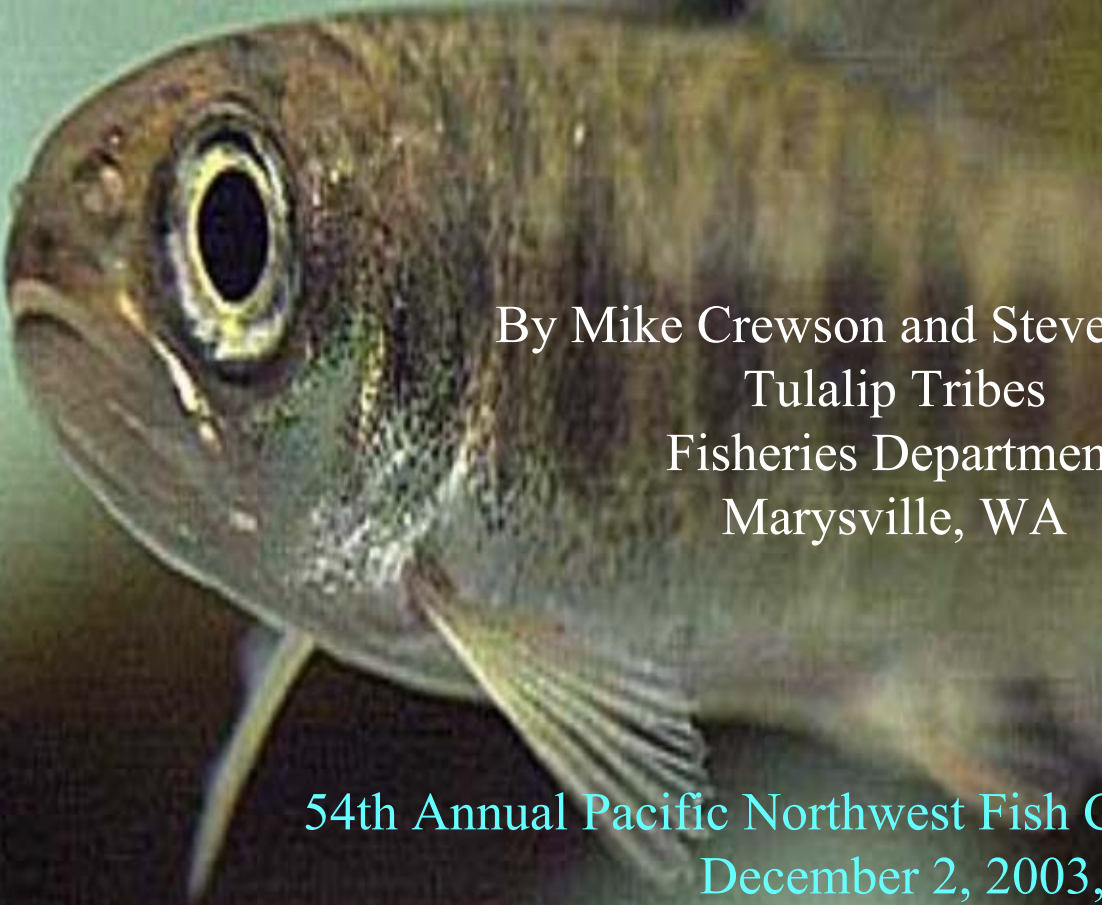


# Changes in Tulalip Tribal Enhancement Program Practices to Minimize Negative Genetic and Ecological Interactions Between Natural and Hatchery Fish



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# ***TULALIP HATCHERY***

- 
- A photograph of the Tulalip Hatchery. A long, single-story building with a brown roof and a concrete foundation is situated behind a body of water. The building has several windows and a ramp leading to the water. In the foreground, there are concrete structures in the water, possibly for fish farming. A red pickup truck and a dark car are parked on the right side of the building. The background is filled with dense green trees under a blue sky with some clouds.
- ✿ **Maintain traditional fishing opportunity**
  - ✿ **Manage for natural production**
  - ✿ **Selectively harvesting the hatchery returns**
  - ✿ **Minimal impacts on natural salmon stocks**





# Program goals:

Maximize hatchery program effectiveness, & minimize negative genetic and ecological effects on natural fish

## Change or modify:

- Broodstock source and selection criteria
- Incubation and rearing methods
- Release practices
- Post-release monitoring



# Changed Source of Chinook Broodstock

- ❖ From **fall Chinook**: An out of basin stock
- ❖ To summer Chinook: Native to the Skykomish River

