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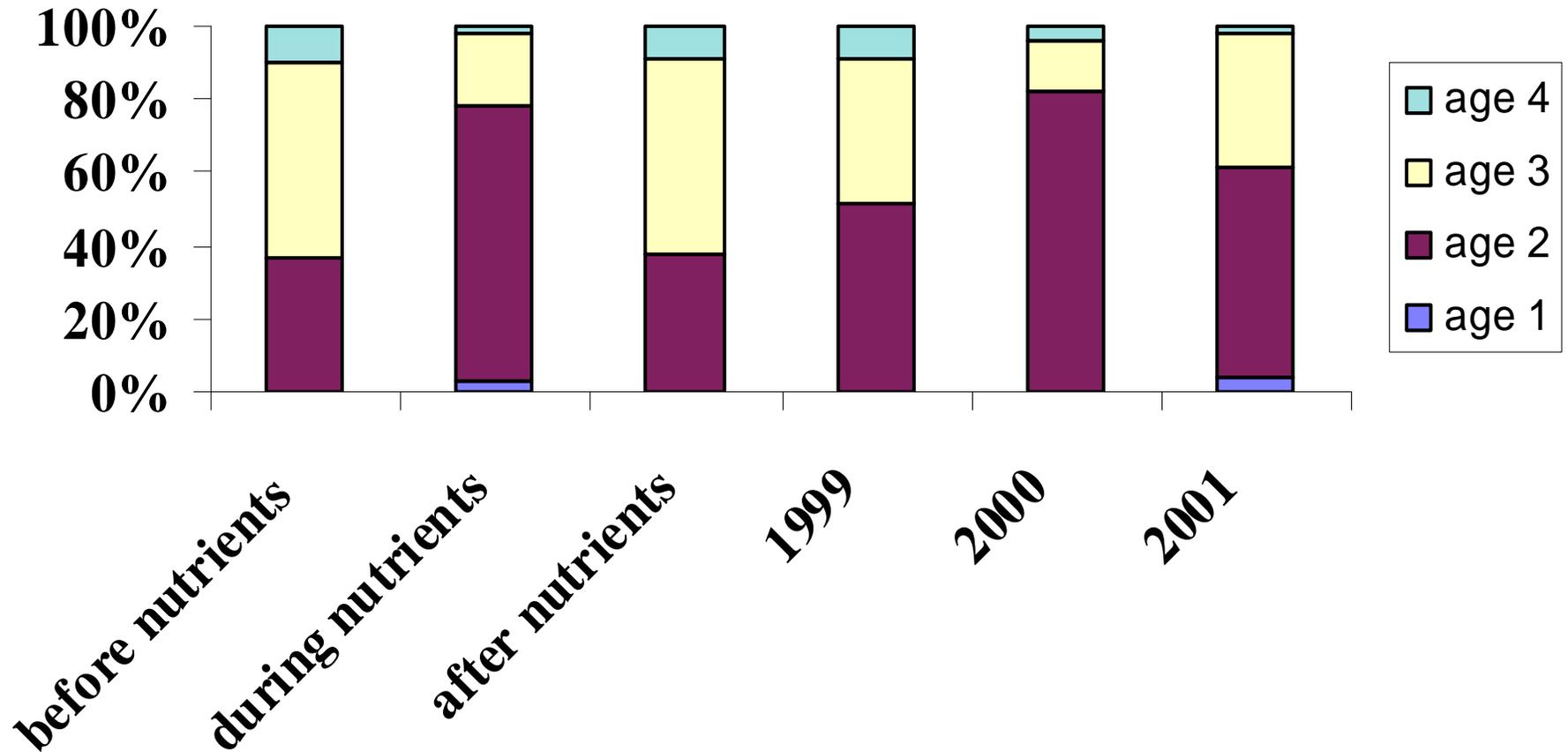


