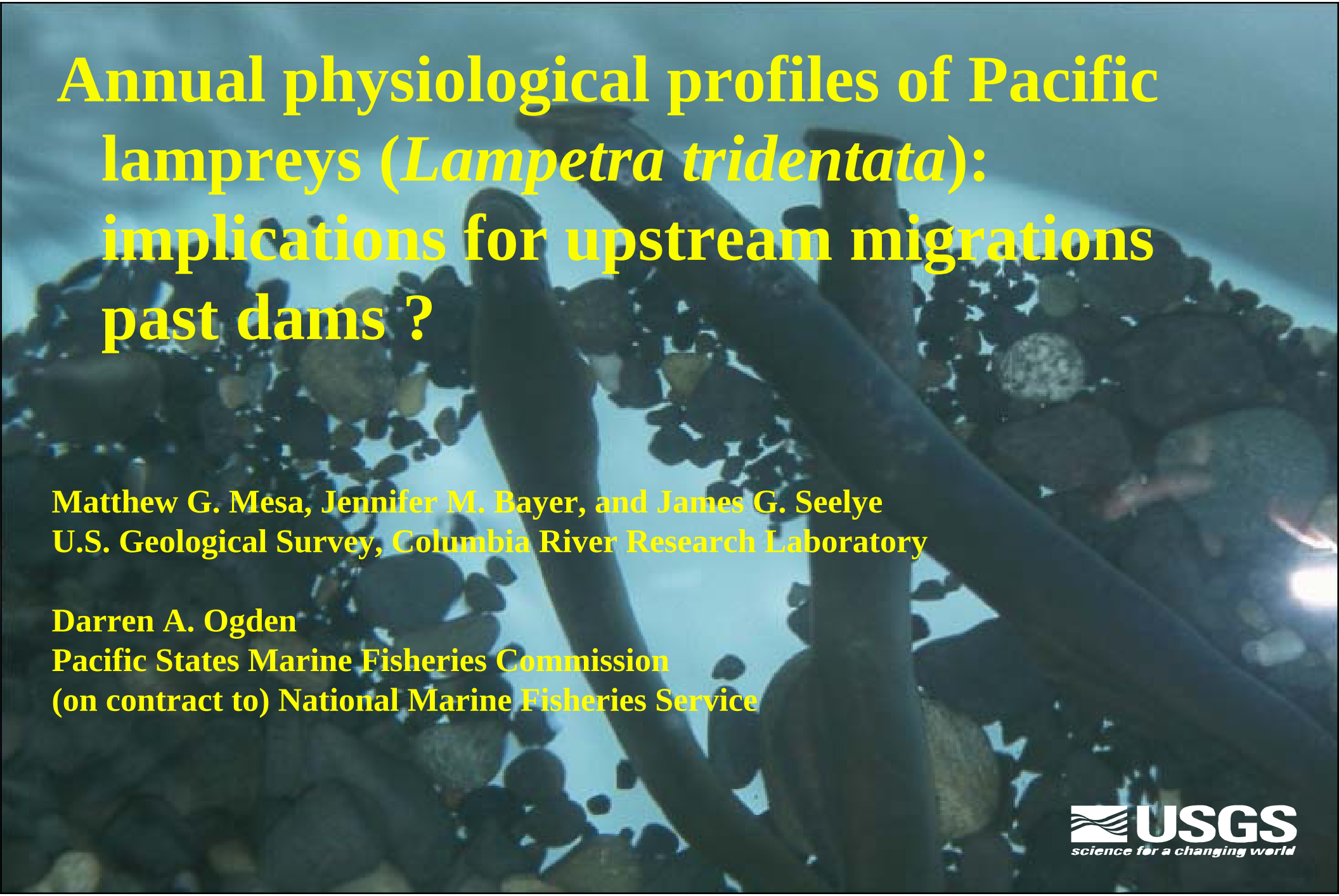

Annual physiological profiles of Pacific lampreys (*Lampetra tridentata*): implications for upstream migrations past dams ?

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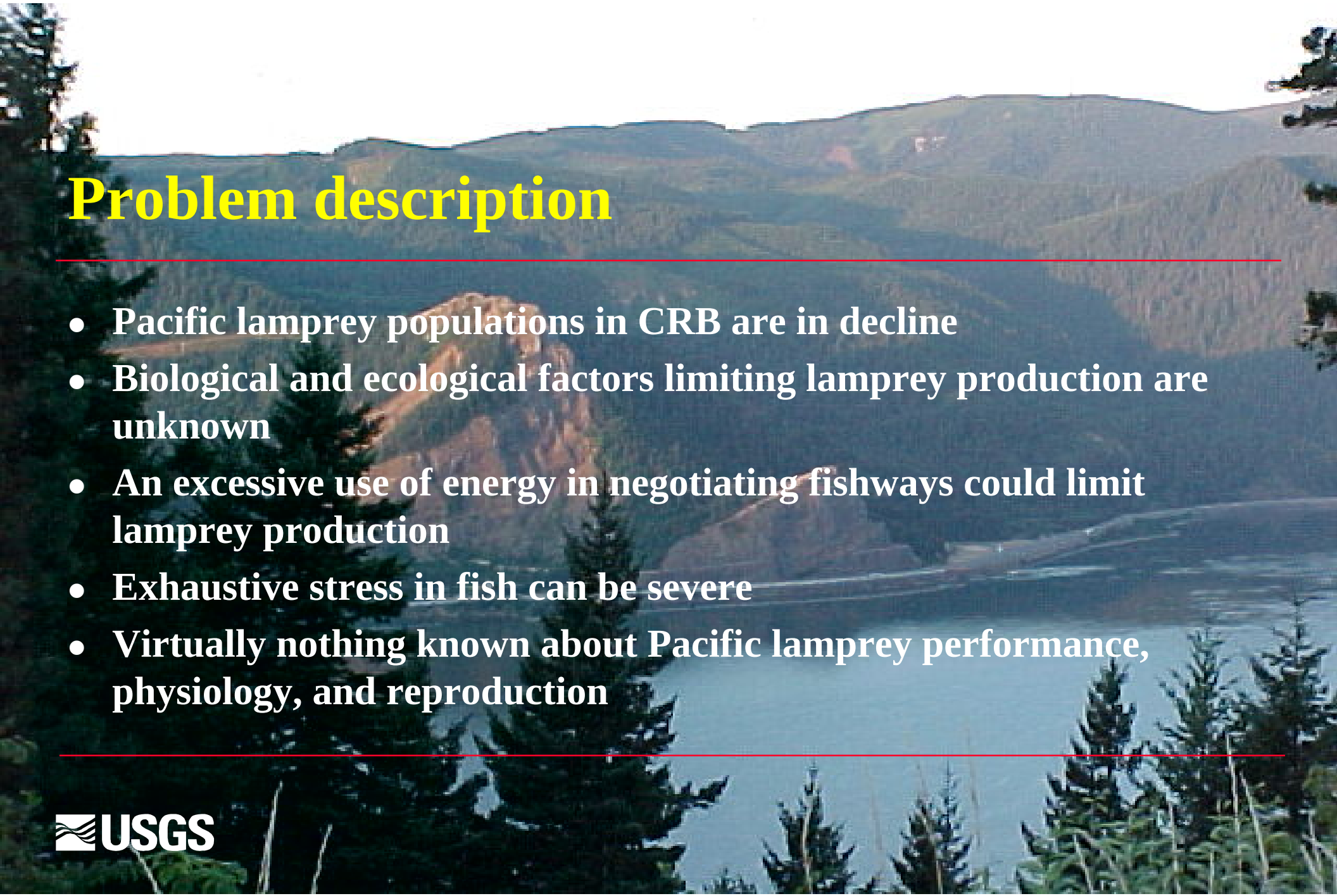

