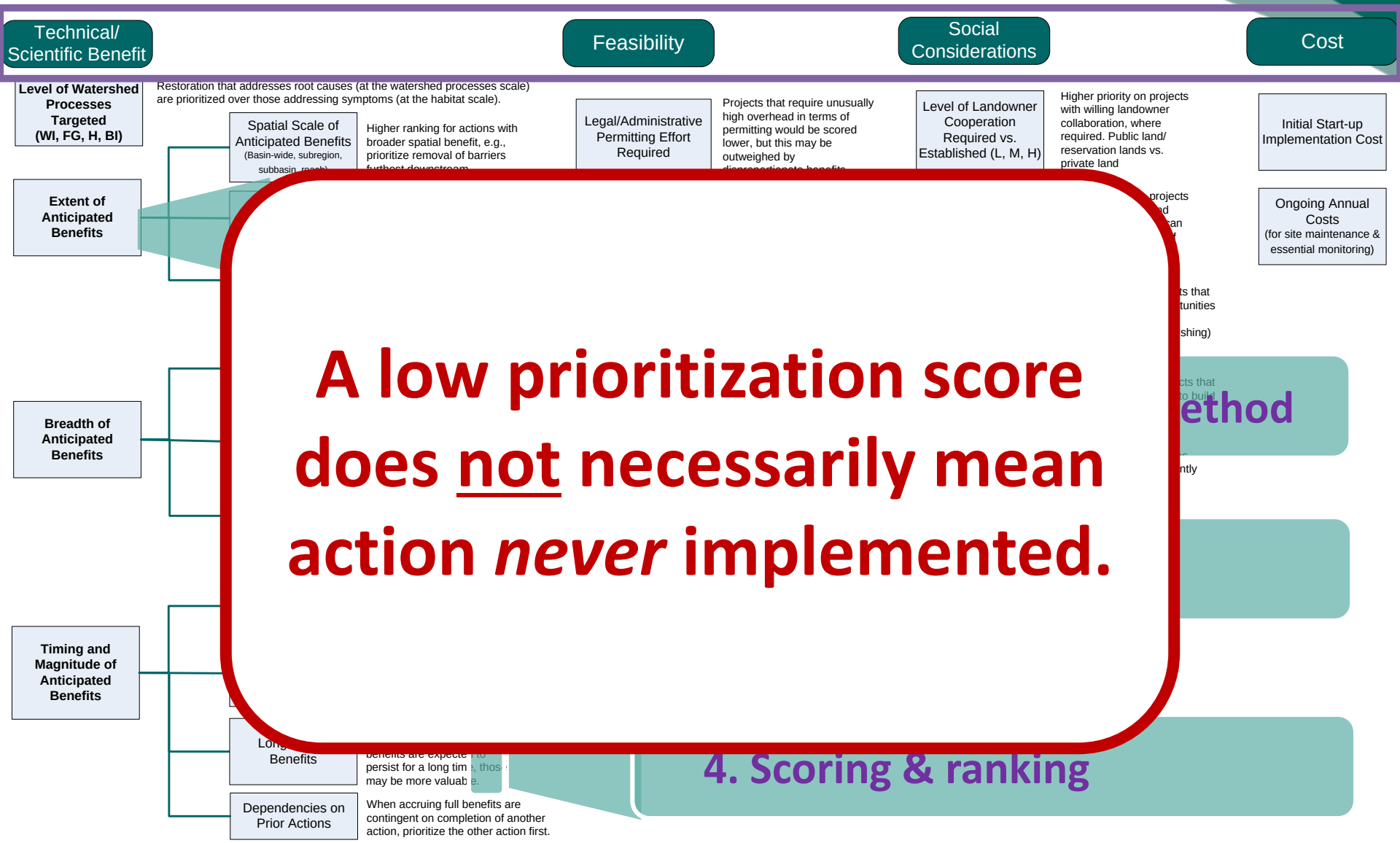
Facilitates reprioritization on *regular intervals* as new opportunities & information available.



Approach	Pros	Cons
Project effectiveness – ranks projects based on effectiveness from literature review	• Simple interim approach if no or limited data available	• Ignores local contexts on effectiveness
Refugia – emphasizes protecting refugia first, and restoration near/around refugia	• Useful for single species dependent on a habitat type that is not highly fragmented (or broadly degraded)	• Not well suited to highly degraded environments needing rehabilitation • Doesn't work well for multiple species with diverse habitat requirements
Preference methods *(discrete choice)* – respondents state preference between scenario 1 & 2 & iterate through *n* pair-wise comparisons	• Grounded in theory of human behaviour / utility theory (people choose option that maximizes benefit) • Variations that ask respondents to allocate effort reveal priorities	• Not suitable for long lists of actions/scenarios where pair-wise preference comparisons grow exponentially • Rationale for choices remains implicit to each respondent

Approach	Pros	Cons
Multi-criteria scoring – Multiple criteria are used and scored to determine an overall rank 	• Widely used, adaptable, transparent & easy to document • Incorporates multiple considerations • Adaptable to varying spatial scales	• Element of subjectivity in scales and weightings employed (care needed) • Demands modest amount of information needed to score criteria
Cost-Benefit – Traditional C/B ratio in $ terms	• Attempts to provide a common currency for comparing across projects	• Many benefits not readily translatable in economic terms. Omits these benefits.
GIS and life-cycle models – Estimates population benefits by attempting to predict impacts of restoration action on individual life-stages	• Based on empirical data for specific life stages and species (incld. habitat-abundance relationships) • Can handle complex data types	• Complex, time consuming & requires detailed habitat and fish population data by life stage • Rankings sensitive to assumptions • “Black box”

Preliminary framework

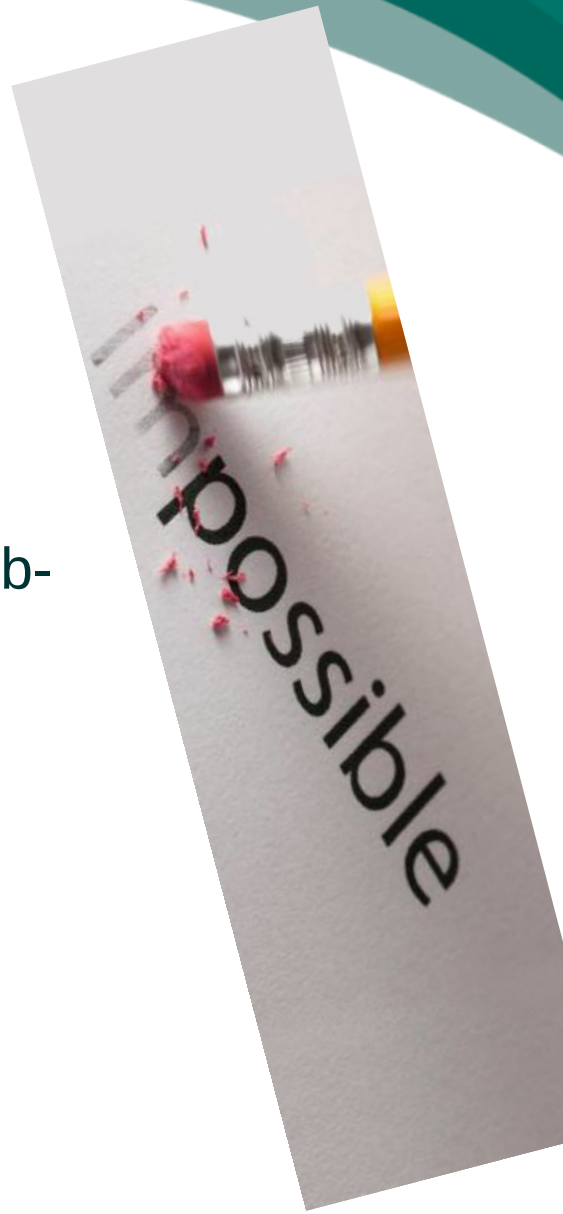


A low prioritization score does not necessarily mean action *never* implemented.

