

HISTORIC POPULATION AND COMMUNITY
TRENDS RELATED TO THE
ARKANSAS RIVER SHINER *NOTROPIS GIRARDI* AND
PEPPERED CHUB *MACRHYBOPSIS TETRANEMA*



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What's the point of this?

- Analyses performed as a part of Species Status Assessment (SSA)
- SSA's thoroughly describe the viability of a species.
 - Viability is the ability of a species to sustain wild populations or:
 - Resiliency – ability to withstand random events (e.g. droughts)
 - Redundancy – ability to withstand catastrophic events (e.g. massive oil spill)
 - Representation – ability to adapt to changing conditions (plasticity)
- Conclusions relevant to listing (ESA) status are above our paygrade.
- These analyses will inform recovery planning.

Species of Concern



- Arkansas River Shiner
- Listed Threatened 1998
- Pelagic broadcast spawner

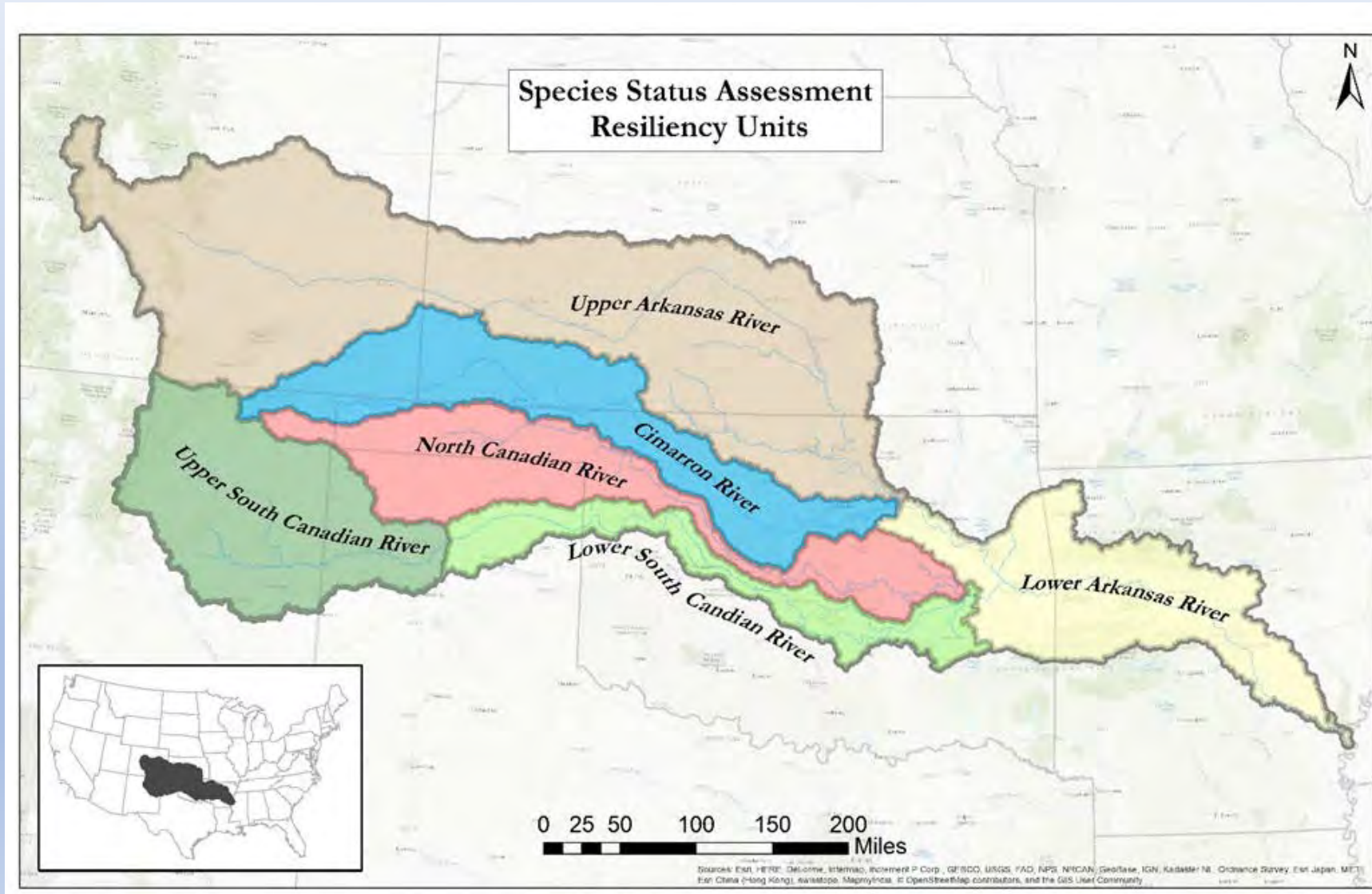


Photos: Chad Thomas, Texas State University-San Marcos

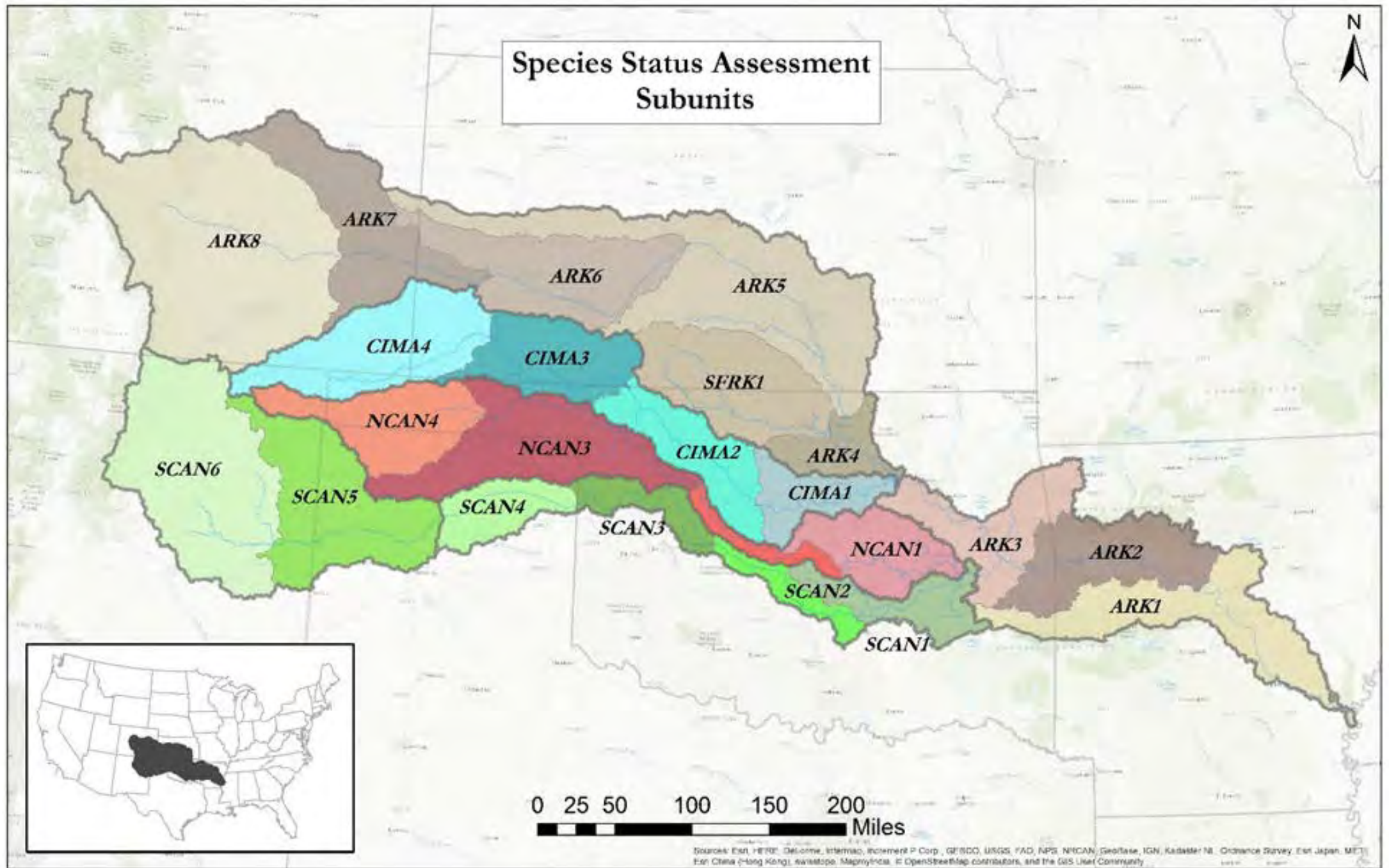
- Peppered Chub
- Imperiled, petitioned to list