**Pacific Salmon and Wildlife**  
**Ecological Contexts, Relationships,**  
**and Implications for Management**

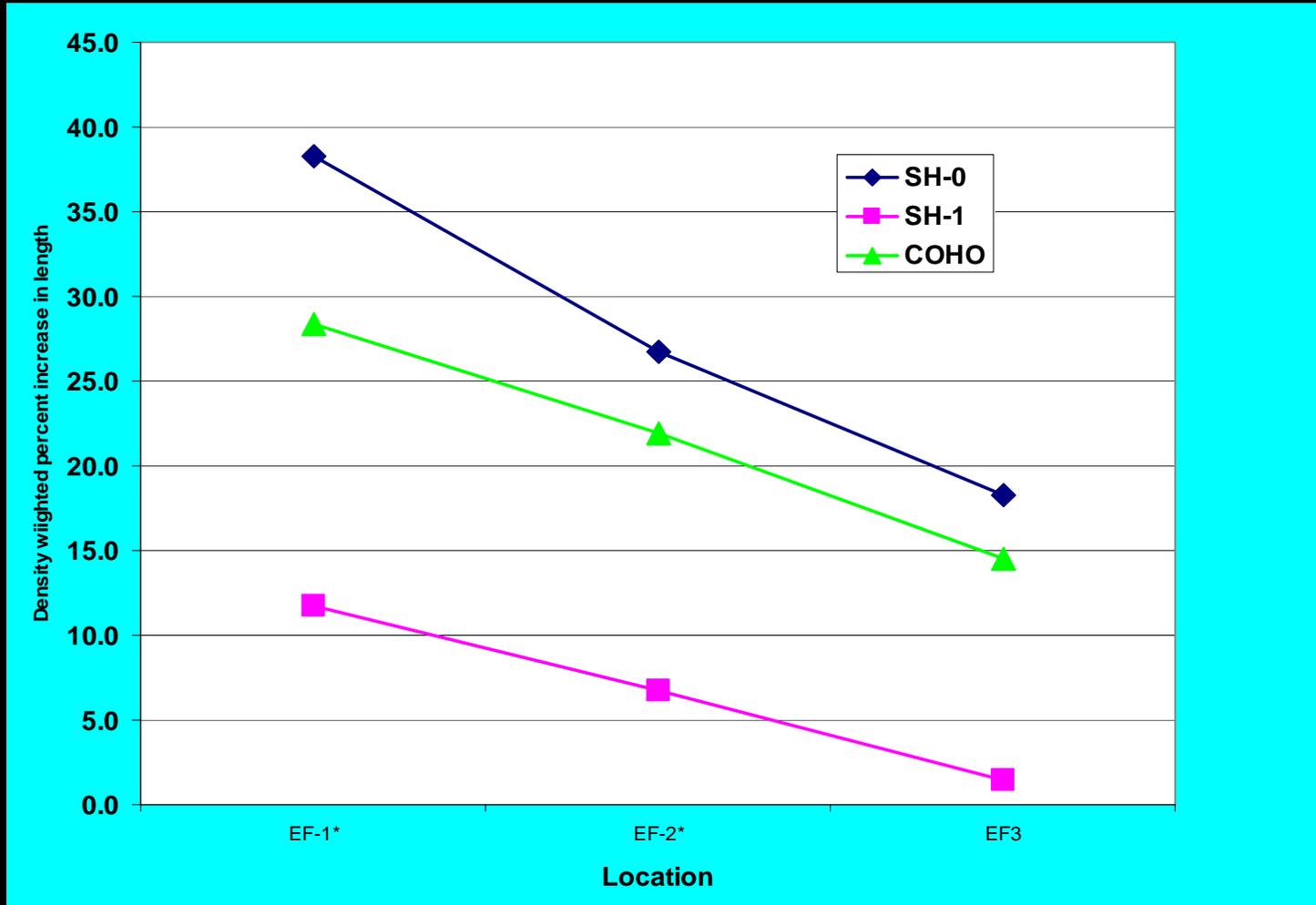