See handout

Challenges

1. Agreement on specific scoring scales & weighting factors for each criterion
   - Care needed to ensure diff. scales do not impart differential weighting
   - Need to assign *default values* when missing data preclude scoring vs. certain criteria
2. Geographic resolution to perform scoring (sub-watersheds, subbasins, subregions)
   - Effort to devote to site prioritization (GIS)
   - Connectivity measures often require GIS
3. At large scales w many projects, need automation tools (e.g., Excel) & inventory approach to *streamline & maintain* process
4. Establishing & training a representative & trusted technical group to carry out scoring (repeat every 2-3 yrs)



Survey Feedback – example responses (1)

- **Q12. *What are your general likes and dislikes with the approach?***
- Respondents indicated that (a revised) multi-criteria scoring approach would be useful. *Only one respondent questioned the need for scoring.*
- Suggested improvements included:
  - Some criteria won't differentiate actions (e.g., lack of data, similar across all projects): **"trim the tree" "less is more"**
  - Ensure scoring is repeated every 2-3 years (not "one and done"); this is consistent with Adaptive Management (learning)
    - Scoring system itself should be periodically refined
  - Ensuring differential weighting (not all criteria are equal)
    - Higher weighting on biological/scientific benefit
  - Remove portfolio diversification criteria

Survey Feedback – example responses (2)

- Costs and benefits:
  - Hard to accurately estimate cost until project is designed – need broad, general cost categories
  - Including economic benefit discounts species which aren't harvested
- Likes and dislikes of criteria varied across respondents:
  - address multiple limiting factors vs. implement key project for single limiting factor
  - focus on large projects that have lasting benefit
  - include critical project monitoring as part of a project description
  - level of collaboration needs more categories than L, M, H;
  - consider level of "watershed care" for long term, sustained commitment
- Clarify acronyms
  - WI = Watershed Inputs, FG= Fluvial Geomorphic, H=Habitat, BI=Biological Interactions
-

2 Case studies

Score Sheet, Habitat Restoration Projects (Value to Delta Fishes)
Project Name

EcoRestore? Y N Agency in charge:

Region: Suisun, Sac River, N Delta, Yolo BP, S/C Delta

Status: Finished/in progress/approved/proposed/wild idea.

Tidal: Y N, Partial. Multibenefit? Y N Fish a major goal? Y N ?

A. Size: ACRES_____
1.<10 acres
2. 10-99
3. 100-1000 acres
4.1000-10,000 acres
5. 10,000+acres

B. Physical connectivity via water/flow to major waterway (e.g. Sac River)
0. None to waterways
1. Occasional connection, small, unpredictable (e.g. drainage ditch)
2. Seasonal connection, regular but short term
3. Regular tidal and/or seasonal connection (or potential), narrow channel(s) (<10 m wide)
4. Permanent connection to tributary to major waterway including sloughs and floodways.
5. Permanent tidal or seasonal connection to major waterway, including sloughs floodways.

C. Proximity to other restoration or natural areas
1. Isolated, an island of habitat, no similar natural areas within 10 km
2. Semi-isolated, nearest similar natural areas within 1-10 km
3. Other natural areas close by (within 1 km) but not adjacent
4. Adjacent to another natural area
5. Adjacent to at least two other natural areas

D. Native/desirable fish species likely supported by project, directly or indirectly (See Table 1)
0. 0
1. 1-2
2. 3-4
3. 5- 6
4. 7-8
5. 9+

E. Listed fishes that will benefit or potentially benefit from project? (6 species total)
WRCS, SRCS, CVSH, DS, LFS GST
0. None
1. 1
2. 2
3. 3
4. 4
5. 5-6

F. Auxiliary ecosystem benefits (benefits to native plants and animals other than fishes)
1. Little or none
2. Comparatively low diversity, mostly seasonal use
3. Moderate diversity, year around and seasonal use
4. High diversity, year around and seasonal use
5. Biodiversity hotspot, with endemic species and high concentrations of migratory birds

G. Monitoring plus active management for desirable species
0. Not a project feature (no or minimal) monitoring
1. Monitoring (actual or planned) present so reactive management possible
2. Project features allow for partial active management (e.g.weed control, internal gates)
3. Small-scale active management projects planned or in place (e..g a tidal gate) or none needed
4. Large-scale active management program present on paper and partly instituted or none needed
5. Large-scale active management in place and working, with more planned or possible, or none needed.

H. Food production for fish
1. Local production only, interior ponds/marsh
2. Interior production with low export to outer channels
3. Moderate seasonal export of internal production
4. High seasonal export of invertebrates, nutrients taking place or likely to
5. Year around high export of invertebrates, nutrients etc. taking place or likely to.

I. Aquatic invasive species issues, real or projected
0. Area contains 100% undesirable alien species; invasive (weedy) species dominate aquatic ecosystem
1. Some native species present in low numbers; weedy species most abundant
2 Roughly even mixture of native and alien species; weedy species abundant
3. Invasive species not a problem or easily controlled; some natives abundant
4. Native species dominate (more than 75% of individuals of major taxa)
5. Invasive species largely absent or with active prevention program

Total score % score (x/45)
Scores (%)
75-100 Highly desirable project
50-74 Moderate desirablity
25-49 Low desirability
<25 Not desirable

Regional Plan to Conserve Pacific Lamprey (North Coast Regional MU)

Multiple factor scores

PRIORITIZATION

Scale of threats addressed
- 4 - Regional: Action addresses threat in >50% of region (action's impact, not overall threat)
- 3 - Multi-HUC: Action addresses a threat in multiple HUC's (<50% of region)
- 2 - HUC: Action addresses a threat in a single HUC
- 1 - Drainage: Action addresses threat within a drainage, reach or site, w/o broader impacts

Scope of threats addressed
- 4 - High: 71-100% of total population, occurrences, or area affected
- 3 - Medium: 31-70% of total population, occurrences, or area affected
- 2 - Low: 11-30% of total population, occurrences, or area affected
- 1 - Insignificant: <10% of total population or area affected

Severity of threats addressed
- 4 - High: 71-100% degradation or reduction of habitat/habitat function, and/or 71-100% reduction of population within scope
- 3 - Medium: 31-70% degradation or reduction of habitat/habitat function, and/or 31-70% reduction of population within scope
- 2 - Low: <30% degradation or reduction of habitat/habitat function, and/or <30% reduction of population within scope
- 1 - Unknown or n/a: Severity of threat unknown, or assessment and severity not applicable