Area of Concern



Species Status Assessment Subunits



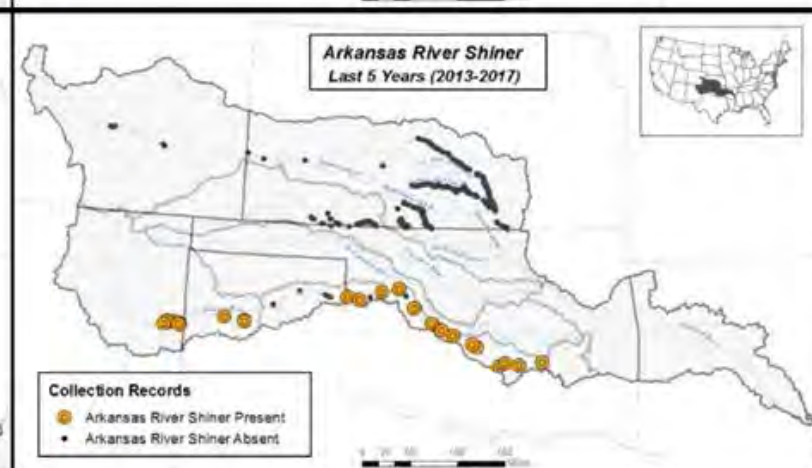
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeBCO, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Mapbox India, OpenStreetMap contributors, and the GIS User Community

Data Sources

Type	Source	# Collections	# Lots	Data Use
Literature	1891 Jordan, D.S.	2	11	Presence/Absence
Museum Collection	Burke Museum - University of Kansas	303*	1,580	Presence/Absence
Museum Collection	Museum of Southwest Biology	5*	5	Presence/Absence
Museum Collection	Museum of Zoology - University of Michigan	210	639	Presence/Absence
Museum Collection	Natural History Museum - Eastern New Mexico University	47	133	Presence/Absence
Museum Collection	Oklahoma State University Museum Ichthyology Collection	1,292	4,074	Presence/Absence
Museum Collection	Sam Noble Museum of Natural History - University of Oklahoma	905	7,654	Presence/Absence
Online Database	Fishnet2	420*	3,286	Presence/Absence
State Agency Collections	Arkansas Game and Fish Comission	24	28	Presence/Absence
	TOTAL Presence/Absence	3,208	17,410	
Federal Agency Collections	U.S. Fish and Wildlife Service - New Mexico- Fisheries	102	499	Abundance
Federal Agency Collections	U.S. Fish and Wildlife Service - Oklahoma- Ecological Services and Fisheries	293	2,156	Abundance
Literature	1955 Lewis and Dalquest	34	108	Abundance
Literature	1997 Pittenger and Schiffmiller	5	23	Abundance
Literature	1997 Polivka and Matthews	8	58	Abundance
Literature	2002 Giggelman et al.	11	65	Abundance
Literature	2002 Wilde	31	230	Abundance
Literature	2005 Wilde	258	1,704	Abundance
Literature	2009 GEI Report	15	71	Abundance
Literature	2010 Wilde	26	97	Abundance
Online Database	Fishes of Texas	37	109	Abundance
State Agency Collections	Colorado Parks and Wildlife Department	272	1,902	Abundance
State Agency Collections	Kansas Department of Wildlife, Parks, and Tourism	2,932*	17,180	Abundance
State Agency Collections	OK Dep. of Env. Qual. - Jimmy Pigg (partial confirmed data)	917	9,308	Abundance
State Agency Collections	Texas Parks and Wildlife Department	3	32	Abundance
University Collections	Oklahoma State University - Dr. Shannon Brewer	40	418	Abundance
	TOTAL Abundance	4,984	33,960	
	OVERALL TOTAL	8,192	51,370	

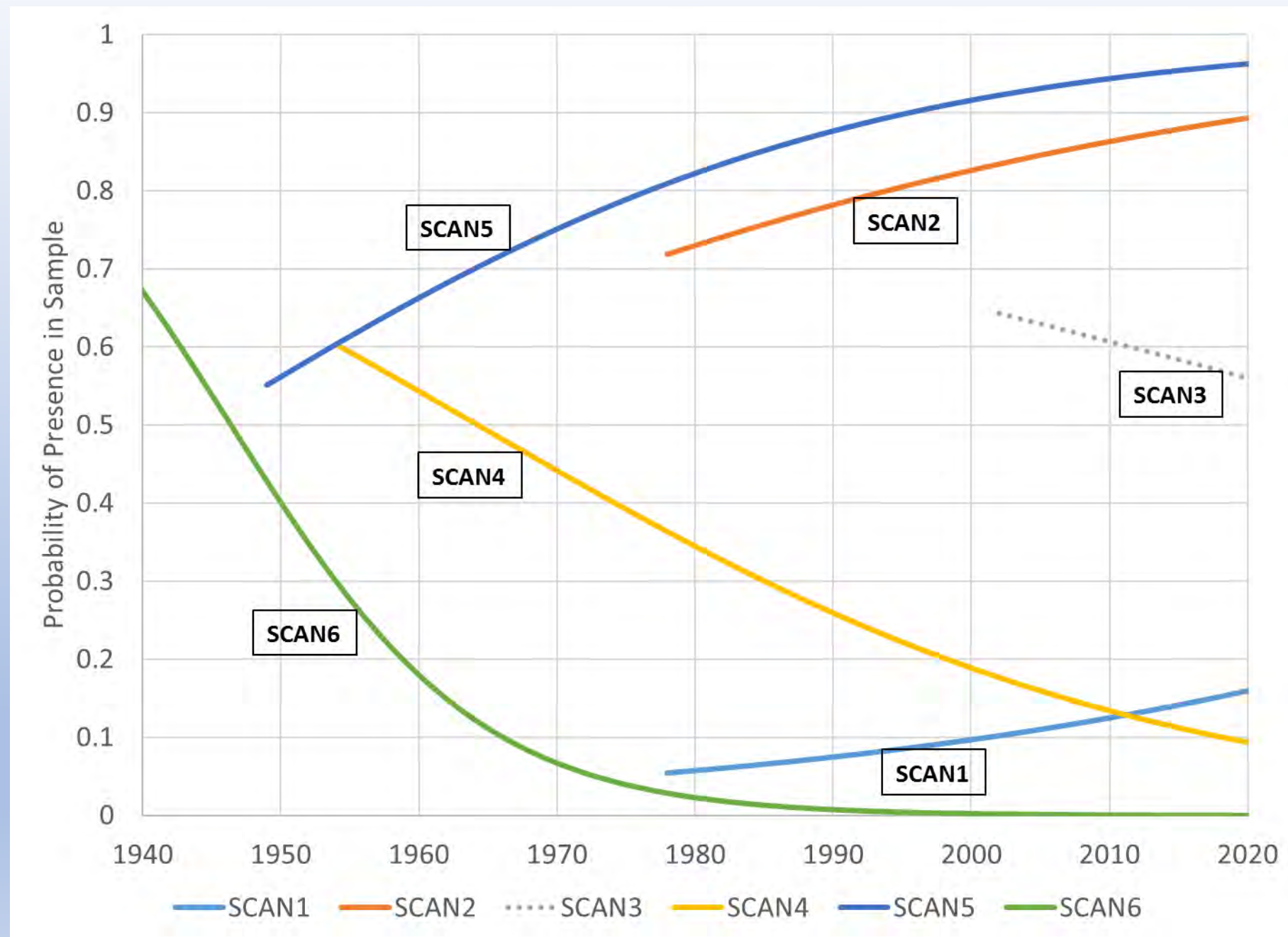
Arkansas River Shiner (*Notropis girardi*)



