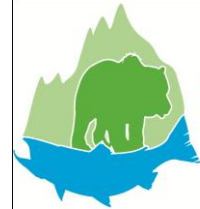




Ministry of  
Forests, Lands and  
Natural Resource Operations



FISH AND WILDLIFE  
COMPENSATION PROGRAM

# Update on Arrow Lakes Fisheries

## March 2014

The FWCP in the Columbia region is a partnership of BC Hydro, the Province of BC, First Nations and the public.

**BC**hydro   
FOR GENERATIONS



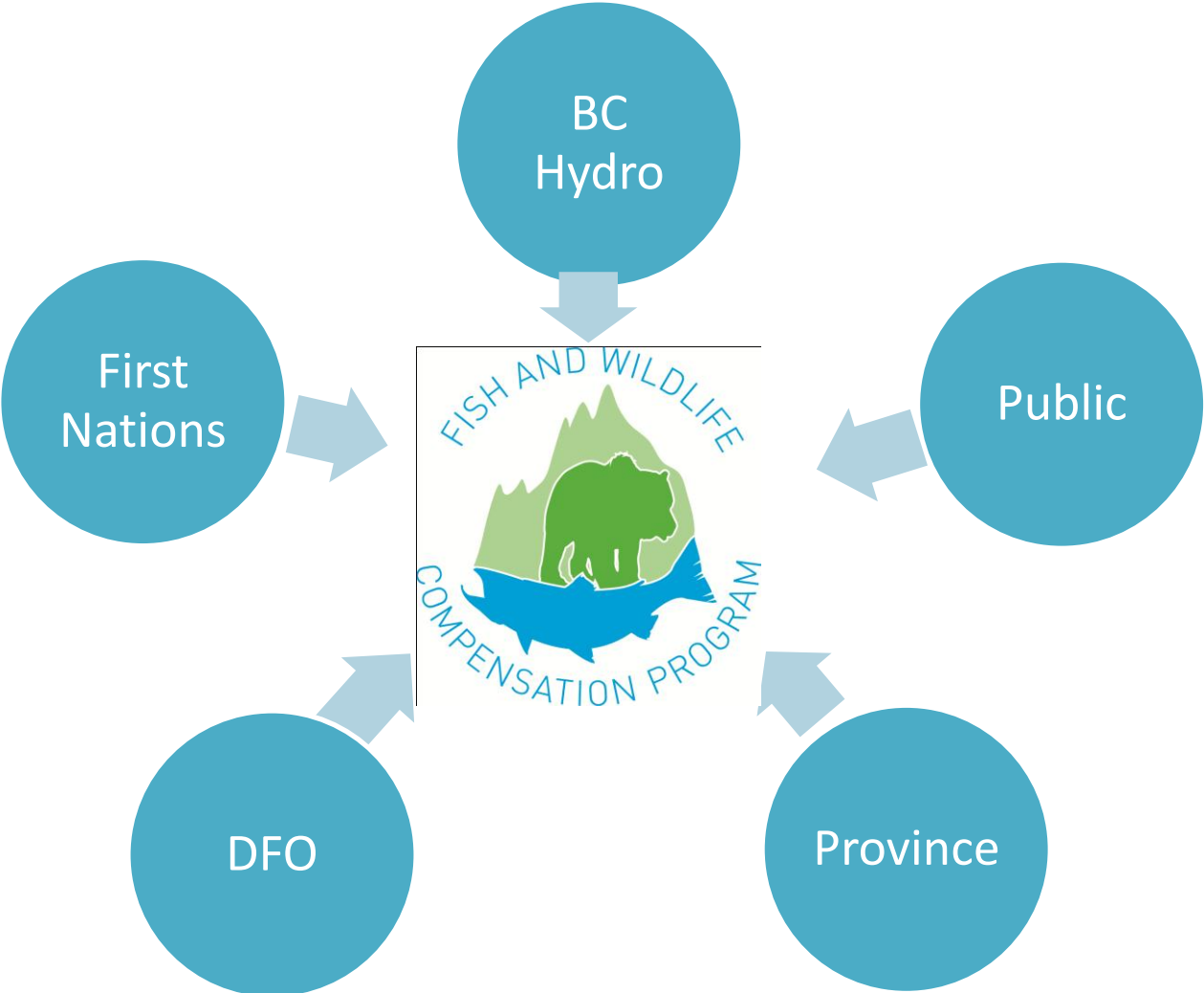
Ministry of  
Forests, Lands and  
Natural Resource Operations

## Agenda

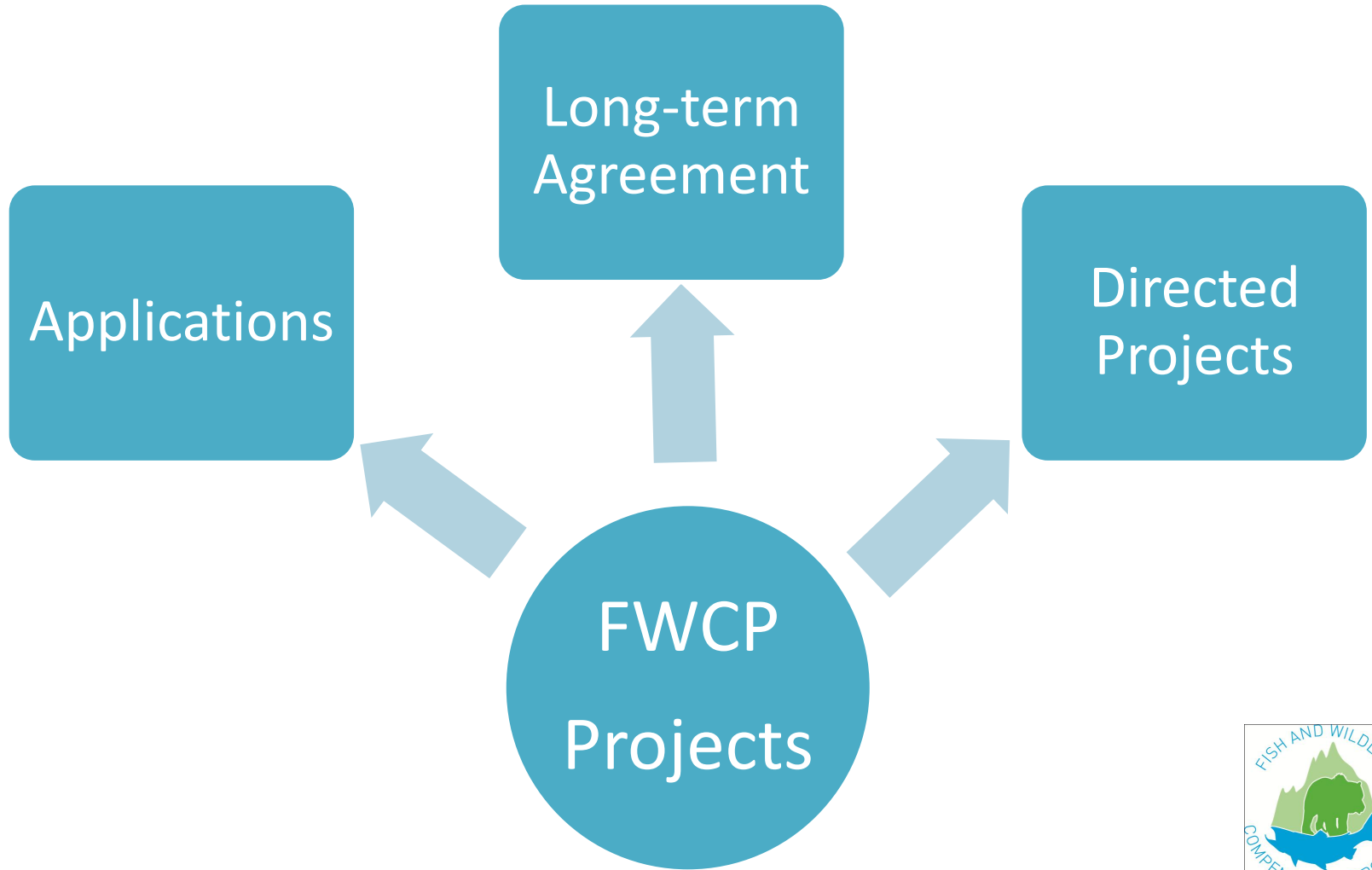
- Fish and Wildlife Compensation Program; and Ministry of Forests, Lands, and Natural Resource Operations
- Nutrient Restoration Program
- Arrow Lakes Reservoir Fishing Trends
- Hill Creek Spawning Channel
- Fisheries Management – Next Steps
- Q & A



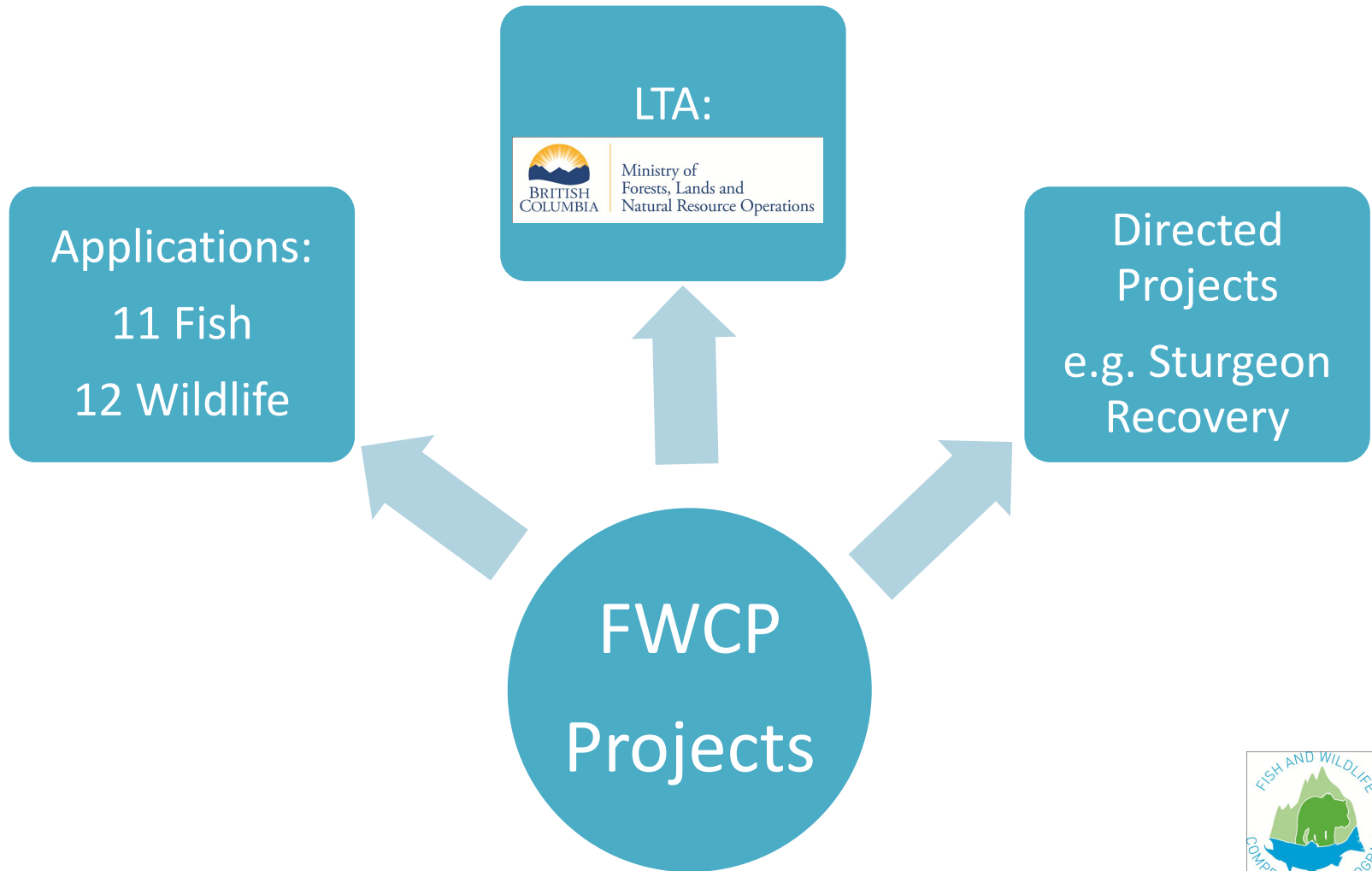
# FWCP Partnership



# FWCP Project Delivery



# FWCP Project Delivery



# FWCP Project Delivery - Examples

## Application-Based

- Arrow Lakes Bull Trout Redd Counts
- Norn Creek Fish Habitat Enhancement
- Slocan Lake Bull Trout Spawning Survey
- Wetlands on Wheels, Conservation in the WK

## Long Term Agreement - FLNRO

- Nutrient Restoration Arrow Lakes Reservoir
- Nutrient Restoration Kootenay Lake
- Spawning Channels
- Habitat Restoration (e.g. Deer Park)
- Western Toads Summit Lake
- Non-Game Enhancement

## Directed Projects

- Sturgeon Recovery



## Sturgeon Recovery Initiative (BC Hydro)

- No test harvest
- Monitoring Revelstoke spawning
- hydraulic modelling at the spawning area - look at habitat features are effected by discharge
- Juveniles, analysing growth and habitat use for hatchery released individuals (from the Narrows to Greenslide creek.)



