



Insights into Spawning Behavior of Delta Smelt at the FCCL

Bay-Delta Sciences Conference
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UC DAVIS
UNIVERSITY OF CALIFORNIA

Outline

- Background
 - Genetic management at the FCCL
 - Questions about Delta Smelt spawning behavior
- Experiment
 - Use genetic parentage analysis to examine reproductive behavior
- Results



Making crosses at the FCCL (~Feb-May)

FCCL: Sort, tag, and clip mature adults (~2,400/generation)



GVL: Genetic analysis, parentage analysis



FCCL: 2x/week, recommend and make crosses



Delta Smelt at the FCCL

Goal: Maximize retention of wild genetic diversity, minimize domestication selection

1. Collect and cross wild fish
2. Minimize kinship of individuals
 - Minimizes inbreeding
3. Equalize family contribution
 - Maximizes effective population size



Questions

1. How many times can males and females spawn?
2. What is the variance in reproductive success of individual males, females and pairs?
3. Do Delta Smelt broadcast spawn?
 - Or is there non-random mating?
4. Are Delta Smelt likely to mate with unrelated individuals?
5. How does genetic diversity change from parents to offspring if Delta Smelt are allowed to spawn naturally in a tank?

Experiment Overview



Tank A

300 adults

Tank B

310 adults

2011

Tank C

37/64
females/males

Tank D

22/24
females/males

2012



1. Wipe tanks every day to check for and detach eggs
2. Drain eggs into net, if >500, incubate eggs and raise fry to ~ 7 days
3. Send to GVL for genotyping and parentage analysis (N=96)

Results from 2011

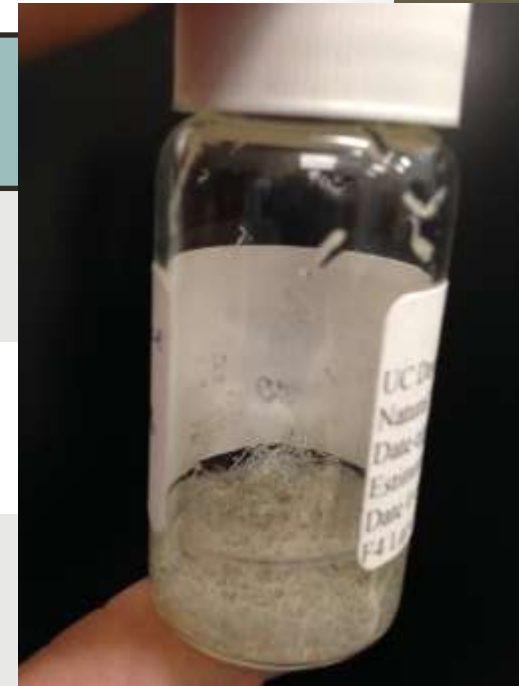
Tank A

300 adults

Tank B

310 adults

	Tank A	Tank B
N dates	10	4
N offspring typed	906	345
N proportion adults spawned	61%	34%
Mean unique pairs/date	58	47



Need more resolution!!

Results from 2012

Tank C

37/64
females/males

Tank D

22/24
females/males

	Tank C	Tank D
N dates analyzed	12	3
N offspring typed	1,047	345
Prop. spawning dams/sires	62% females 80% males	36% females 63% males
Mean unique pairs/date	18	13

