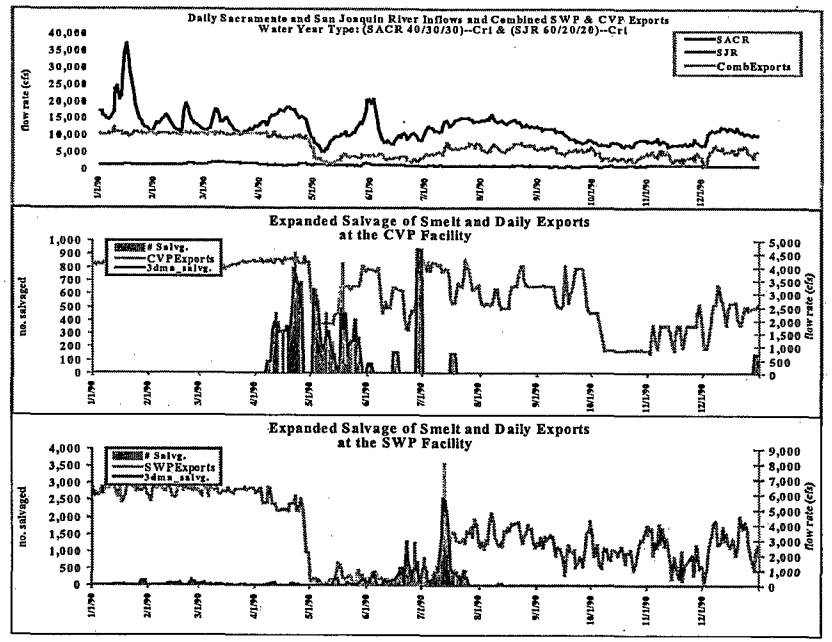
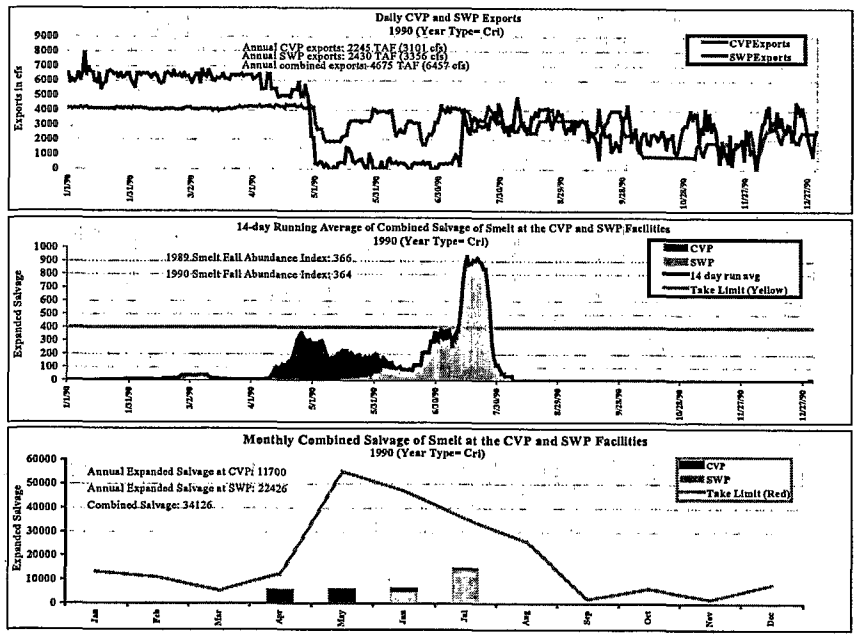
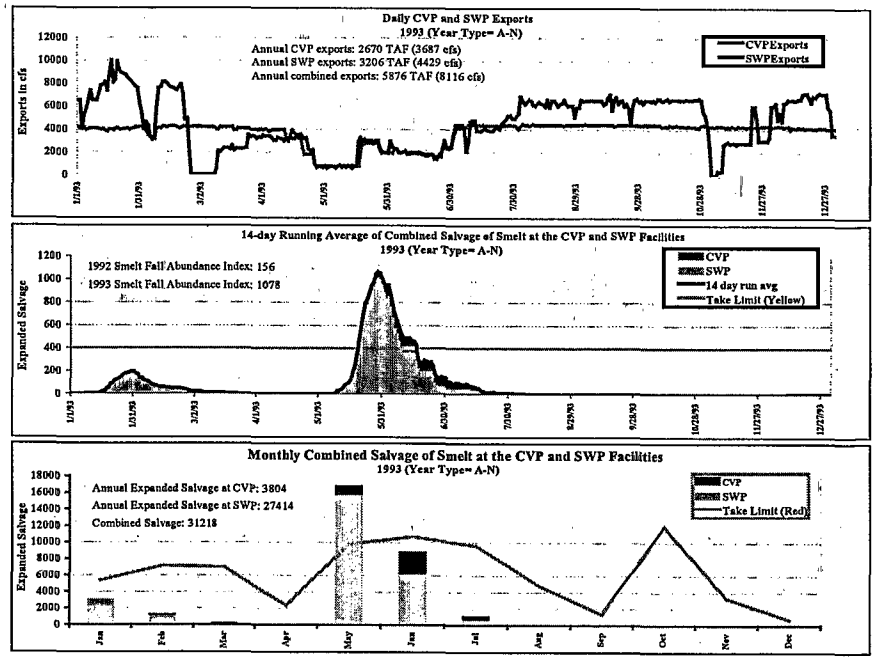
Objectives of Using the Fish Triggers