# Columbia River and Arrow Sturgeon Release



May 1 Castlegar; May 7(?) Shelter Bay



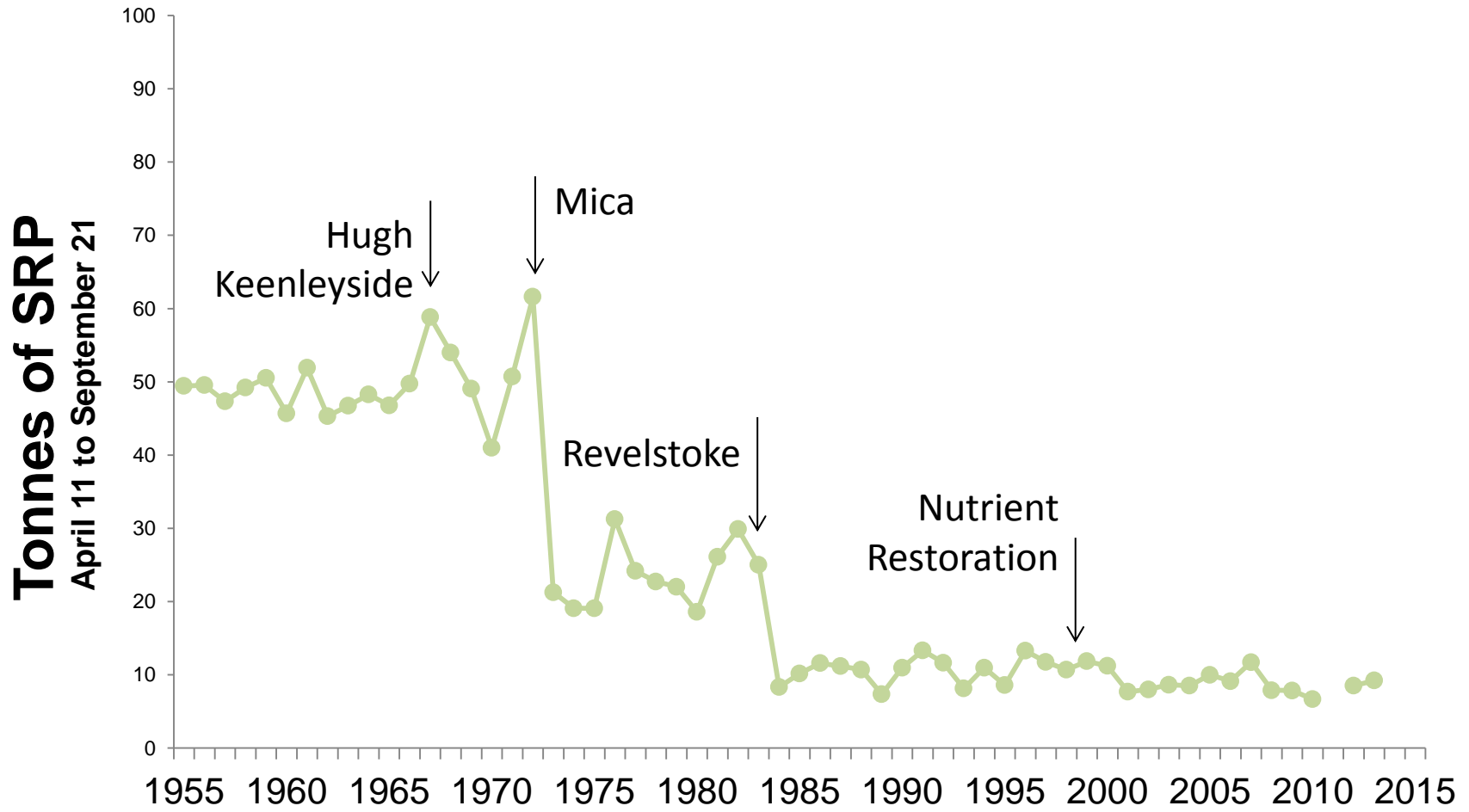


# Arrow Lakes Reservoir Nutrient Restoration Program



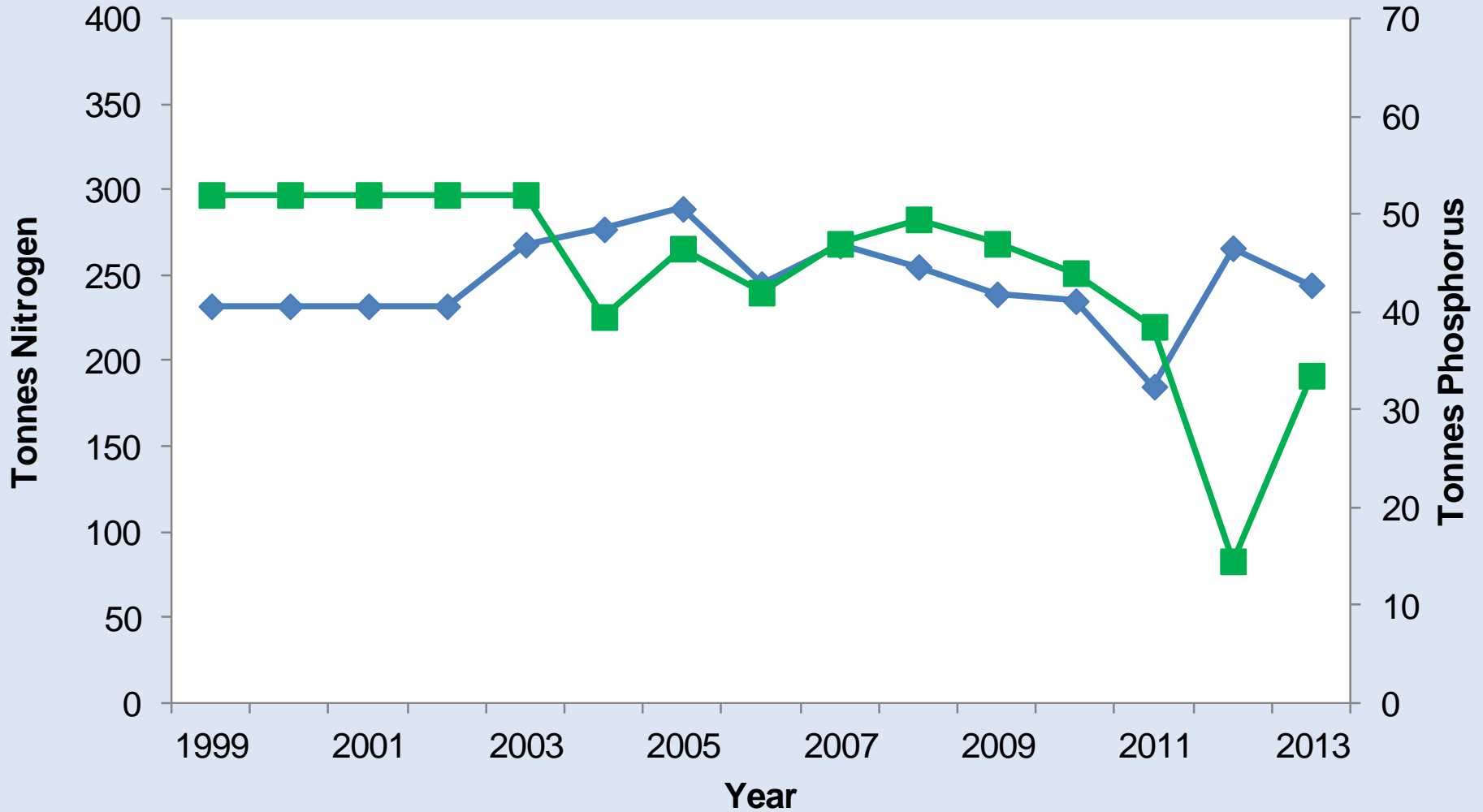
Nakusp – March 31, 2014

# Phosphorus Inputs to Arrow from the Columbia River

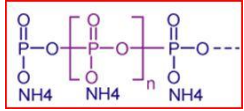


# Tonnes of nutrient additions to Upper Arrow

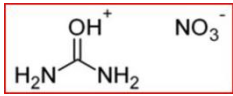
—◆— Tonnes N    —■— Tonnes P



# Food Web

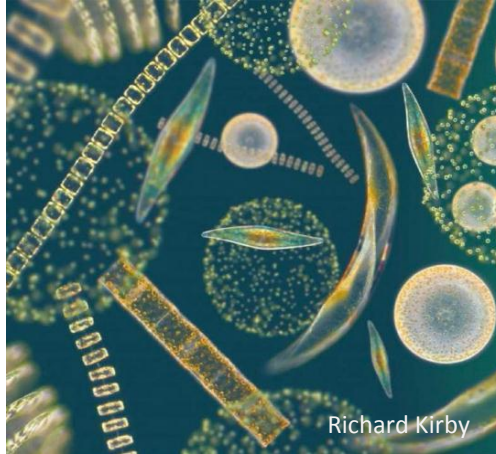


Phosphorus



Nitrogen

Nutrients



Phytoplankton  
(microscopic plants)



Zooplankton  
(free floating animals)



Piscivores  
(Bull Trout and Rainbow Trout)

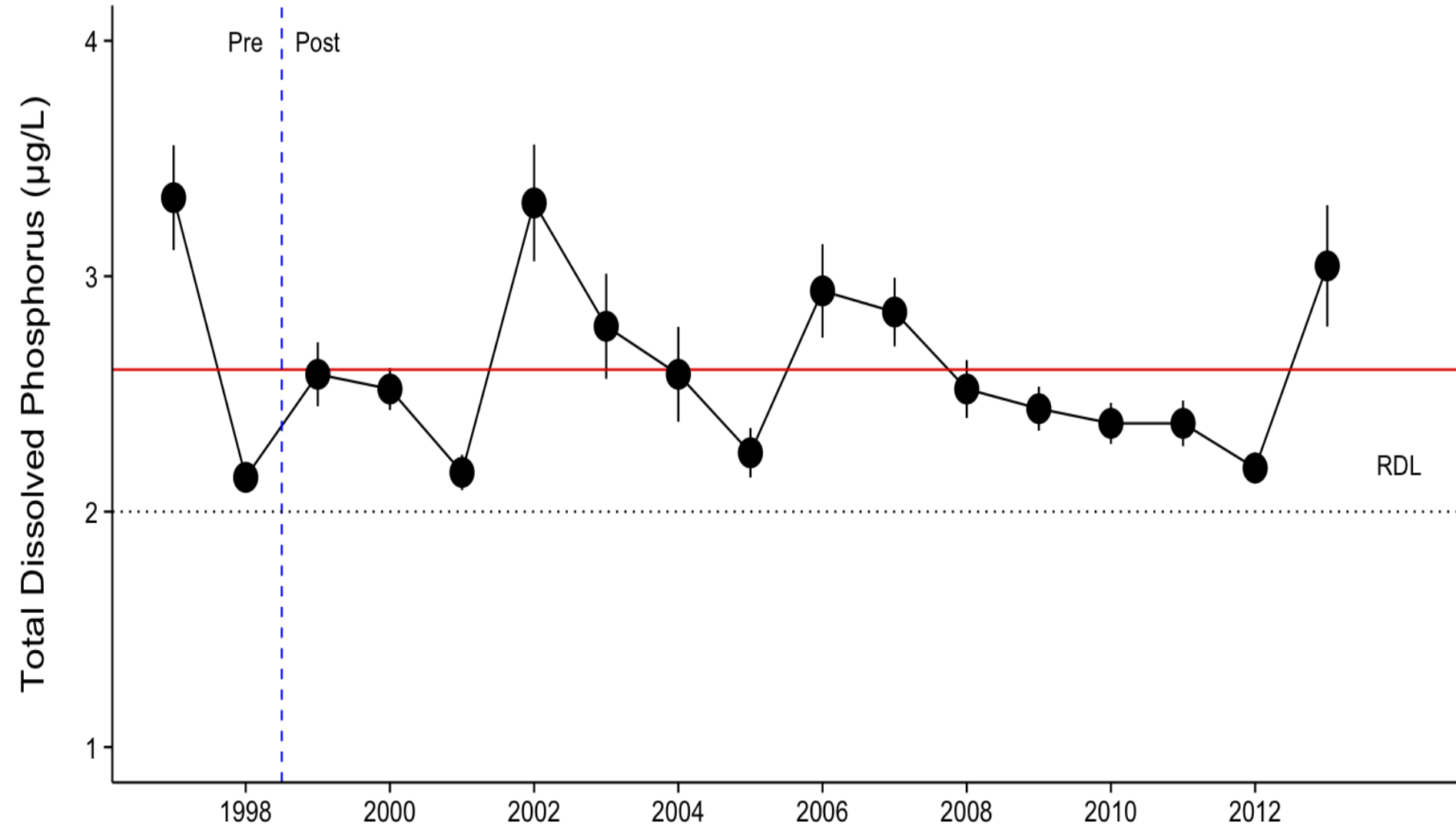
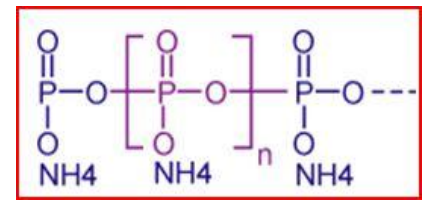