Problem description

- Pacific lamprey populations in CRB are in decline
- Biological and ecological factors limiting lamprey production are unknown
- An excessive use of energy in negotiating fishways could limit lamprey production
- Exhaustive stress in fish can be severe
- Virtually nothing known about Pacific lamprey performance, physiology, and reproduction

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Objectives

1. Determine the critical swimming speed and physiological responses to exhaustive stress of radio-tagged and untagged Pacific lampreys
2. Examine the relation between telemetered EMGs, VO_2, and physiological indicators of stress in Pacific lampreys during prolonged swimming performance
3. Using telemetered EMGs and laboratory information, assess the metabolic costs of wild Pacific lampreys as they move through the upstream fish passage facilities at Bonneville Dam
4. Document sex steroid and other physiological profiles for Pacific lampreys on an annual basis

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Background/justification: physiological profiles

- High % of lampreys fail to pass BON: is it because they *can't* or because they *don't* want to?
- Upstream migrating adults at least one year from spawning
- Physical constraints in fishways significant, but is that all?
- Possible underlying physiological basis for a tendency to migrate?

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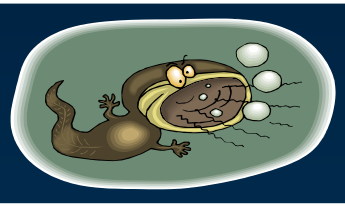
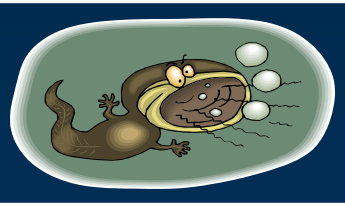
Methods: laboratory study

Collect lampreys from BON
Late summer 2000
Early summer 2002



N = 20



N = 20

1. **Rear lampreys in living streams with substrate, simulated photoperiod**

2. **Sample blood from fish every 6 weeks until spawning**

3. **Monitor morphological changes**

4. **Assay samples for sex steroids, thyroid hormones, nutritional factors, etc.**

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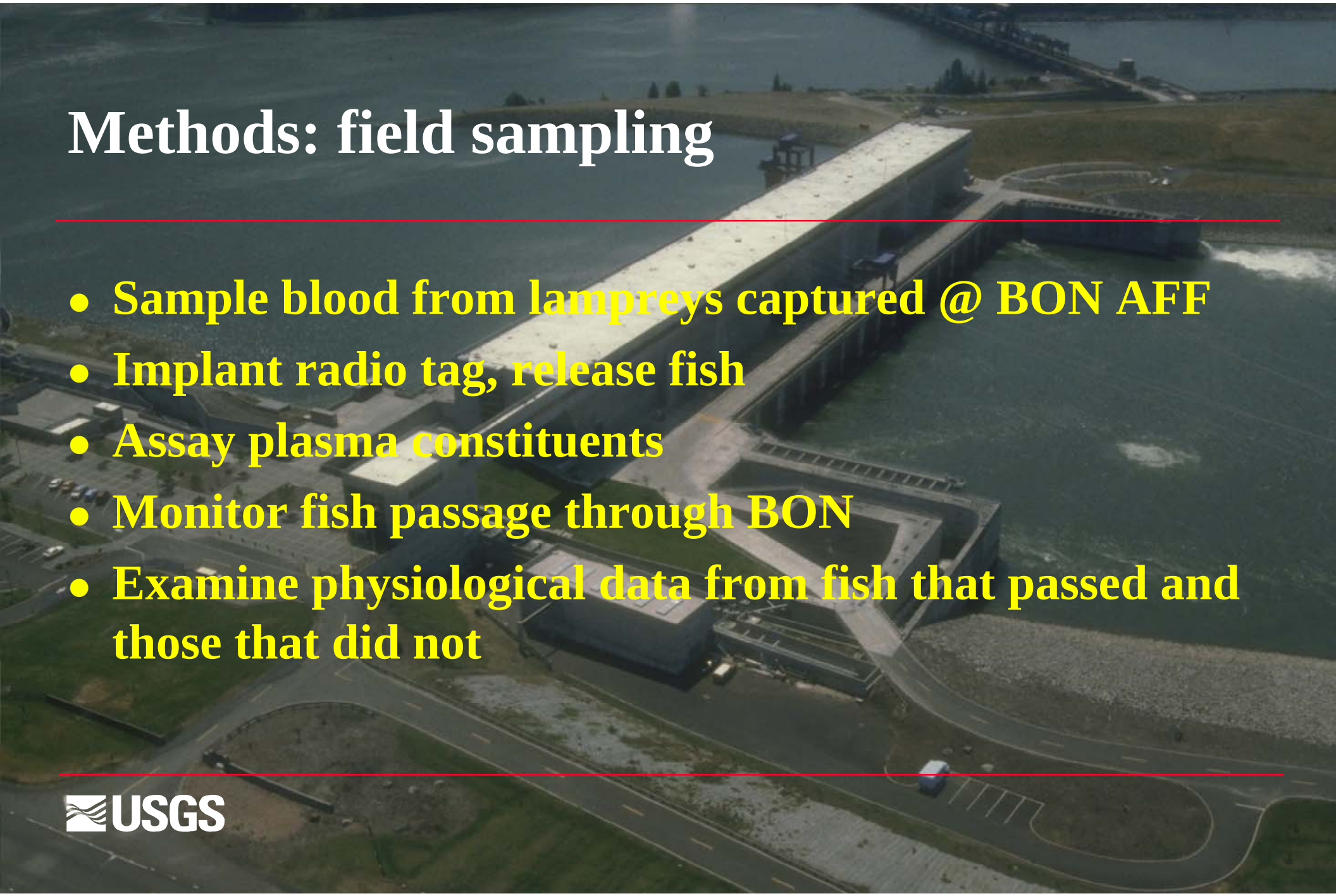

