

ECOLOGY OF EMERALD BAY: THREATS FROM NEWLY ESTABLISHED INVASIVE SPECIES AND OPPORTUNITIES FOR DEVELOPING A MANAGED NATIVE-NONNATIVE FISHERY?

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California State Lands

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Tahoe Baikal Institute participants 2005

Some photos courtesy of Tom Bachand

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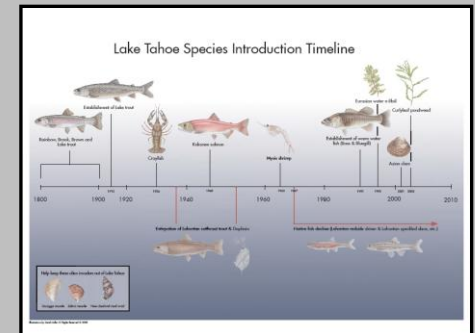
Davis TERC, CDFG and NDOW (in kind)

Today's discussion

Ecology of Emerald Bay: A place of few scientific investigations but a home to many visitors



Issues with recent invasions



Fisheries structure, condition, and fishing opportunities?



Emerald Bay- a popular destination for boaters and folks who want a beautiful view of the lake


Top 100 Bay Area Restaurants Sponsored by **seamless** San Francisco Chronicle | SF

Solitude in Tahoe's Emerald Bay

Kayakers can slip into reserved spot at secluded boat-in camp

John Flinn, Chronicle Travel Writer
Sunday, June 29, 2003

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(06-29) 04:00 PDT Lake Tahoe -- As the setting sun turns Emerald Bay gold, the motorboats and Jet Skis go home and all you can hear is the honk of Canada geese and the slurp of kayak paddles.

We're en route to one of the most exclusive addresses in California: a home on the shore of this sublime, fjordlike inlet. Alas, we've not been invited to spend the night at Vikingsholm, the Scandinavian-style castle at the head of the bay. But our accommodations suit us just fine: nylon tents and sleeping bags at the Emerald Bay Boat-In Campground.

At this 20-site camp, inaccessible by road except on rare occasions, we don't have many of the gilded comforts enjoyed by