✓ *Genetically and ecologically more similar to the locally-adapted chinook populations*





# Broodstock Selection Criteria

- Selecting eggs and milt from early returns only (before mid - August)
- Avoid late returns (after September 1<sup>st</sup>), likely remnant fall stock
- Since all hatchery stock are mass marked and/or coded-wire tagged denoting their Skykomish summer stock origin,
- Current strategy: select only marked and/or tagged hatchery returns





# Tulalip Hatchery Programs

Species	No. Released	% Marked	Mark Type	Return
Summer Chinook	1,500,000	100%	otolith mark	5,000 - 20,000?
	100,000	7%	CWT/Ad	(Under Evaluation)
Fall Chinook	200,000	100%	otolith mark	1,000 - 2,500
	100,000	50%	CWT/Ad	
Coho	1,000,000	5-10%	coded-wire tag/Ad	40,000- 100,000
	300,000	33%	Ad-only	
Chum	8,000,000	100%	genetic mark	15,000 - 100,000



# Thermal Mass-Marking

## Measure relative:

- survival rates (for each Chinook stock),
- hatchery and natural escapements,
- ecological interactions,
- smolt and adult timing patterns,
- evaluations of comparative straying,
- Marine and freshwater distribution patterns,
- contributions to fisheries,
- incidental impacts on listed chinook stocks while targeting a particular stock,
- size at age, and
- Ex-vessel value



# Thermal Marking of Otoliths

- ❖ Evaluate net performance of the summer Chinook stock
- ❖ Important consequences for Tribal hatchery program and fishery



# *Upper Tulalip Creek Pond*

- Large earthen reservoir (160 m X 40 m X 3 m)
  - > 22,000 m<sup>3</sup> or >800,000 ft<sup>3</sup>
- Natural rearing conditions include:
  - Overhead and within-pond cover, LWD
  - Riparian side cover, undercut banks
  - Natural substrate, low rearing densities
  - Natural inflow, high water quality
  - Natural feed and predators



# *Lower Tulalip Creek Pond*

- Large earthen reservoir (50 m X 20 m X 3 m)
  - $> 3,000 \text{ m}^3$  or  $> 100,000 \text{ ft}^3$
- Natural rearing conditions:
  - LWD, RIPARIAN SIDE COVER
  - UNDERCUT BANKS
  - NATURAL SUBSTRATE
  - NATURAL FLOW, GOOD WATER QUALITY
  - LOW REARING DENSITIES
  - NATURAL FEED ORGANISMS AND PREDATORS



# *Lower Tulalip Creek Pond*

- Release Pond
  - Release valve and fish ladder
  - Release directly into Tulalip Bay
  - Mouth of Tulalip Creek



# ***Battle Creek Pond***

- Large earthen reservoir  
**> 5,000 m<sup>3</sup> or ~ 200,000 ft<sup>3</sup>**
- Natural rearing conditions include:
  - **Overhead and within-pond cover, LWD**
  - **Riparian side cover, undercut banks**
  - **Natural substrate, low rearing densities**
  - **Natural inflow, high water quality**
  - **Natural feed and predators**