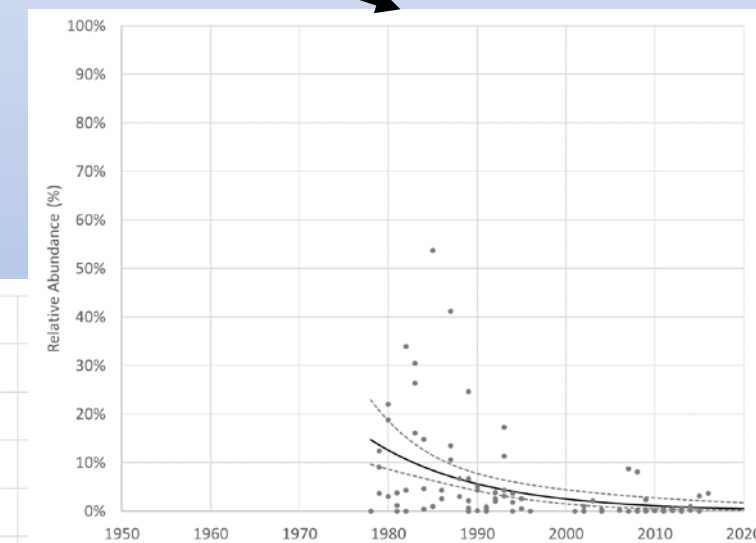
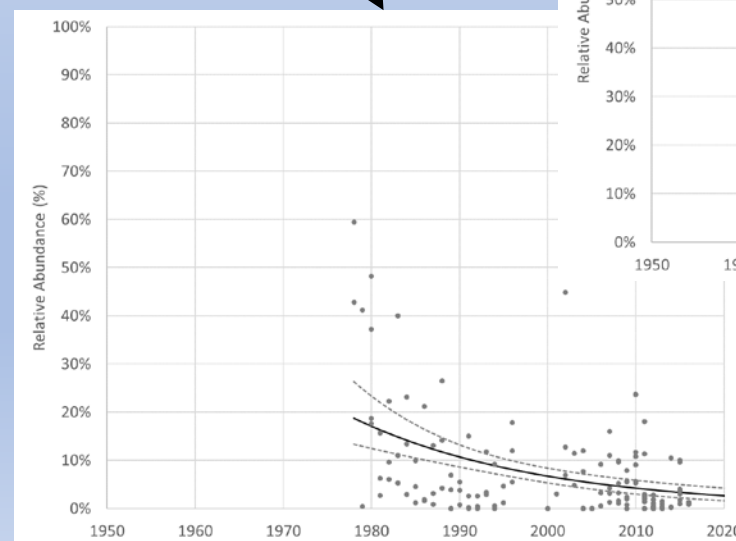
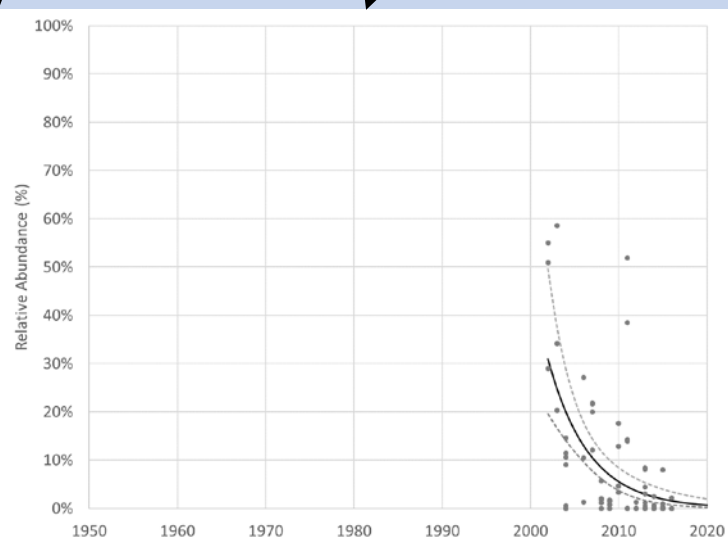
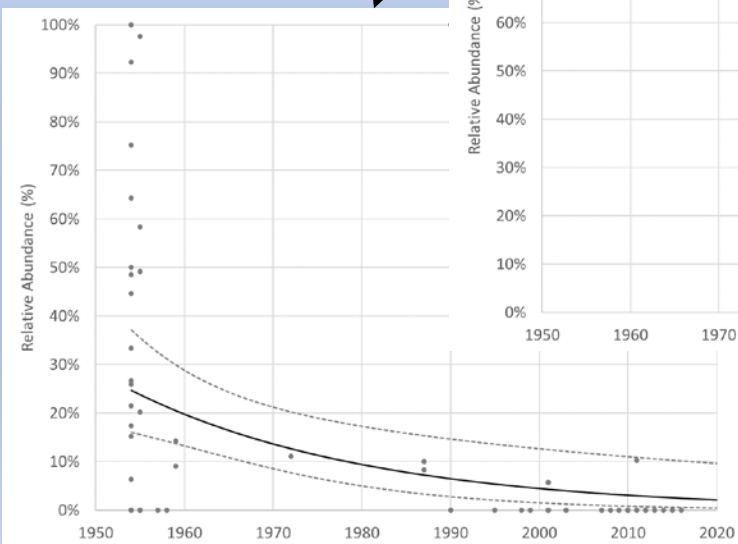


River	Section	Period of Record				Samples After Record
		First Report	Last Report	Proportion Positive	Total Samples	
Arkansas	Salt Fork	1926	1987	29.8%	188	600
	1	1959	1959	100.0%	1	17
	2	1927	1963	19.6%	51	58
	3	1936	1981	2.5%	315	372
	4	1934	1998	7.2%	222	9
	5	1939	1978	33.3%	90	1360
	6	1926	1952	33.3%	21	110
	7	1950	1950	2.9%	34	189
	8	None	None	N/A	N/A	166
Cimarron	1	1929	1993	23.0%	369	113
	2	1926	1991	29.9%	137	141
	3	1941	1992	31.8%	107	98
	4	1926	1992	9.4%	96	44
North Canadian	1	1932	1993	13.0%	92	22
	2	None	None	N/A	N/A	195
	3	1928	1993	20.7%	246	125
	4	1926	1963	50.0%	28	2
South Canadian	1	1926	2016	53.7%	229	0
	2	1920	2016	77.9%	353	0
	3	1928	2016	63.3%	166	0
	4	1926	2011	39.4%	104	15
	5	1939	2016	88.3%	549	0
	6	1939	1977	16.1%	31	30

- Logistic regressions
- All available data
- Starts Year of record
- Run in R
- Dotted lines $P > 0.05$

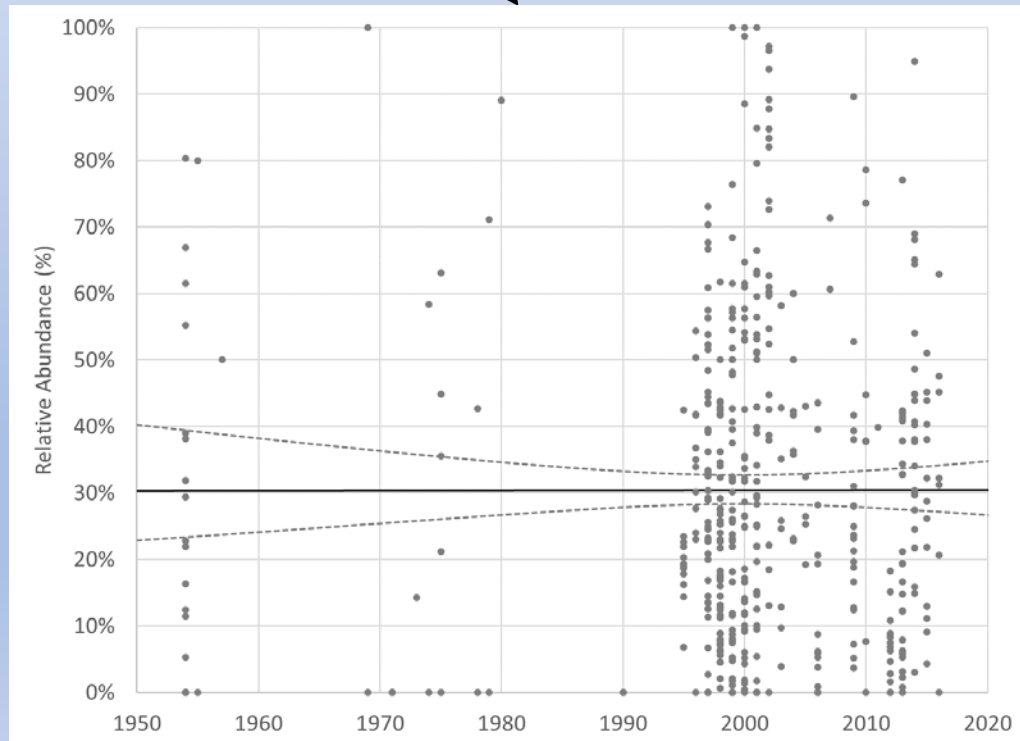


- Quasi-Poisson Regressions
- Relative abundance data
- Starts Year of record
- Run in R





- Quasi-Poisson Regressions
- Relative abundance data
- Starts Year of record
- Run in R