Methods: field sampling

- Sample blood from lampreys captured @ BON AFF
- Implant radio tag, release fish
- Assay plasma constituents
- Monitor fish passage through BON
- Examine physiological data from fish that passed and those that did not

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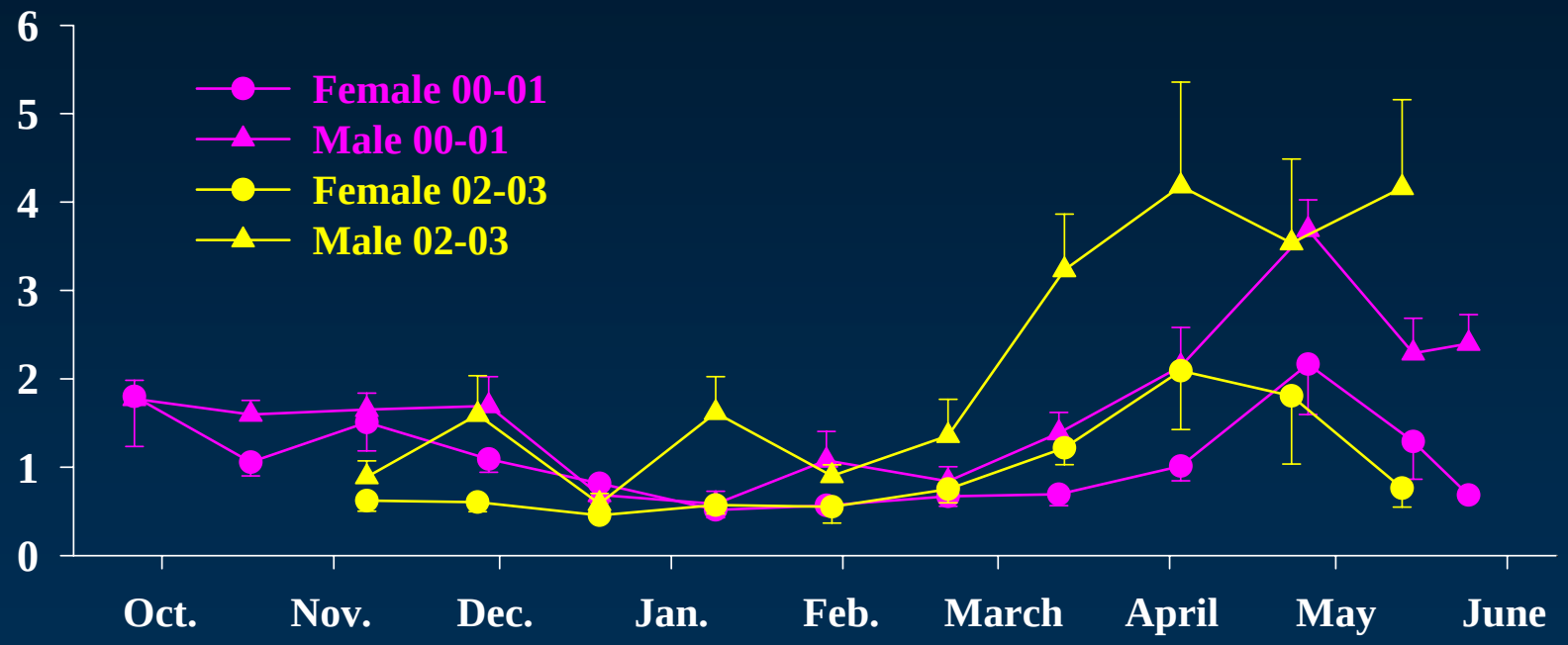
Laboratory results: sex steroid profiles

Estradiol (ng/mL)



