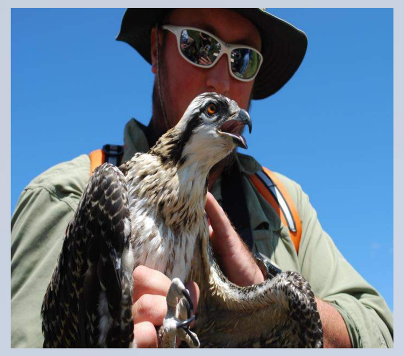
Osprey Habitat Suitability in West- Central Idaho: Impacts of Prey Abundance On Osprey Breeding Success


Zach Sanchez[1], Annie Baxter[1], J. Tyrell Styhl[1], Dusty Perkins[1,2], Marc Bechard[3,4,5], Rob Miller[4,6]

College of Western Idaho[1], Dept. of Life Sciences, Technology, Engineering and Mathematics, College of Western Idaho[2], Dept. of Life Sciences, Boise State University[3], Dept. of Biological Sciences, Raptor Research Center, Division of Research, Boise State University[4], College of Arts and Sciences, Boise State University[5], Intermountain Bird Observatory, Boise State University[6]

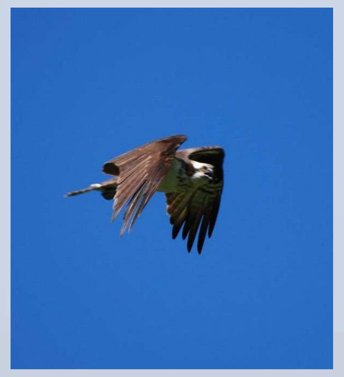


Background

- Ospreys (*Pandion haliaetus*) are fish-eating, top apex-predators of aquatic ecosystems that are adapted to human landscapes and sensitive to a variety of ecosystem changes. These characteristics make them a useful sentinel species for monitoring human-caused ecosystem changes (Grove et al. 2009).
- Following population declines in the U.S. during the 1950s – 1970s associated with DDT, osprey populations near Lake Cascade have increased dramatically as a result of increased conservation efforts.
- Current reproductive success appears to be variable and several areas are unoccupied despite the existence of apparently suitable habitat. (Poole et al., 2002,Van Daele, Van Daele, & Johnson, 1980).
- Since 2003, fisheries management practices at Lake Cascade have removed native Northern Pikeminnow (top aquatic predator) and Largescale suckers; while stocking non-native yellow perch and hatchery rainbow trout (Allan et al. 2002).
- Since ospreys rely exclusively on fish, impacts on ecosystem productivity and prey availability caused by changes in fisheries management may be revealed by evaluating osprey breeding ecology and success (Van Daele et al., 1980, Perkins, 2006).

Objectives

- We evaluated and quantified prey biomass near osprey nests to better understand how changes in fisheries management and prey availability contribute to osprey habitat suitability, distribution and reproductive success.

Hypothesis and Predictions

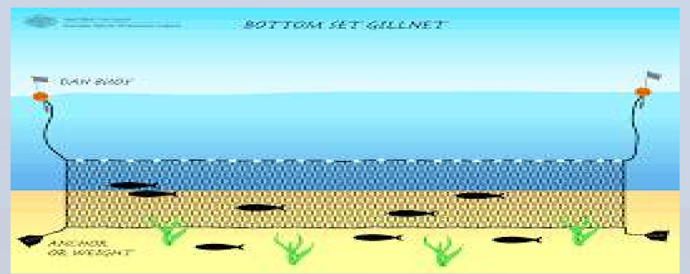
- We hypothesized that osprey reproductive success would be positively correlated with the biomass of preferred prey within 2km of nest locations.
- We predicted osprey nesting success would be positively correlated with benthic feeding fish biomass (large-scale sucker, bullhead). Osprey capture and consume high proportions of these fish; which appear to be particularly vulnerable because they are slow and least aware of attacks from prey above them. (Vana-Miller, 1987, Van Daele and Van Daele 1982, Perkins 2006, USFWS, 2000).

Methods

Field Work-
- Monitored 129 nesting territories and determined occupancy in early breeding season
- Assessed nesting success of occupied osprey nests at 80% nestling fledging age.