***Battle Creek Pond***  
***Rear View (90 X 20 X m long)***





# Natural Predators

Double-Crested Cormorant



River Otter





# ***Cormorants in Upper Tulalip Creek Pond***





# *Upper Tulalip Creek Pond*





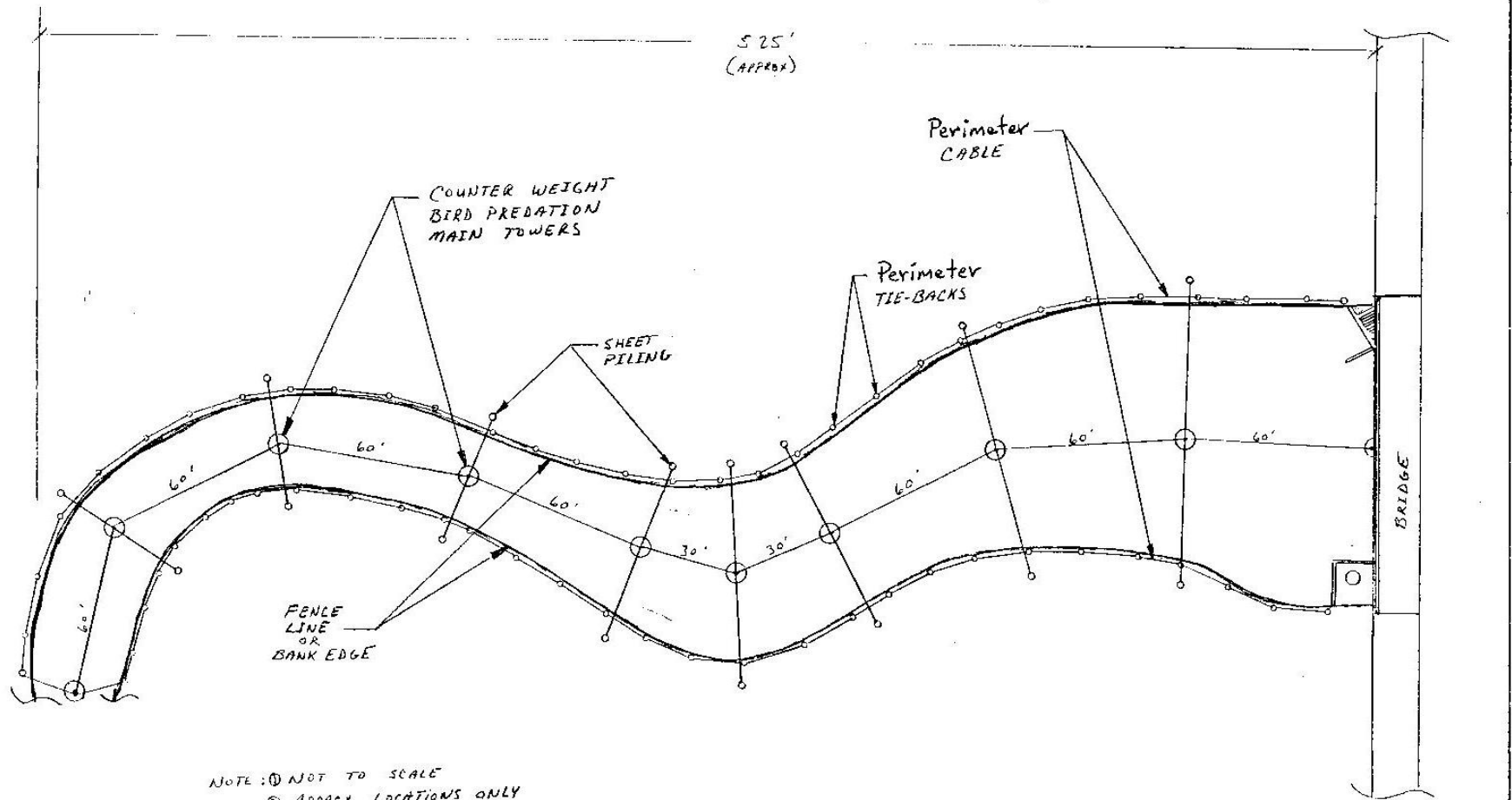
# *Upper Tulalip Creek Pond*



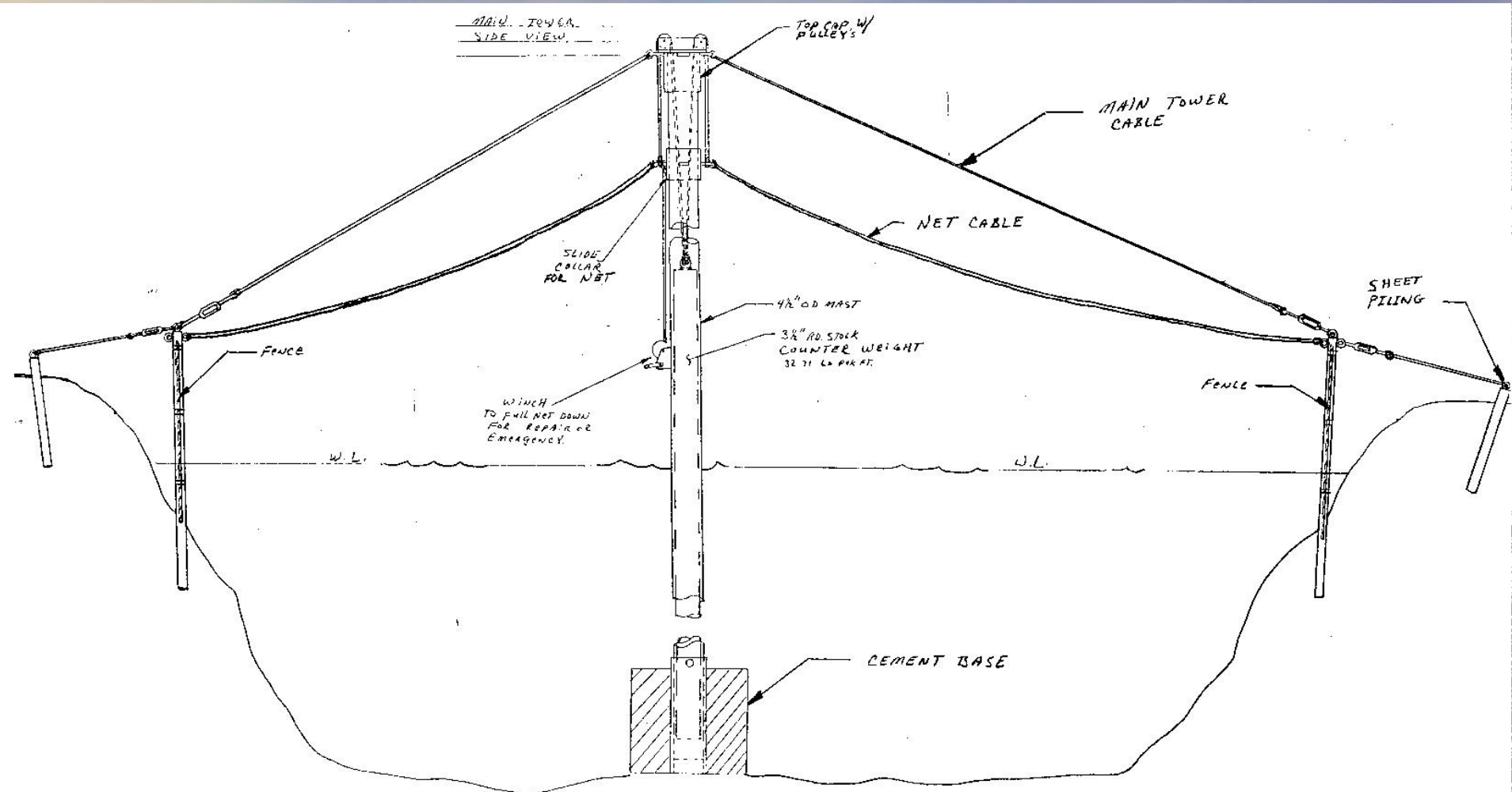


# Bird net structural support posts and cables

**Initial idea:** Bird net reaches to perimeter fence  
"safe zone", outside zone: predation training area



# Upper Tulalip Creek pond bird net, otter fence, and predation arena





# Release Monitoring



Electronic Fish Counter



# ***Fish Counting Tunnels***

***Electronic coho smolt counter  
plugged into 16, two-inch-diameter  
counting tunnels***



# ***Mounting Counting Tunnels***

↵ ***Mounted on screened panels and stop logs in fishway weir between the upper and lower ponds***

↵ ***Smolts pass through counting tunnels From upper to lower ponds during release***



# ***View From Lower Pond***

Electronic counter mounted in weir

Screened panels above outflow to lower pond







# Sampling Program

- ✱ Coded-wire tags
- ✱ Scales
- ✱ Otoliths
- ✱ Genetic stock identification





# Sampling Program

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# Sampling Program

- ✱ Coded-wire tags
- ✱ Scales
- ✱ **Otoliths** →
- ✱ Genetic stock identification
- ✱ Genetic stock identification





# Sampling Program

- ✱ Coded-wire tags
- ✱ Scales
- ✱ Otoliths
- ✱ Genetic stock identification



# Hatchery Contribution Estimate From Otolith Sampling

Year	8D Catch	Hat. %	Hat. #
1997	8,295	96.8%	8,033
1998	7,101	92.1%	6,537
1999	15,076	97.7%	14,735
2000	7,605	89.9%	6,840
2001	4,511	93.4%	4,213
	42,588	94.0%	36,144