Effectiveness of action
- 4 - High: Removes or causes threat to be insignificant; or provides all information needed to address threat (ie. Assessments, Coord., Research, Survey)
- 3 - Medium: Substantially reduces threat; or provides substantial information/collaboration
- 2 - Low: Has some effect on threat, but does not reduce it substantially; or provides minimal information/collaboration
- 1 - Insignificant: Minimally effective or not targeted at a known threat

Feasibility

Technical difficulty
- 4 - Simple: Utilizes simple technology or readily achievable methods
- 3 - Moderate: Moderately complex, but utilizes existing technology and standard methods
- 2 - Difficult: Requires high level of engineering, assessment, development or multiple stakeholder support development
- 1 - Unfeasible: Not likely to be possible at this time (5 years) due to excessive technical difficulty or complicated economic or political issues

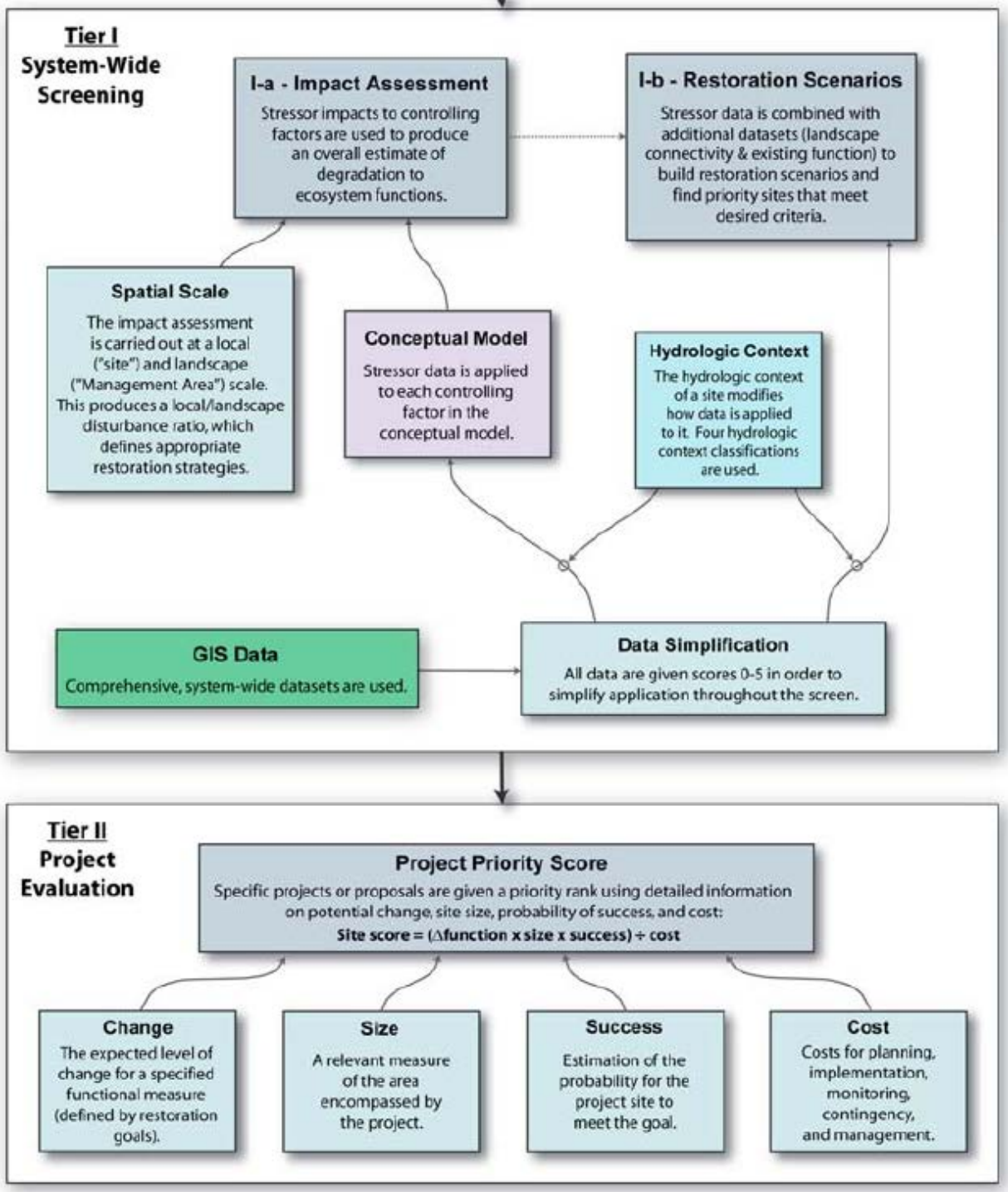
Duration to implement
- 4 - Short: 0-2 years
- 3 - Medium: 3-5 years
- 2 - Long: > 5 years
- 1 - Extended: extended time frame or perpetual

Readiness
- 4 - Underway: Already underway or funded
- 3 - High: Can be initiated in the next two years.
- 2 - Medium: Could be initiated in the next 3-5 years.
- 1 - Low: May take five or more years for additional assessment and planning

Cost
- 4 - Inexpensive: $ < 10 k
- 3 - Moderate: $ 10-50 k
- 2 - Expensive: $ 50-250 k
- 1 - Very Expensive: $ 250 k - millions

Funding Source
- 4 - Funded: Funding has been obtained
- 3 - Identified: Appropriate funding sources identified and likely to participate
- 2 - Unspecified: Various appropriate funding sources exist but have not been selected
- 1 - Uncertain: Funding is uncertain

Partner participation
- 4 - High: All potential stakeholders are supportive
- 3 - Medium: Necessary stakeholders are supportive
- 2 - Low: Additional stakeholders need to be incorporated


Tier I
System-Wide Screening
I-a - Impact Assessment
Stressor impacts to controlling factors are used to produce an overall estimate of degradation to ecosystem functions.
I-b - Restoration Scenarios
Stressor data is combined with additional datasets (landscape connectivity & existing function) to build restoration scenarios and find priority sites that meet desired criteria.
Spatial Scale
The impact assessment is carried out at a local ("site") and landscape ("Management Area") scale. This produces a local/landscape disturbance ratio, which defines appropriate restoration strategies.
Conceptual Model
Stressor data is applied to each controlling factor in the conceptual model.
Hydrologic Context
The hydrologic context of a site modifies how data is applied to it. Four hydrologic context classifications are used.
GIS Data
Comprehensive, system-wide datasets are used.
Data Simplification
All data are given scores 0-5 in order to simplify application throughout the screen.
Tier II
Project Evaluation
Project Priority Score
Specific projects or proposals are given a priority rank using detailed information on potential change, site size, probability of success, and cost:
Site score = (Δfunction x size x success) ÷ cost
Change
The expected level of change for a specified functional measure (defined by restoration goals).
Size
A relevant measure of the area encompassed by the project.
Success
Estimation of the probability for the project site to meet the goal.
Cost
Costs for planning, implementation, monitoring, contingency, and management.