Kokanee



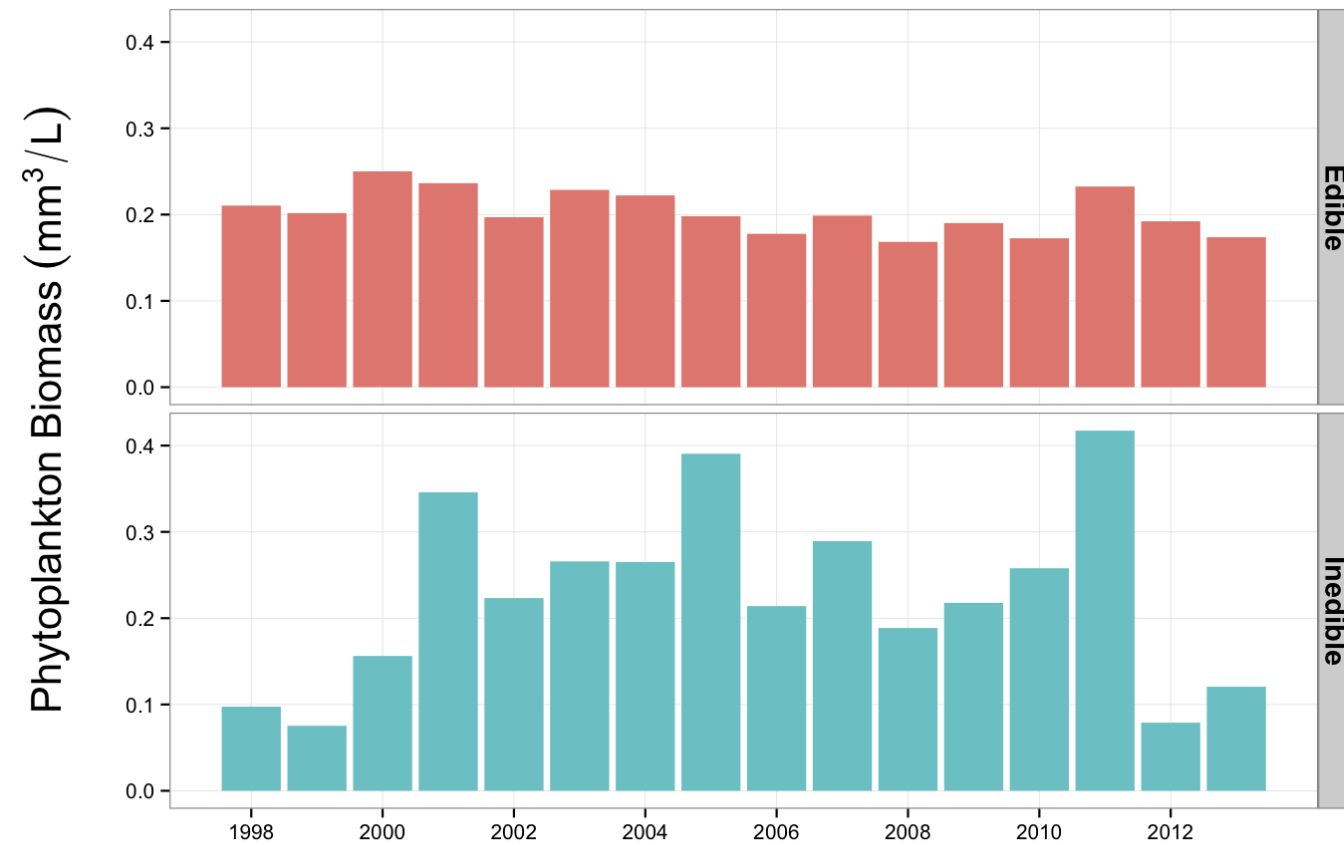
Mysids

# Water Chemistry – Phosphorus



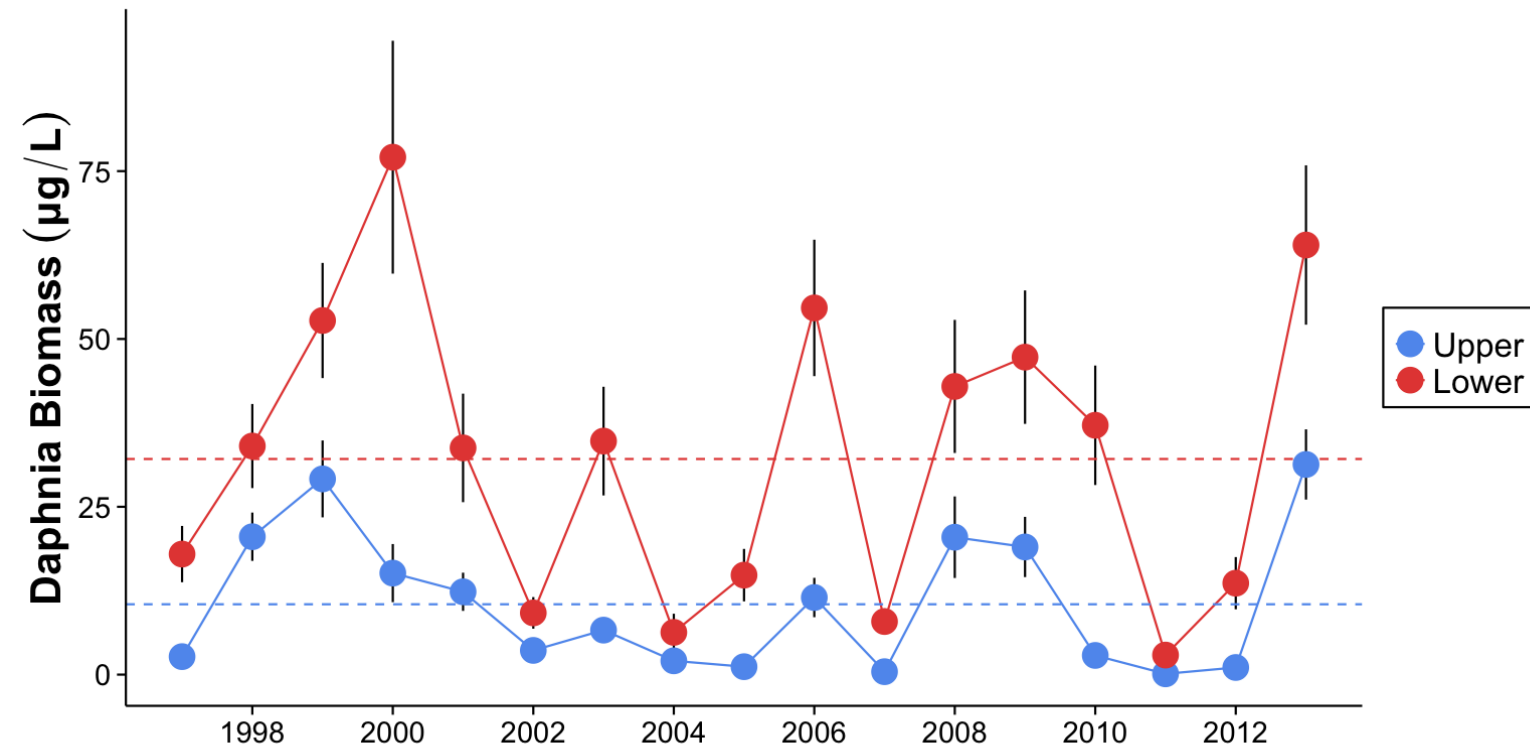
# Phytoplankton

## Edible vs. Inedible Biomass



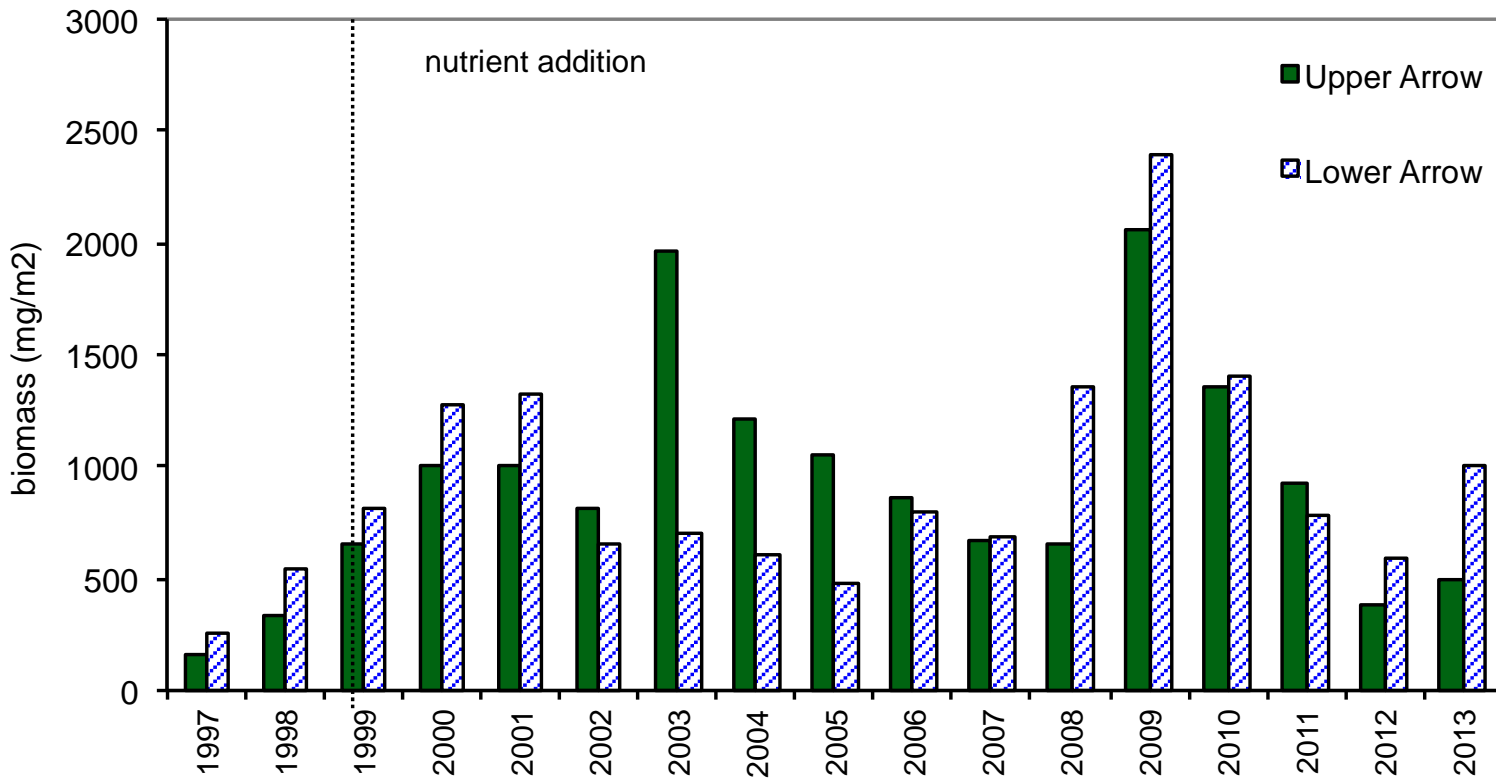
# Zooplankton

1997 – 2013 annual average Daphnia biomass by basin



# Mysids

Long term annual average biomass by basin



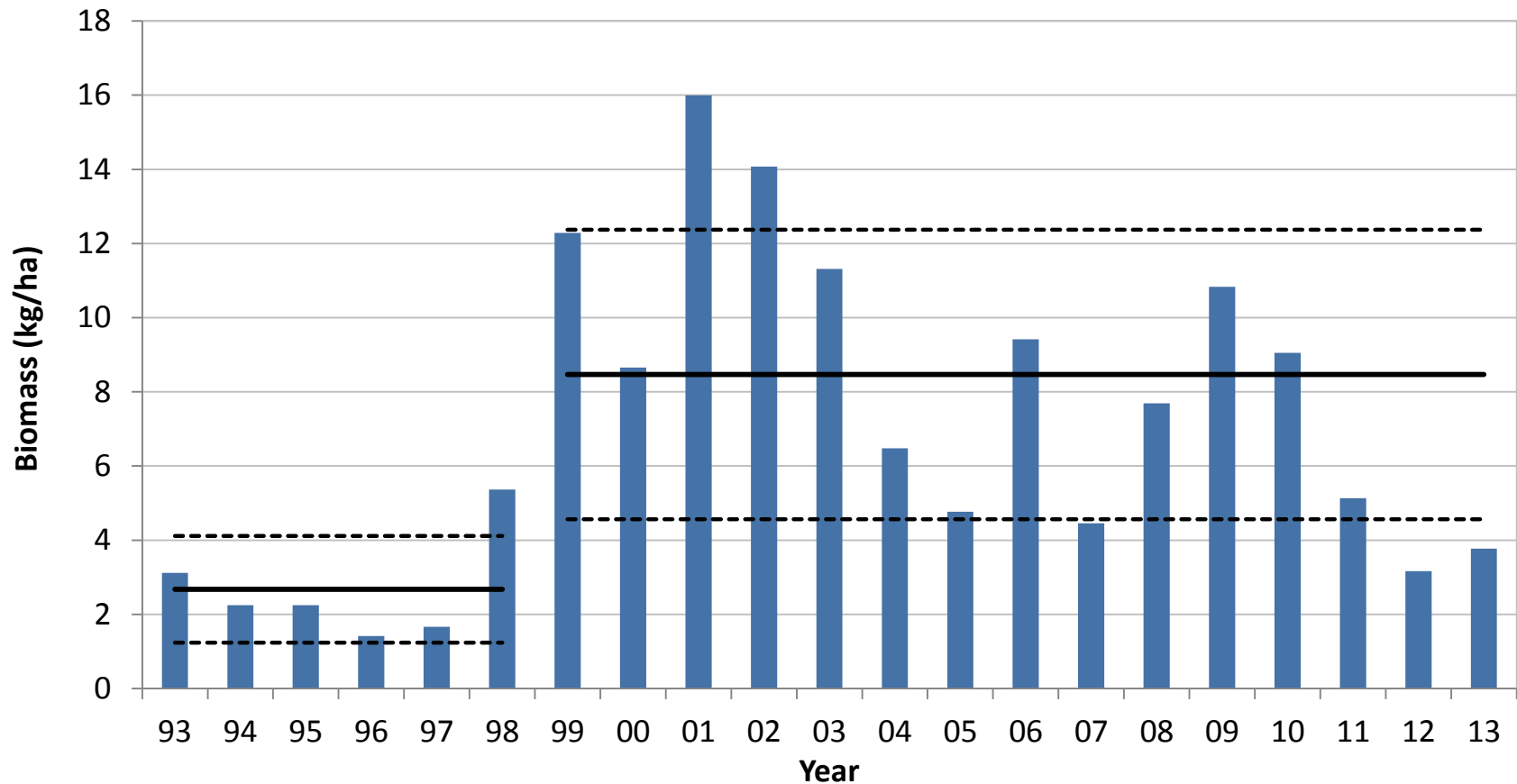


# Kokanee

## Biomass

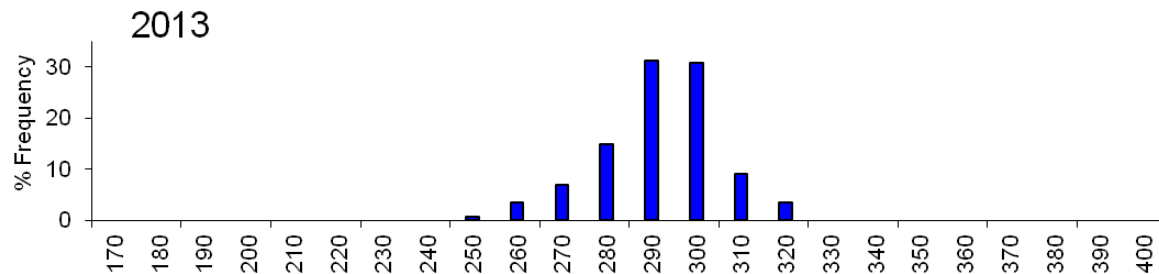
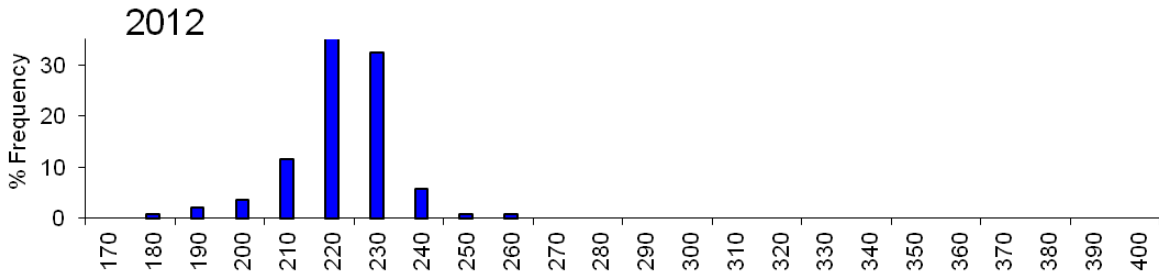
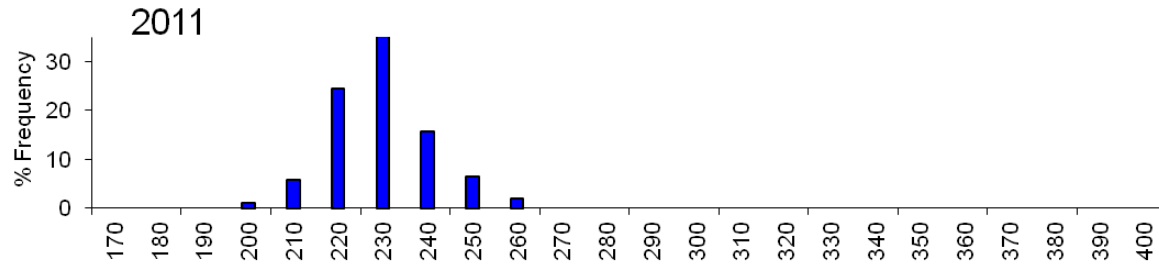
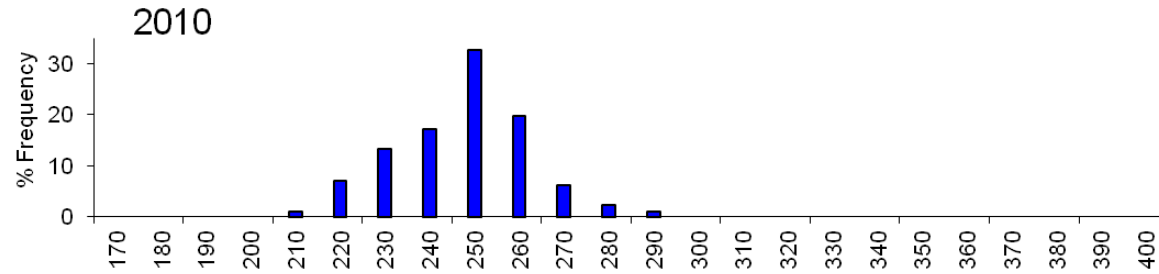


Arrow Lakes Reservoir - kokanee biomass density

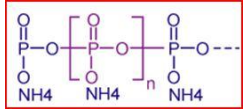


# Kokanee

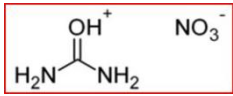
## Fork Length



# Food Web Interaction Studies

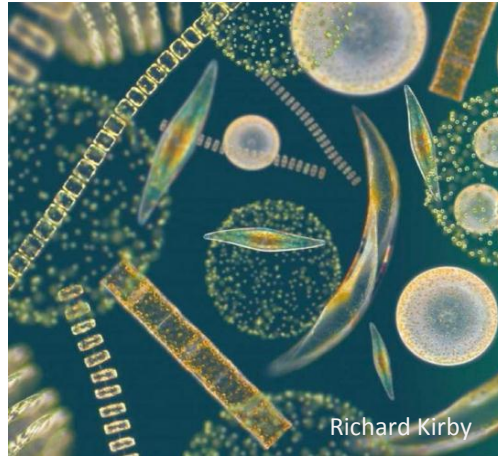


Phosphorus



Nitrogen

Nutrients



Phytoplankton  
(microscopic plants)



Zooplankton  
(free floating animals)



Piscivores  
(Bull Trout and Rainbow Trout)



Kokanee



Mysids

# Acknowledgements

## Major Contributors



Ministry of  
Forests, Lands and  
Natural Resource Operations

Kootenai Tribe of Idaho  
Ministry of Environment