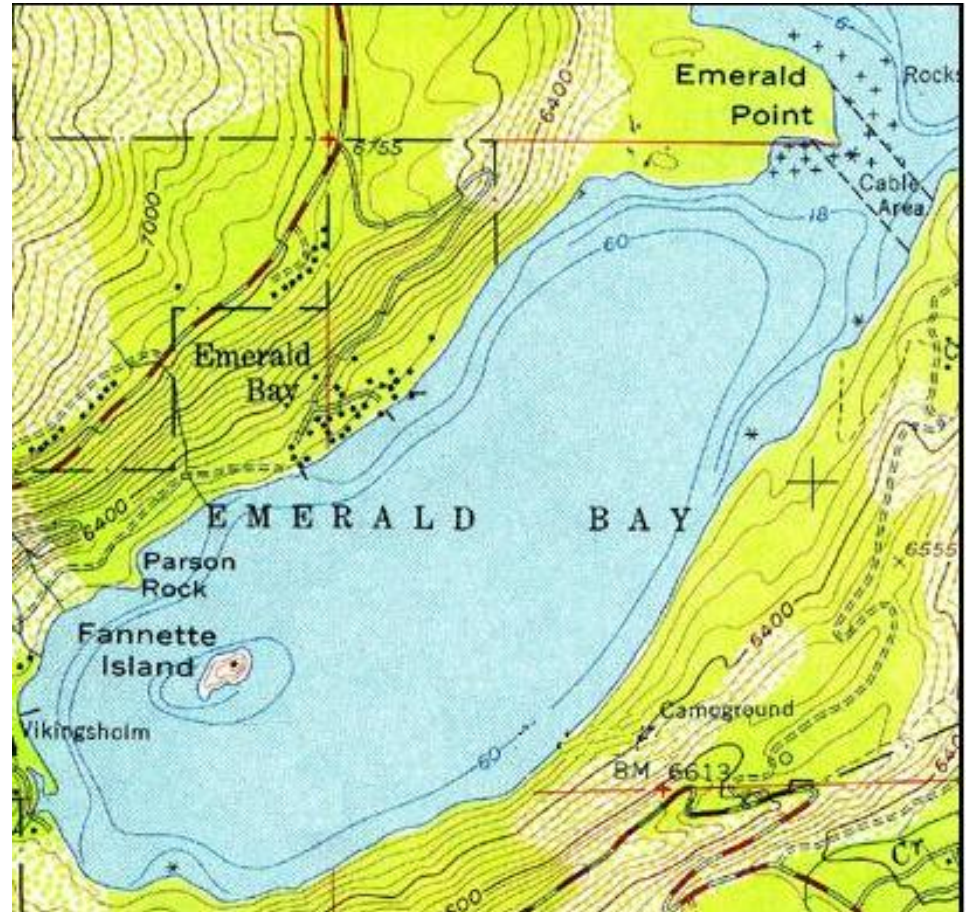
John Flinn

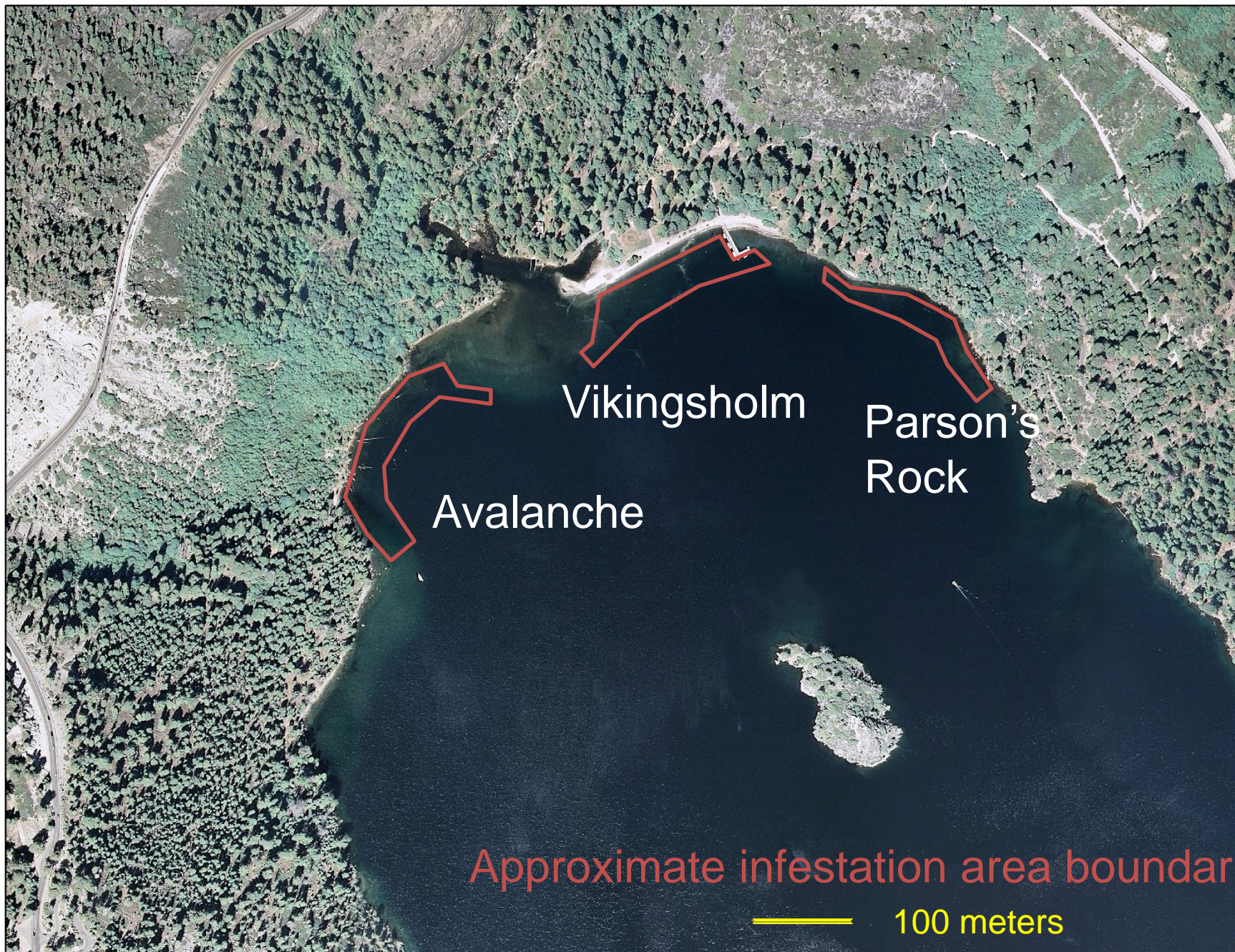


95% of all boaters travel to Emerald Bay regardless of origination
(Wittmann et al, in review)

Very few limnological investigations targeting Emerald Bay

- Emerald bay is relatively limnological isolated to Lake Tahoe, 2-4 m “lip” as it connects to Tahoe
- Similar biological assemblage as Lake Tahoe including mysid shrimp but also contains cladocerans due to the increased productivity (6.5 mg C/ sq per day) compared with Lake Tahoe (0.52 mg C/ sq m per day)
- Limited sampling during the 1960s bistate surveys
- Late 1980s fisheries surveys by UC Davis
- UNR/ UCD investigations 2005, 2011
- California State Lands, TRCG plant surveys and control





