ID#	Perform some action	On some element	On some attribute	At some place	From the current level (1999)	To the target level (1996-1997)	Comments

ID#	Perform some action	On some element	On some attribute	At some place	From the current level (1999)	To the target level (1996-1997)	Comments
1.1	Maintain or attain	Primary Producers: algae on hard substrates and rooted macrophytes on soft substrates	Biomass	Mainstem from Glen Canyon Dam to Paria River in both pools and on cobble bars identified by specific sampling sites	?? +/- ?? g/m^2 (Cobble)[1] ?? +/- ?? g/m^2 (Pool)	25 +/- 8.6 g/m^2 or 146 +/- 12 g/m^2 (Cobble)[2] ?? +/- g/m^2 or 51 +/- 11 g/m^2 (Pool)	Target is avg. of 1996 & 97 data which we believe represents the best biomass estimates for the period in which data is available and which we selected as the target level because they appeared to be good years to support desired species.
			Composition		RM / % Algae / % Macrophytes table: Pool — Need/Need, Need/Need, Need/Need; Cobble — Need/Need, Need/Need, Need/Need	Information Need	Given the change in composition, the idea of Cladophora as a keystone species has been called into question. Scientists have said composition is an information need and should not be broken down below algae and macrophytes at this point in time.

Composition detail table:

RM	% Algae	% Macrophytes
Pool		
	Need	Need
	Need	Need
	Need	Need
Cobble		
	Need	Need
	Need	Need
	Need	Need

[1] To be provided from Shannon et al.

[2] Need to resolve difference between data from Shannon et al. and AGFD

all.Protect or improve the aquatic foodbase so that it will support viable populations of desired species at higher trophic levels.

ID#	Perform some action	On some element	On some attribute	At some place	From the current level (1999)	To the target level (1996-1997)	Comments
1.1			Distribution (area)		Information Need	Information Need	
1.2	Maintain or attain	Benthic invertebrates	Biomass	Mainstem from Glen Canyon Dam to Paria River	?? +/- ?? g/m^2 (Cobble) ?? +/- ?? g/m^2 (Pool)	?? +/- ?? g/m^2 (Cobble) ?? +/- ?? g/m^2 (Pool)	
			Composition		Cobble: % Tubificids % *Gammarus* % Chironomids % Gastropods % Other Pool % Tubificids % *Gammarus* % Chironomids % Gastropods % Other	Information Need	
			Distribution (area)		Information Need	Information Need	

ID#	Perform some action	On some element	On some attribute	At some place	From the current level (1999)		To the target level (1996-1997)	Comments

ID#	Perform some action	On some element	On some attribute	At some place	From the current level (1999)		To the target level (1996-1997)	Comments
1.3	Maintain or attain	Primary Producers: algae on hard substrates and rooted macrophytes on soft substrates	Biomass	Mainstem below the Paria River on cobble bars identified by specific sampling sites	RM	g/m^2	$50\ g/m^{2(27)}$	
					Cobble			
					2			
					61			
					68			
					127			
					205			

			Composition		RM	% Algae	% Macro phytes	Information Need	Metric is relative % of algal species. MAMB is for miscellaneous algae, macrophytes, and bryophytes
					Pools				
					2				
					61				
					68				
					127				
					205				
					Cobble				
					2				
					61				
					68				
					127				
					205				

ID#	Perform some action	On some element	On some attribute	At some place	From the current level (1999)		To the target level (1996-1997)	Comments
1.4	Maintain or attain	Benthic invertebrates	Biomass	Mainstem below the Paria River	0.960 g/m^2 (Cobble)[27] 0.054 g/m^2 (Pool)[27]		(To be provided based on 1996-7 data)	
			Composition		Cobble: % Tubificids % *Gammarus* % Chironomids % Gastropods % Other Pool % Tubificids % *Gammarus* % Chironomids % Gastropods % Other		Information Need	Metric is relative % of species.
			Distribution		Information Need		Information Need	
1.5	Maintain or attain	Foodbase drift: Diptera Gammarus Other Bugs CPOM FPOM DOC	Abundance	Mainstem below GCD	RM 2 61 68 127 205	AFDM	(To be provided based on 1996-7 data)	