## Other Contributors:

Arrow Helicopters Ltd.

Highland Helicopters

Limno-Lab Ltd

Waterbridge Ferries

Columbia Aquatic and Technical Services

Ashley and Associates

Kootenay Wildlife Services Ltd

Redfish Consulting

University of British Columbia

Eco-Logic Ltd

Agrium

Crescent Bay Construction

# Arrow Lakes Fishing Trends

www.arrowlakesnews.com

## Blue Knuckle Derby brings



Above left, the winning fish, but it's the guy on the right who caught it. Clockwise from upper right: Tracey Roberts and Tammy Hascarl have some fun; second place winner Charlie Wild with his prizes; Ernie Marven; a moment of fishing peace; trucks and trailers at the alternate launch; one happy fisher.

TRACEY ROBERTS, CLAIRE PARADIS/ARROW LAKES NEWS



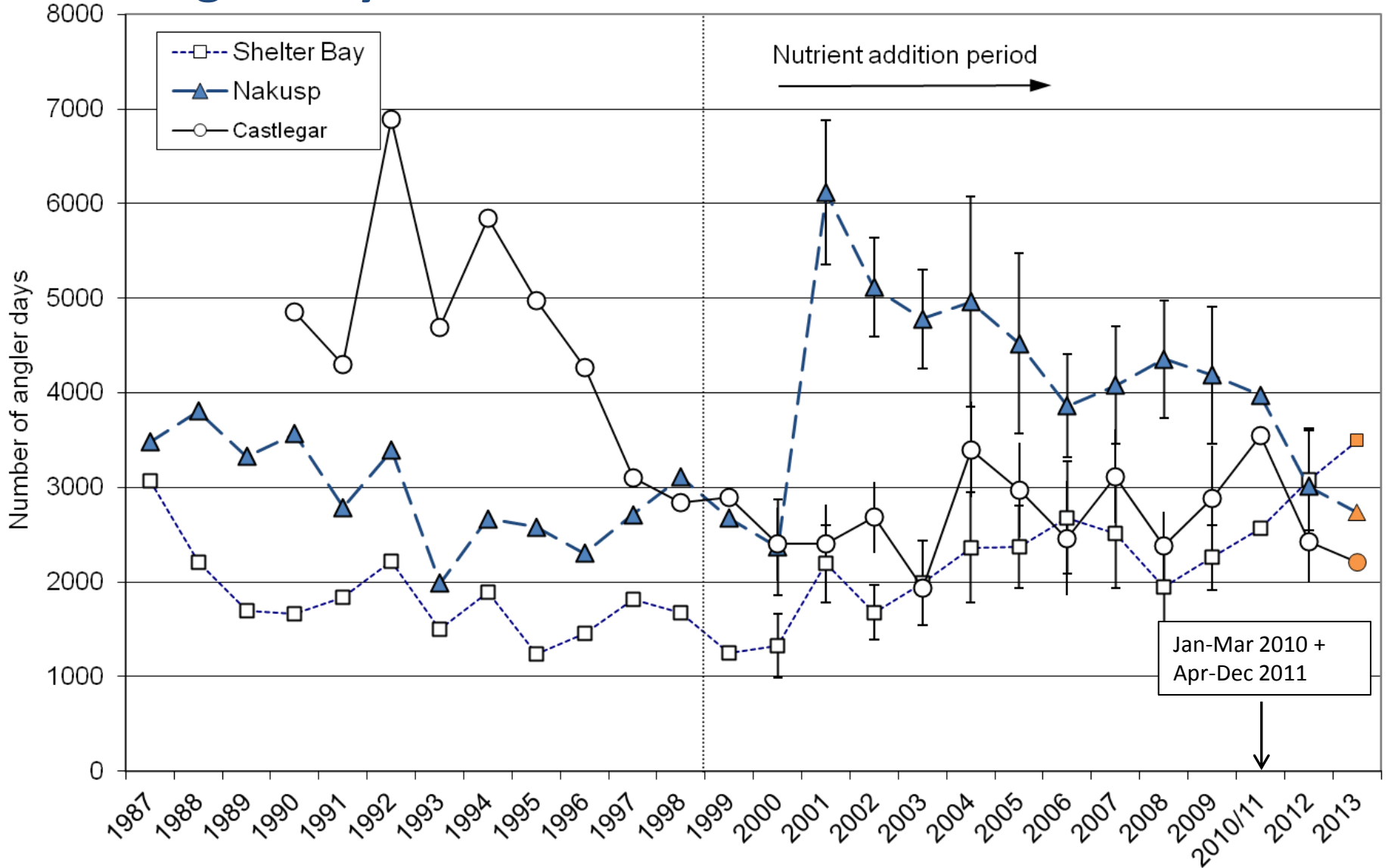
### Look what landed

First prize winner Kim Perepolkin, right, and third place angler Walter Perepelkin pose with their trout Saturday, Feb. 16 at the conclusion of the fishing derby staged by Scotties Marina on Lower Arrow Lake. Seventy-five entrants had signed up for the annual event and fifteen fish made it to the scale by the four o'clock cut-off time.