Special Edition Technical Report



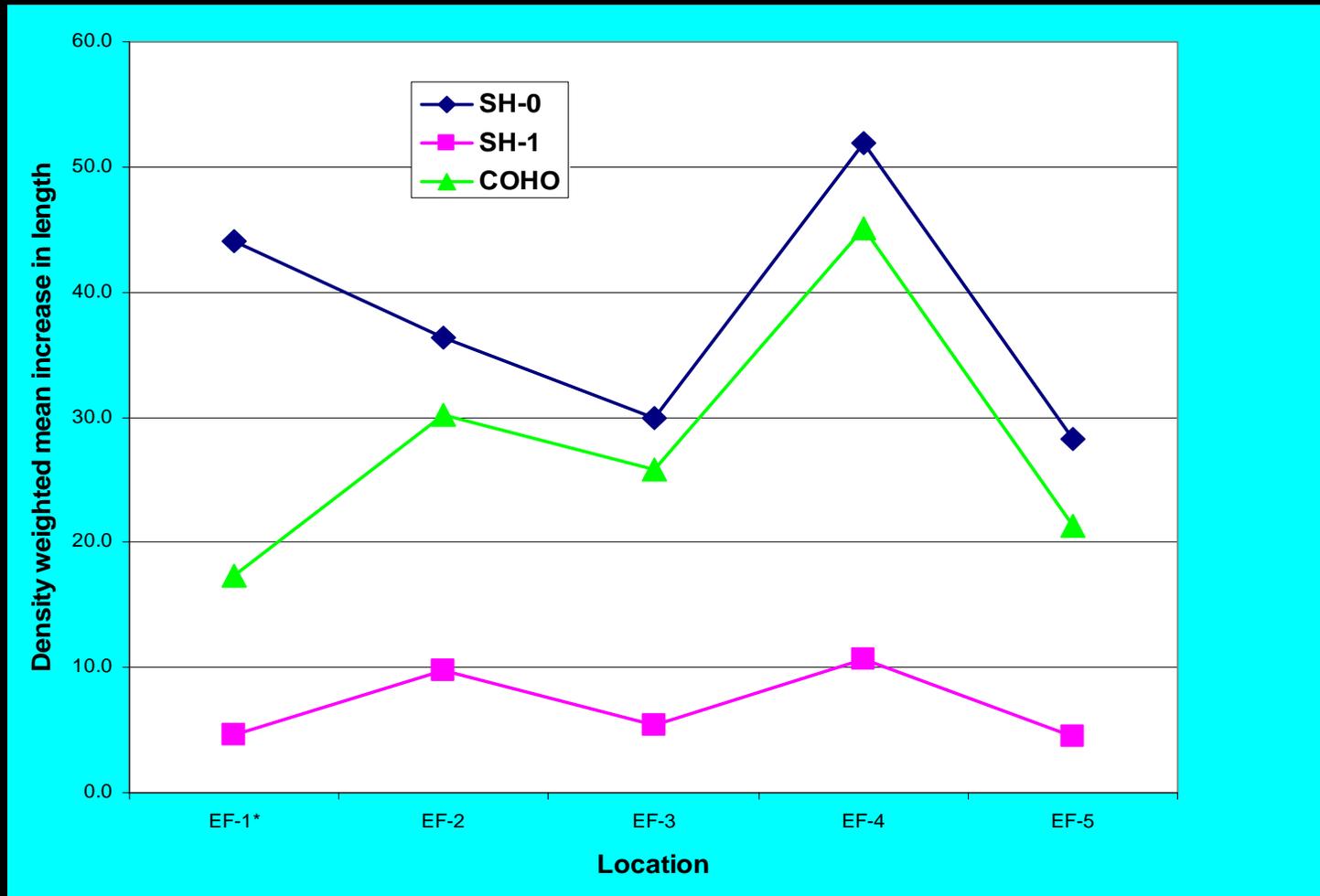
# Effect of nutrient addition on Keogh steelhead smolt