Vikingsholm

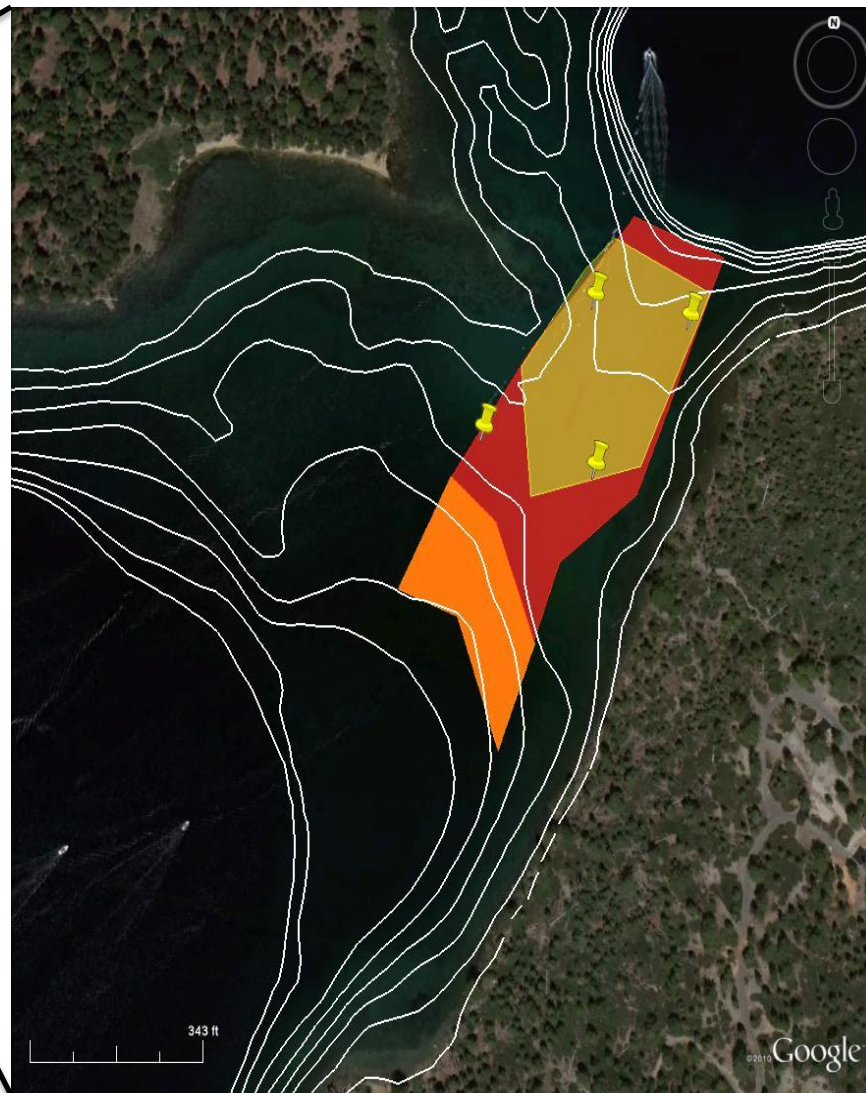
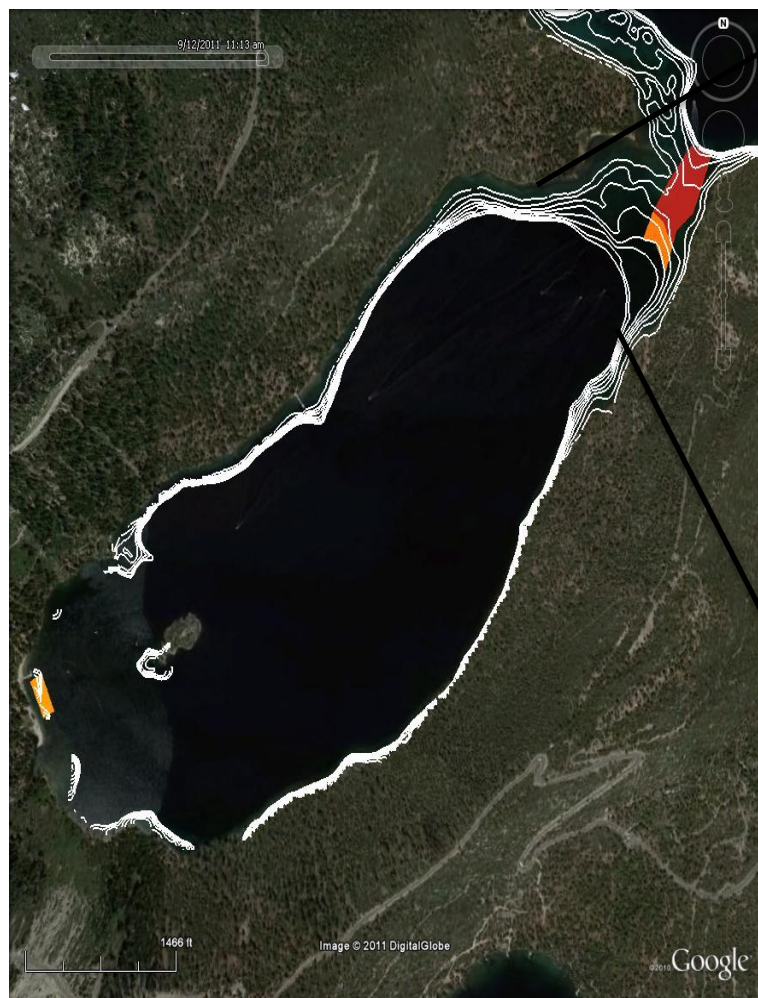
Parson's
Rock

