Inventor all aerial photographic and digital imagery available ugh the GCMRC library
(Information in red denotes data collected as part of the remote sensing initiative)

Acquisition date	Type	Product	From approximate River Mile[1]	To approximate River Mile[1]	Scale[2] or resolution[3]	Number of images or files	Dam release in m^3/sec (ft^3/sec)	Comments
1935	Black and white	9" print	-19.3	239.8	unknown	54	unknown	6 missing
1952	Black and white	18" print	-13.5	3.5	1:7,920	6	unknown	
5/14/65	Black and white	9" print	0	255	1:12,000[4]	652	680-792 (24,000-28,000)	8 known missing (RM 209-214) USGS/WRD may have duplicates
06/17/73	Black and white	9" print	43-48, 51-56, 105-110, 120-123,	166-168, 209, 219-221	1:14,400[4]	50	76-396 (2,700-14,000)	Bureau of Reclamation may have duplicates
08/08/79	Color	9" print	-1.5	16	1:3,000[4]	100	623 (22,000)	
06/27/80	Color Infrared	9" print	-15.5	211	1:3,600[4]	400	1047 (37,000)	Spillways open
07/11/80	Color Infrared	9" print	17 [House Rock]	220	1:3,600	200	707 (25,000)	
10/20/80	Black and white	9" print	47 Little Colorado River - 0	72 12	1:4,800	100		Negatives may be with FWS in Pinetop
06/09/82	Color	9" print	34 (segments)	182	1:37,000	51		Mileage inventory in photo box
06/09/82	Black and white	9" print	36 Rapids survey	166	1:32,000 1:37,000	37		Names of rapids on photographs
10/22/84	Black and white	9" print & film	-15.5	260	1:3,000	600	144-226 (5,100-8000)	

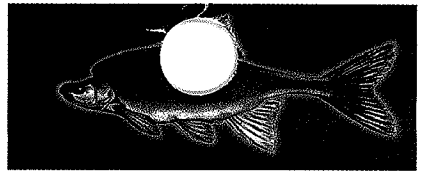
Acqui date	Type	Product	From approximate River Mile[1]	To approximate River Mile[1]	Scale[2] or resolution[3]	Number of images or files	Dam release in m^3/sec (ft^3/sec)	Co nts
05/30-06/02/93	Color	9" print and film (rolls 4-10)	-15.5	267 + Little Colorado River	1:4,800	1,730	226 (8,000)	
05/29/93	Color	9" print and film (roll 1)	46.5	60.0	1:25,000	297 (for all 1993 photos)	226 (8,000)	
05/29/93	Color	9" print and film (roll 1)	-11.3	-7.0	1:3,000		226 (8,000)	
05/29/93	Color	9" print and film (roll 1)	75.4	120	1:8,000 & 1:10,000		226 (8,000)	
05/29/93	Color	9" print and film (roll 2)	214	267	1:15,000		226 (8,000)	
09/02/93	Color	9" print and film (roll HI 1478C)	F1	unknown	1:25,000	unknown	226 (8,000)	Photos missing; Horizons may have film
05/28-29/94	Color	9" print and film (roll 1-10)	-15.5	281 + Little Colorado River	1:4,800	1,730	226 (8,000)	
05/28-29/94	Black and white	9" print and film (roll 1-10)	29 2	42 9	1:6,000 & 1:14,400	152	226 (8,000)	
05/29-31/95	Color	9" print and film (roll 1-9)	-15.5	281 + Little Colorado River	1:4,800	1,730	226 (8,000)	
03/24/96	Color	9" print & film (roll unknown)	-9,43,51,55,68	71,93,122,194 ,209	1:4,800	10	226 (8,000)	Kearsley Veg. sites
03/24-26/96	Black and white	9" print & film (roll 1-8)	-15.5	281 + Little Colorado River	1:4,800	1,730	226 (8,000)	
03/31/96	Black and White	9" print & film (roll HI 1823)	174 [Toroweap]	179 [Prospect]	1:14,400	23	226 (8,000)	
04/04-07/96	Black and White	9" print & film (roll 1-8)	-15.5	281 + Little Colorado River	1:4,800	1,730	226 (8,000)	