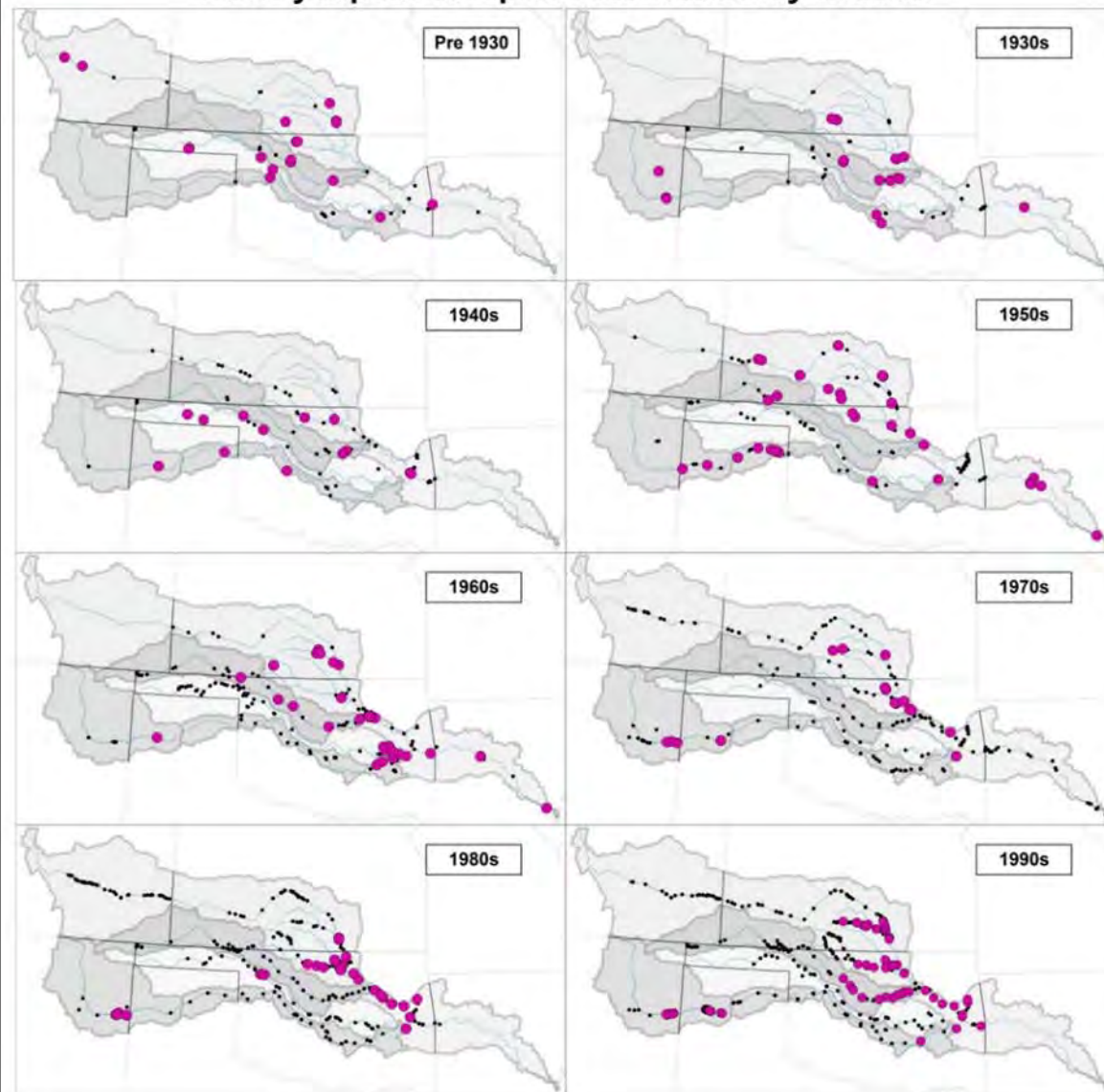
Analysis Sub-Unit		Intercept		Slope		N
		Estimate	P-value	Estimate	P-value	
Arkansas River Shiner						
	SCAN1	156.6847	0.0000	-0.0802	0.0000	89
	SCAN2	91.0128	0.0000	-0.0469	0.0000	146
	SCAN3	429.3764	0.0000	-0.2151	0.0000	81
	SCAN4	71.0727	0.0051	-0.0371	0.0042	86
	SCAN5	-1.2970	0.8180	0.0001	0.9850	466
Peppered Chub						
		-				
	SCAN1	101.7260	0.3910	0.0468	0.4290	89
	SCAN2	-27.3000	0.0555	0.0000	1.0000	146
	SCAN3	-27.3000	0.6230	0.0000	1.0000	81
	SCAN4	84.4882	0.3120	-0.0459	0.2820	86
	SCAN5	9.3348	0.4010	-0.0059	0.2910	466

Peppered Chub (*Macrhybopsis tetranema*)



Genus species	Species code	Common name
<i>Extrarius aestivalis</i>	Extaes	Speckled chub
<i>Extrarius aestivalis tetranemus</i>	Ext aestet	Chub sp?
<i>Extrarius tetranemus</i>	Exttet	Speckled chub
<i>Hybopsis aestivalis</i>	Hybaes	Speckled chub
<i>Hybopsis amblops</i>	Hybamb	Bigeye Chub
<i>Hybopsis amnis</i>	Hybamn	Pallid Shiner
<i>Hybopsis sp.</i>	Hybpxx	Chub sp?
<i>Hybopsis scylla</i>	Hybscy	Chub sp?
<i>Hybopsis storerianus</i>	Hybsto	Silver Chub
<i>Hybopsis tetranemus</i>	Hybtet	Peppered Chub
<i>Macrhybopsis aestivalis</i>	Macaes	Speckled Chub
<i>Macrhybopsis aestivalis tetranemus</i>	Macaestet	Chub sp?
<i>Macrhybopsis hyostoma</i>	Machyo	Shoal Chub
<i>Macrhybopsis storeriana</i>	Macsto	Silver Chub
<i>Macrhybopsis tetranema</i>	Mactet	Peppered Chub
<i>Chub sp</i>	Macxxx	Chub sp?
<i>Notropis girardi</i>	Notgir	Arkansas River Shiner

Macrhybopsis Complex Distribution by Decade

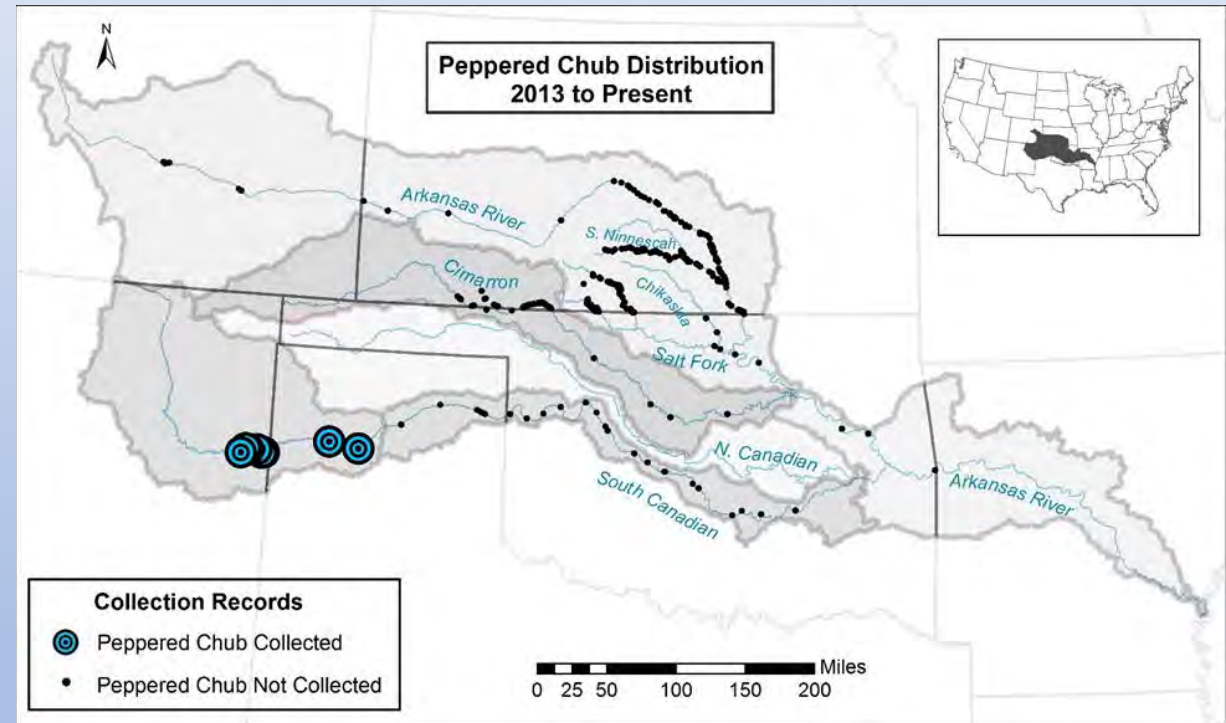
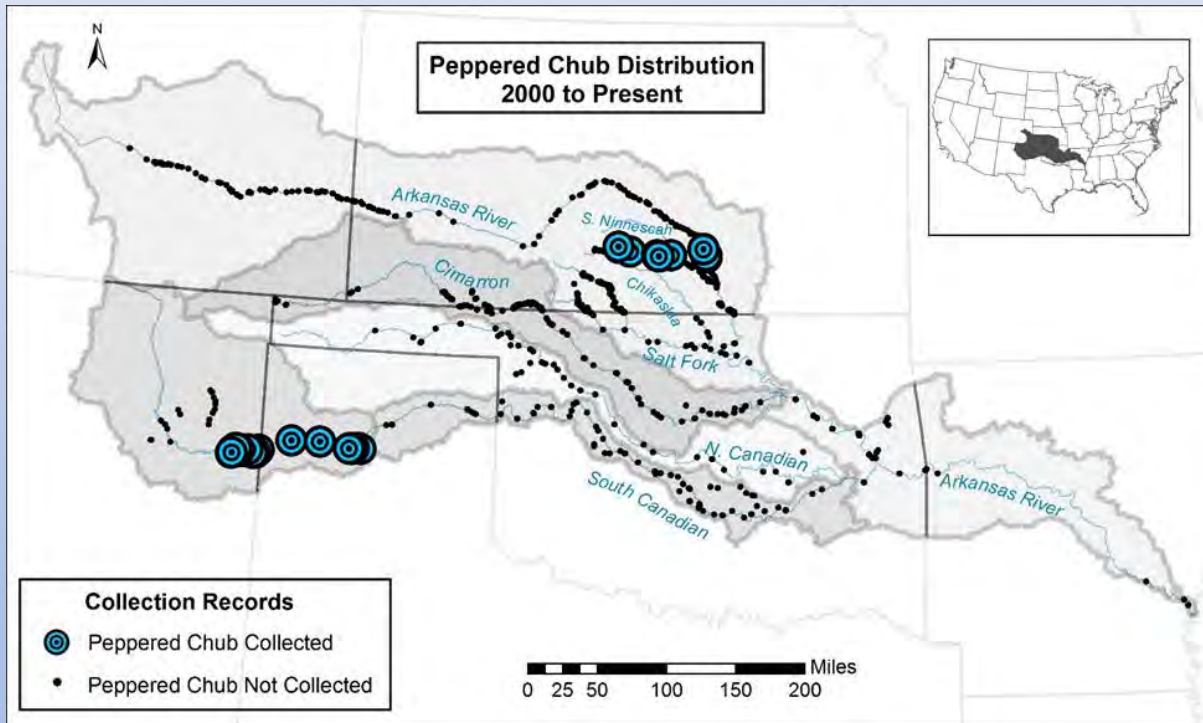