Tank C pair matrices



March 15	MP40	MP29	MP145	MP109	MP35	MP45	MP100	MP116
FP60	6		28	3		8	2	
FP133	13	2			5			
FP64								12

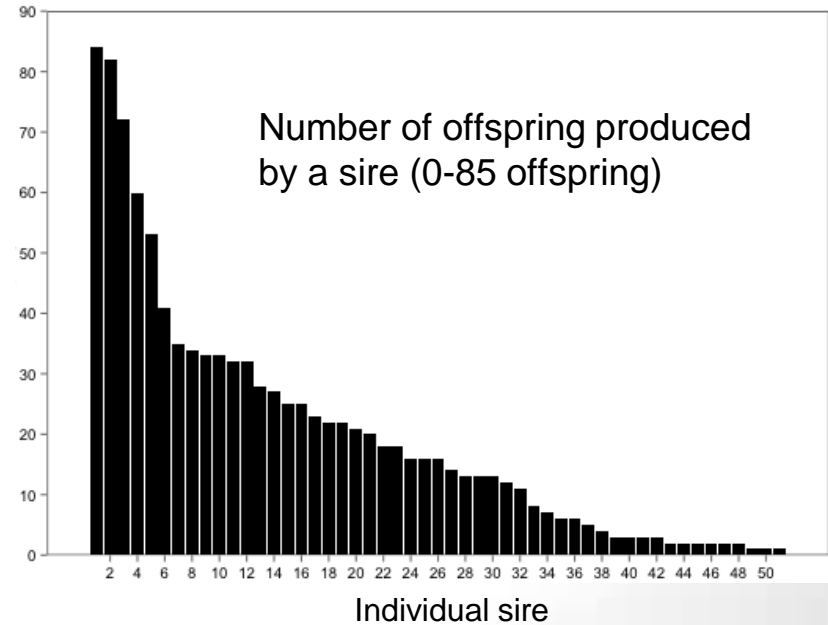
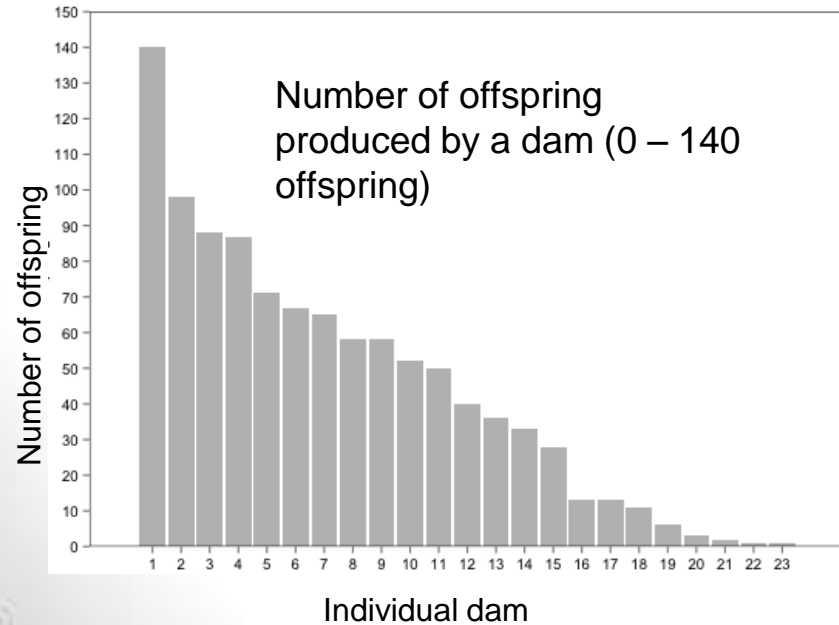
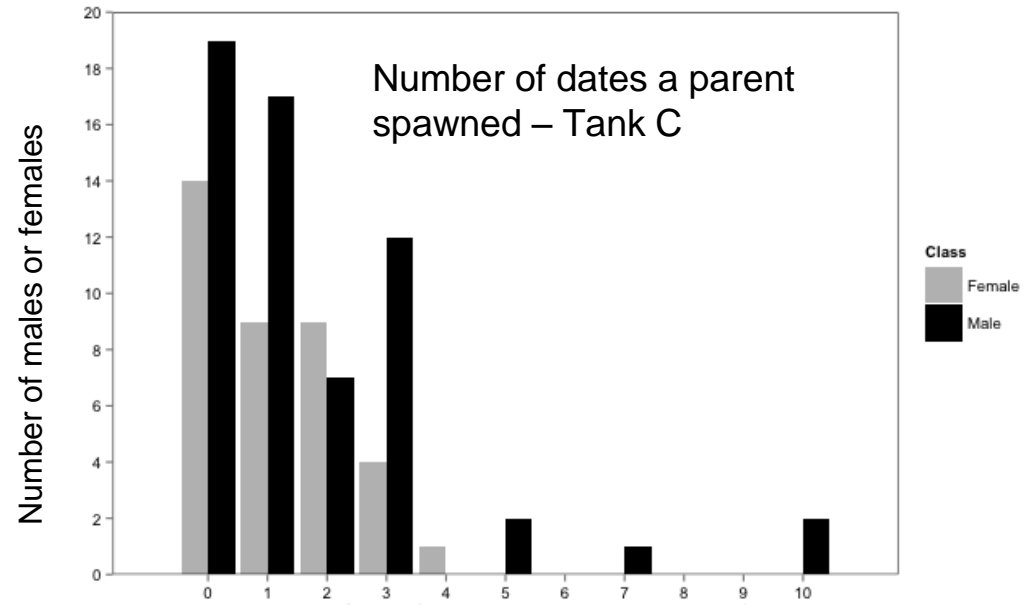
April 2	MP123	MP50	MP140	MP45	MP40	MP115	MP38	MP104	MP44	MP124	MP136
FP126	13	25	3	22	10	1	8	2			2
FP131									1		
FP67										3	