3 Workstation instructions

WORKSHOP ACTIVITY

Day 1 (only) – Prioritizing Klamath restoration actions

1. **Level of support for multi-criteria scoring approach**
   Not "as-is" but *the **approach*** given refinements. Note any major reservations. [10 mins]

2. **Identify essential MISSING criteria (max 1-3 new items).**
   Without discussing removing or weighting at this step. [10 mins]

3. **Vote on most important (best)/least value (worst) criteria** [10 mins]

4. **Participants share rationale** -- esp. red dots (least value/worst criteria). [15 mins]

SURVEY FEEDBACK ON APPROACH – 2

Q13. ***Criteria that you would add or remove?***

- Dislikes:
  - social considerations should not eliminate projects with high ecological value
- Likes:
  - natural fluvial geomorphic processes are very important; they create habitat
- Additions:
  - benefit to recreational and subsistence fisheries
  - restoration of water quantity and lake levels

SURVEY FEEDBACK ON APPROACH – 3

Q14. Criteria deserving greater weight

- # of goals addressed, # of limiting factors addressed, # of species benefiting, and level of benefit
- Expected level of benefit, benefits to high value sites, and longevity of benefits
- Restoration of water quality in Upper Klamath Lake

Confluence of the salmon and Klamath Riverst,USFWS

Klamath Basin Integrated Fisheries Restoration and Monitoring Plan

Objectives Hierarchy, Core Performance Indicators & Monitoring Framework Workshop

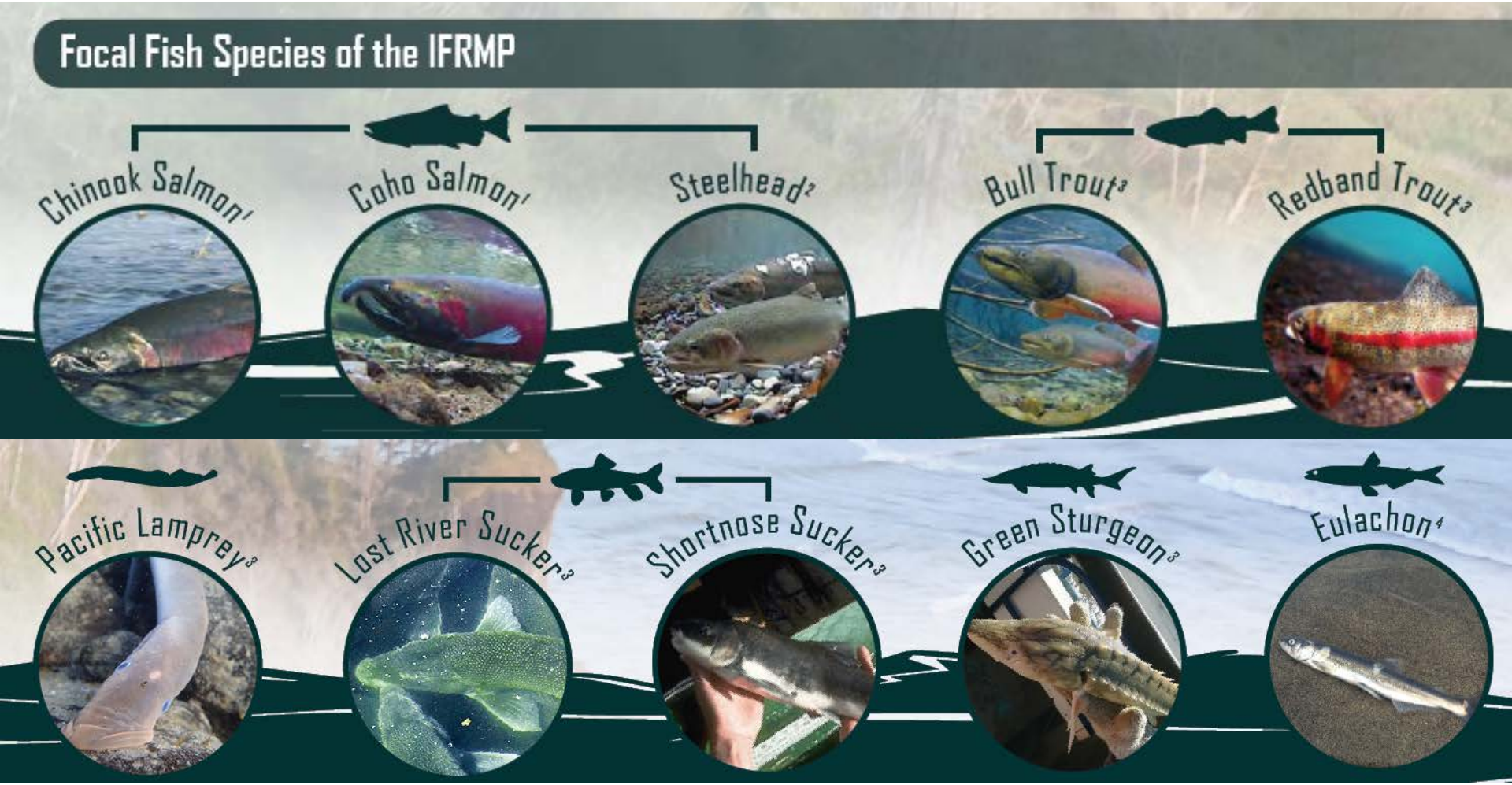
David Marmorek

Workshop Overview July 10 2018

ESSA

Focus of the Plan

- IFRMP = **Fisheries**



IFRMP Guiding Principles

1. Big picture, **integrative whole-basin approach** (*not* "bits & pieces") to fisheries restoration and monitoring needs.

2. **Use best available science**, leveraging (rather than re-inventing) past efforts at synthesis.

3. Use an **inclusive, transparent** process involving representatives of all interested participants, **peer review**.

4. **Use Adaptive Management (AM) framework & best practices** to promote learning and adjustment of the Plan through time.

5. Provide strong scientific evidence to guide future decision-making on **fisheries restoration & monitoring priorities**.

Workshop Objectives

1. Review **draft goals & objectives & assign candidate core performance indicators**
2. Review **major monitoring needs & uncover gaps**
3. Solicit input on preliminary ideas to help **prioritize restoration actions and monitoring activities**

Agenda – Day 1 (Tuesday July 10, 2018)		
8:45am-9:00am	**Arrive – settle in**	
9:00am-9:40am	**Welcome, project overview & workshop objectives** ☐ *Kick-off participatory exercise*	Chris Wheaton (PSMFC); David Marmorek (ESSA)
9:40am-10:15am	**Introduction to Draft IFRMP Objectives Hierarchy & Draft Key Performance Indicators**	Natascia Tamburello (ESSA)
10:15am-11:15am	**Big picture overview of considerations for a Klamath integrated monitoring framework**	Darcy Pickard (ESSA)
11:15am-12:30pm	**Introduction to initial concepts for prioritizing (sequencing) restoration actions and monitoring activities**	David Marmorek (ESSA)
12:30p-**1:30pm**	**Lunch – ON YOUR OWN**	
1:30pm-1:45pm	**We need your input! ⇒ Divide participants amongst 3 stations**	ESSA workstation facilitators
1:45pm-4:00pm	**Subgroup workstations (round 1) …** ☐ Objectives and CPIs (Natascia) ☐ Monitoring framework (Darcy) ☐ Prioritization concepts (Dave)	ESSA workstation facilitators *3 x 45 min. rounds* *1:45pm-2:30pm* *2:30pm-3:15pm* *3:15pm-4pm*
4:00pm-5:00pm	**Reconvene in Plenary: Day 1 Closure** ☐ Report from station 1: Objectives and CPIs (Natascia) ☐ Report from station 2: Monitoring framework (Darcy) ☐ Report from station 3: Prioritization concepts (Dave) *~ PLENARY DISCUSSION, guided (Dave) ~* ☐ *+/- wall – after 10 min. silent generation participants identify what topics should receive more/less attention on Day 2?*	ESSA workstation facilitators
5:00p	**Adjourn**	