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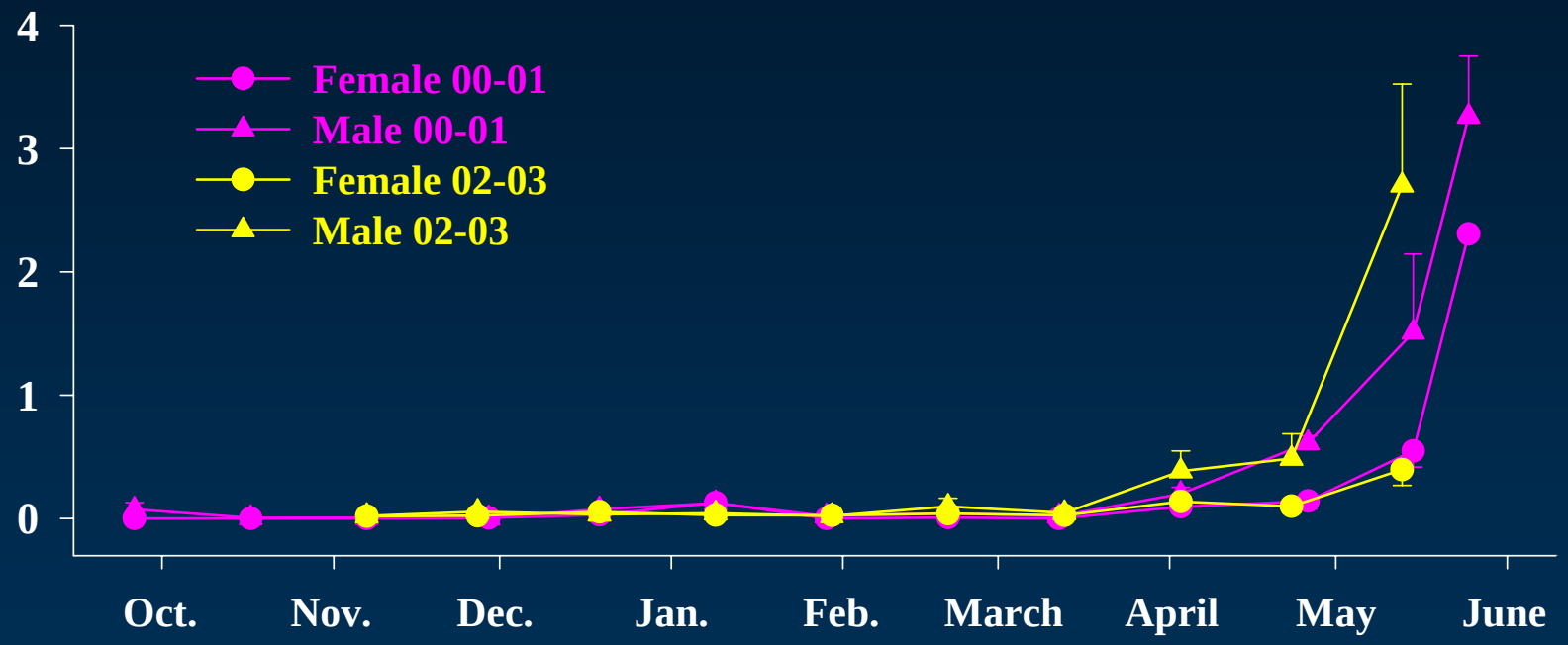
Laboratory results: sex steroid profiles

Progesterone (ng/mL)



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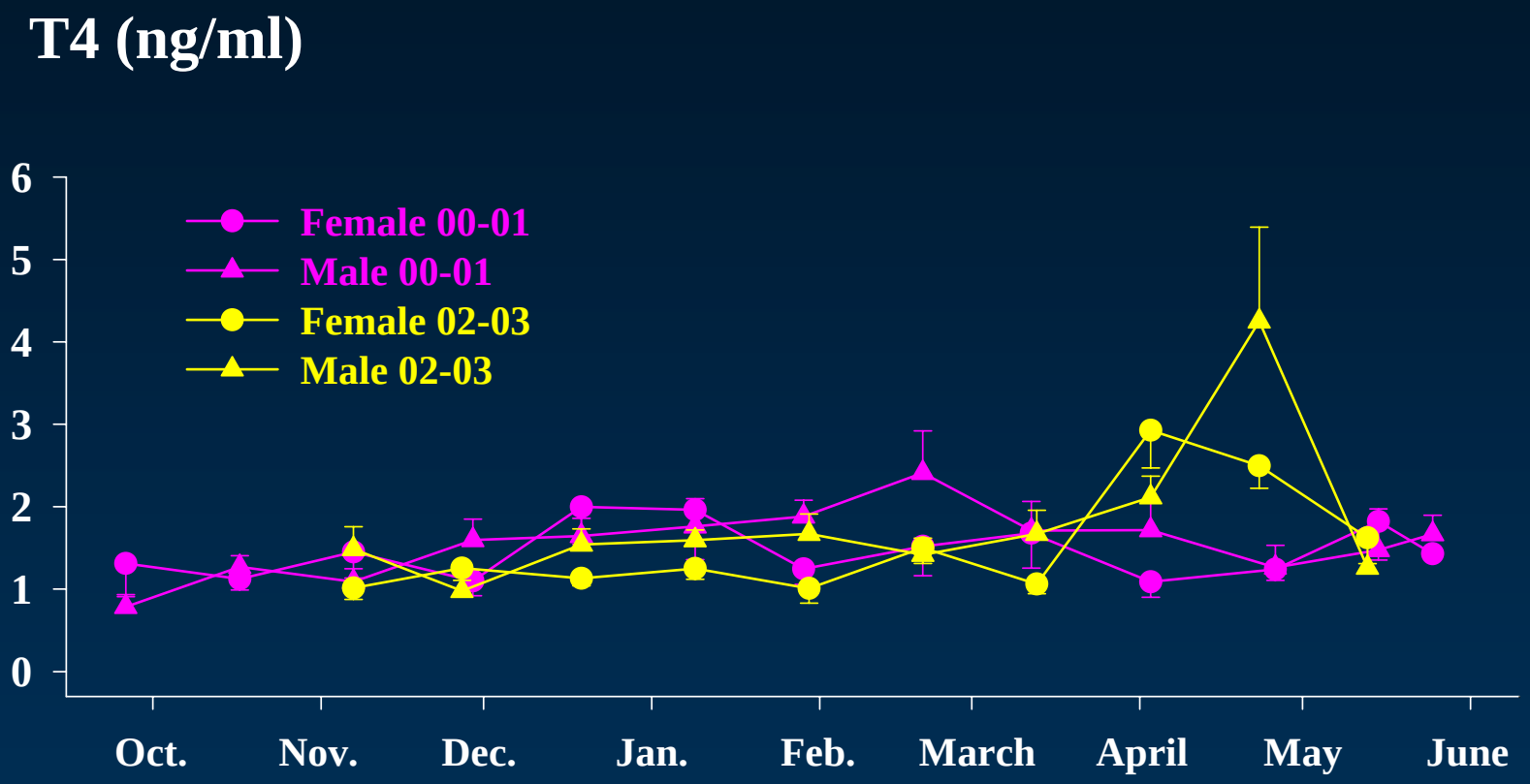
Laboratory results: thyroxine