# SALMON CREEK INCREASE IN LENGTH



# SNOW CREEK INCREASE IN LENGTH



- Snow Creek

## Salmon Creek

### Coho Salmon

	Mean FL	Survival to return	Mean FL	Survival to return
• 1977	99	7.9%	102	20.0%
• 1978	101.3	9.11%	102.1	12.1%

Chum salmon escapement biomass per square metre

	Biomass	Biomass
• 1976	0.037	0.217
• 1977	0.014	0.122
• 1978	0.037	0.362
• 1979	0.003	0.069
• 1980	0.012	0.464

# MODELS AND BEST AVAILABLE SCIENCE IN KARLUK LAKE, ALASKA

- Sockeye escapement goal at MSY = 675,000.
- Sockeye escapement goal at MSY, including nutrient interactions, is 800,000-1,000,000.
- Sockeye escapement capacity based on limnological considerations, is 2,000,000.

# Sediment shakes salmon science

Population cycles of salmon vary drastically over millennia

By SCOTT SIMPSON

Pacific salmon populations were in drastic fluctuation for thousands of years before human activity began showing an impact on spawning stocks, according to a Canada-U.S. research team in an article to be published today in *Nature*.

Using sediment samples from the bottoms of remote Alaskan lakes, a team of paleogeologists and marine biologists have unearthed evidence of the rise and fall of sockeye salmon populations over a period of time exceeding 2,000 years.

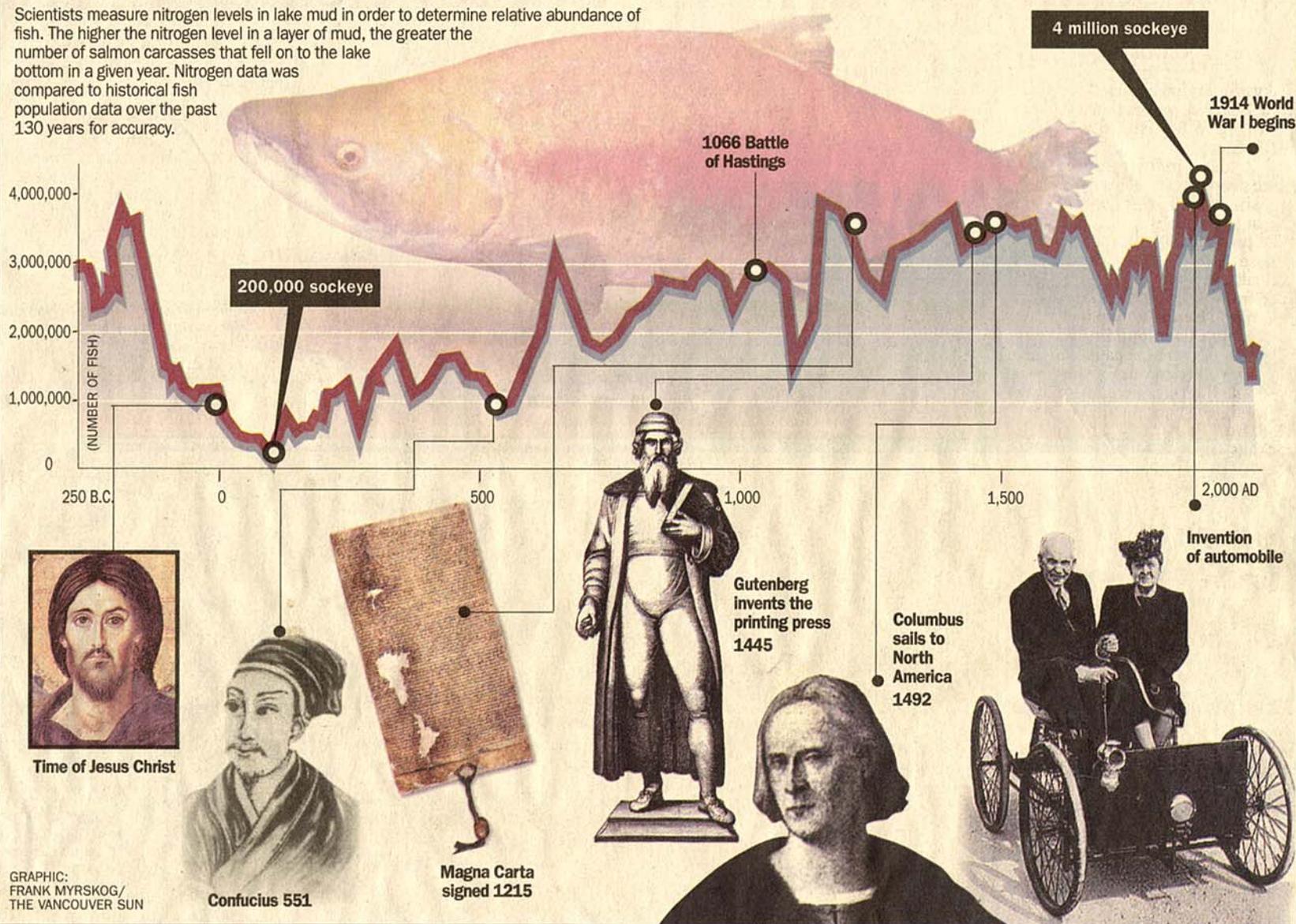
In some cases, the sediment shows that troughs in salmon abundance persisted for several human lifetimes.