Data Analysis –
- Fisheries data was collected by Idaho Department of Fish and Game (IDFG) in McCall during gill netting efforts at pre-determined sites in the Fall of 2013 and 2014.
- Due to limited time and resources, only a representative sample of fish masses (10mm length classes) were recorded.
- We constructed power and polynomial regression models to estimate fish mass (Kg) from midpoint length class.
- Generated composite estimated biomass valued for each species at each nest site.
- Employed a multivariate generalized linear model with model selection procedures to evaluate the relative importance of prey species biomass in relation to osprey nesting success.





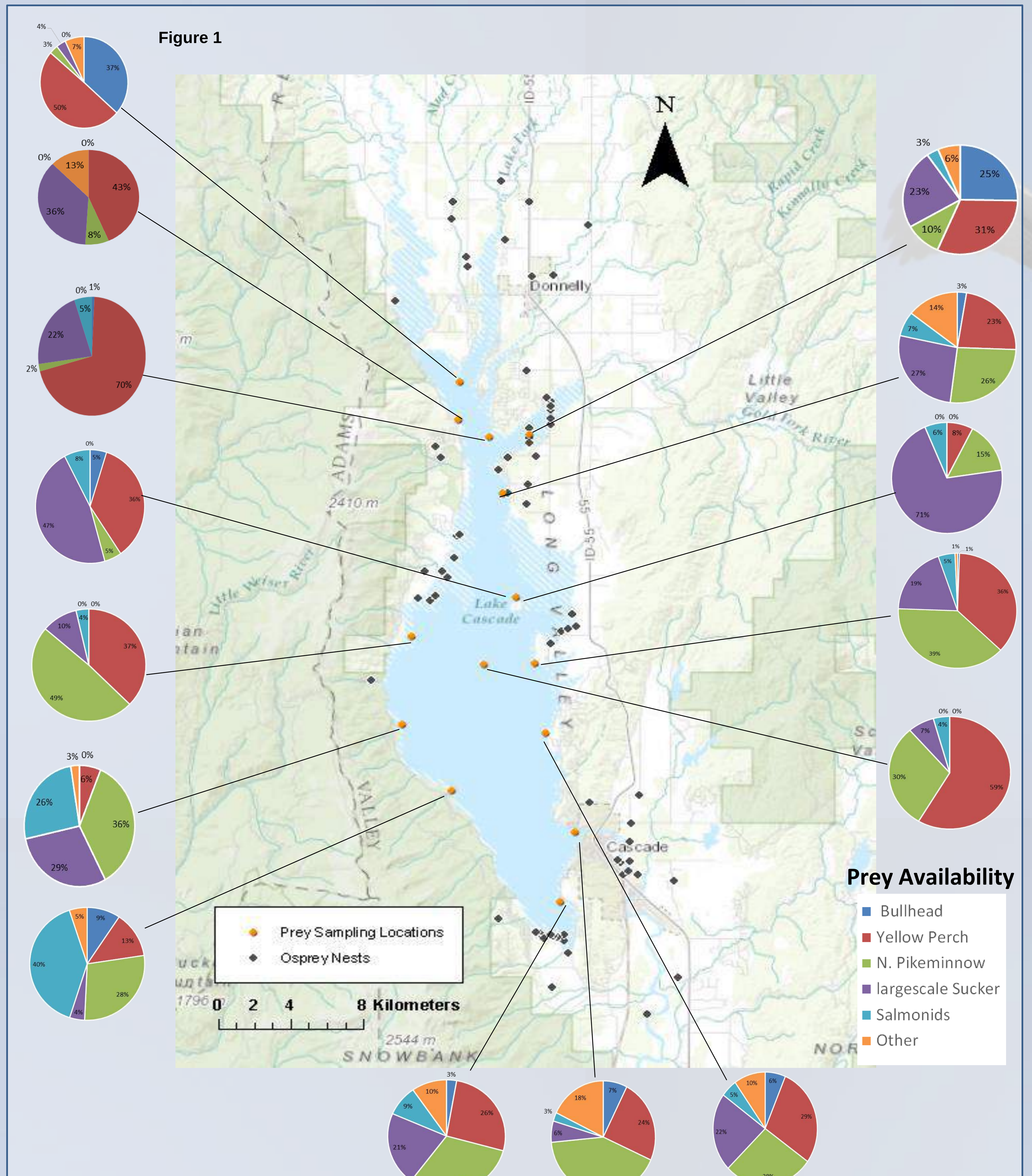


Table 1

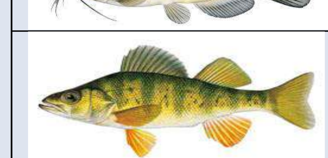
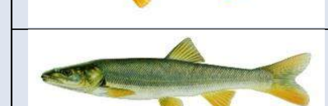
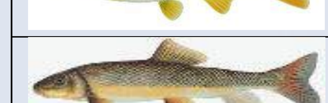
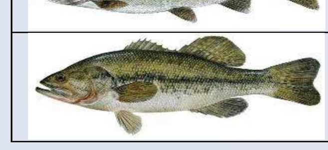
Prey Species Image	Prey Species Name	MIN	MAX	RANGE	MEAN ± Std. Er.	MEDIAN	Individuals Sampled	Total Est. Biomass (kg)	Percent Total Biomass
	**Bullhead**	0.00	25.17	25.17	5.45 ±0.99	2.81	134	44.37	3%
	**Yellow Perch**	0.43	70.50	70.06	19.57 ± 2.10	12.54	441	504.80	39%
	**Northern Pike Minnow**	0.25	76.98	76.73	15.28 ± 2.30	10.22	335	339.98	27%
	**Large-scale Sucker**	0.27	60.90	60.63	15.82 ± 2.06	10.04	303	278.19	22%
	**Salmonids[1]**	0.00	10.85	10.85	3.25 ± 0.35	3.38	75	66.14	5%
	**Other[2]**	0.00	14.95	14.95	4.20 ± 0.48	4.58	90	46.58	4%

Figure 1: Map of Long Valley, Idaho with occupied Osprey nests and prey sampling locations used for prey availability analysis during the 2015 breeding season. **Table 1**: Descriptive statistics of available fish biomass near 69 occupied osprey nests (estimated using fall gill-net sampling data). [1]Salmonids included: mountain whitefish, trout, salmon. [2]Other Included: pumpkinseed, bass, crappie.

Results

- Of 69 occupied nests, 51 (74%) were successful.
- 88% of prey biomass near osprey nests was from Yellow Perch (39%) , Northern Pikeminnow (27%) and Largescale Suckers (22%).
- Bullheads accounted for the least overall biomass (3%) among prey (Table 1).