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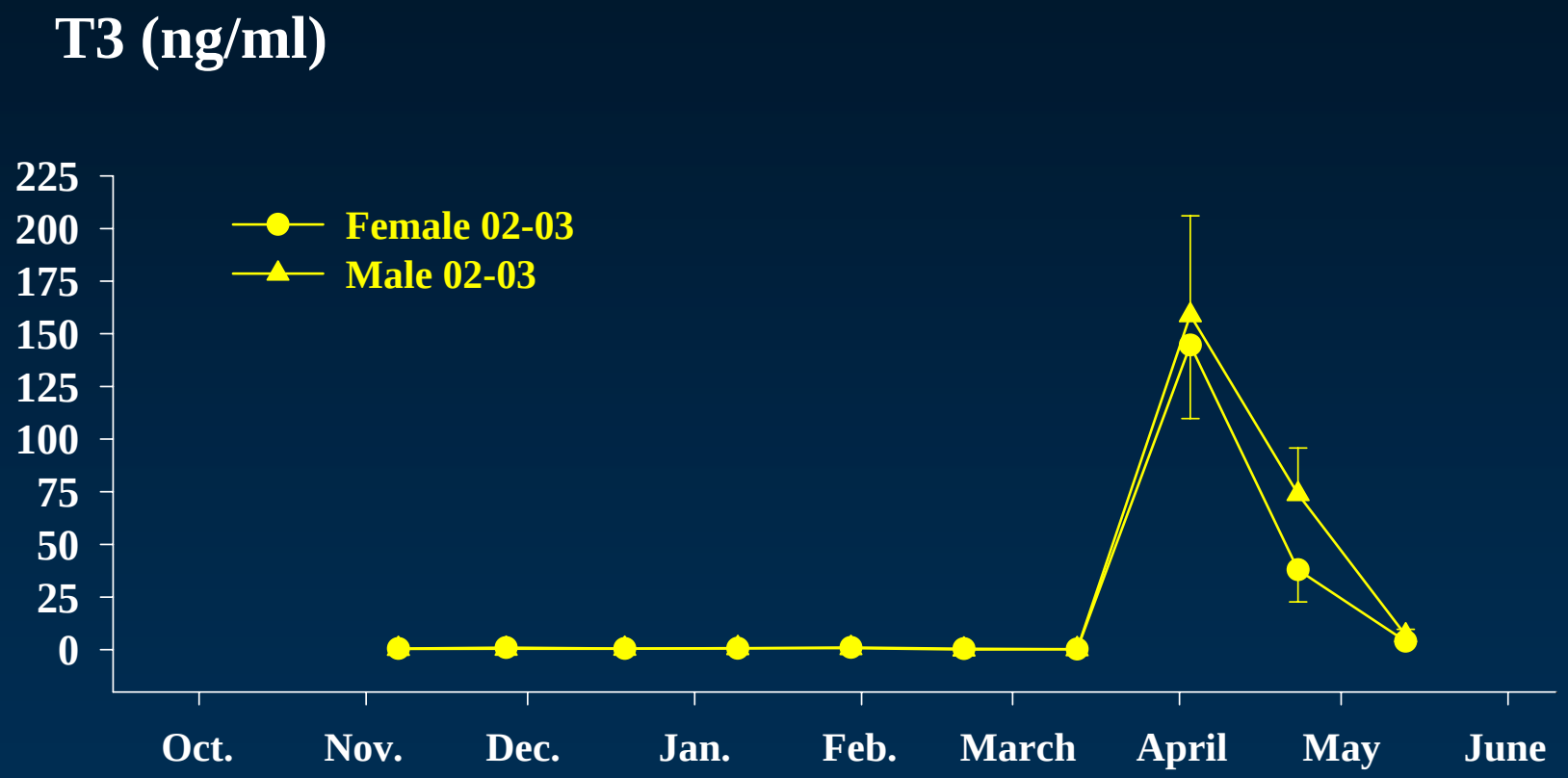
Laboratory results: triiodothyronine



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Field results: sample dates & numbers

2000-2001				2002-2003			
Sample Dates	Females	Males	Total	Sample Dates	Females	Males	Total
6/7 – 6/8	7	5	12	6/3 – 6/7	14	5	19
6/11 – 6/14	16	16	32	6/10 – 6/14	8	15	23
6/19 – 6/22	15	10	25	6/17 – 6/22	16	7	23
6/25 – 6/28	11	9	20	6/24 – 6/27	8	7	15
7/2 – 7/5	10	5	15	7/1 – 7/3	10	5	15
7/9 – 712	13	7	20	7/8 – 710	13	7	8
7/23 –7/25	9	4	13	7/15 –7/19	9	4	14
8/21 – 8/24	8	3	11	7/22 – 7/26	8	3	15
8/27 – 8/31	12	13	25	7/29 – 8/2	5	8	13
				8/5 – 8/7	6	2	8
Total	101	72	173	Total	91	62	153