Collection Records

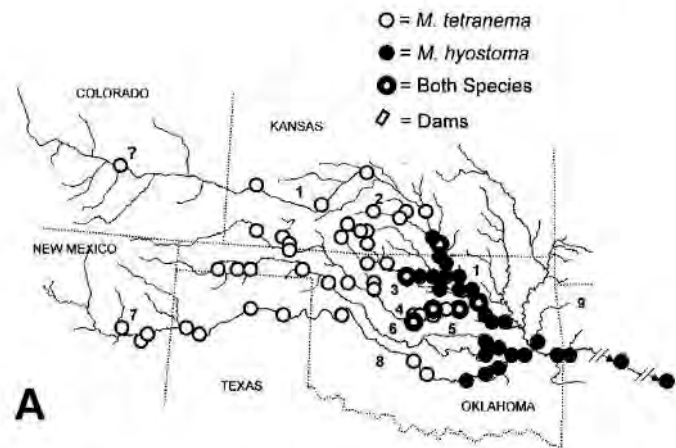
- Macrhybopsis Complex Present
- Macrhybopsis Complex Absent



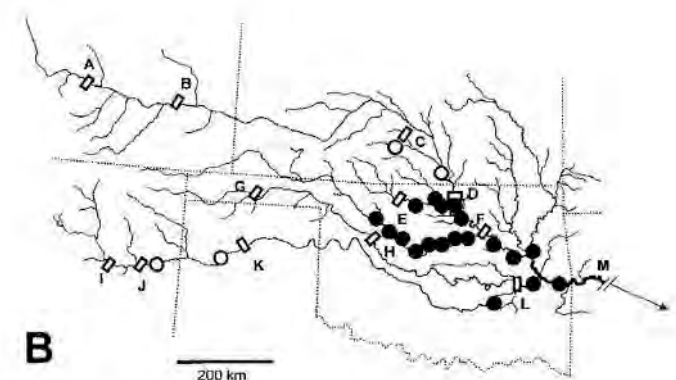
Recent Samples



LUTTRELL ET AL.—STAT



A



B

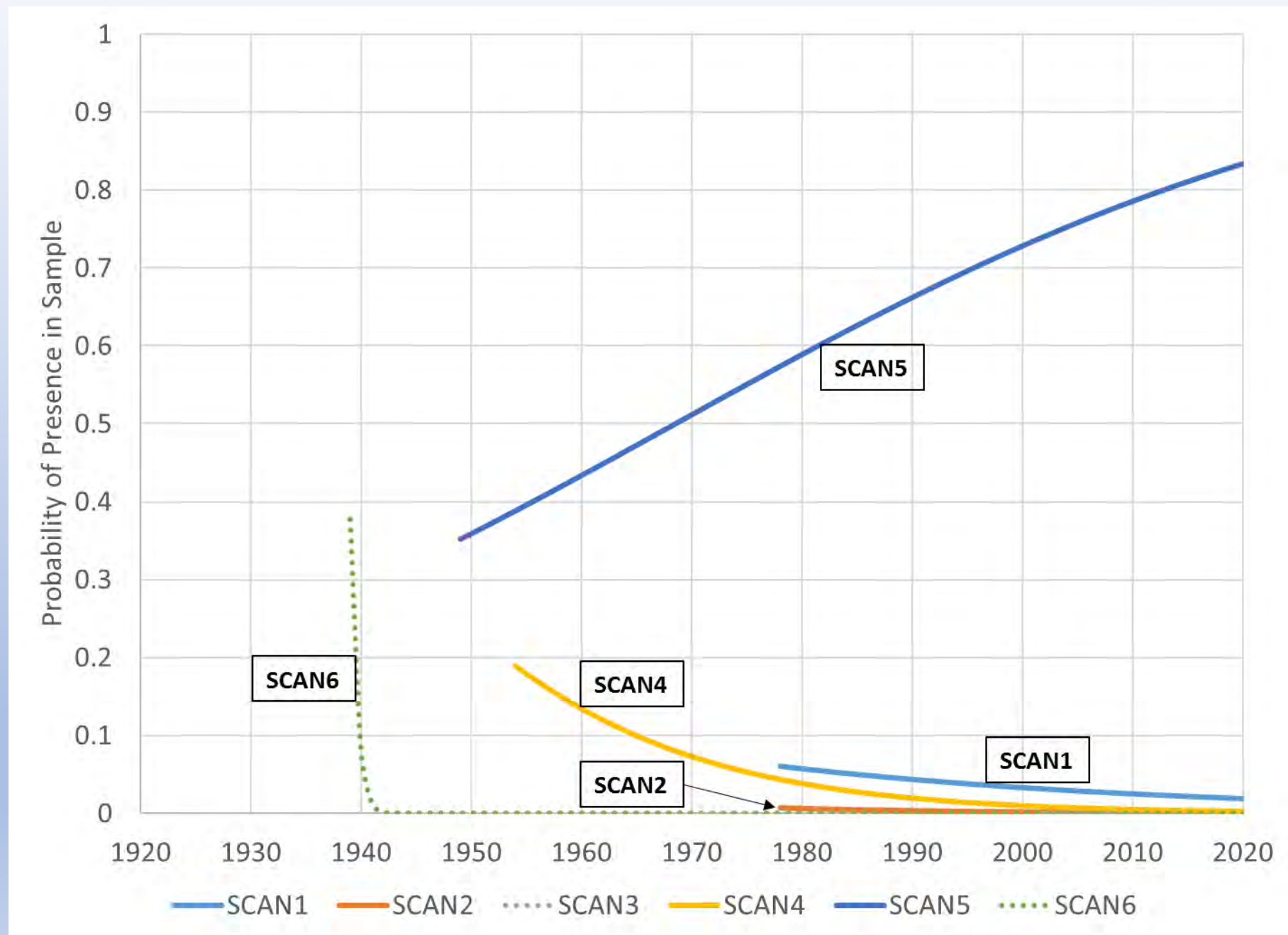
River	Section	Period of Record				
		First Report	Last Report	Proportion Positive	Total Samples	Samples After Record
Arkansas	Salt Fork	1926	2010	13.8%	398	390
	1	1959	2003	23.5%	17	1
	2	1939	1993	19.6%	92	9
	3	1946	2008	6.8%	664	5
	4	1934	2009	18.6%	231	0
	5	1889	2012	17.6%	792	668
	6	1950	1958	63.6%	11	105
	7	None	None	N/A	N/A	194
	8	1889	1889	33.3%	6	158
Cimarron	1	1929	2011	18.7%	487	0
	2	1928	2010	16.1%	273	6
	3	1950	1963	20.8%	24	522
	4	None	None	N/A	N/A	152
North Canadian	1	1959	1962	21.7%	23	81
	2	None	None	N/A	N/A	195
	3	1928	1982	8.9%	90	281
	4	1926	1949	69.2%	13	17
South Canadian	1	1929	2002	7.3%	178	45
	2	1932	1952	21.1%	19	321
	3	1928	1940	33.3%	6	160
	4	1949	1959	17.6%	51	67
	5	1939	2016	70.1%	549	0
	6	1939	1939	25.0%	4	57

ORANGE - indicates lower section of rivers occupied by shoal chub (*M. hyostoma*)

PURPLE - indicates midsections of rivers potentially occupied by both species

BLUE - indicates upper sections of rivers occupied by peppered chub (*M. tetranema*)

- Logistic regressions
- All available data
- Starts Year of record
- Run in R
- Dotted lines $P > 0.05$