~400 larvae hatched on both dates

Tank C

23/51
dams/sires

	Times spawned	Offspring produced
Dam	≤ 4	0-140 offspring
Sire	≤ 10	0-85 offspring



Pair matrices – Tank D



April 12	MP04	MP10	MP09	MP12	MP06	MP86	MP84
FP17	9	8	31	4	2	1	1
FP18				1	13	3	

N fry hatched: ~ 150

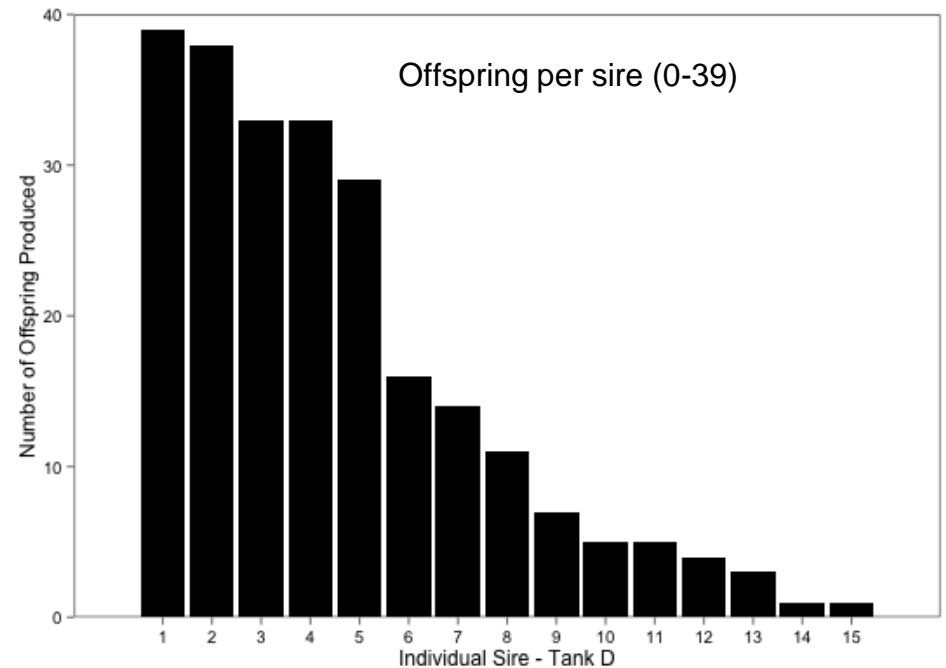
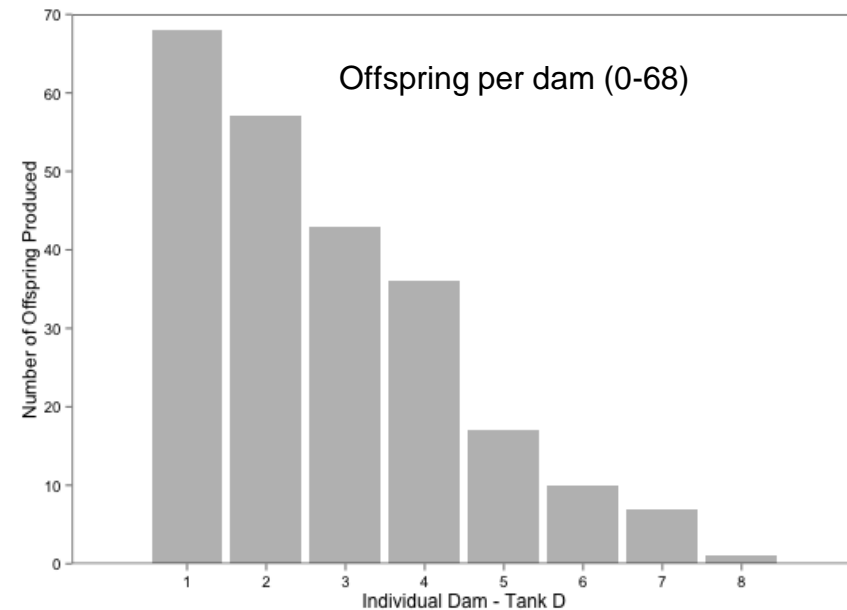
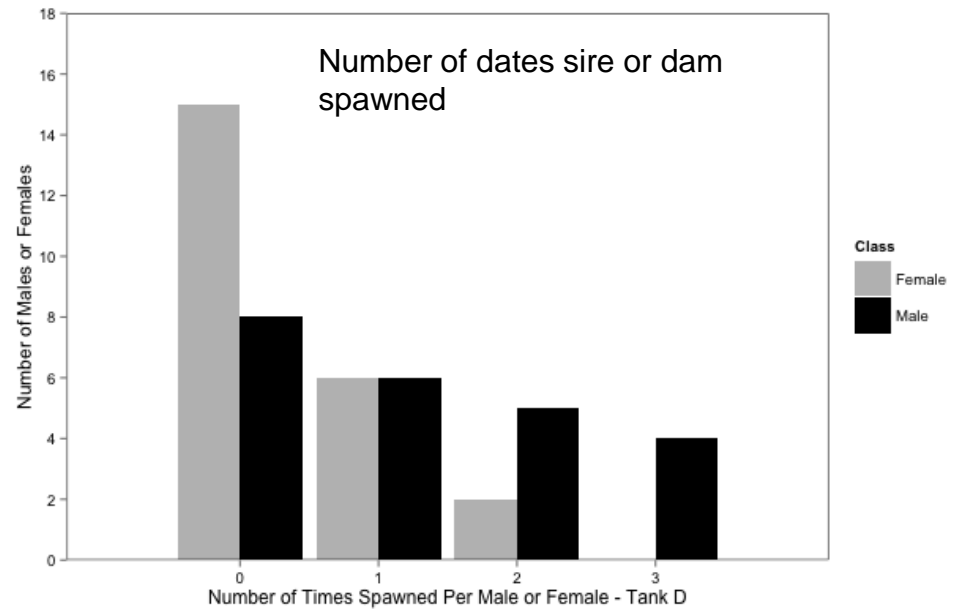
April 25	MP10	MP07	MP06	MP76	MP12	MP79	MP81	MP86	MP77	MP09	MP04
FP14	20	6	17		6		5	3	7	1	2
FP91	1		1	1	4	3					
FP16						1					