Earning bragging rights enhanced by prize money of \$910 was Perepolkin with a 12.13 pounder. Don Sutherland (not pictured) claimed second place with a 10.5 lb. fish, good for \$350. Walter Perepelkin's 9 pounder netted \$280 for his efforts.

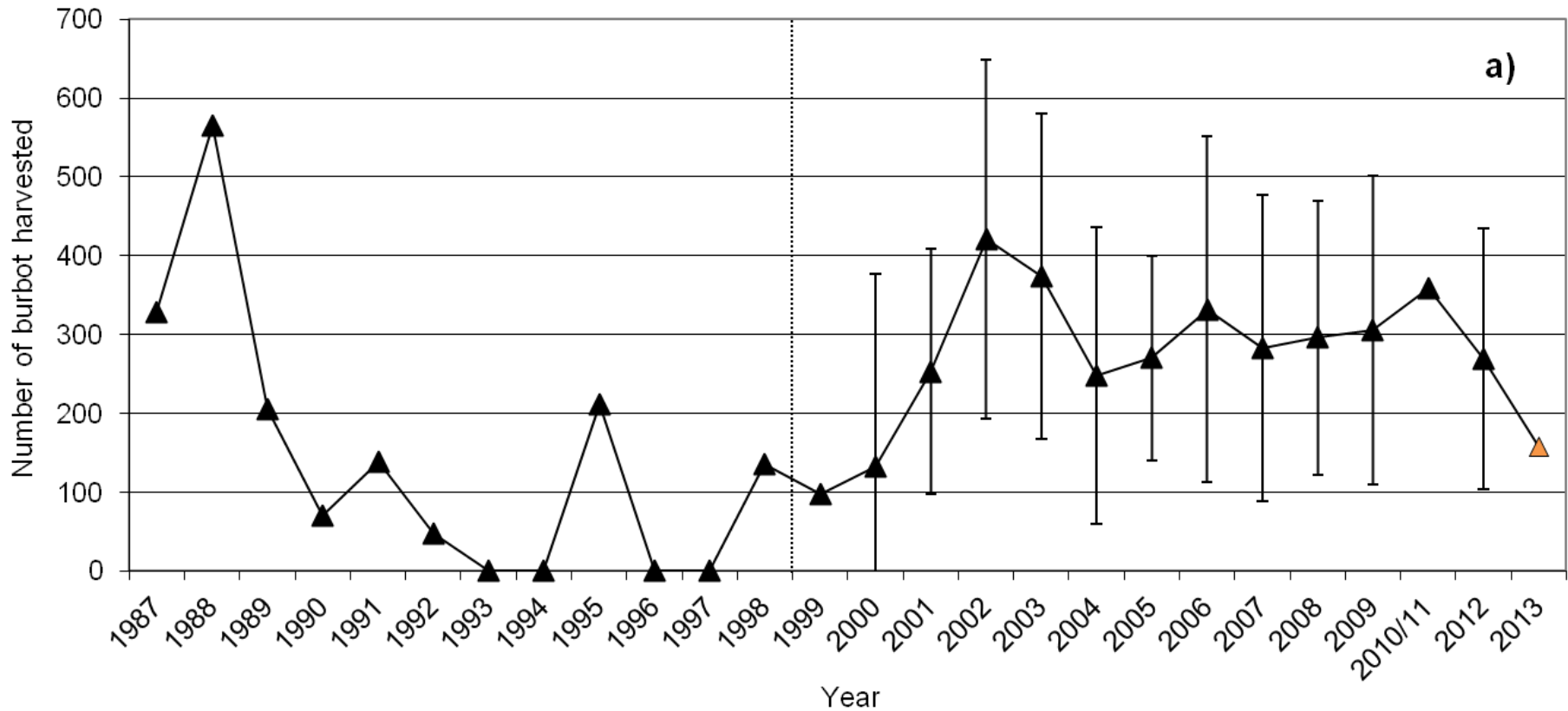
Jim Sinclair

# Angler days on Arrow Lakes Reservoir 1987-2013

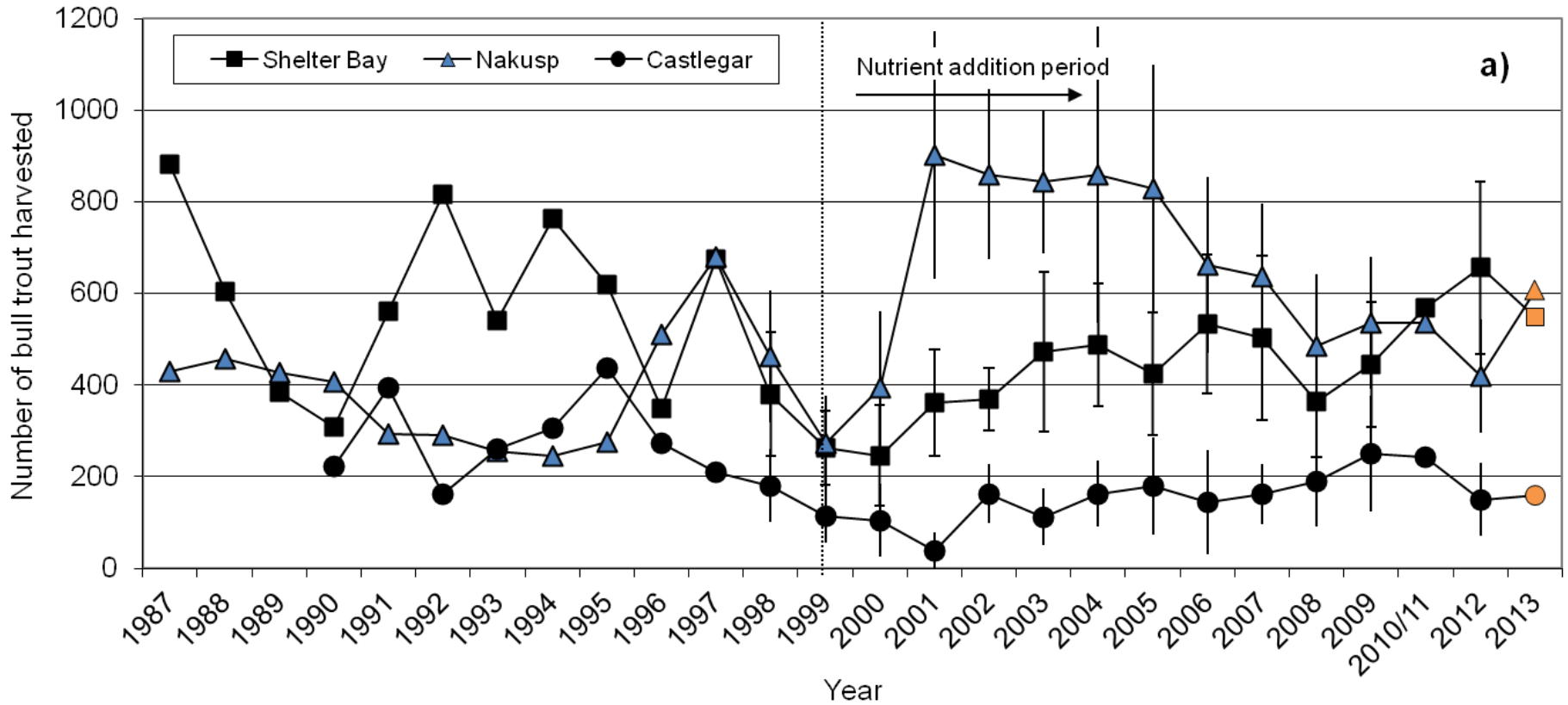


Orange points = preliminary estimates

# Arrow Lakes Burbot harvest (Nakusp)

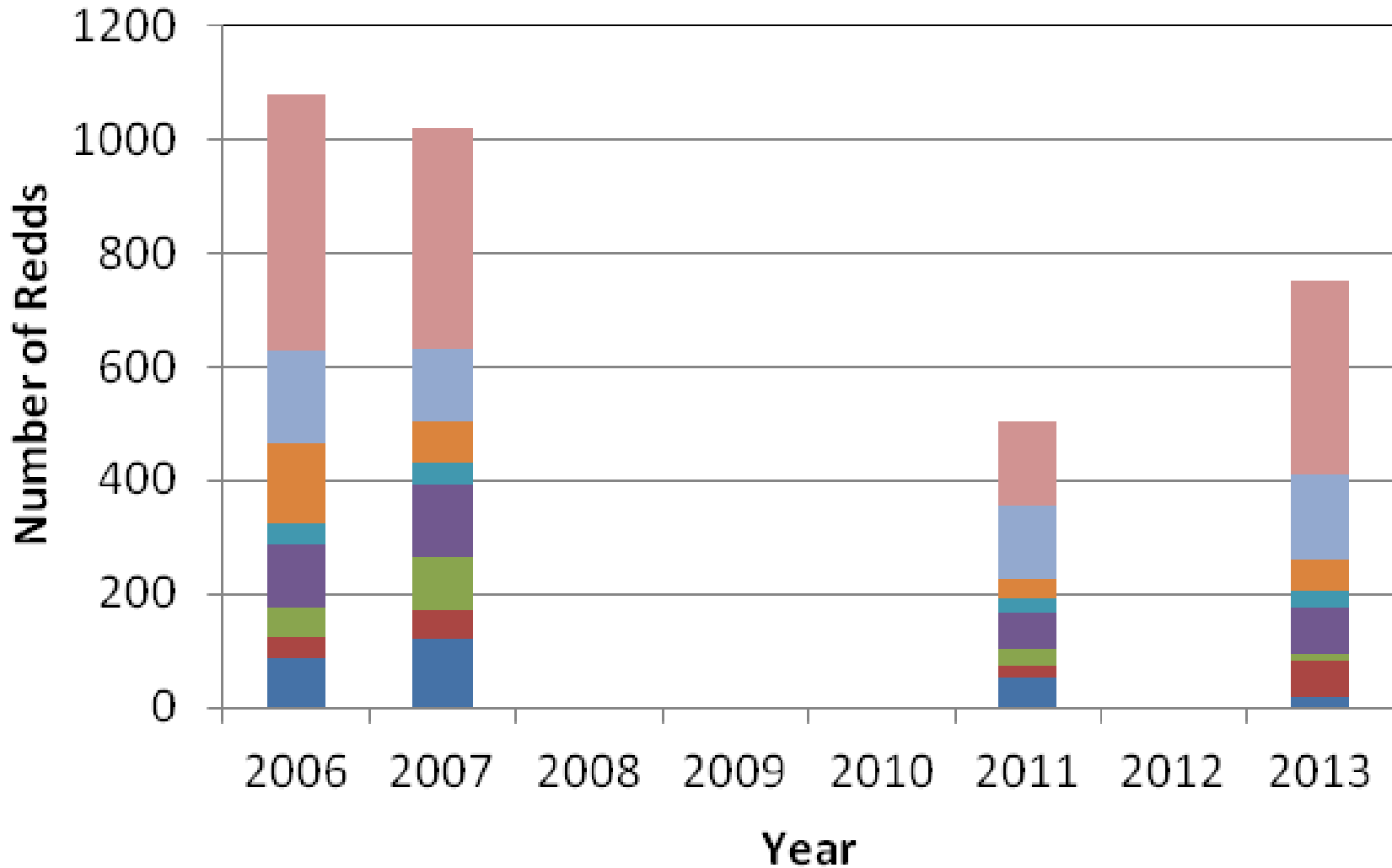