South Canadian River Community

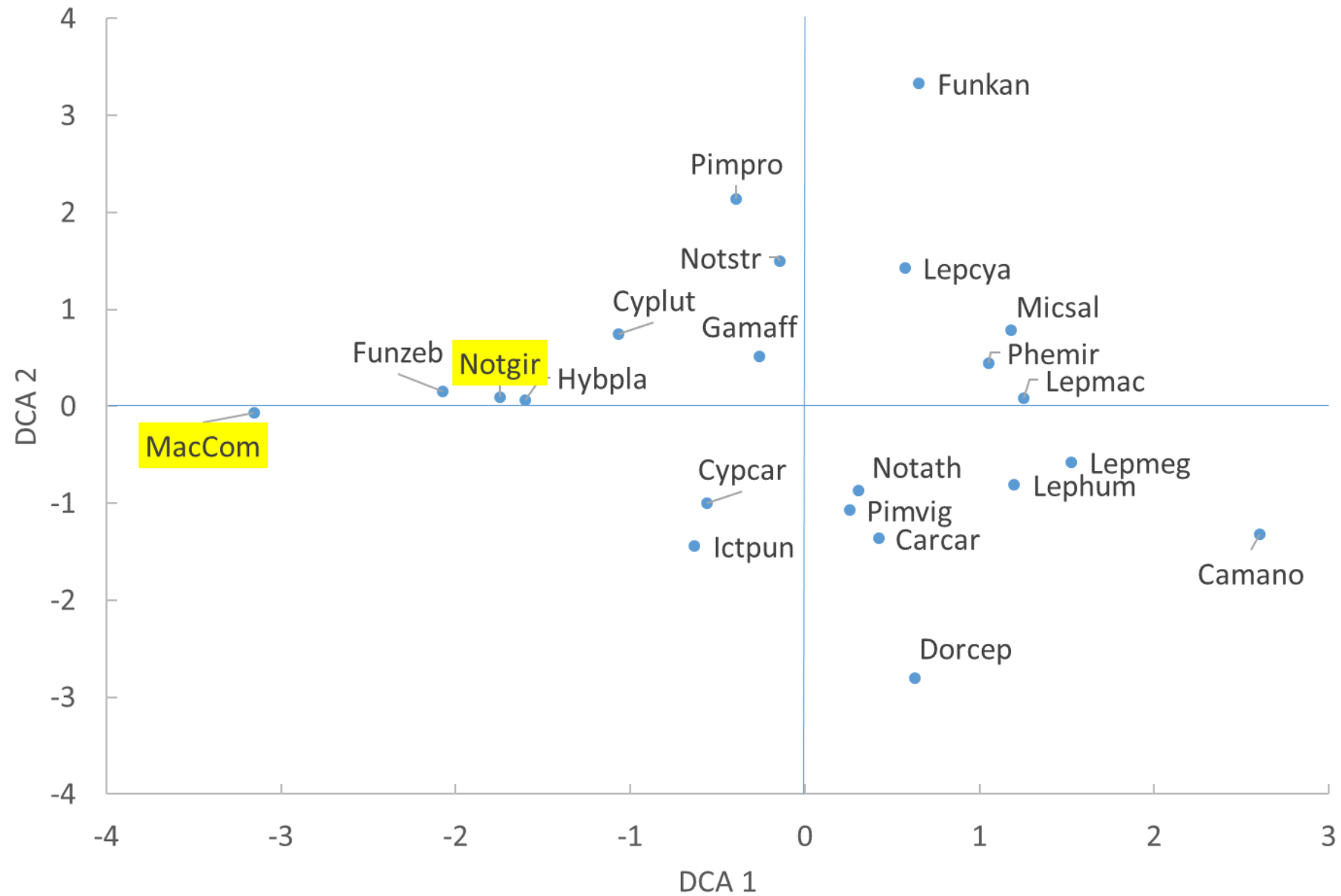


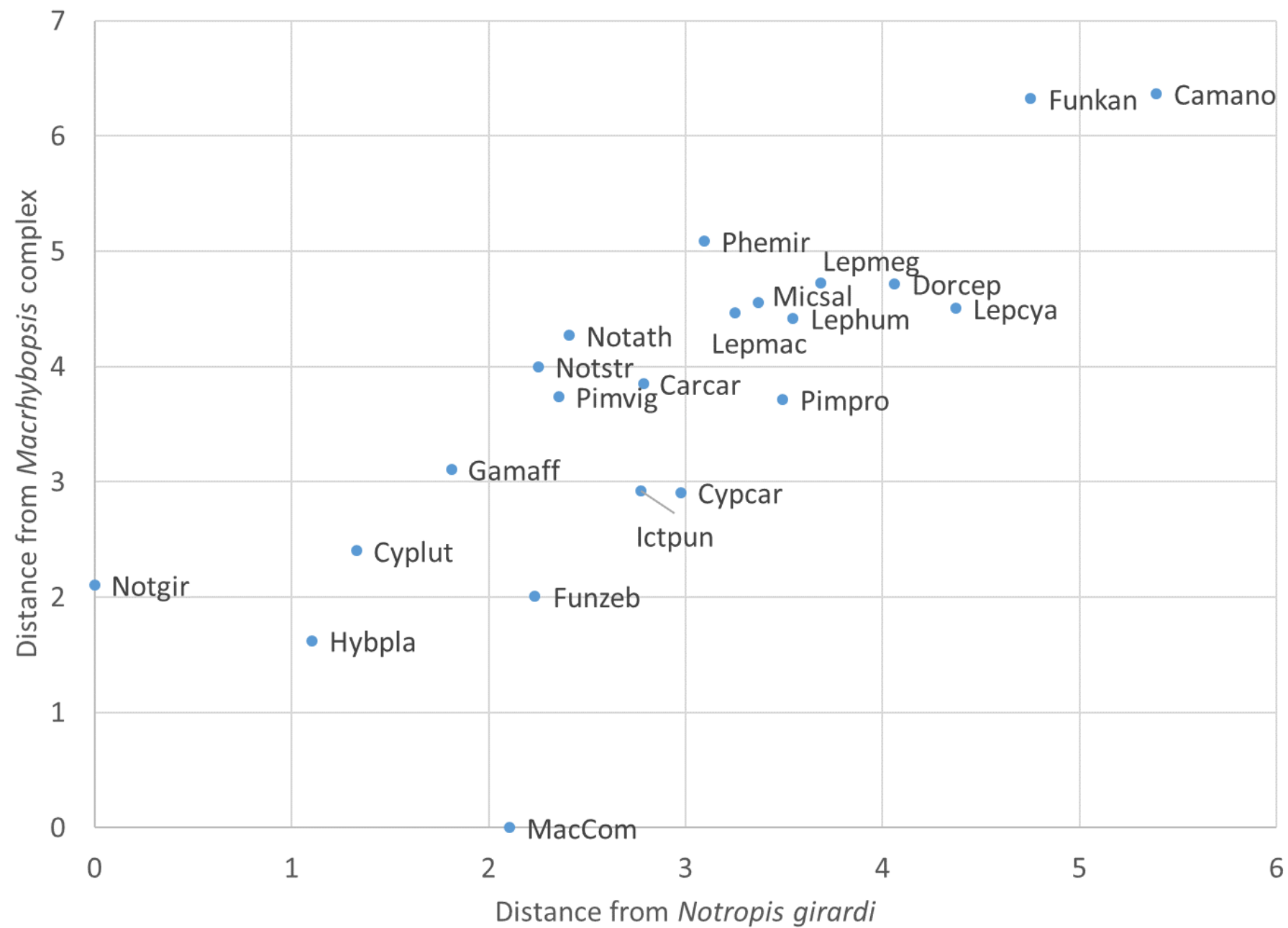
Multivariate Analysis

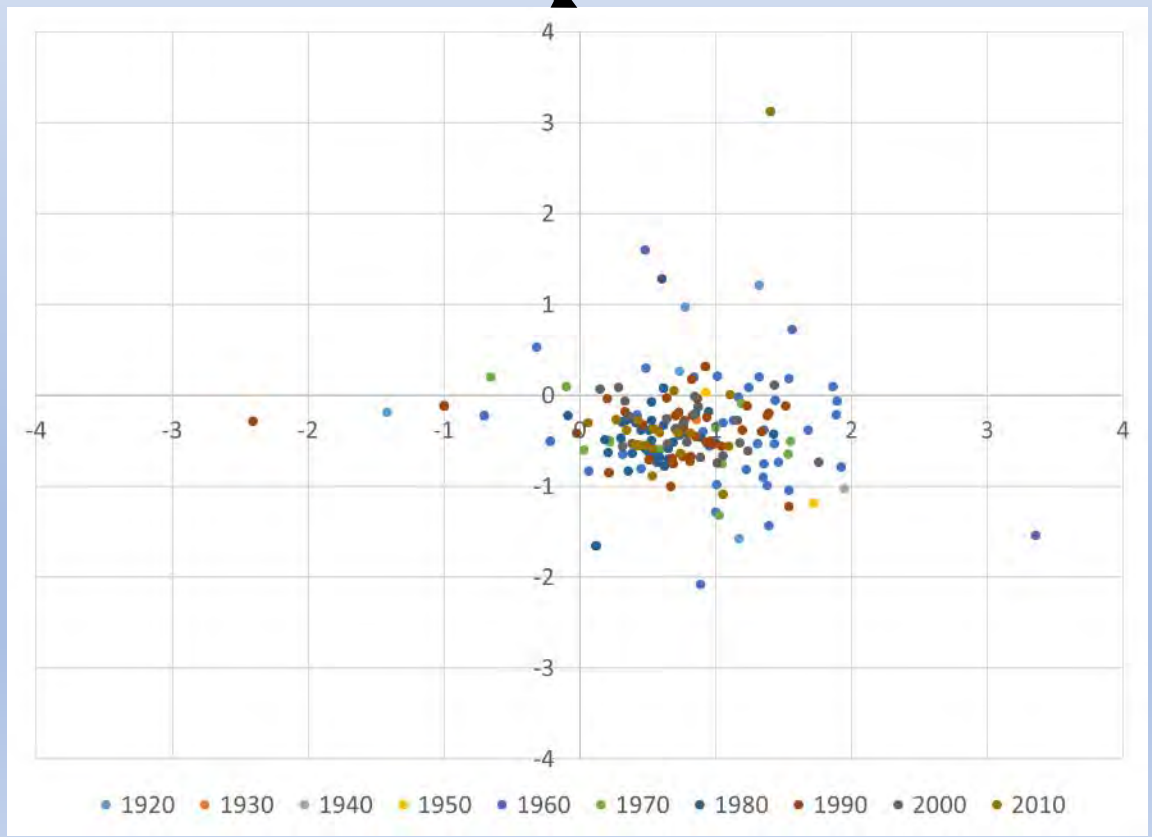
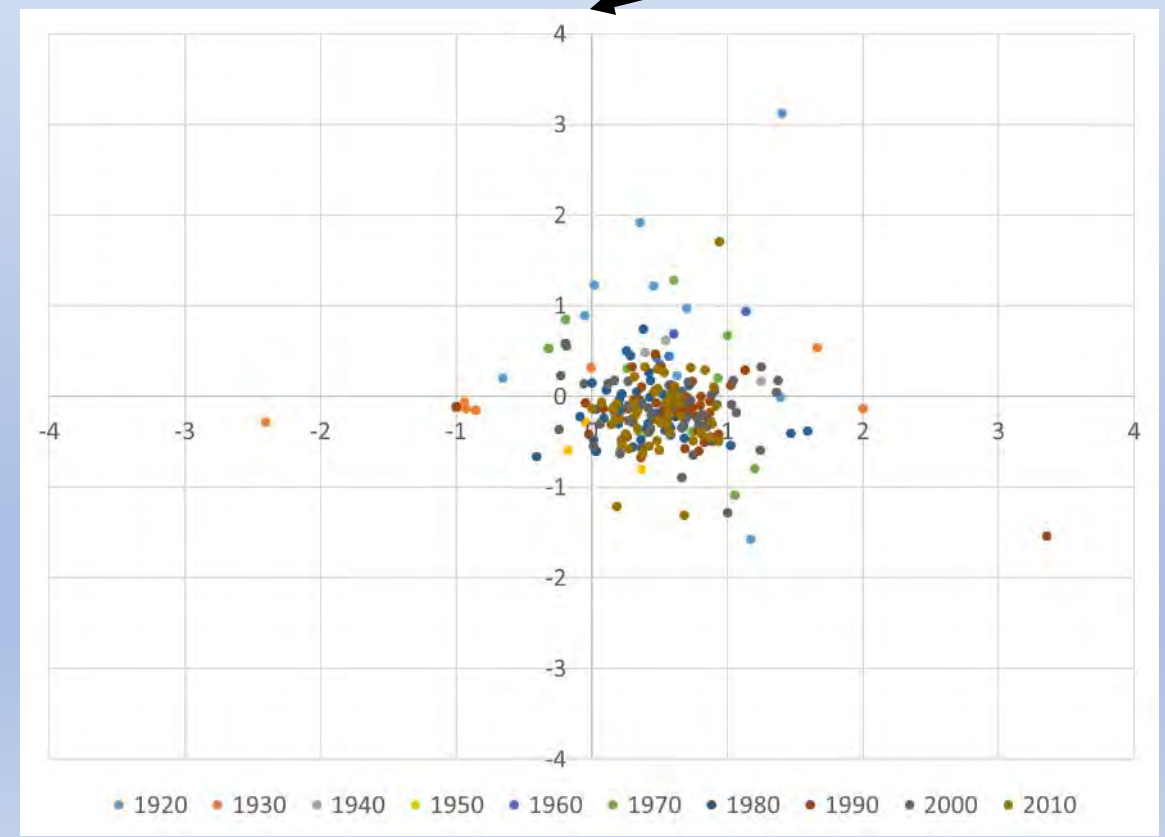