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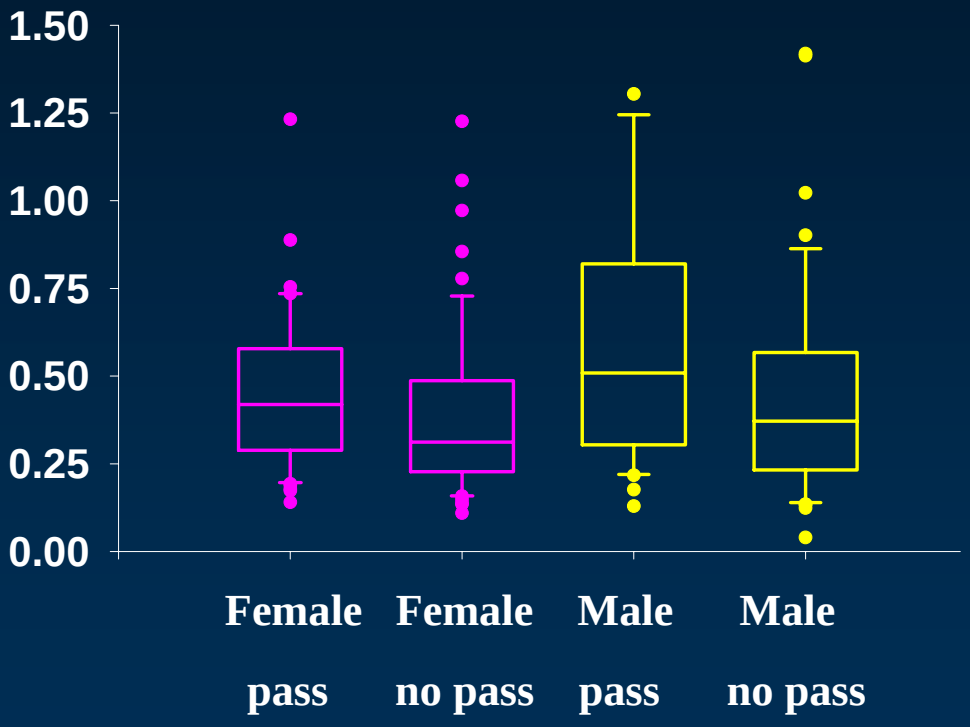
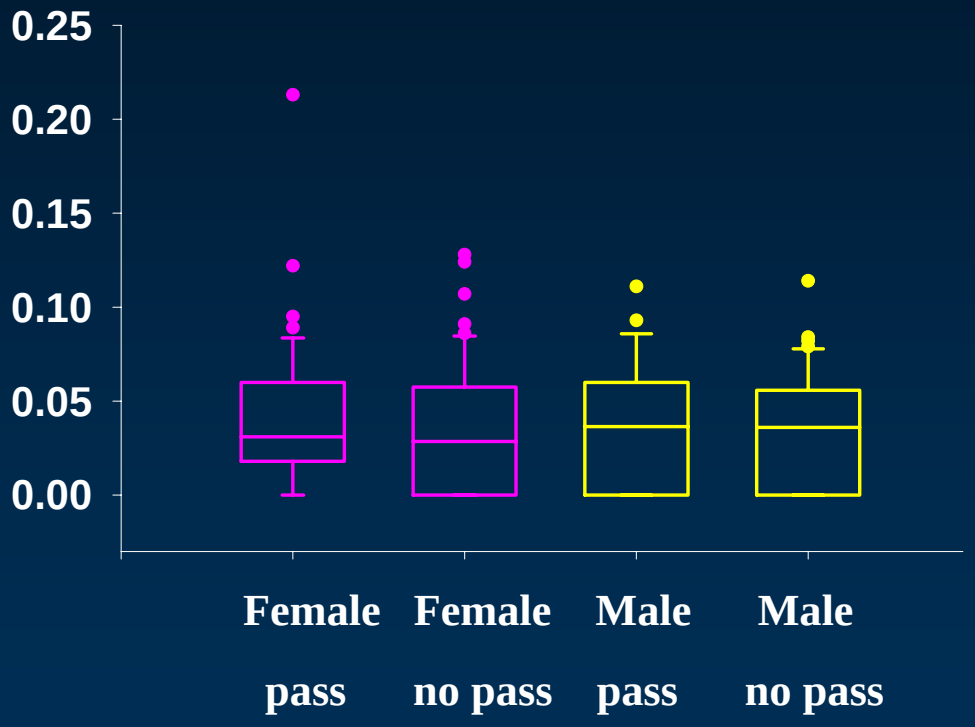
Field results: sex steroids 2000-2001

Estradiol (ng/mL)



Progesterone (ng/mL)



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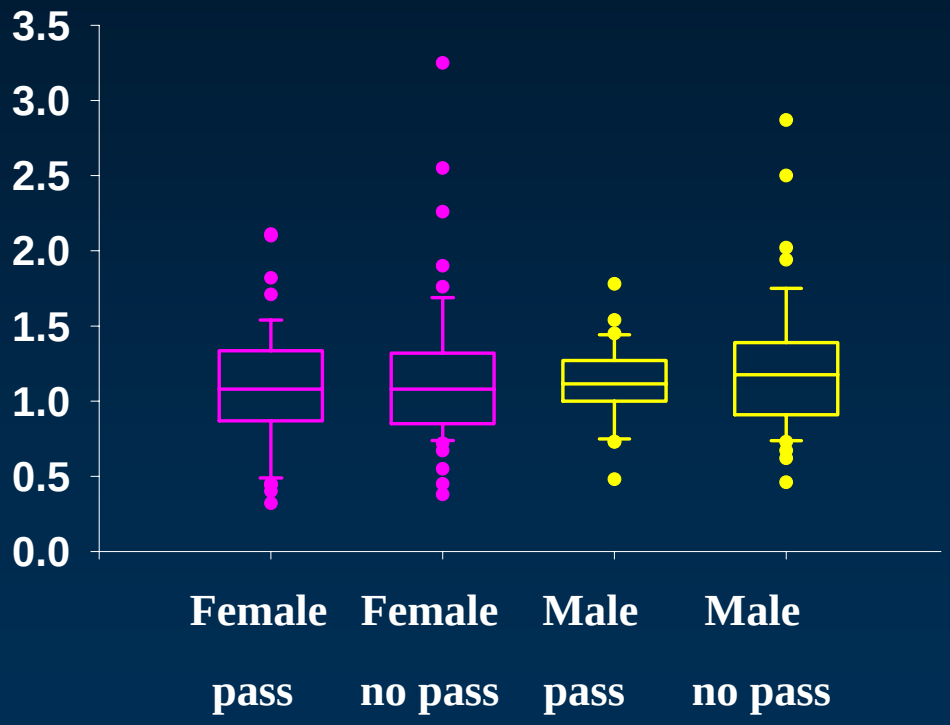
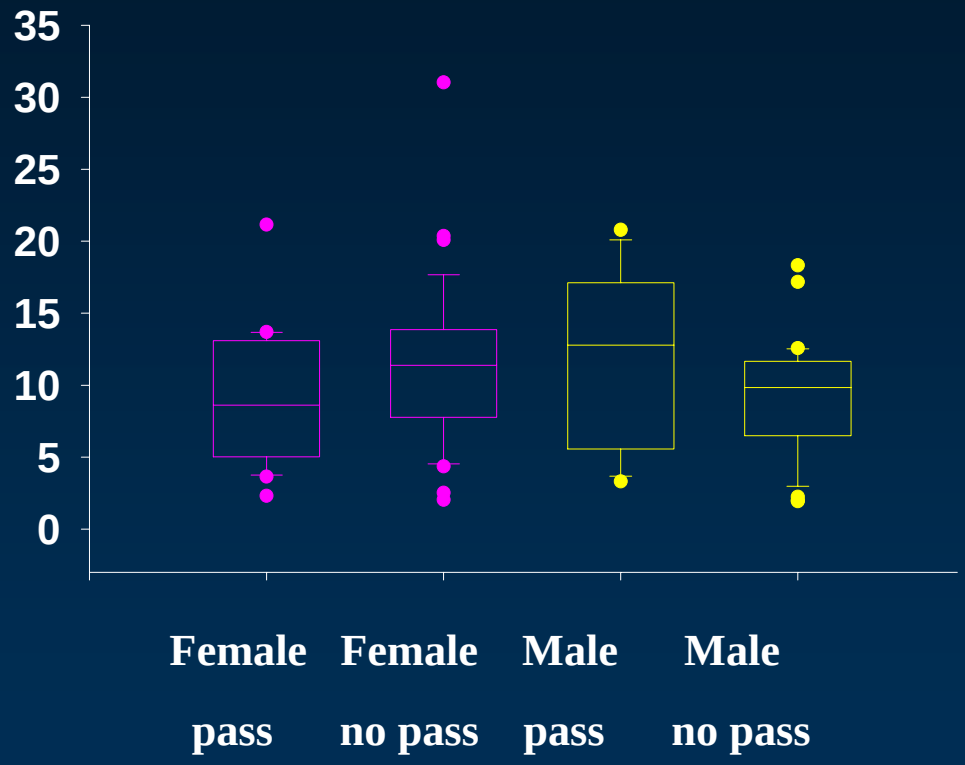
Field results: thyroxine & melatonin 2000-2001