# Arrow Lakes Bull Trout harvest

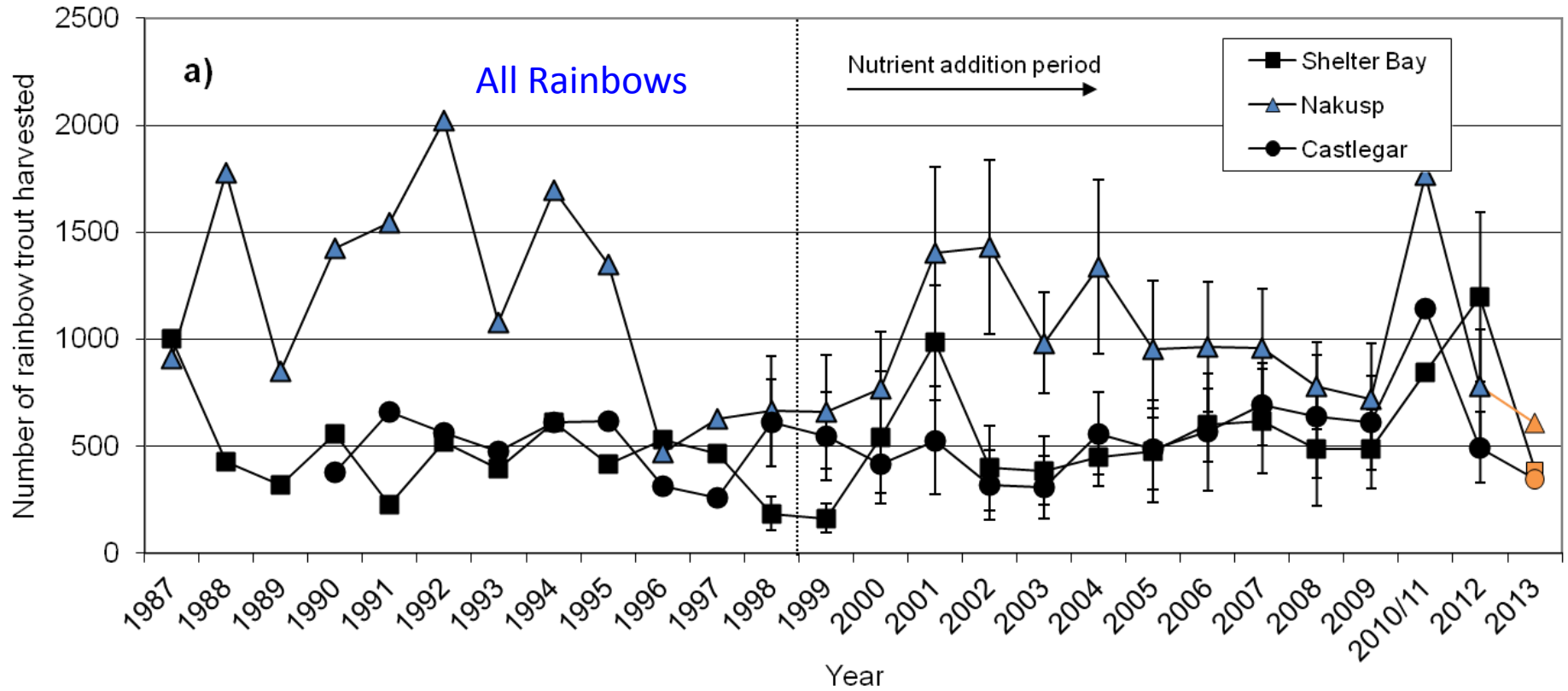




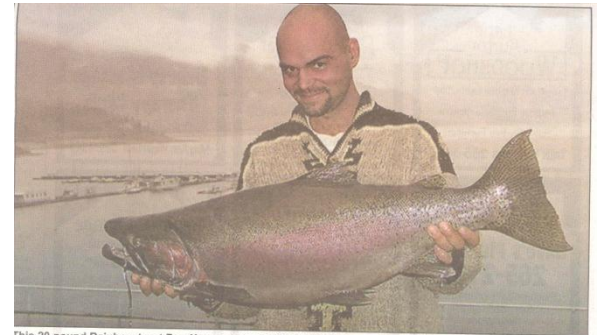
## Bull Trout spawning status – Arrow Index redd counts



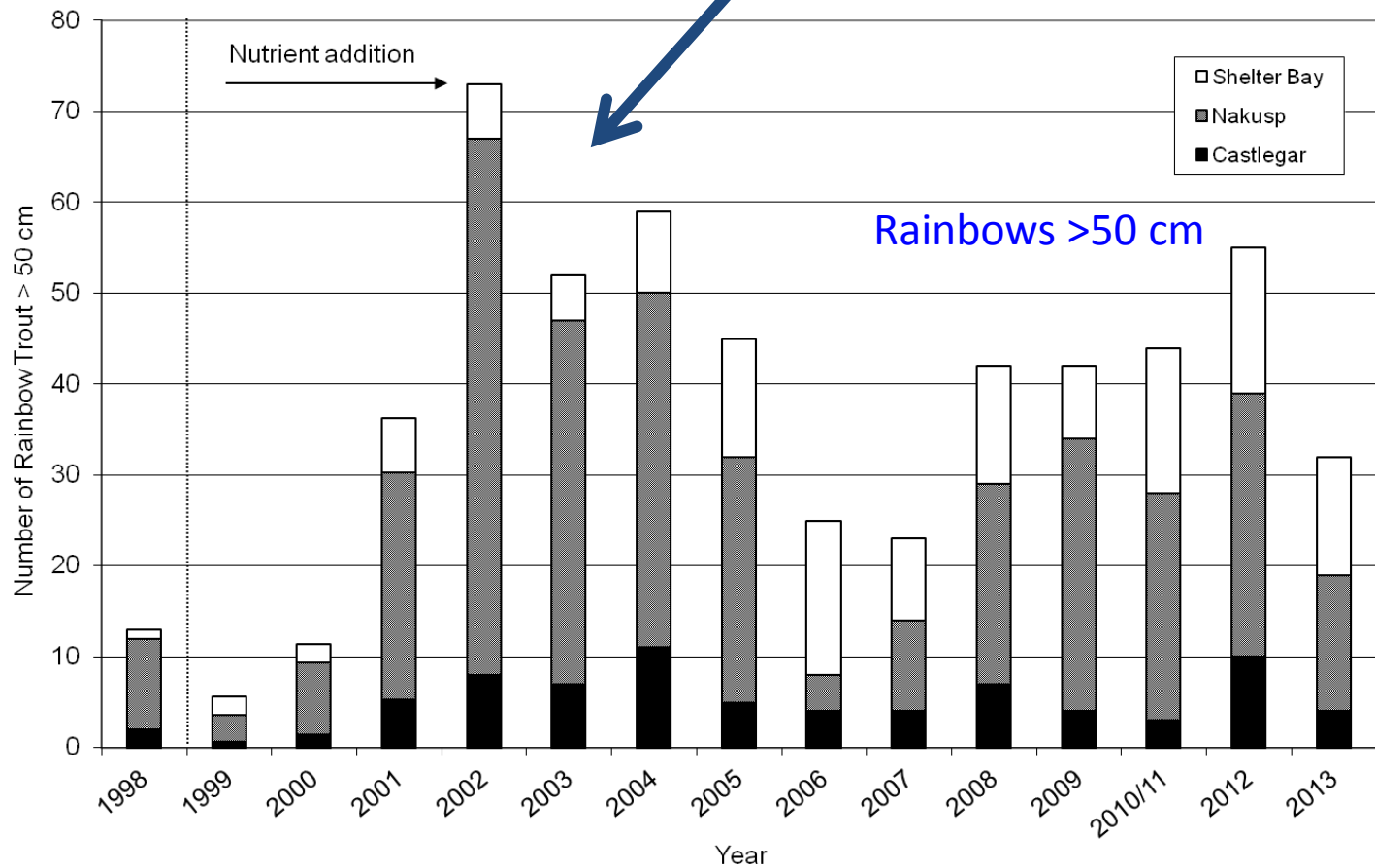
# Arrow Lakes Rainbow Trout harvest



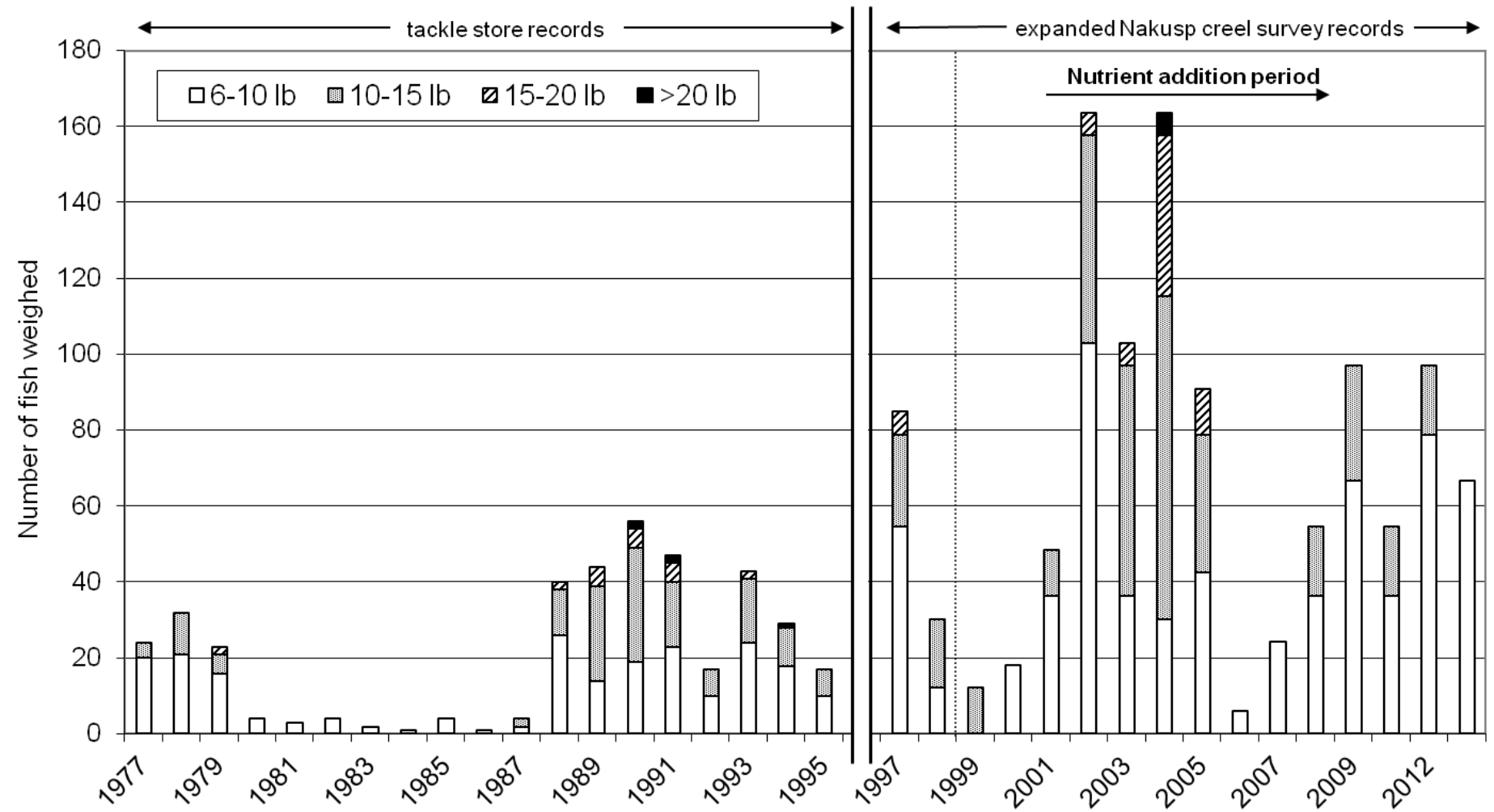
# Piscivorous (Kokanee-eating) Rainbow harvest



This 20-pound Rainbow trout Dan Nero caught on the weekend is proof the fishing's getting good in area lakes.  
**Nakusp man nets monster Rainbow**