Day 2

Agenda – Day 2 (Wednesday July 11, 2018)

8:45am-9:00am	**Arrive – settle in**	
9:00am-9:40am	**Opening: Day 2 workstation task/process** ☐ Review workstation focal topics for Day 2 ☐ *Review participant groupings, 2 workstations only on Day 2*	David Marmorek (ESSA)
9:40am-12noon	**Subgroup workstations (round 2) …** ☐ Objectives and CPIs (**Natascia** / Dave) ☐ Monitoring framework (**Darcy** / Marc)	*2 x ~1hr:10 min. rounds:* *9:45a-10:50a* *10:50a-noon*
12:00p-1:00pm	**Lunch – ON YOUR OWN**	
1:00pm-2:30pm	**Subgroup workstations (round 3) …** ☐ Objectives and CPIs (**Natascia** / Dave) ☐ Monitoring framework (**Darcy** / Marc)	*Folks may stay with topic they have most interest*
2:30pm-3:30pm	**Plenary discussion** ☐ Report from station 1: Objectives and CPIs (Natascia) ☐ Report from station 2: Monitoring framework (Darcy) *~ PLENARY DISCUSSION, guided (cross-pollination) ~* 	Dave Marmorek (ESSA)
3:30pm-4:00pm	**Workshop Closure** ☐ Workshop plus/delta review ☐ Review of "Topics for Further Discussion" ☐ Next steps	Dave Marmorek (ESSA)
4:00pm	**ADJOURN** ☐ Folks departing for travel home	

Pre-Workshop Survey

- **Great response rate – 31 respondents**!
  Topic facilitators will provide summary of results
  - Q2 Do you believe that high-level goals and objectives in Workshop Briefing Document *reflect suite required for whole-basin recovery*?
  - Q3-Q6 Please list your input on your “Top 3” specific actions that would have *disproportionately high benefit* (for each tier of organizing framework)
  - Q7 Can you think of any other specific actions that you consider to be important but do not fit under the initial objectives hierarchy?
  - Q8 Based on your knowledge of monitoring efforts in the basin, are there particular elements of current monitoring that you think are *being done well or are deficient*?
  - Q9 Having considered the objectives hierarchy, what are the "Top 3" key basin-wide *monitoring questions* from your perspective?
  - Q12 What are your *general likes and dislikes for the restoration action prioritization criteria* in our initial rough framework? What should be added? Removed? Rationale?

ROADMAP

Iterative

1	2	3	4	5	6
What's wrong?	What might help?	The desired state of the system?	How will you know if actions are helping?	Define considerations to focus Plan	Sorting & focusing

YOU ARE HERE

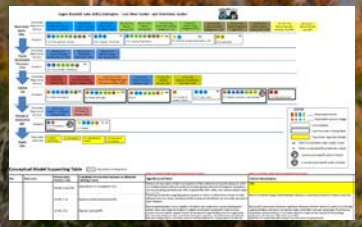
(Section 2)

Restoration actions **(Section 4)**

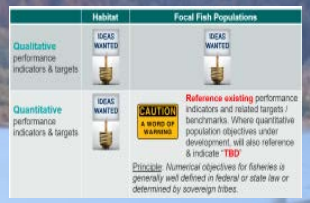
Objectives, Suitability thresholds **(Section 3)**

Core Performance Indicators, Monitoring **(Section 5)**

Scope and focus Plan, ID gaps; Prioritization Framework; **(Section 6)**



Conceptual models, uncertainties

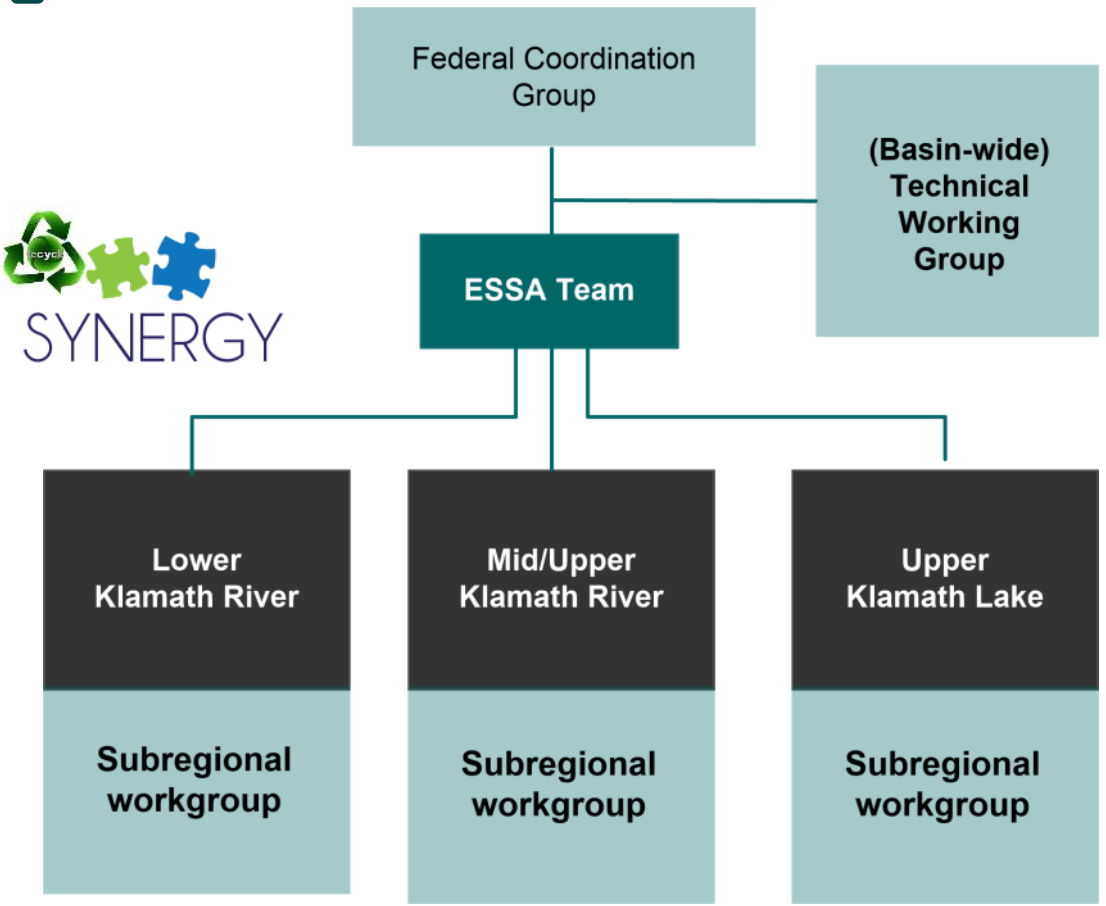


Core Perf. Indicators

Integrated with Existing / Ongoing Planning Efforts

- Clean Water Act Section 401 Certification
- Klamath River Renewal Corporation
- Coho Interim Measures Committee
- Klamath Fish Reintroduction Plan*