- Reduce fish mortality.
- Recover export opportunities.
  (by reducing the frequency of "yellow and red-light" alerts)
- Allow more freedom and flexibility for the operators to achieve the various objectives--satisfying Delta standards, reducing fish losses, lowering operating costs, improving water quality, meeting flood control requirements, export supply, and other operational requirements.







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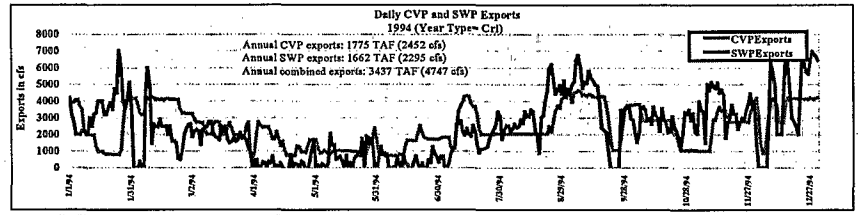

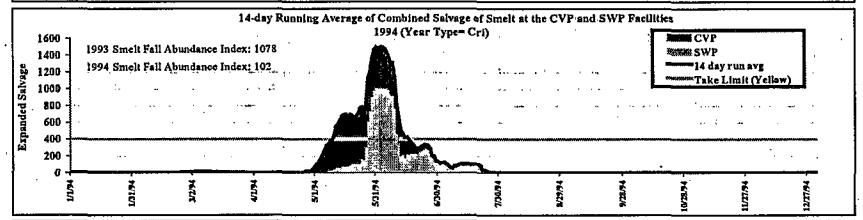