Acquis date	Type	Product	From approximate River Mile[1]	To approximate River Mile[1]	Scale[2] or resolution[3]	Number of images or files	Dam release in m^3/sec (ft^3/sec)	Co nts
10/04/98	AVIRIS	digital	-5.5	-12.0	2.7 m	10	283-410 (10,000-14,500)[5]	Data available upon specific request
09/05/99	Black and White	9" print & film (roll unknown)	-15.5	281 + Little Colorado River	1:4,800	1,730	439 (15,500)	
09/05/99	Color	9" print & film (roll unknown)	0 select areas	190	1:4,800	160	439 (15,500)	Flight lines same as Black and White mission
9/06/99	Color	digital	-3 1 20.5 29	0 3 23.5 32	40 cm	10	439 (15,500)	Mission described in Open-File Report 02-222, available through the GCMRC library
16 intervals between 1990-91	Black and White from helicopter	2" film negatives	0 select areas	224	variable	2,000	variable	Brian Cluer's Beach Sites
09/28/1999 - 10/01/1999	CIR	3 band CIR Digital Orthophoto	-15.5	280	30 cm	3000	Variable	Collected with Kodak Digital Camera
03/26-04/03/00	Color Infrared	9" print, film, and 14-micron digital scans of raw tif images, orthophotos, and compressed sidded images	-15.5	281 + Paria, Little Colorado River, Kanab, Tapeats, Shinumu & Havasu confluences	1:20,000 .276 m (.92 foot) resolution	625	226 (8,000)	

Acquisition date	Type	Product	From approximate River Mile[1]	To approximate River Mile[1]	Scale[2] or resolution[3]	Number of images or files	Dam release in m^3/sec (ft^3/sec)	Comments
08/29-31/00	Black and White	Digital unprocessed tif files, xml files orthophotos, and compressed sidded images Raw and processed lidar points, contour vectors, DEMs[6] and TINs[7]	-15.5	85	0.18288 meter (0.6 foot) resolution, 4096 pixel swath	940	226 (8,000)	
09/02/00	Black and White, high gain	Digital unprocessed tif files, xml files orthophotos, and compressed sidded images	-15.5	0	0.18288 meter (0.6 foot) resolution. 4096 pixel swath	168	226 (8,000)	
09/04/00	Color	9" print & film photogrammetric vector contours, TINs, and DEMs	44 59	47 62	both river segments at three scales: 1:12,800, 1:6,400, and 1:4,000	23 33 48	226 (8,000)	
09/06/00	Color Infrared	9" print, film, and 14-micron digital scans	-15.5	103	1:20,000 .3048 m (1.0 foot) resolution	181	1,754 (31,000)	Collected under overcast conditions

Acqui date	Type	Product	From approximate River Mile[1]	To approximate River Mile[1]	Scale[2] or resolution[3]	Number of images or files	Dam release in m^3/sec (ft^3/sec)	Co nts
5/26/02-5/28/02	Color	Unrectified imagery and vector digital data stored as e00 files & html files	-2.2 1.1 21.9 29.4 42.5 54.4 63.3 86.4 119.1 207.3 224.3	0.1 2.8 23.6 32.0 45.4 56.1 66.2 87.9 123.0 208.9 225	.25 meter contour interval	11 coverages	226 (8,000)	Integrated Long Term Monitoring Reaches
5/24/02-06/05/02	Natural color, panchromatic and color infrared	Digital unprocessed tif files, xml files orthophotos, and compressed sidded images	-15.5	279.8	.22 m resolution per pixel for panchromatic, .44 m resolution per pixel for multispectral data	234 ortho quarter quads	226 (8,000)	

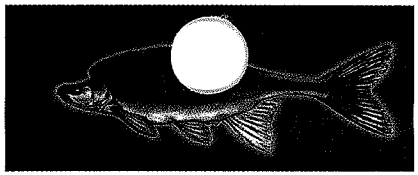
[1] Refers to approximate distance from Lee's Ferry
[2] The relationship between distances on a map and the corresponding distances on the earth's surface expressed as a fraction or a ratio (constant for a given map).
[3] The area on the ground represented by one pixel
[4] Scale is inferred by doubling the altitude of the plane
[5] Range of stream gage data at Lee's Ferry during daylight hours for that date
[6] Triangular Irregular Network
[7] Digital Elevation Model
[8] For more detail regarding missing areas see *Breelove, Michael. 2002. EnerQuest 2001 Panchromatic and Color-Infrared Image Data Review of Deliverables Contract 01-WRCN-0019* available electronically through the GCMRC library.