SYNERGY

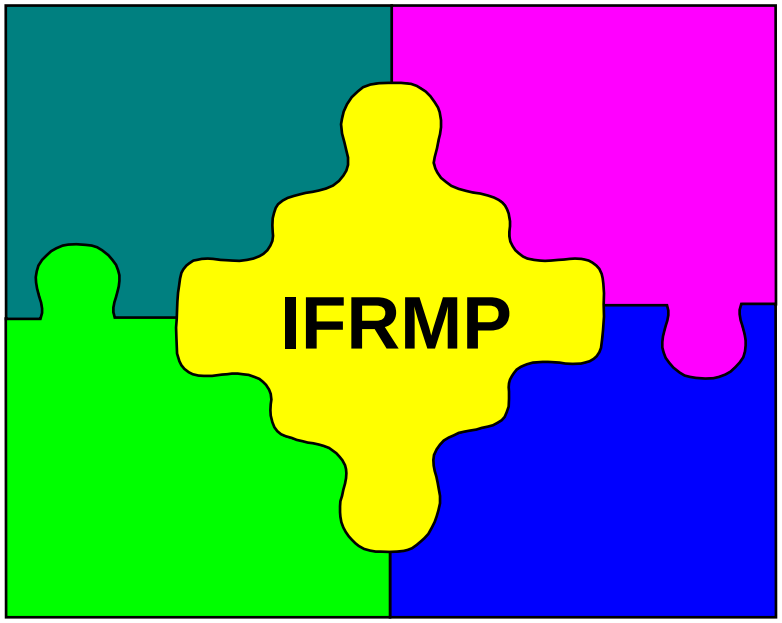


*"Integration" = maximizing synergies with related fishery restoration & recovery efforts underway in the basin (**i.e. not duplicating**).*

Scope of IFRMP …

Harvest & Hatchery Management; Species reintro. & recovery plans

Multi-Jurisdictional Coordination Scheme



KRRC Planning for Dam Removal

"Aquatic Resource measures"

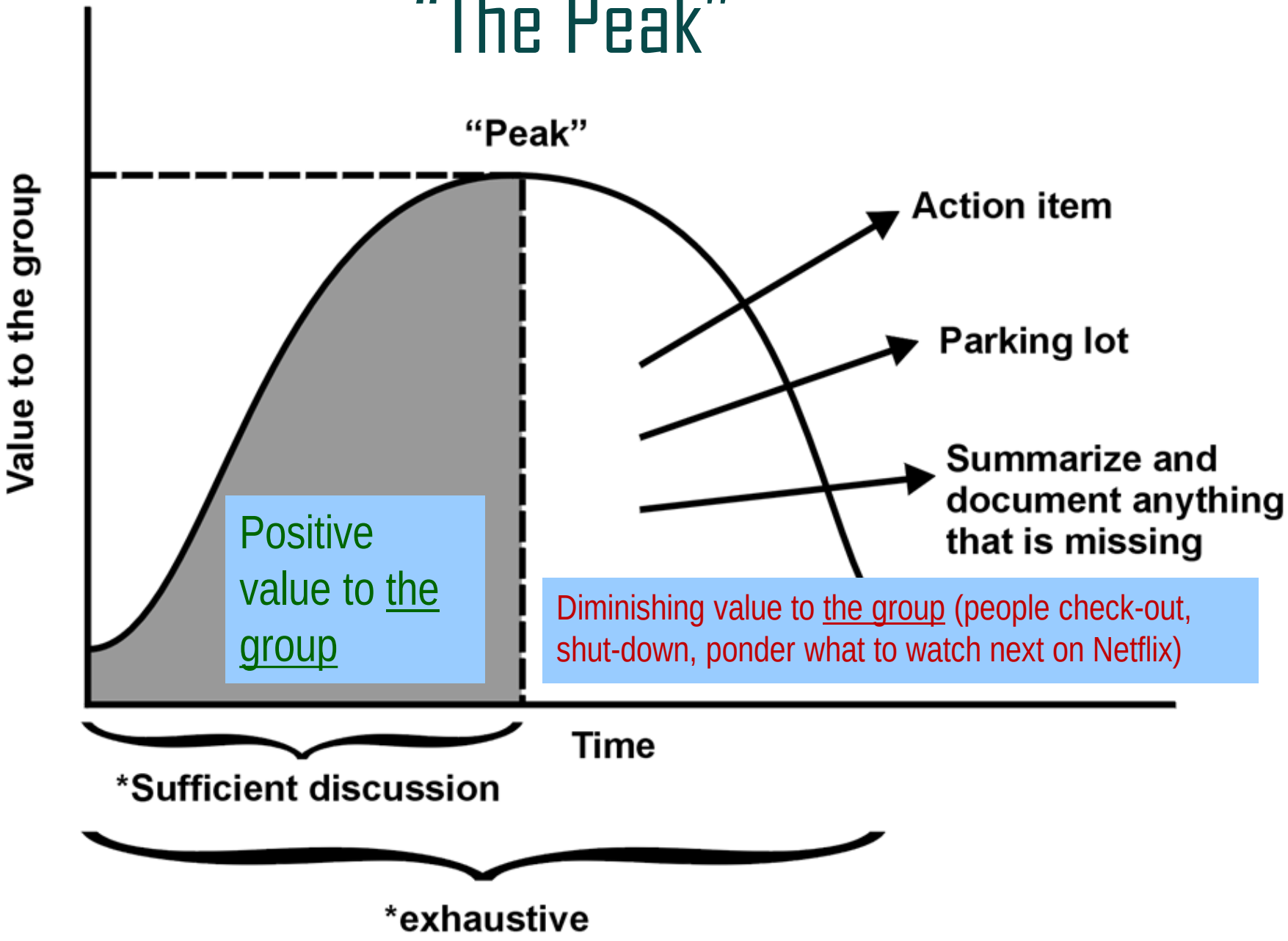
Adaptive Management readiness components

MEETING NORMS

Some requests...