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments
2.1	Maintain or attain	Humpback chub (150 mm and larger)[1]	Abundance	LCR aggregation[2]	4330 – 4811 individuals[3] with a mean of 4508 individuals	Information Need	Target to be based on 91-96 population estimate, PVA, & N_e
				8 mainstem aggregations	Information Need ?? Confidence interval with a mean of 225 individuals[36] ??	Information Need	Target to be based on 91-96 population estimate, PVA, & N_e
2.2	Maintain or attain	Humpback chub (51 mm to 150 mm) Is this the right size class ??	Year class strength	LCR aggregation	Information Need. Consider using a CPUE index for different year classes, at some place in the LCR at some time during the year.	Information Need. Intended to be an index that will indicate spawning success.	Metric is "catch per unit effort" (CPUE). See Gorman and Bramblett.[9] See synthesis by Coggins.
				8 mainstem aggregations	Information Need	Information Need	
2.3	Maintain or attain	Humpback chub (> 200 mm[3])	Recruitment	LCR aggregation	Information Need	Information Need	
				8 mainstem aggregations	Information Need	Information Need	
2.4	Establish	Humpback chub	Populations	CRE downstream of GCD	One self-sustaining population in the LCR	One additional self-sustaining population	Make IN language consistent with the language contained in the BO.

[1] Length is based on the size at which a HBC is able to be pit-tagged.
[2] The LCR aggregation is defined as . . . [TO BE ADDED].
[3] Length at which 50% of fish are thought to be sexually mature.

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments
2.5	Attain	Humpback chub	Condition	LCR aggregation	Information Need. What is the appropriate index? K_n, slope-intercept relationship, other	Information Need. Should be a threshold of condition that the fish don't drop below.	PEP should be asked to evaluate the method that would be used to calculate condition and the value to be established as the threshold
				8 mainstem aggregations	Information Need	Information Need	
			Disease and other parasites	LCR aggregations	Information Need	Information Need	
				8 mainstem aggregations	Information Need	Information Need	
2.6	Reduce	Non-native fish: Rainbow Trout, Brown Trout, Carp, Catfish	Predation on native fish	CRE below GCD	Information Need	Information Need. Needs to be defined as the level above which the predation rate may / will (?) negatively affect native fish.	Metric is rate of predation. See Gorman and Bramblett.[9]

Alternative for 2.6:							
	Reduce	Native Fish	Mortality due to fish predation as a % of overall mortality	LCR	Information Need	Information Need	
				Mainstem	Information Need	Information Need	

2. Maintain or attain viable populations of existing nati.   .sh and remove jeopardy from humpback chub and razorb..   . sucker

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments
2.7	Attain	Razorback sucker	Populations	CRE below GCD	0 individuals[9]	Information Need	Target is capability of the habitat to support the species. Make consistent with the BO.
2.8	Maintain	Flannelmouth sucker	Abundance and Distribution	CRE below GCD	?? AGFD to provide[9]	Information Need	Appropriate metric to be determined
		Bluehead sucker			?? AGFD to provide[9]	Information Need	Appropriate metric to be determined
		Speckled dace			?? AGFD to provide[9]	Information Need	Appropriate metric to be determined

4. Maintain a wild reproducing population of rainbow trout above the Paria River, to the extent practicable and consistent with the maintenance of viable populations of native fish.

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments
4.1	Maintain or attain	Rainbow trout (RBT)	Abundance	Mainstem from Glen Canyon Dam to Paria River	260,000 +/- 30,000 Age II+ individuals[23]	100,000 – 250,000 Age II+ individuals	An upper threshold level of population abundance should be developed that triggers some action to reduce population abundance so population densities don't drive the other suite of RBT indicators below acceptable levels.
			Electrofishing CPUE		Information Need	Information Need	??
			Proportional Stock Density (PSD)[1]		15%	Information Need	Might replace measure of "length at age" in the future. Value of metric needs to be assessed.
			Length at Age		15" by Age III[23]	15 – 18" by Age III	
			Condition		$W_r = 0.82$[23]	$W_r = 0.90$	
			Whirling disease and other parasitic infections		Absence	Absence	

[1] Ratio of number of fish greater than 16" divided by the number of all fish greater than 12". Provides a measure of the abundance of fish at a certain size which should translate into a target for both abundance and length at age.

4. Maintain a wild reproducing population of rainbow tro... above the Paria River, to the extent practicable and consistent with the maintenance of viable populations of native fish.

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments
			Spawning habitat		Information Need	Information Need	Metric is quality and abundance of habitat.

4. Maintain a wild reproducing population of rainbow trt. ~bove the Paria River, to the extent practicable and consist... with the maintenance of viable populations of native fish.

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments

ID#	Perform some action	On some element	On some attribute	At some place	From the current level	To the target level	Comments
4.2	Maintain or attain	Rainbow trout	Natural Recruitment		100%	100%	
			Distribution	Lees Ferry RBT found below the Paria River	Information Need.	Information Need. Some number that suggests minimal competitive or predator / prey effect on downstream native fish.	Need research and data that demonstrates predator / prey and competitive effect.