N fry hatched: ~ 1,500

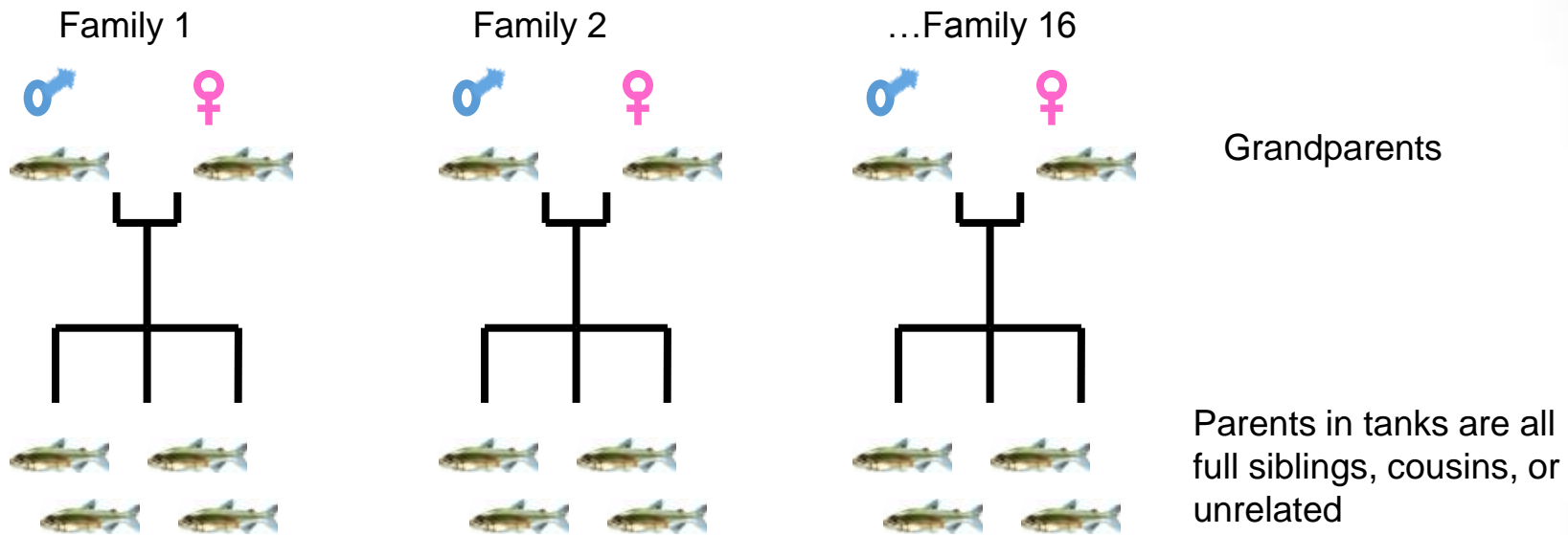
Tank D

8/15 dams/sires

	Times spawned	Offspring produced
Dam	≤ 2 dates	0-68 offspring
Sire	≤ 3 dates	0-39 offspring




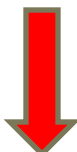





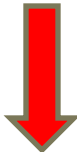
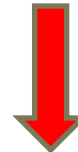
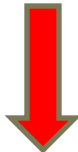


Do delta smelt avoid mating with siblings?



Delta smelt no more likely to mate with siblings than non-siblings.
(Chi square test, $p > 0.05$)

Genetic diversity

Tank	Mean N_a	H_o	H_e
A			
B			
C			
D			

Overall reduction in genetic diversity from parent tank to all offspring tanks combined

Take home points

- Delta smelt mating is non-random
- A few highly successful individuals/pairs
- Delta smelt adults do not avoid mating with siblings
- Genetic diversity decreases



Next Steps



- Additional replicates
- Examine morphology/age/genotypes of highly successful females and males
- Additional tanks with 25 males/25 females
- Place completely unrelated individuals in tanks
- Infrared cameras to observe spawning events

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