Non-native control ad hoc report

January 2003
Report to AMWG

Bill Persons
Gary L. Burton
William Davis
Dennis Kubly
Kerry Christensen
Steven Gloss
Christopher Harris
Norm Henderson
Pamela Hyde
Ted Melis
Andre Potochnik
Nikolai Ramsey
Mike Yard
John Shields



Charge to the committee:

Amended AMWG motion passed January 18, 2002:

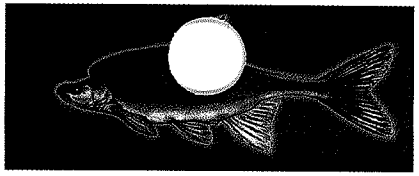
1. Evaluate methods to remove non-native fish except for rainbow trout from Bright Angel Creek in 2002;

2. Evaluate methods to remove non-native fish from the LCR in 2002;

3. Gather public input, and conduct public education and environmental compliance on long-term removals in #1 and #2 above;

4. **Establish a TWG ad hoc committee to develop a 2002-2006 research, monitoring and management work plan for meeting MO 2.5 and 2.6 of the 17 August 2001 draft of the AMP Strategic Plan. The TWG will report back to the AMWG at the next meeting.**

5. **Using data from #1 - #4 above, make recommendations on future removals.**



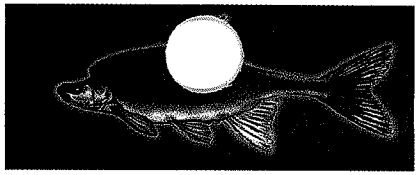
Management Objectives

Management Objectives 2.5 & 2.6 (which were referenced in the motion)

(MO 2.5) Attain humpback chub condition in the LCR and main stem aggregations. Target is viable populations and removal of jeopardy.

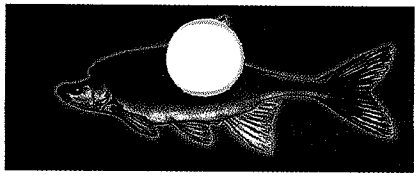
(MO 2.6) Reduce native fish mortality due to non-native fish predation/competition as a percentage of overall mortality in the LCR and main stem to increase native fish recruitment.

(Note: numbering of management objectives is that used in the August 17, 2001 draft of the AMP Strategic Plan).