Avalanche

Approximate infestation area boundaries

100 meters

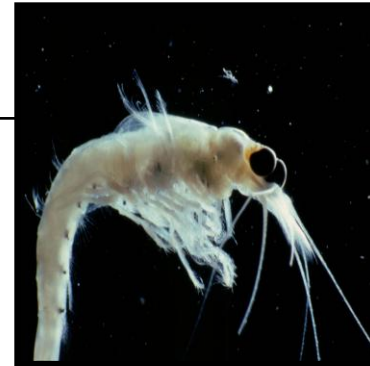
Clam infestation in Emerald Bay



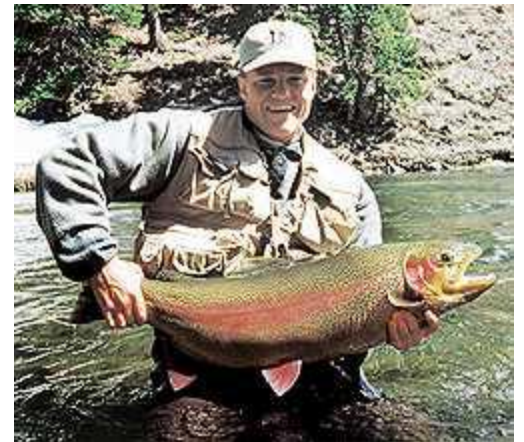
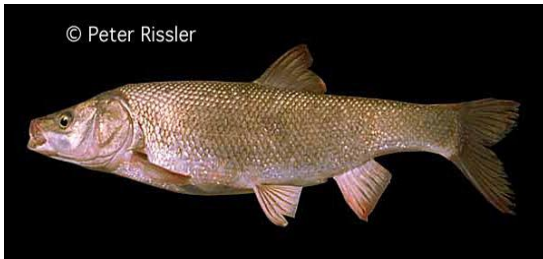
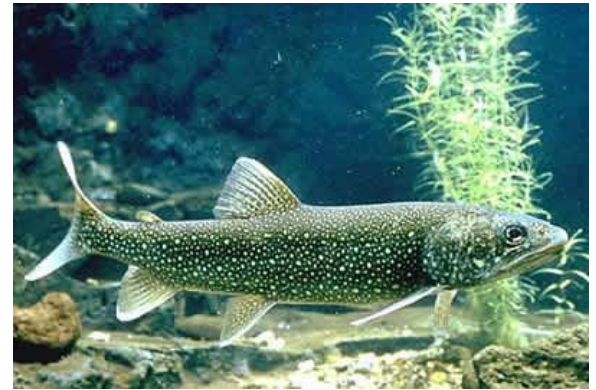
Allen, Webb, Gamble, UC Davis TERC

Emerald Bay now contains the largest number of invasive species next to the Tahoe Keys, still large native compliment of species

Native	Tahoe keys	Emerald Bay
tui chub	X	X
tahoe sucker	X	X
lahontan reddsides	X	X
speckled dace	X	X
mountain white fish	X	X
Established Nonnative Coldwater fishes		
rainbow trout	X	X
lake trout		X
brook trout	X	
german brown trout	X	X
kokanee salmon		X
Established Invasive warmwater fishes, invertebrates, and plants		
largemouth bass	X	X
bluegill	X	X
brown bullhead catfish	X	X
goldfish	X	
golden shiners	X	
smallmouth bass	X	
black crappie	X	
crayfish	X	X
mysid shrimp		X
curly Leaf pond weed	X	
water milfoil	X	X



**We still have a compliment of native species
(plankton to fishes), can we create a dual
native and nonnative fishery?**



Can we create a multipurpose fishery in Lake Tahoe with native and nonnative trout?

- Multiple efforts to “restore”, stock, or maintain Lahontan cutthroat trout into the waters of Tahoe basin
 - Lake Tahoe
 - 1960’s CDFG/NDOW investigations indicated high loss rates of stocked cutthroat trout primarily due to predation from nonnative lake trout
 - Upper Truckee River
 - Competition from nonnative brook trout
 - Active management has yielded a population that needs assistance for maintenance
 - Marlette Lake
 - Not an active lake for restoration but an important brood stock source for the Nevada Department of Wildlife
 - Fallen Leaf Lake
 - UCD/UNR studies and subsequent published studies indicate that lake trout consume cutthroat trout, less consumption when over 10 inches or greater
 - limited spawning activity noted in Glenn Alpine Creek over time
 - Predatory lake trout are stunted in growth compared to other lakes due to an energetic bottle neck (reason unknown but may be due to light conditions and mysid encounter rates)