T4 (ng/ml)



Melatonin (pg/ml)



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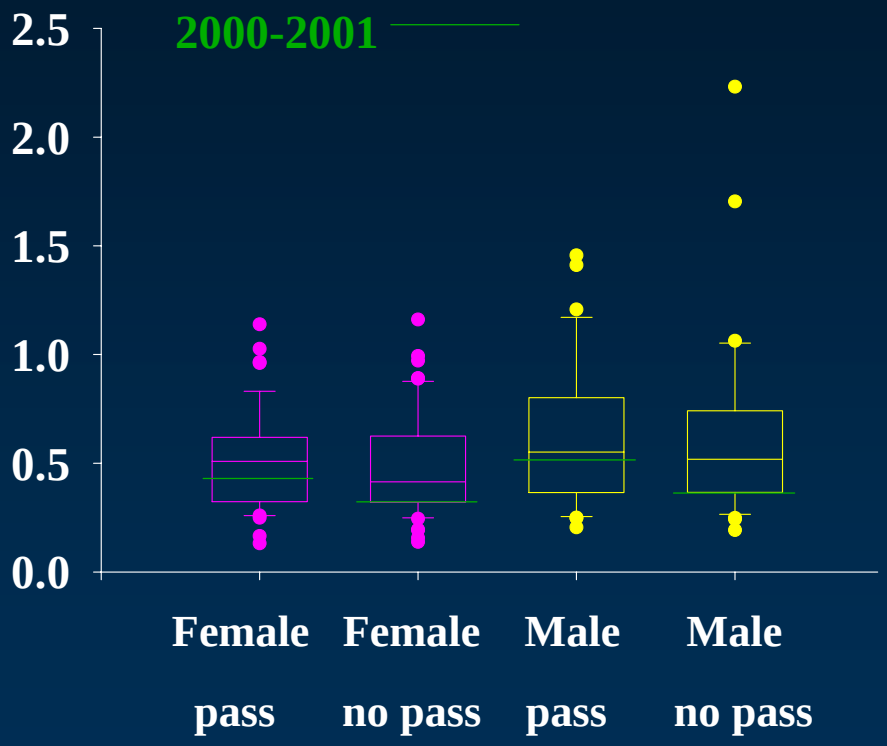
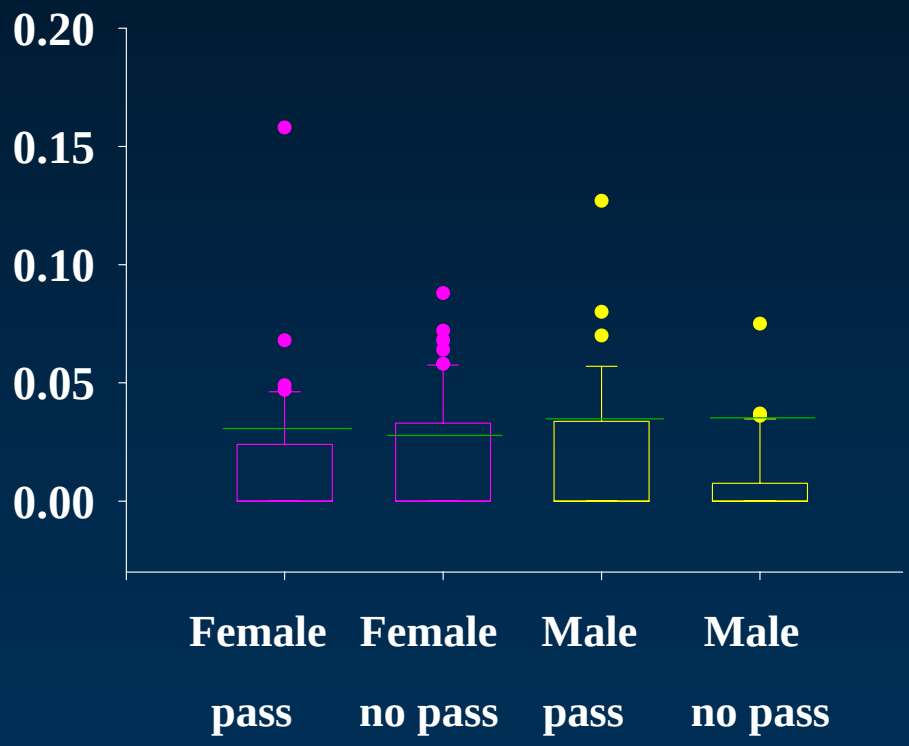
Field results: sex steroids 2002-2003