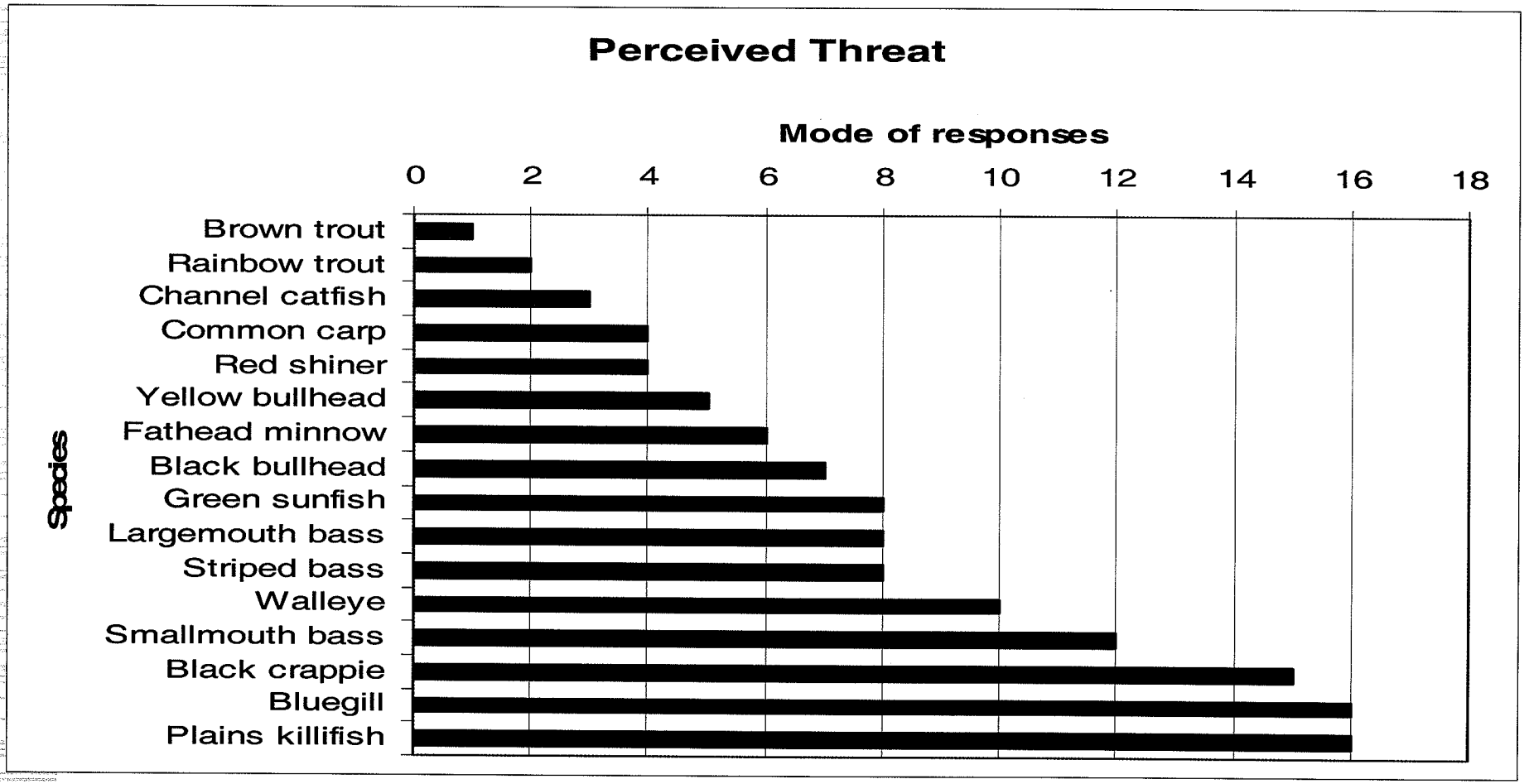


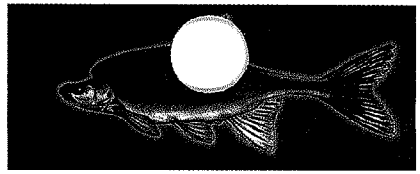
MO 2.6

(MO 2.6) Reduce native fish mortality due to non-native fish predation/competition as a percentage of overall mortality in the LCR and main stem to increase native fish recruitment.



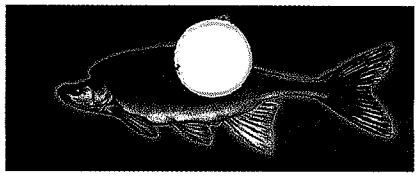
Threats


Perceived Threat
Mode of responses
0
2
4
6
8
10
12
14
16
18
Species
Brown trout
Rainbow trout
Channel catfish
Common carp
Red shiner
Yellow bullhead
Fathead minnow
Black bullhead
Green sunfish
Largemouth bass
Striped bass
Walleye
Smallmouth bass
Black crappie
Bluegill
Plains killifish



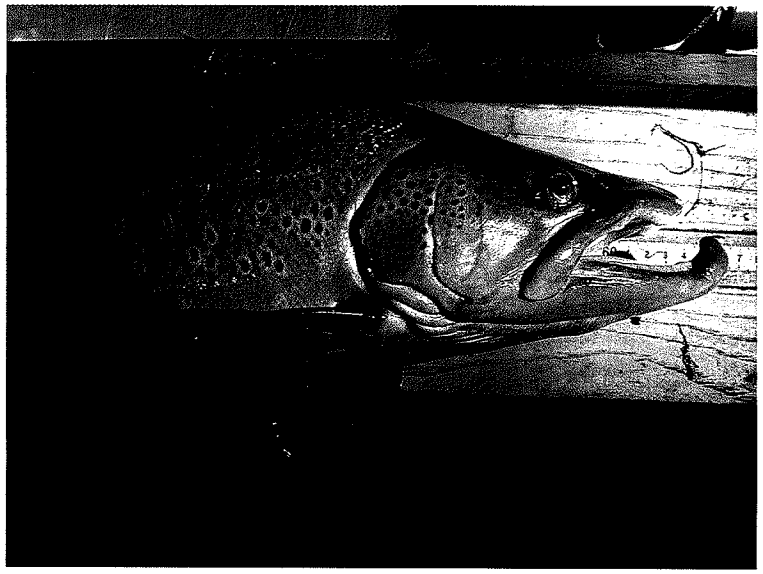
Control Methods:

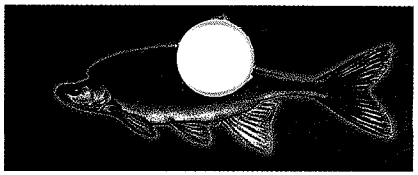
- Electrofishing or net
- Traps or weirs
- Seine
- Chemical
- Managed flow
- Temperature Control
- Other



Brown Trout Control:

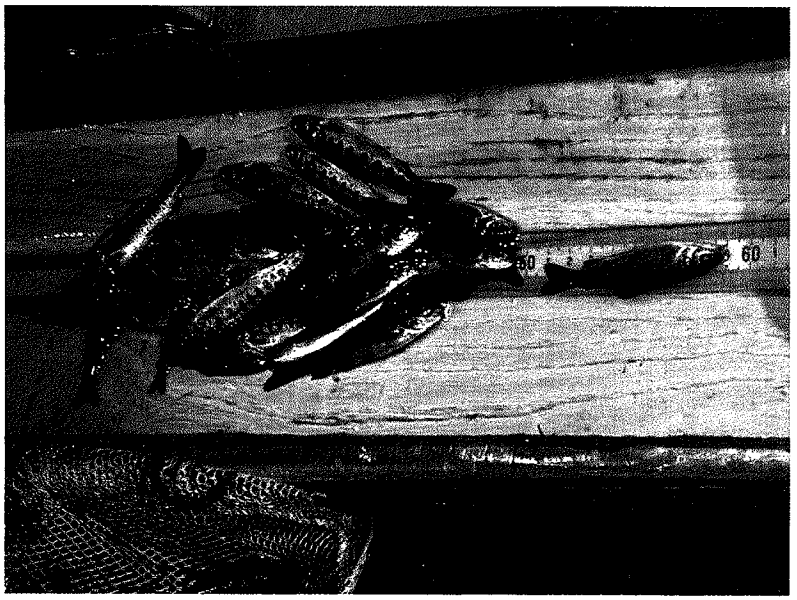
- Electrofish or net
- Chemical control
- Traps or weirs

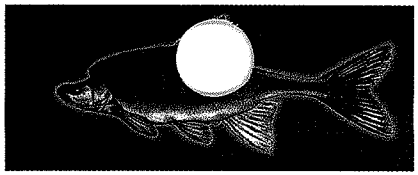




Rainbow Trout Control:

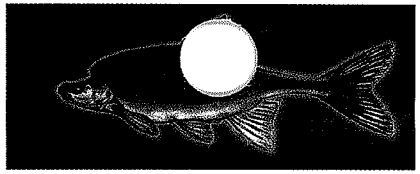
- Electrofish or net
- Managed flow
- Temperature control





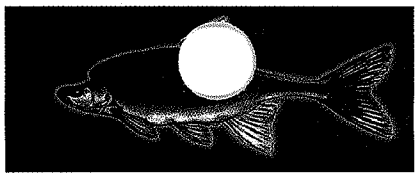
Catfish Control:

- Traps or weirs
- Chemical control
- Temperature control



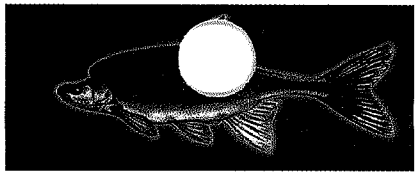
Report Recommendations 1:

Improve public information and education efforts concerning non-native fish impacts on native fishes.



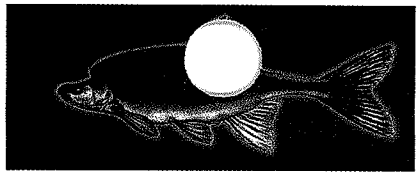
Report Recommendations 2:

Evaluate methods to remove brown trout from Bright Angel Creek and consider the removal of rainbow trout after public input.