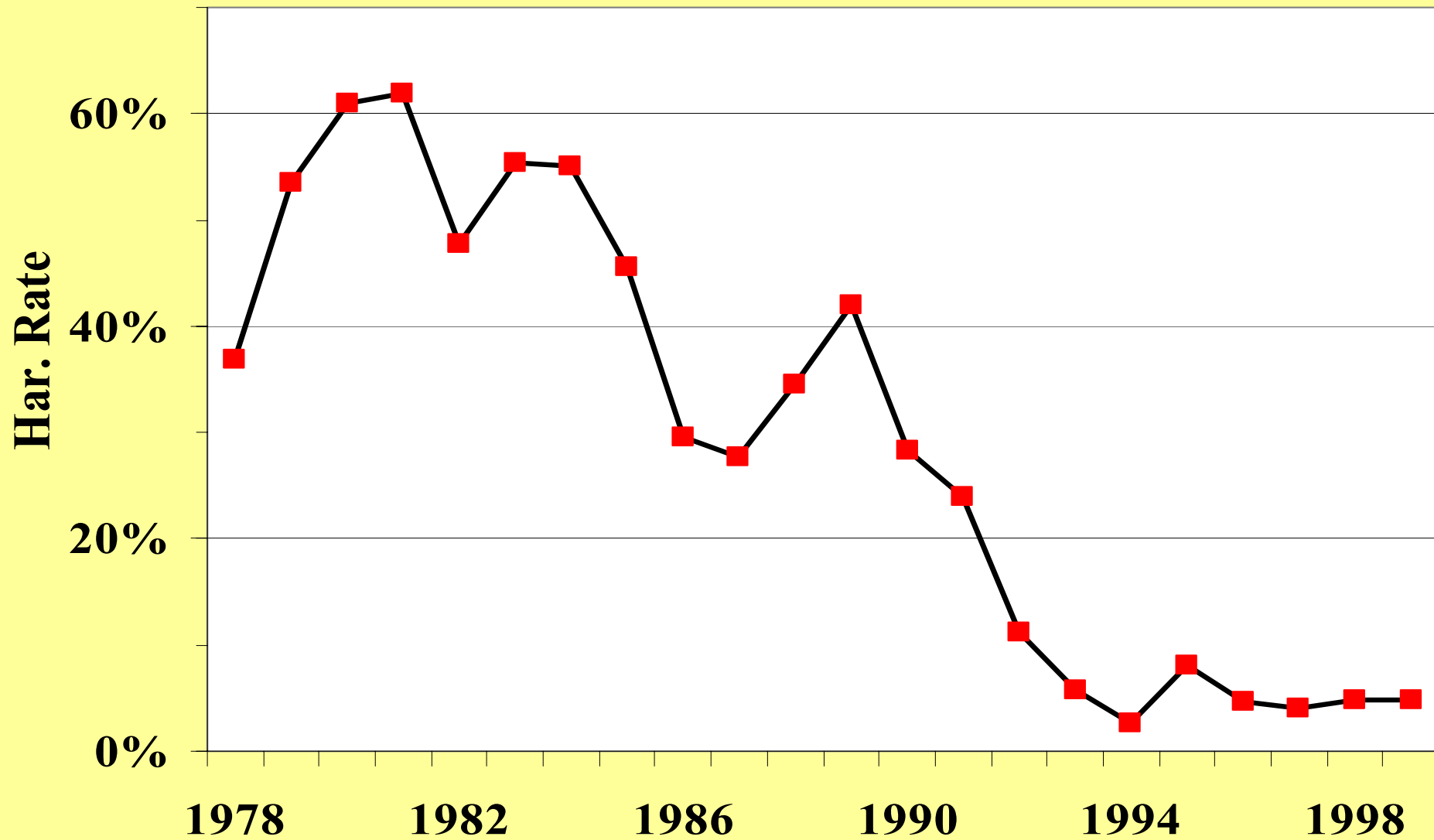


Hatchery/Natural Chinook Contribution to Snohomish Basin, 1997.				
Spawning Escapement by Origin				
	Sub-basin	Natural Origin	Hatchery Origin	Total
	Wallace River	289	424	713
		41%	59%	
	Skykomish/Pilchuck	1,275	265	1,540
		83%	17%	
	Snoqualmie	1,892	151	2,042
		93%	7%	
	Overall	3,455	1055	4,510
		77%	23%	100%

Hatchery/Natural Chinook Contribution to Snohomish Basin, 1998.				
Spawning Escapement by Origin				
	Sub-basin	Natural Origin	Hatchery Origin	Total
	Wallace River	210	1,335	1,545
		14%	86%	100%
	Skykomish/Pilchuck	1,285	1,584	2,869
		45%	55%	100%
	Snoqualmie	1,361	530	1,892
		72%	28%	100%
	Overall	2,856	3,449	6,305
		45%	55%	100%



## Area 8A/8D Harvest Rates on Wild Chinook



# Snohomish Chinook

"Then" & "Now"