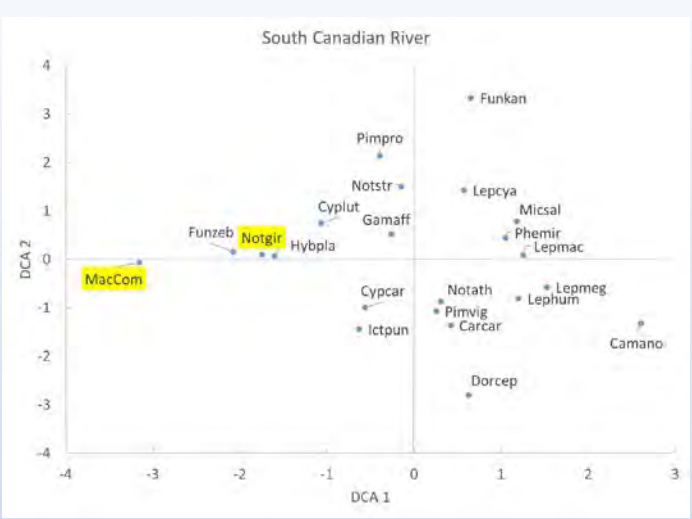
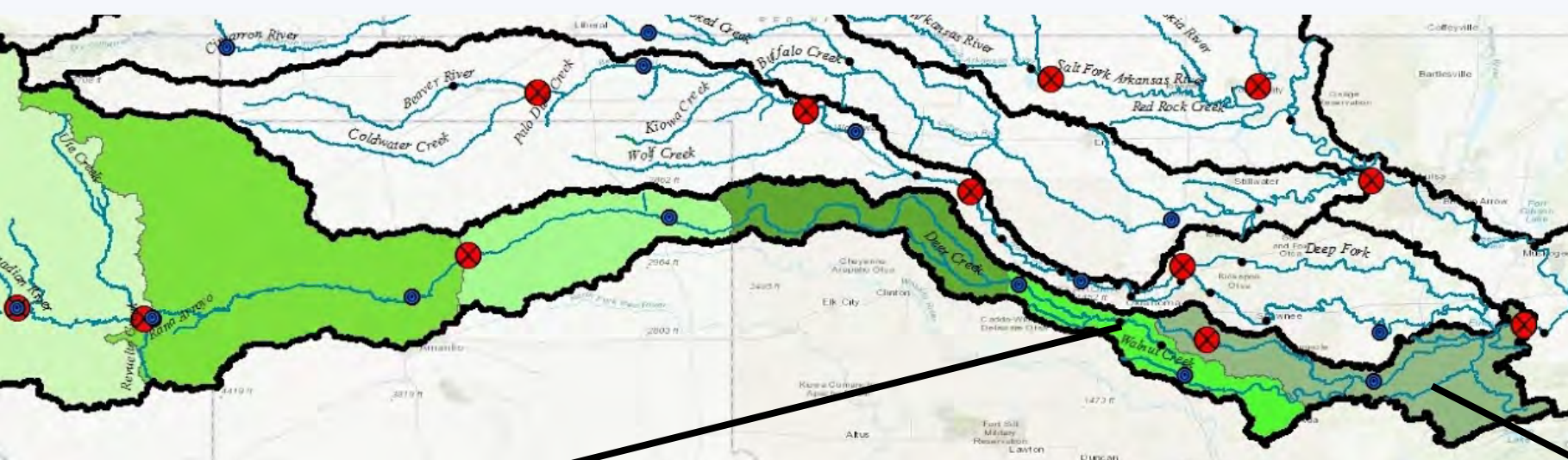
- South Canadian River
- Presence/Absence data
- Only species in >10% of samples
- Run in R
- Detrended correspondence analysis (Vegan package)