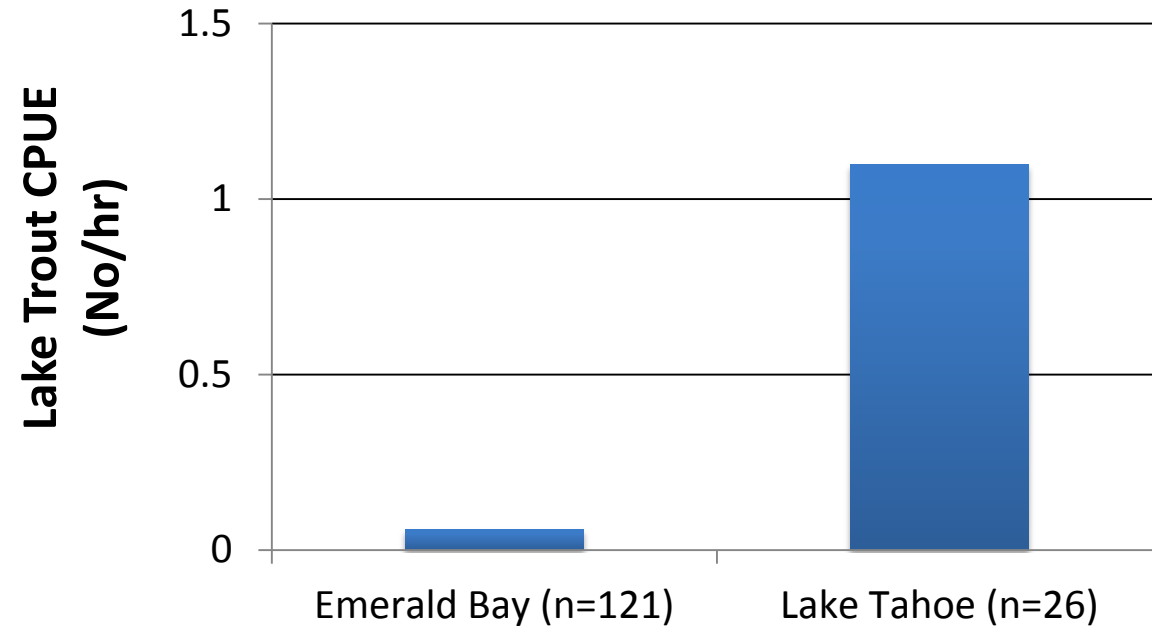
- Fallen Leaf Lake (cont'd)
 - To minimize predator loss and create a limited dual managed fishery for lake trout and stocked trout it was recommended to stock trout 10 inches or greater or as smaller fingerlings to avoid energetic changes to the fishery
- **One thing that we observed multiple times in conversations with anglers and interview with some guides is that people in the Tahoe basin have not had the opportunity to fish for large, viable cutthroat trout**
- We also observed that historical compilation of data from Emerald Bay suggests that lake trout population structure may be from other lakes in the area allowing for a dual managed, put and take fishery
- Recommended to set up easy access points for the public to fish for cutthroat trout to develop their interest in fishing for these historical giants and explore an investigations of the ecological structure of Emerald Bay

2012- Ecological study of Emerald Bay evaluation of STOCKED cutthroat trout

- 2011 NDOW with the cooperation of CDFG and the request of UNR stocked the bay with hatchery raised Lahontan cutthroat trout
- In early July 2011 UNR student from the American Fisheries Society Chapter and NDOW staff tagged 6,6245 LCT in the Mason Valley Hatchery
 - 863 kg or 392 lbs of fish in total
 - 6.4-15.1 inches in length
- Floy tags with individual numerical codes and call in information
- Stocking occurred with permission from CDFG in the creek and along the West shore near Vikings home
- Pre LCT stocking (19 May- 13 July), 52 overnight gill nets sets ranging from 1-18.5 hrs/ net
- Post stocking LCT (18 July – 20 Oct), 64 overnight gill net sets ranging from 12-42 hrs/ net
 - Original intent was to conduct tagging for lake trout population studies and movement/ migration within and in/ out of the Bay as a result of stocking
 - Diet analysis over time to determine potential loss rates of this stocked trout