Estradiol (ng/mL)



Progesterone (ng/mL)



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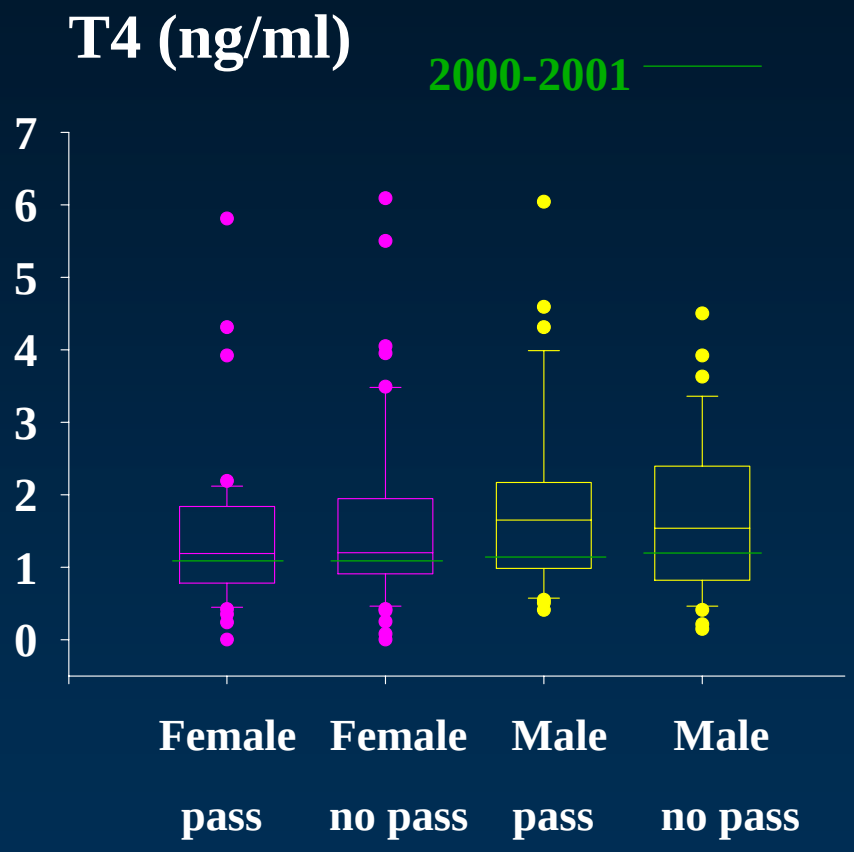
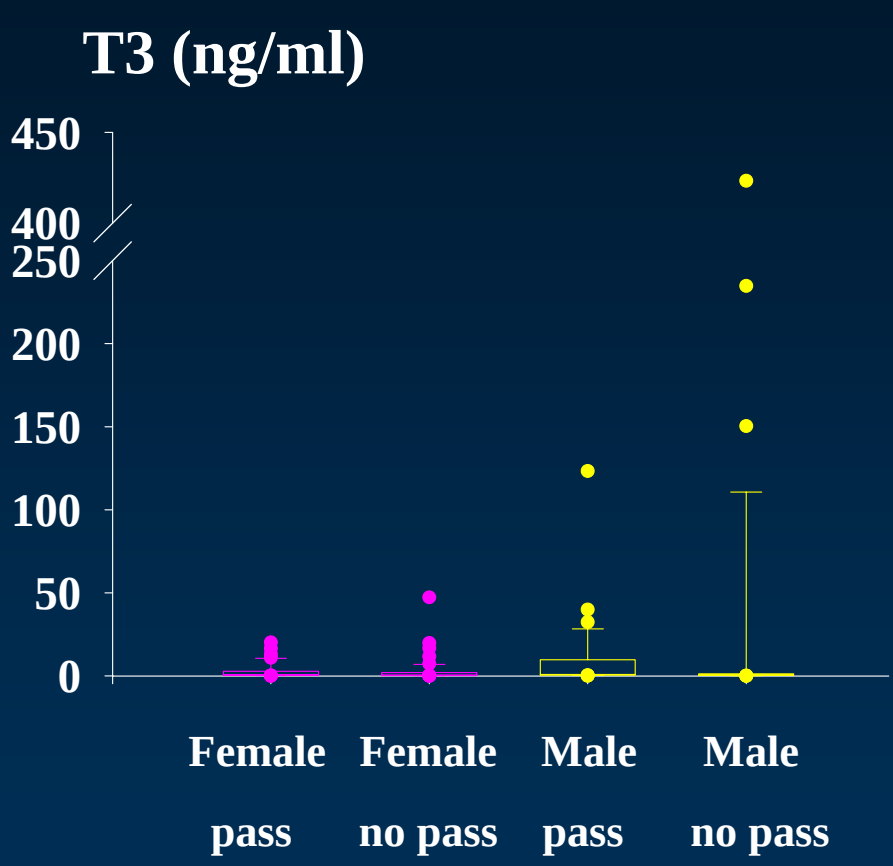
Field results: T4 & T3

2002-2003





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Summary: laboratory study

- First descriptions of morphological and physiological changes during overwintering and final reproductive development in Pacific lampreys
- Changes in E2 & P covaried between genders, correlated with 2° sexual characteristics and peak ripeness, & levels were higher in M than in F
- T4 surges in April in M & F (*02-03 only*)
- Dramatic increase in T3 in early Apr. for M & F

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Summary: field study

- ***2000*: 101 F & 72 M sampled @ BON, 47 F & 27 M passed; *2002*: 91 F & 62 M sampled @ BON, 42 F & 30 M passed**
- **Length and weight of F & E_2 in M that passed the dam significantly greater than those that did not pass (*2000 only*)**
- **Little evidence of a link between physiological status of lampreys @ BON and migratory behavior or motivation**

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