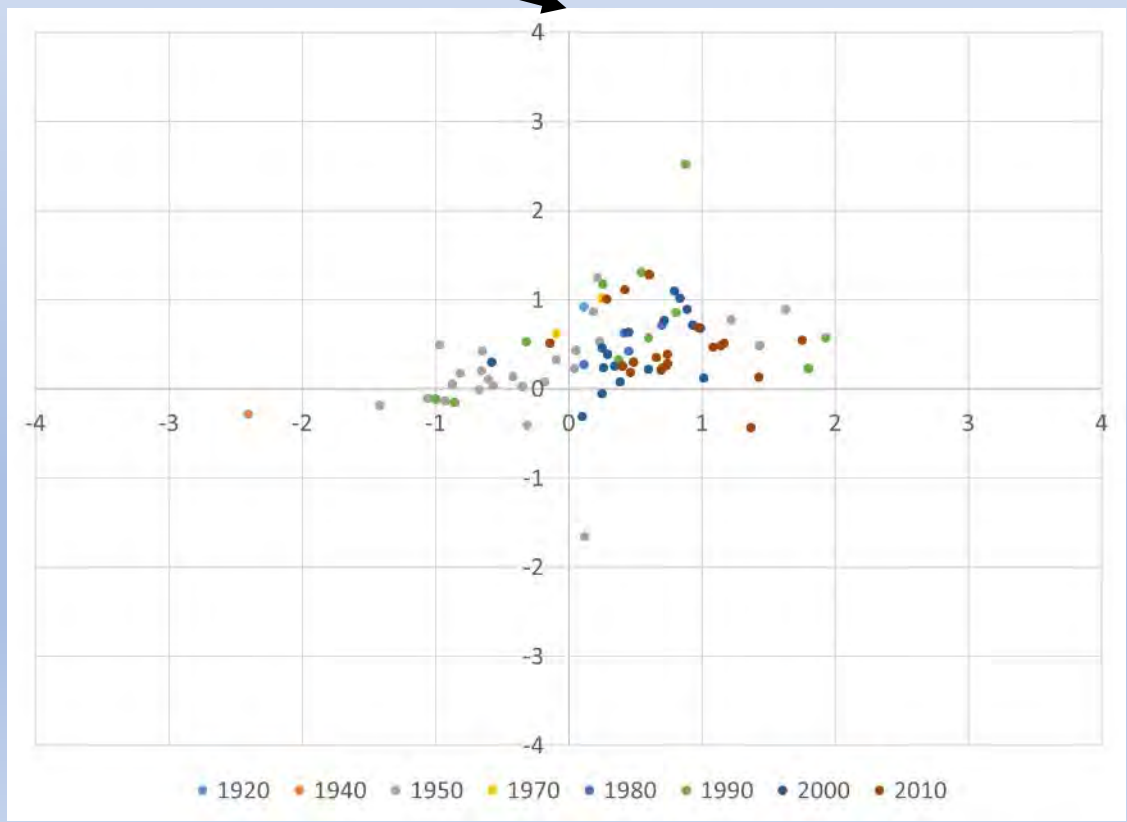
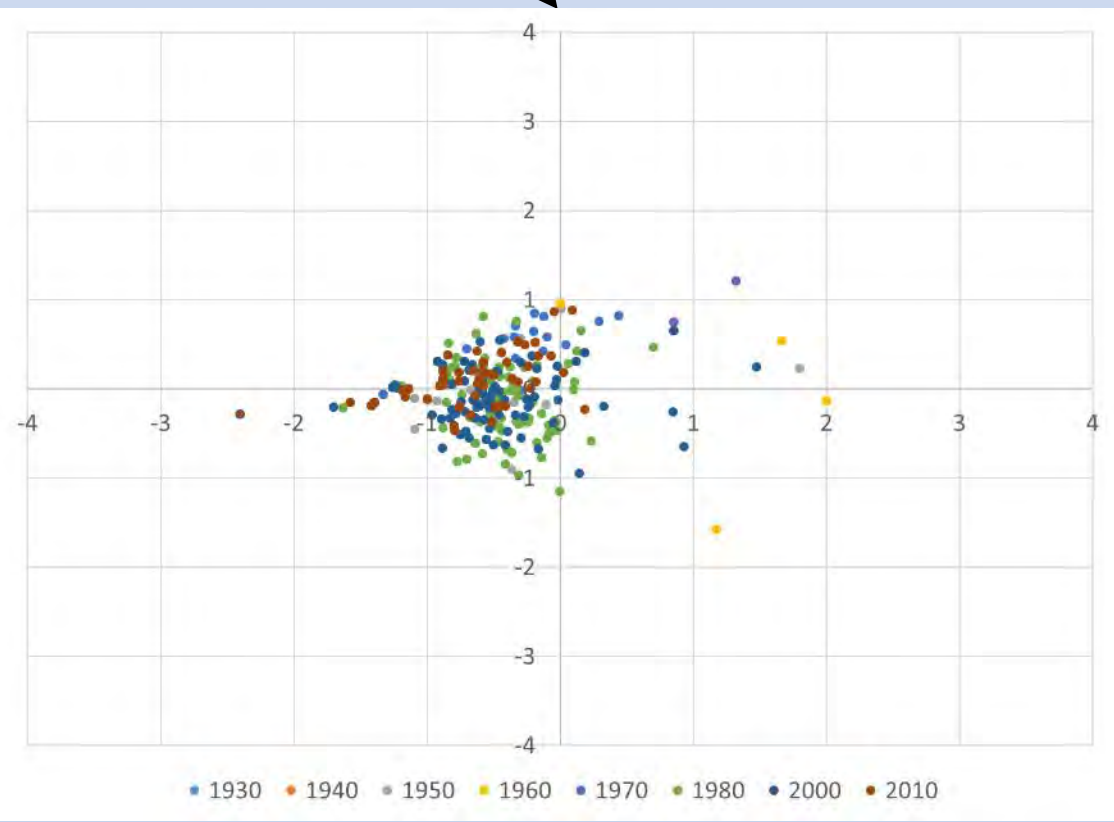
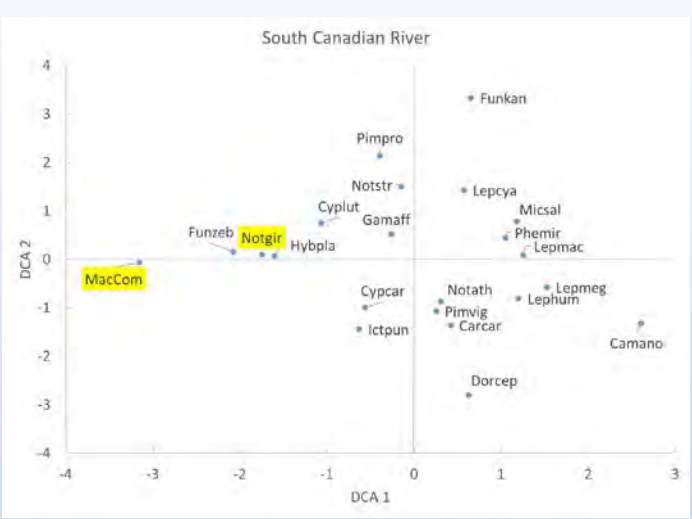
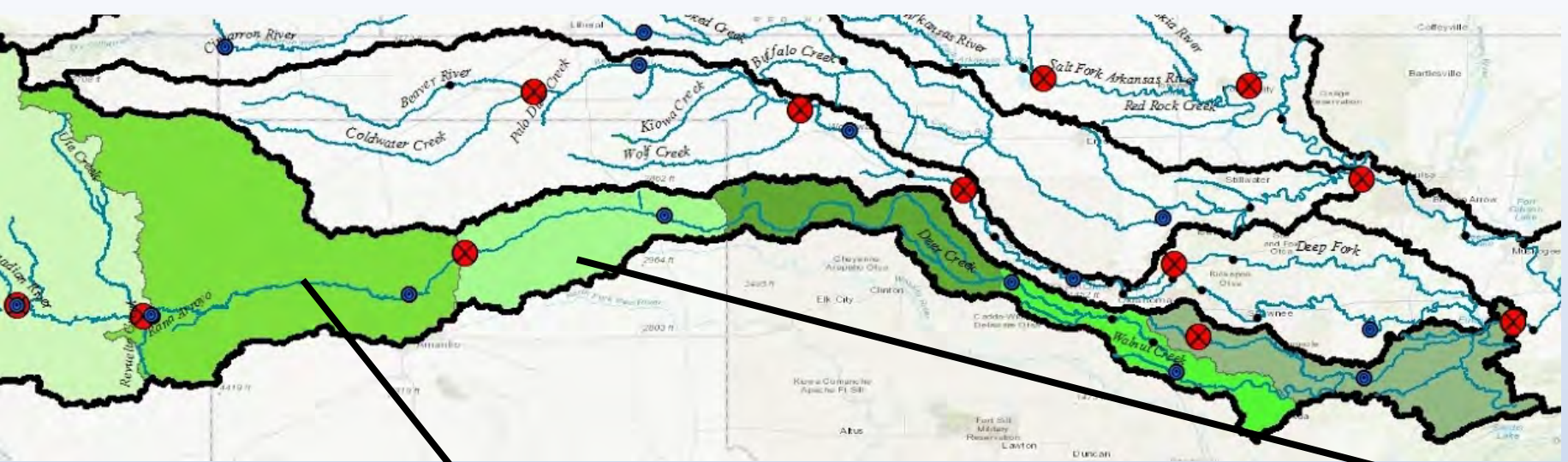
Code	Scientific Name	Common Name
Notgir	<i>Notropis girardi</i>	Arkansas River Shiner
MacCom	<i>Macrhybopsis complex</i>	Chub Complex
Camano	<i>Campostoma anomalum</i>	Central Stoneroller
Carcar	<i>Carpiodes carpio</i>	River Carpsucker
Cypcar	<i>Cyprinus carpio</i>	Common Carp
Cyplut	<i>Cyprinella lutrensis</i>	Red Shiner
Dorcep	<i>Dorosoma cepedianum</i>	Gizzard Shad
Funkan	<i>Fundulus kansae</i>	Northern Plains Killifish
Funzeb	<i>Fundulus zebrinus</i>	Plains killifish
Gamaff	<i>Gambusia affinis</i>	Western Mosquitofish
Hybpla	<i>Hybognathus placitus</i>	Plains Minnow
Ictpun	<i>Ictalurus punctatus</i>	Channel Catfish
Lepcya	<i>Lepomis cyanellus</i>	Green Sunfish
Lephum	<i>Lepomis humilis</i>	Orangespotted Sunfish
Lepmac	<i>Lepomis macrochirus</i>	Bluegill
Lepmeg	<i>Lepomis megalotis</i>	Longear Sunfish
Micsal	<i>Micropterus salmoides</i>	Largemouth Bass
Notath	<i>Notropis atherinoides</i>	Emerald Shiner
Notstr	<i>Notropis stramineus</i>	Sand Shiner
Phemir	<i>Phenacobius mirabilis</i>	Suckermouth Minnow
Pimpro	<i>Pimephales promelas</i>	Fathead Minnow
Pimvig	<i>Pimephales vigilax</i>	Bullhead Minnow

South Canadian River









Thank you for your time!