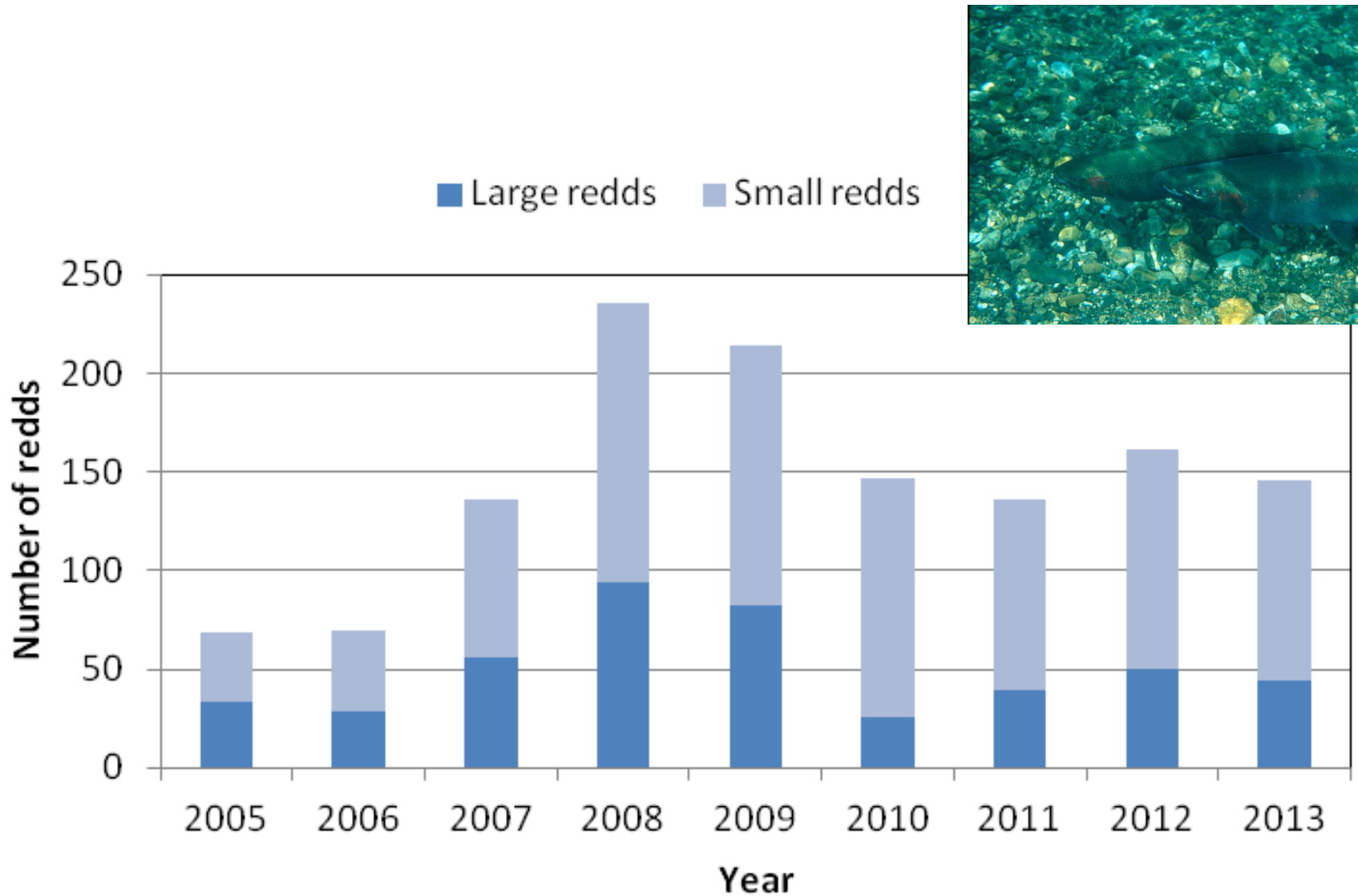
# Rainbow Trout weighed at Nakusp



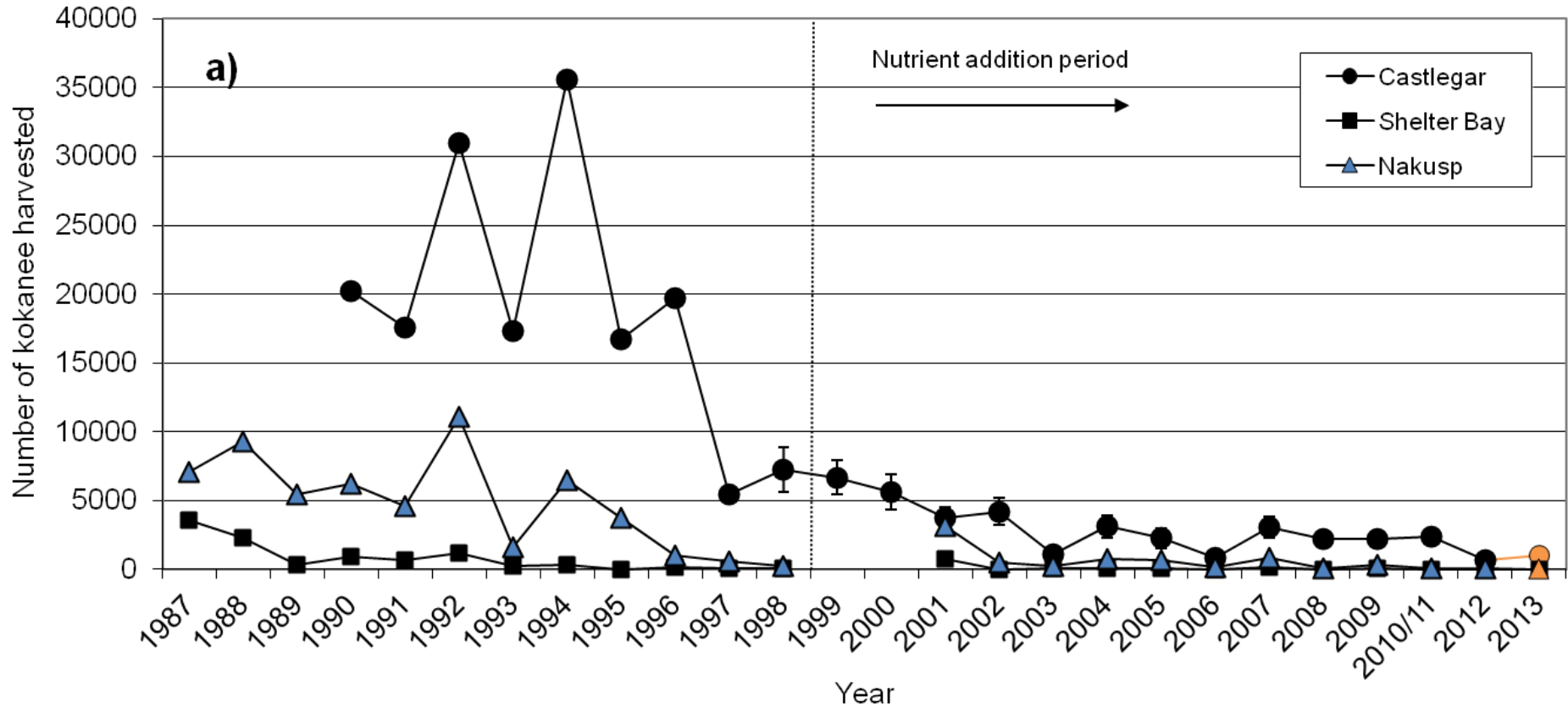
# Rainbow Trout Spawning – HCSC redd counts



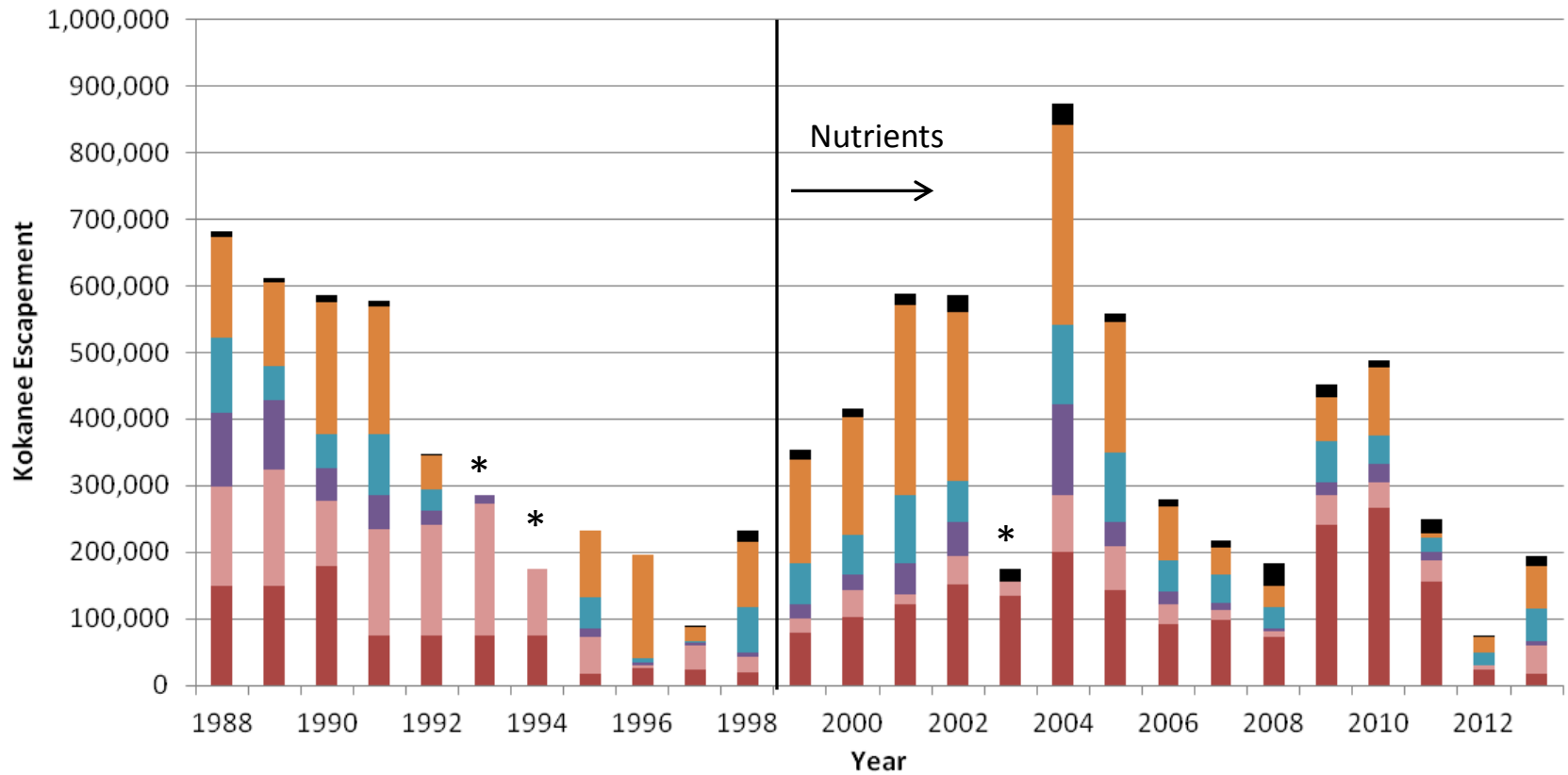
# Rainbow status - redd counts in HC Spawning Channel



# Kokanee harvest



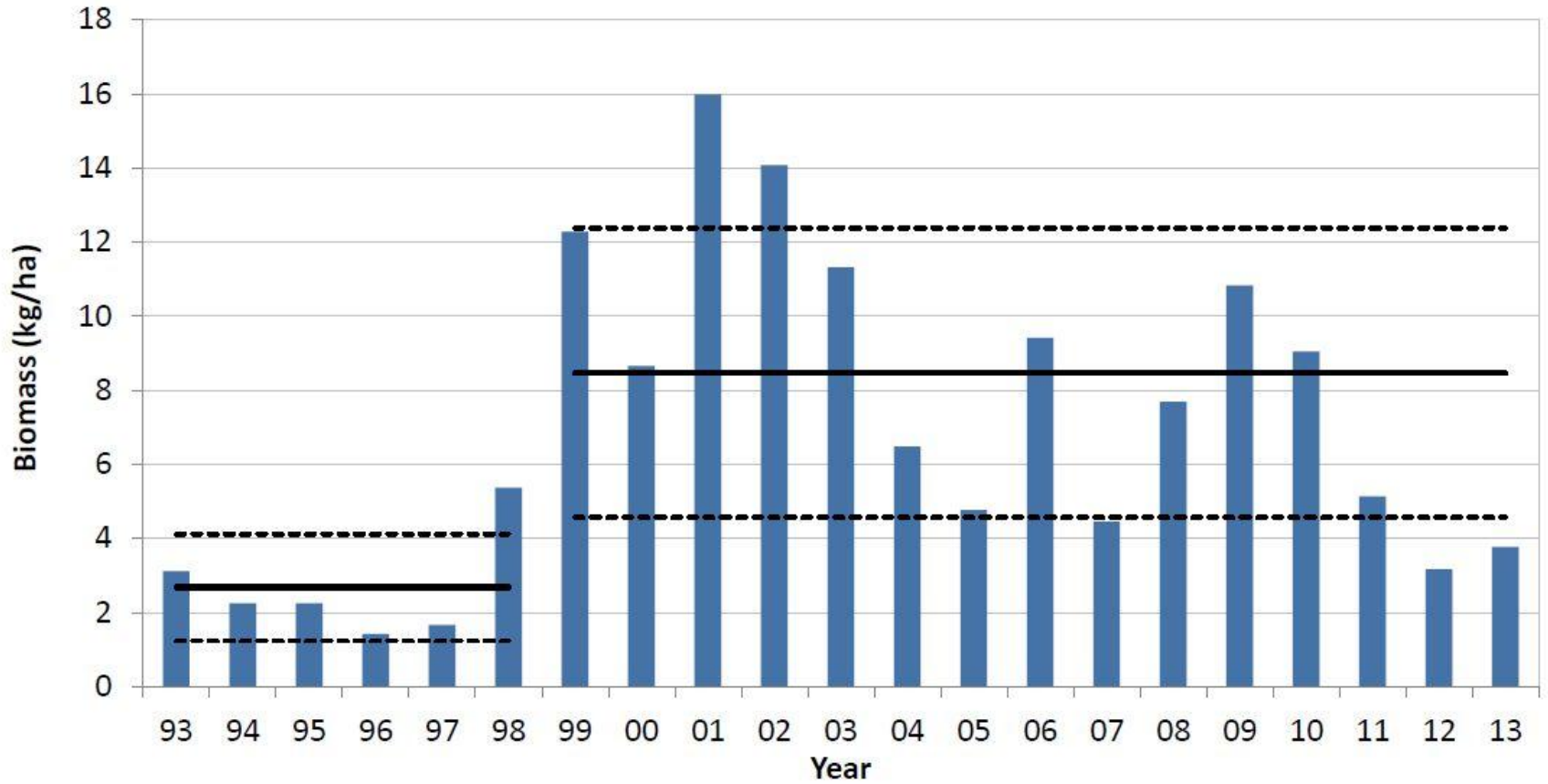
# Kokanee spawner trends – index tributaries