- Please respect the agenda. **State ideas/points succinctly**
- **Listen respectfully** to others.
- Ask questions during defined Q&A sessions
- Be patient, **hard on the problem, easy on the people.**
- Facilitators will intervene when discussions have "**peaked**" (from perspective of broader group)
- Some lines of discussion may be directed to "**Topics for Further Discussion**"

"The Peak"


"Peak"
Value to the group
Action item
Parking lot
Summarize and document anything that is missing
Positive value to the group
Diminishing value to the group (people check-out, shut-down, ponder what to watch next on Netflix)
Time
*Sufficient discussion
*exhaustive

Some requests…

- **Engage** & contribute in subgroups to complete exercises; your input will shape the Plan
- Be patient; please follow exercise instructions
- Silence phones and check emails (if you must) during breaks. **Be present, stay in the moment!**

10 Minutes – Top of mind issues or workshop contributions

Kick-off Exercise

Introduce yourself & share…

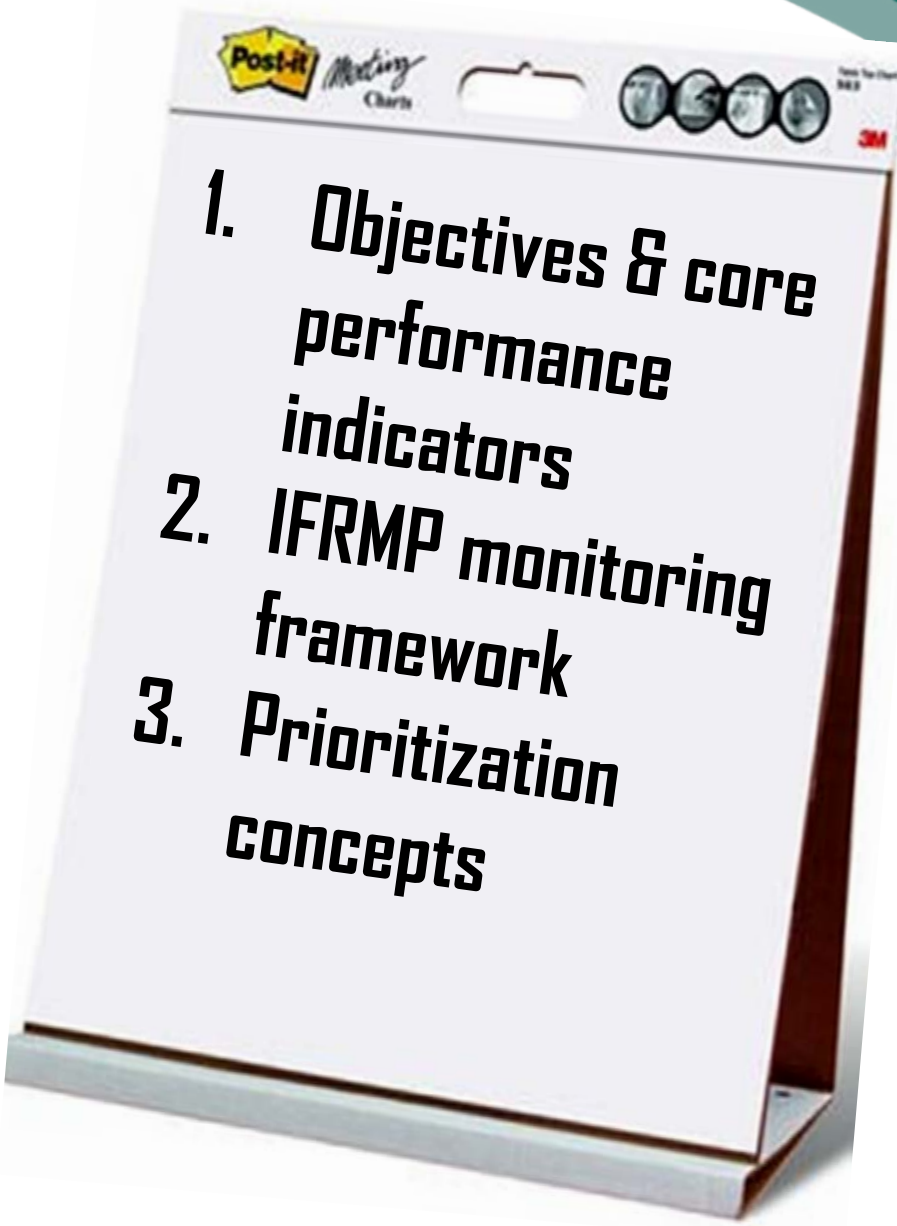
- Name, affiliation

VERY briefly (~15 seconds)…

- **What do you hope to contribute or get out of this workshop**

~OR~

- With respect to any or all of the three major topics at this workshop, ***what critical issues do you want to be sure we talk about***



Next:

Intro presentations on…

1. Objectives & core performance indicators
2. IFRMP monitoring framework
3. Prioritization concepts

Mouth of the Klamath River by Linda Tanner, 2011, licensed under CC by 2.0

Confluence of the salmon and Klamath Riversr,USFWS

Klamath Basin Integrated Fisheries Restoration and Monitoring Plan

Next steps

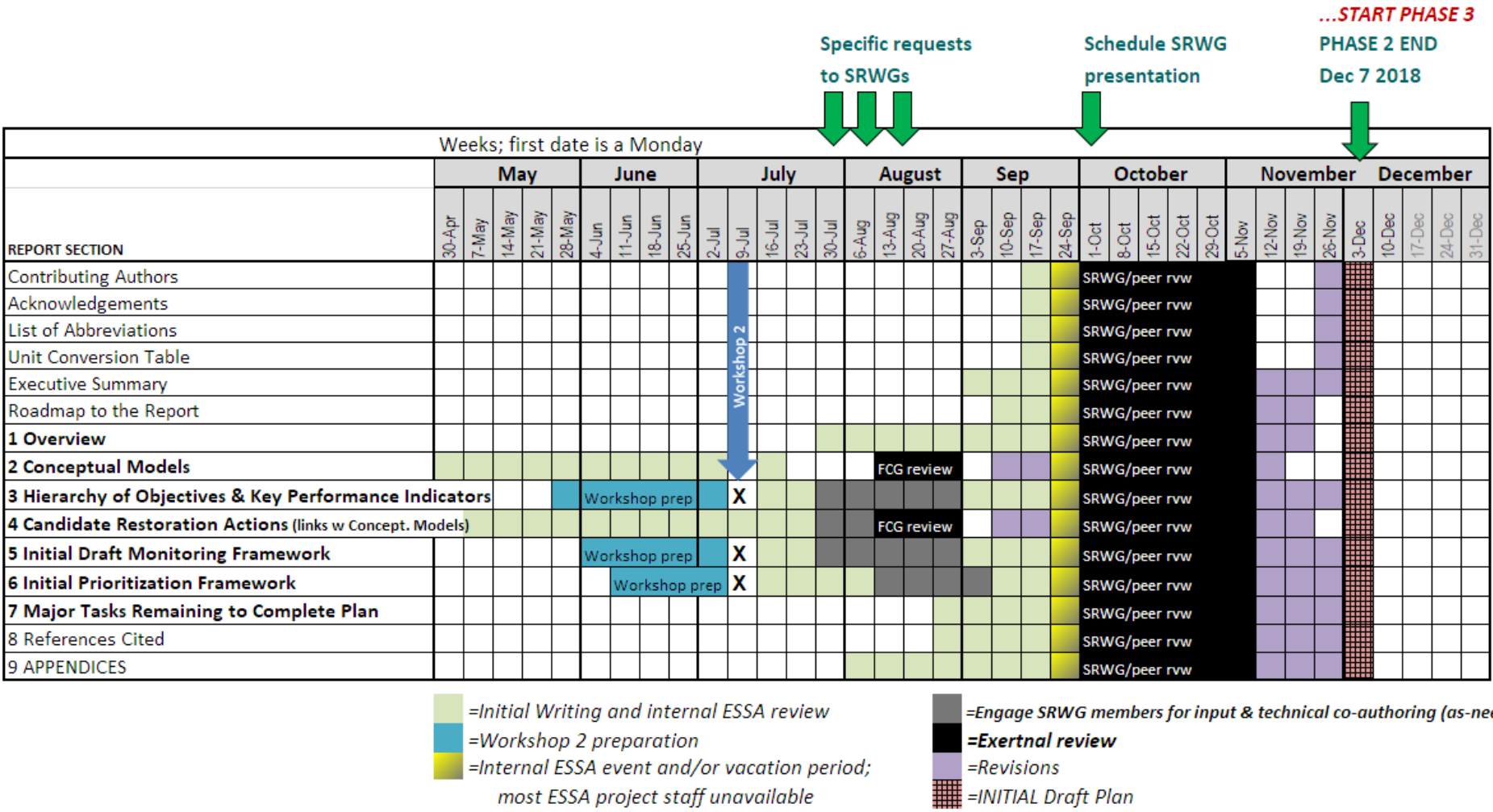
David Marmorek

July 11 2018

Closing

1. Major workshop themes
   - Final workshop **+/delta**
2. **Next steps**
   - Complete Initial Rough Draft Plan chapters (Jul-Sep)
   - Request specific input from SRWG members by end of July (provide input to ESSA in Aug)
   - SRWG overview / peer review instruction webinar (~Oct 3-4)
   - **October to Nov 8 2018 SRWG review**
   - PSMFC-ESSA finalize work scope for Phase 3
   - Release INITIAL Draft IFRMP by **Dec 7 2018**

IFRMP Peer Review Schedule



The IFRMP Planning Process

Phase 1: Synthesis Report

IFRMP web site, doc library & interviews

Phase 1 Synthesis Report

Start Phase 2: Vision, Initial Frameworks &Rough Draft Plan

Form SRWGs

Plan Vision

We are moving!

October 2018

Restoration Phases, Species Conceptual Models

Defining Objectives & Core PIs & link to Restoration Actions

Initial Monitoring & Prioritization Frameworks

Initial Rough Draft Plan Document

Phase 3 (Dec 2018-Nov 2019): Draft Plan with Initial Prioritization

2020-2021

Draft Integrated Monitoring Framework & Finalize Prioritization Methods

Initial Prioritization of Restoration Actions

Integrate parallel initiatives, Prepare Draft Plan Document

Phases 4/5

The IFRMP Planning Process

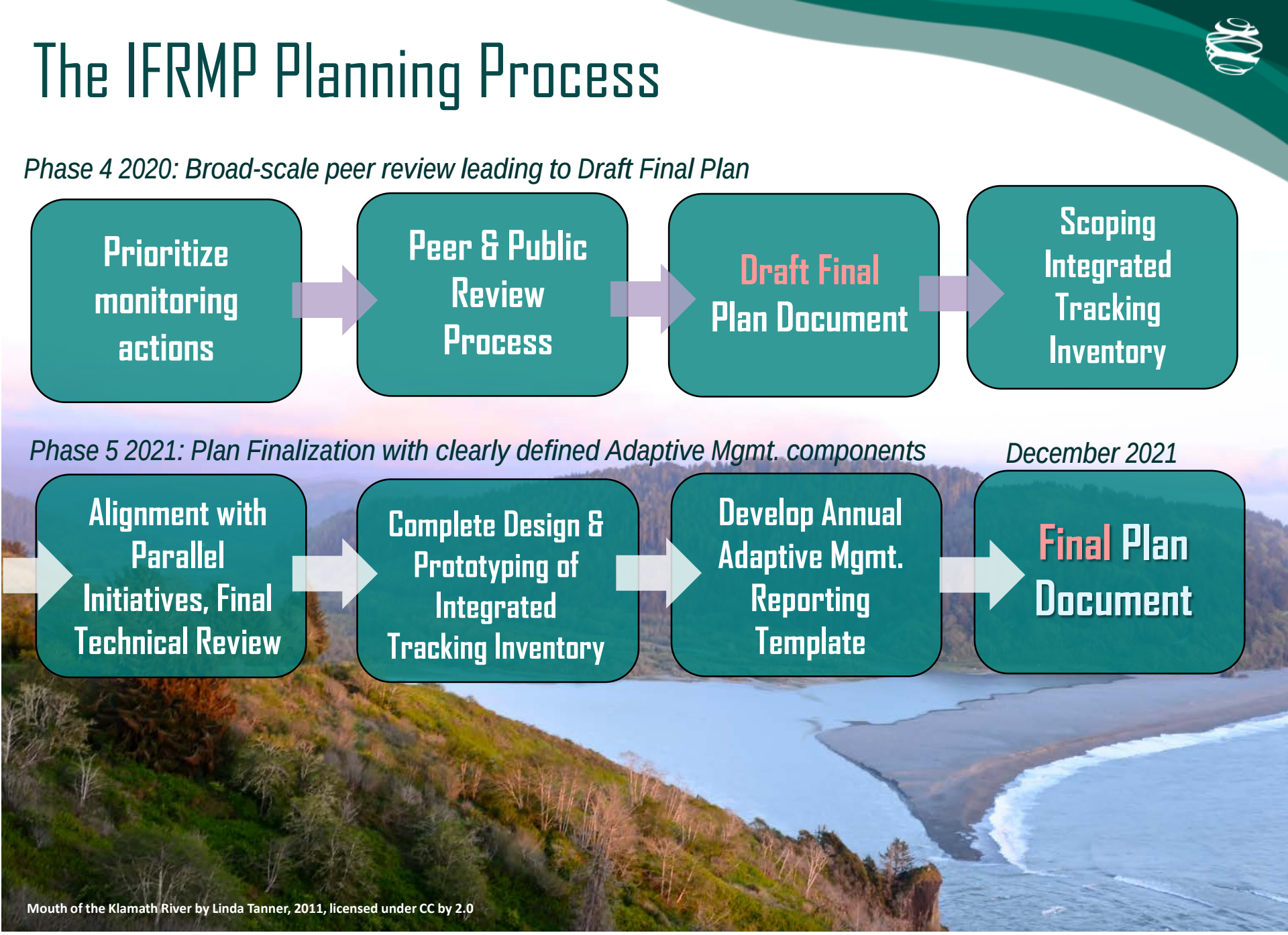
Phase 4 2020: Broad-scale peer review leading to Draft Final Plan

Prioritize monitoring actions → Peer & Public Review Process → Draft Final Plan Document → Scoping Integrated Tracking Inventory

Phase 5 2021: Plan Finalization with clearly defined Adaptive Mgmt. components

December 2021

Alignment with Parallel Initiatives, Final Technical Review → Complete Design & Prototyping of Integrated Tracking Inventory → Develop Annual Adaptive Mgmt. Reporting Template → Final Plan Document



Mouth of the Klamath River by Linda Tanner, 2011, licensed under CC by 2.0