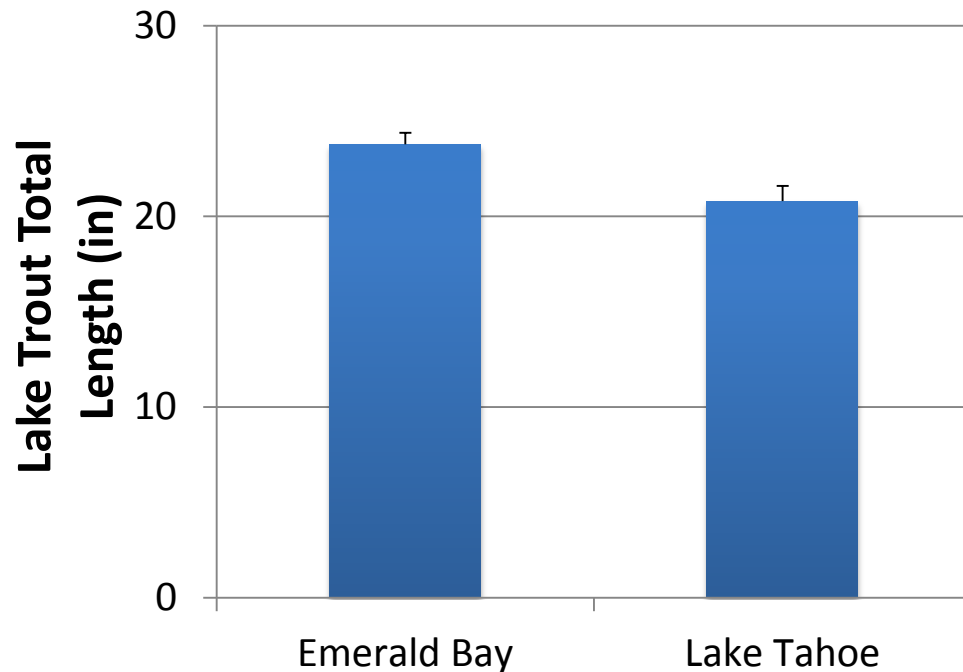
UNR and UCD Emerald Bay ecological study, fate of stocked LCT

- Capture efficiency of lake trout was low compared to historical catch data from Lake Tahoe (late 1990's to mid 2000's)