\* Counts incomplete

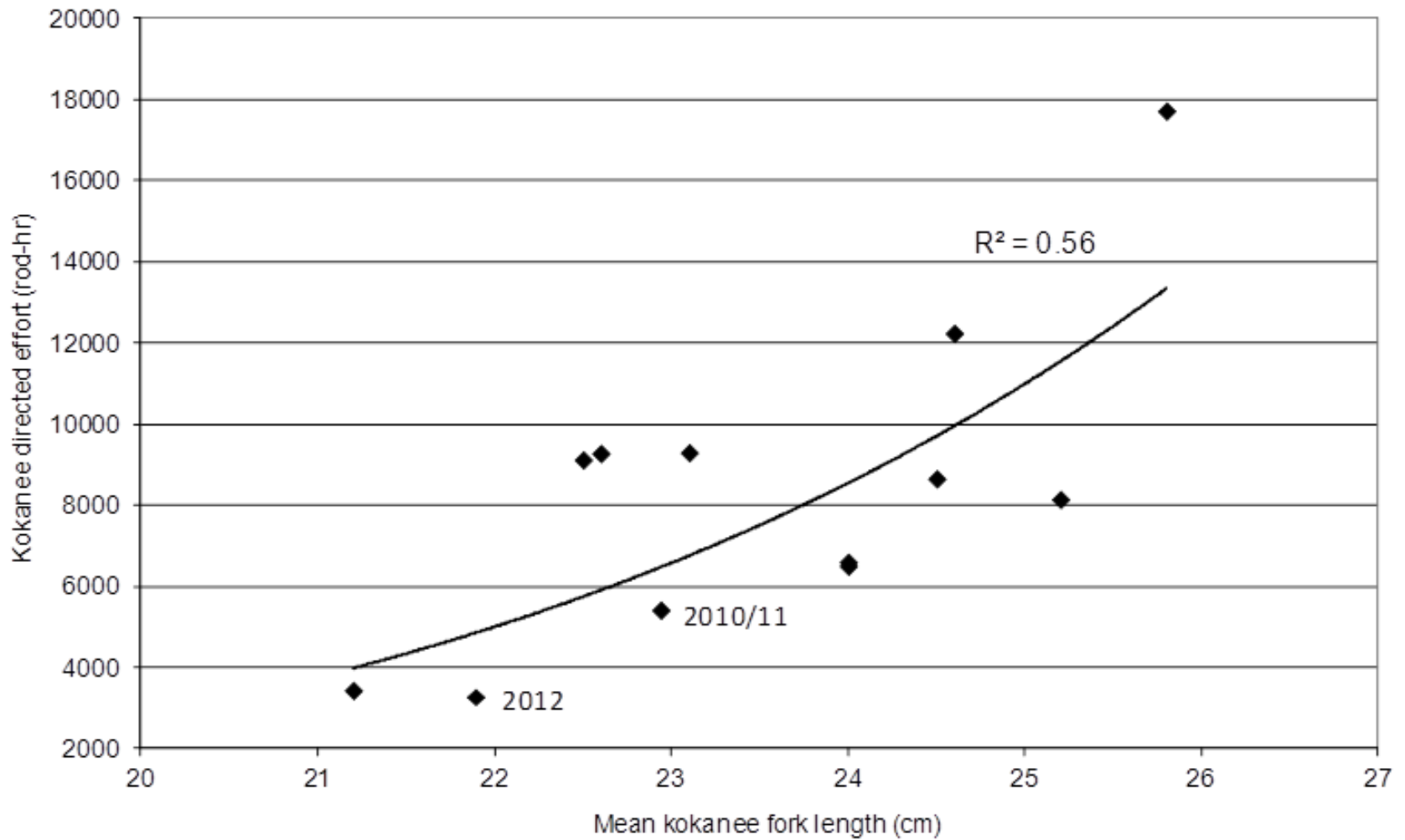


### Arrow Lakes Reservoir - kokanee biomass density



Graph provided by Tyler Weir

# Amount of Kokanee Fishing Related to Kokanee Size



# Current Fishing Summary:

- Bull Trout – harvest below 2001-05 but above 1998-2000
  - Shelter Bay improving
  - Post-nutrient condition (fatness) has been higher for all years except 2013
- Rainbow Trout – harvest below 2001-05 but above 1998-2000
  - Big Rainbow catch fluctuates – usually higher than pre-nutrient years
  - Fewer fish >15 lbs since 2004
- Kokanee – consistent decline in harvest
- Burbot – stable?

# Fisheries Management, next steps

## July 2013 Science Review - Key Conclusions:

Wild Kokanee conservation:

High Hill Creek Spawning Channel fry production →  
decreased survival of wild Kokanee

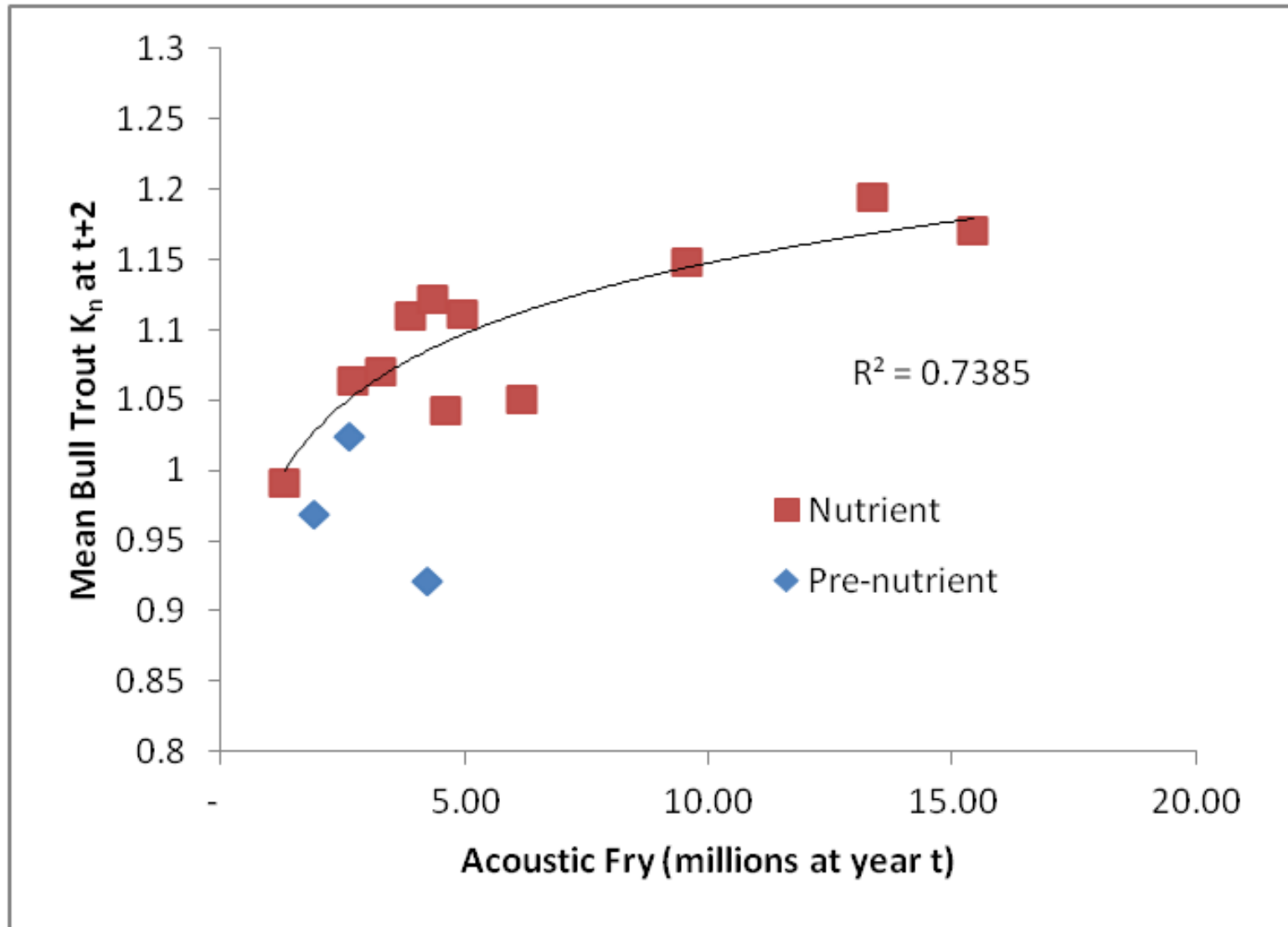
Kokanee densities for fishery:

- Reducing Kokanee densities should lead to increased Kokanee angler-days without significantly reducing Bull Trout angler-days, or quality of food supply for predators

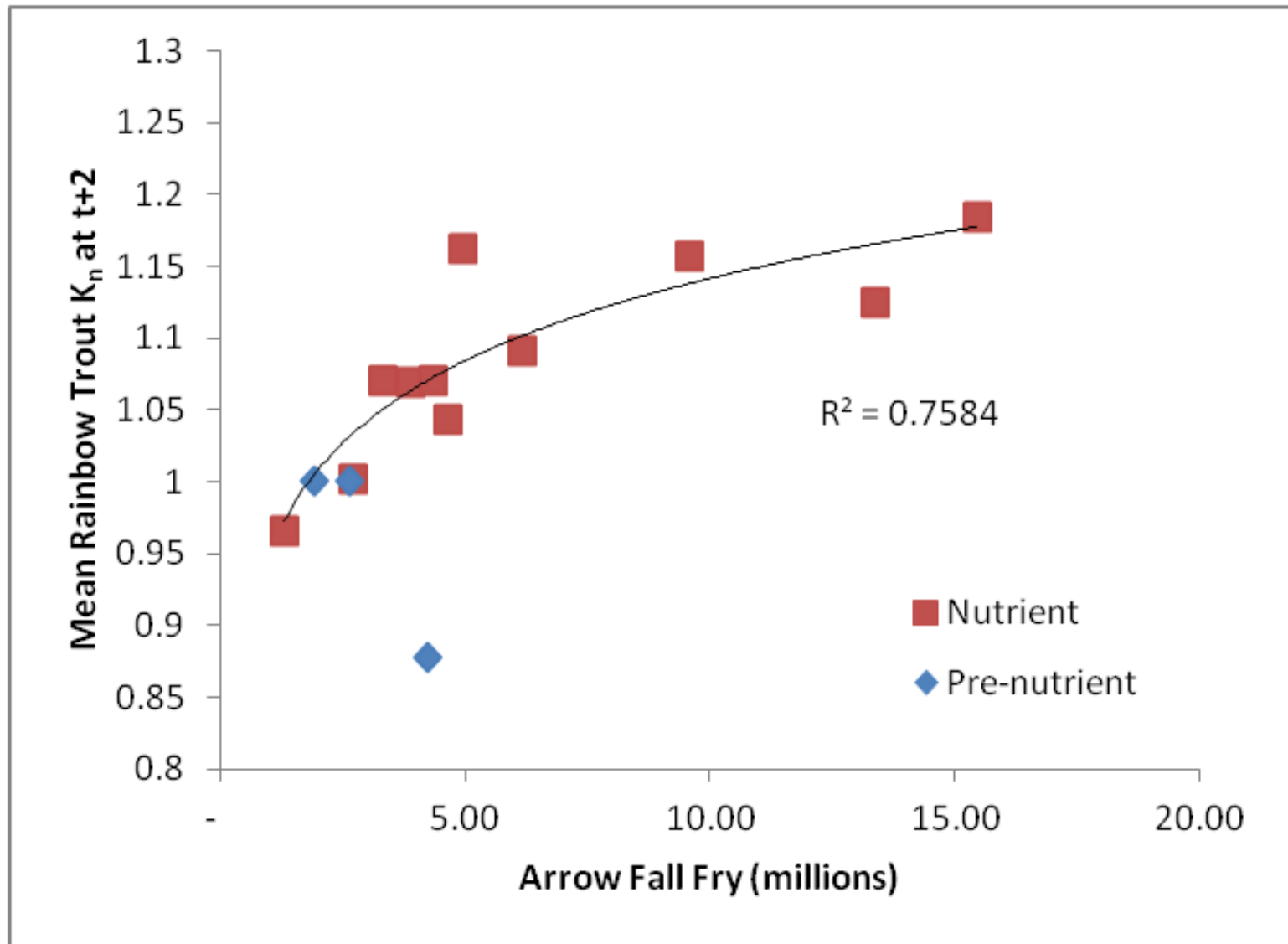
Review Recommendation:

- Hill Creek Spawning Channel fry production target 1-2 M for 4 year cycle

# Bull Trout condition ( $K_n$ ) compared to Kokanee fry abundance

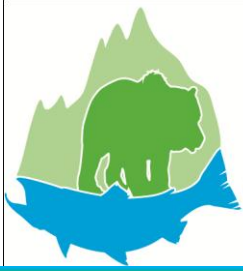


# Rainbow condition ( $K_n$ ) compared to Kokanee fry abundance



# Arrow Reservoir, next management steps

- Continue nutrient additions with annual/weekly adjustments based on flow and other data
- Adjust Kokanee production at Hill Creek Spawning Channel to optimize for fishing and predators
- Analyze and model results to improve nutrient additions (timing, amounts, location) and spawning channel operations



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