Climate change is suggested as the cause — the researchers say they were shocked to document very low population numbers in the period between 100 BC to 300 AD, solely as a result of natural fluctuations in weather and ocean currents and temperature.

"This blows our notion of salmon population dynamics right out of the water," says paleolimnologist Irene Gregory-

## Salmon numbers through the ages

Scientists measure nitrogen levels in lake mud in order to determine relative abundance of fish. The higher the nitrogen level in a layer of mud, the greater the number of salmon carcasses that fell on to the lake bottom in a given year. Nitrogen data was compared to historical fish population data over the past 130 years for accuracy.



Time of Jesus Christ



Confucius 551



Magna Carta signed 1215



Gutenberg invents the printing press 1445



Columbus sails to North America 1492



Invention of automobile

GRAPHIC: FRANK MYRSKOG / THE VANCOUVER SUN

## MANAGERS VS. ECOLOGISTS

- “This hypothesis will continue to be tested when the productivity of systems in which salmon escapement has recently been *increased substantially* is reassessed”

## Comparison of various carcass biomass loading rates and 1998-2002 carcass loadings for the Skagit River. Loadings in kg/m<sup>2</sup>

Load	Justification	Watershed need	% provided min esc	% provided max esc	reference
0.07	no growth increase	1,477,000	30.5%	159.8%	Claeson (pers comm.)
0.15	coho to coho	3,165,000	14.2%	74.6%	Bilby et al. (2001)
0.63	enhance Keogh	13,300,000	3.4%	17.8%	Ashley & Slaney (1997)
0.78	sockeye to insects	16,500,000	2.7%	14.3%	Bilby et al. (2001)
1.9	system capacity	40,100,000	1.1%	5.9%	Wipfli et al. (2003)

# SIMILKAMEEN CHINOOK

- At 0.15 kg/m<sup>2</sup> (way below recommendation) produces a goal of 11,500.
- Since 2001, thousands of chinook have spawned in the river. Up to 8,000+ in 2003
- Pathogen outbreaks have occurred at the rearing pond coincident with large escapements
- In 2003, due to low and warm water most spawners died, pre-spawning.
- The pathogen load ended up killing most other fish in the river in 2003.
- Carcasses, without quality habitat, don't always help the situation.