- GLM results suggest none of the prey biomass variables we evaluated predict osprey nesting success significantly better than the null model (Table 2).

Model	(Intrc)	Blhd	Other	Pkmnw	Prch	Salm	Sckr	Total	df	delta AIC
1.00	1.05								3.00	0.00
3.00	1.09		0.42						4.00	-0.59
5.00	1.09			0.41					4.00	-0.63
2.00	1.06	-0.22							4.00	-1.90
4.00	1.11	-0.35	0.50						5.00	1.95
17.00	1.06				0.18				4.00	-2.00

Table 2: Ranking of the best generalized mixed linear models (within 2 AIC of the top model) as functions of the available biomass of six prey class variables at 69 osprey nests.

Conclusions

- There appears to be no supportable correlations among the abundance of the prey species we evaluated and osprey nesting success.

Alternative hypotheses:
- Osprey prey selection may vary from what is expressed in literature (Van Daele and Van Daele 1982, Perkins 2006). Ospreys are known to consume a variety of species. Vana-Miller (1987) suggests actual prey species may be less critical than the abundance of catchable size classes.
- Abundance estimates may be discordant with what ospreys can capture.
  - Estimates include "uncatchable" (>400 mm) size classes
  - Fall prey sampling may not accurately reflect breeding season fish biomass
  - Osprey may be foraging in areas beyond our sampling range
- Other more influential factors?: land use and cover (Tavares et al. 2015),water characteristics in foraging areas and contaminates (Toschik et al. 2006), as well as human disturbance (Van Daele and Van Daele 1982).
- Optimal Foraging Theory (MacArthur et al. 1966) and Marginal Value Theorem (Charnov 1976) may explain foraging patterns throughout resource patches.

Future Directions/Improvements/Research:
- Re-evaluate how species biomass is determined
- Estimate prey selection by using prey remains or documenting prey deliveries.
- Determine foraging ranges using radio telemetry or GIS transmitters to determine how well biomass estimates represent biomass available to osprey.
- Devise more accurate methods to sample for fish during the breeding season.
- Analyze prey data using percent biomass and frequency as input variables.

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