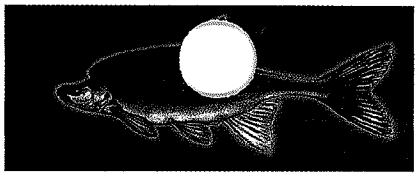
Report Recommendations 3:

Evaluate shocking and removal of rainbow trout near mouth of the Little Colorado River.



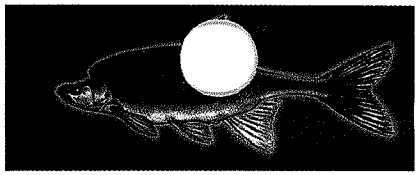
Report Recommendations 4:

Evaluate channel catfish, black bullhead and carp removal using nets and other appropriate methods in the Little Colorado River.



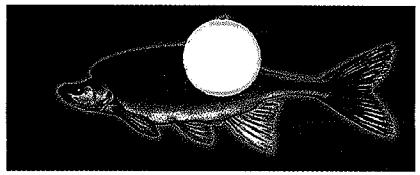
Report Recommendations 5:

Evaluate managed flows to disadvantage trout and other non-native fish.



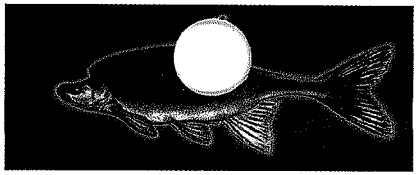
Report Recommendations 6:

Evaluate the feasibility of a Temperature Control Device to improve humpback chub and native fish recruitment.



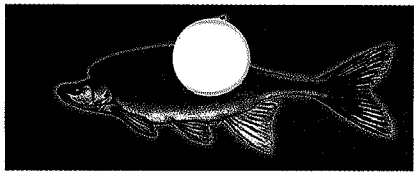
Report Recommendations 7:

Consider sediment augmentation or redistribution to benefit native fishes.



Report Recommendations 8:

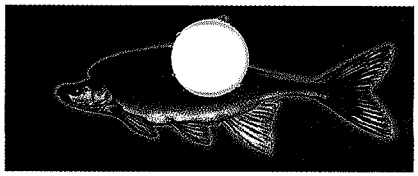
Due to the urgency of the need to protect humpback chub, any feasible control methods should be implemented immediately.



TWG Motion:

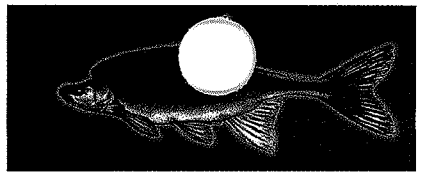
TWG recommends that the AMWG approve the TWG Non-native Fish Control Ad Hoc Group's plan, and recommends further that the AMWG:

- **Develop a comprehensive strategy for ensuring the viability of native fish populations, with emphasis on listed species,**



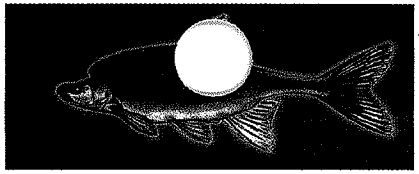
TWG Motion:

- **Control non-native fish in additional tributaries, after public input through appropriate agencies,**



TWG Motion:

- **Increase focus on management actions rather than just evaluations, and**



TWG Motion:

- **clarify the AMWG directive to the TWG to consider actions to improve conditions for the HBC, i.e., for "…meeting MO 2.5 and 2.6 of the 17 August 2001 draft of the AMP Strategic Plan."**

Complete TWG Motion

TWG recommends that the AMWG approve the TWG Non-native Fish Control Ad Hoc Group's plan, and recommends further that the AMWG:

- **Develop a comprehensive strategy for ensuring the viability of native fish populations, with emphasis on listed species,**
- **control non-native fish in additional tributaries, after public input through appropriate agencies,**
- **increase focus on management actions rather than just evaluations, and**
- **clarify the AMWG directive to the TWG to consider actions to improve conditions for the HBC, i.e., for "…meeting MO 2.5 and 2.6 of the 17 August 2001 draft of the AMP Strategic Plan."**

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