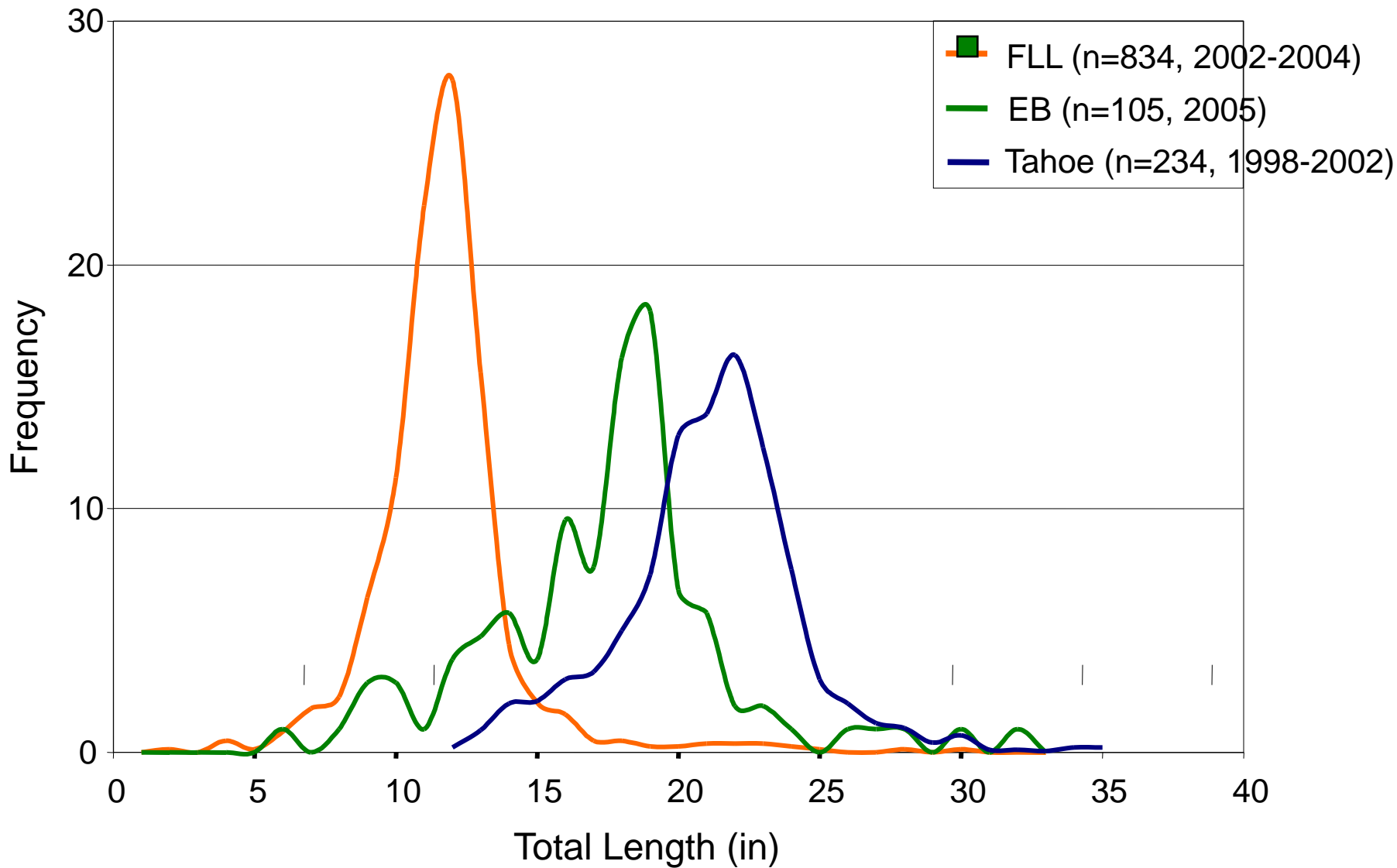


Emerald Bay ecological study and the fate of stocked LCT

- Predatory lake trout trout size was slight smaller in Tahoe compared with Emerald Bay
- Concern since lake trout generally can eat anything approximately half of their length



Lake trout size comparison between lakes- historical data suggests larger lake trout in Tahoe, careful of interannual variability



Where did the Lahontan cutthroat trout go?

- 42 floy tags/ LCT were found in 14 lake trout stomachs over from Aug 2-25 (23 day period)
- Utilized fyke net in August to see if we could find LCT after stocking, found lots of Tahoe suckers, tui chub, bluegill
- Creel census via CAL TROUT interns
 - emphasized weekends and early morning, to determine if fishing guides/ anglers were catching LCT- no luck but not a lot effort, phone calls to guides yielded little information, interns discouraged after the 1st week of creek census
- Received phone calls from anglers Aug 8 2011 to April 10 2012 indicating LCT were caught by hook and line.
- Six of 9 calls were locations in Emerald Bay, 1 no location, and 2 locations in Lake Tahoe (1- Cave Rock in the mouth of a lake trout and 1- Tahoe City)
- Lake trout diets from Emerald Bay? Unsure in 2012 since many stomachs were empty and there was limited catch compared with Tahoe, Donner Lake, Gilmore, and Stony Ridge Lakes
- Very few mysids in the Bay in 2012, non detectable by zooplankton nets and only a few in lake trout stomachs.

Can we have dual stocked cutthroat trout and lake trout fishery in Emerald Bay?

- Who knows? Worth looking into investigating the interannual, limnological dynamics of the bay and predators
- Need to determine productivity and forage production for stocked fishes
- Determine variability in structure of lake trout, based on movements coming into the bay or within bay recruitment?
 - Lake trout CPUE is much lower in Emerald Bay compared with other limnetic ecosystems. Is this normal and how much does it vary compared with Lake Tahoe?
 - 2005 data from UNR and UC Davis suggests a slightly greater size compared with contemporary samplings
 - Age lake trout from the Bay and compare them to Lake Tahoe, perhaps there are older, larger individuals but fewer of them

Can we have dual stocked cutthroat trout and lake trout fishery in Emerald Bay?

- Initiate a population tagging/ acoustic study of lake trout to determine their migration movements in and out of the Bay
 - Hypothesis: limited movement/ mixing of lake trout between Tahoe and Emerald Bay due to thermal gradients, light thresholds. UNR has purchased these tags and can provide as *in kind* match.
 - Lake trout reside in deeper water similar to populations in Lake Tahoe for the entire growing season. UNR can borrow hydroacoustic instruments to determine general habitat utilization.
- Take advantage of the public desire to visit Emerald Bay
- Stock cutthroat trout to allow anglers to fish on a limited basis for cutthroat trout
- Encourage a dual fishery for anglers? Work with them and acknowledge the availability of fishes for their business, have them sample for LCT and mackinaw for research purposes?