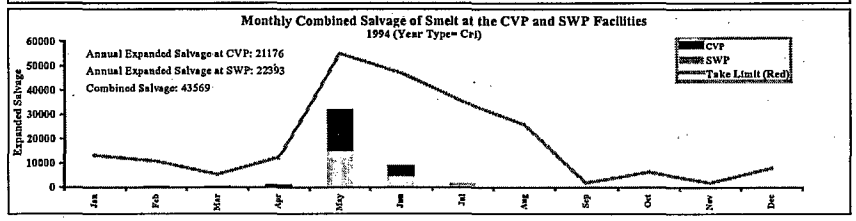

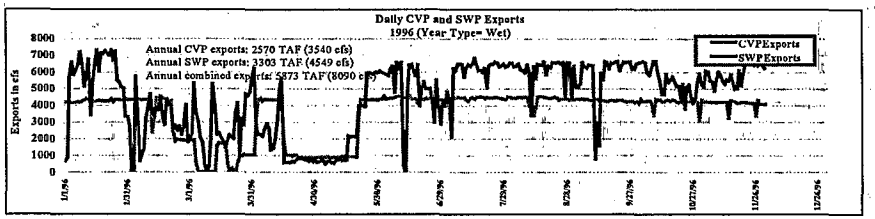

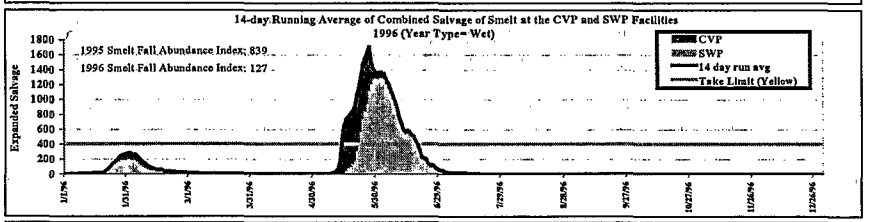

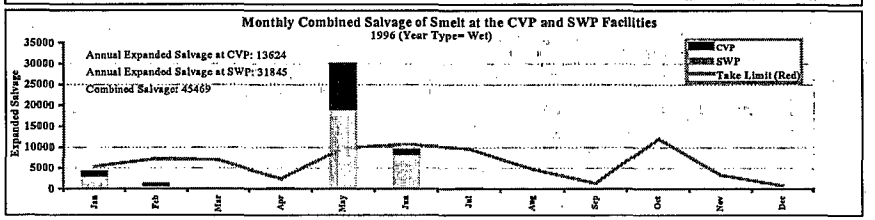

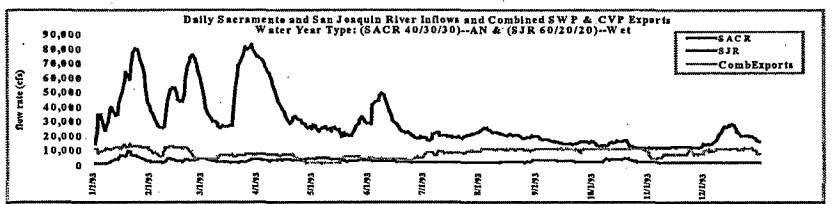

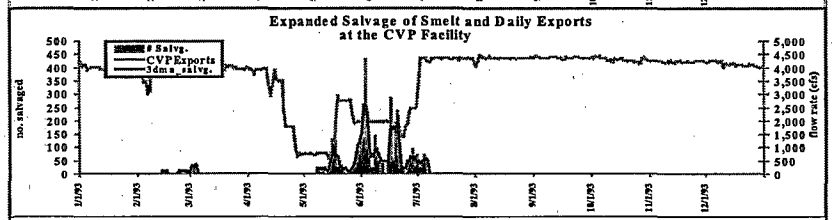

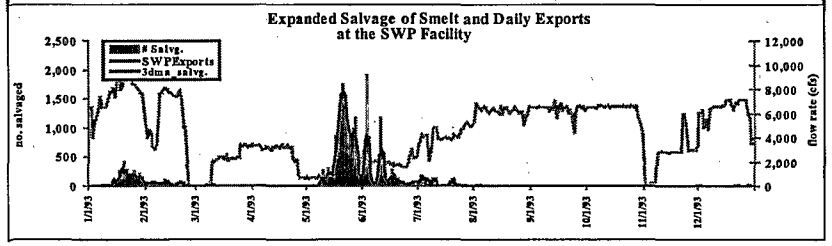

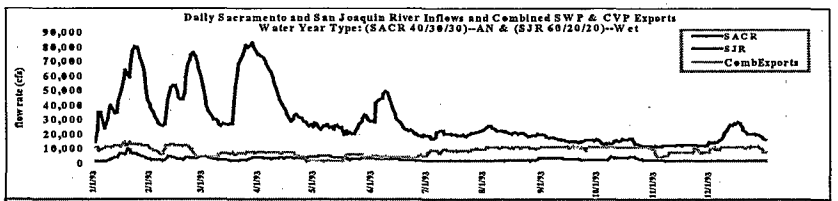

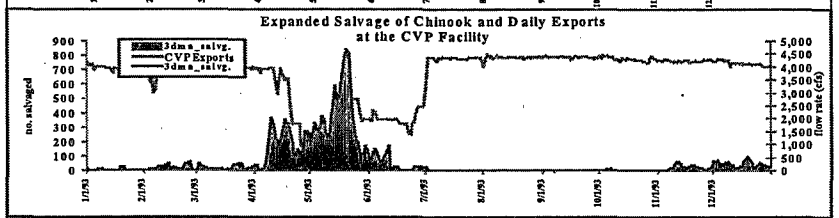

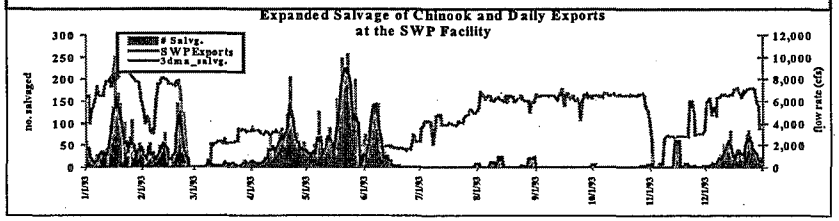

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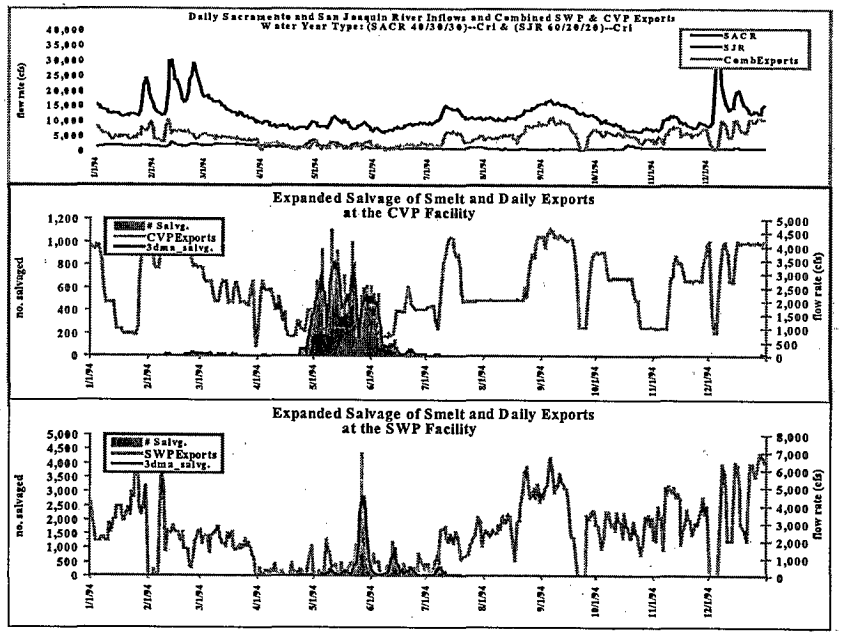

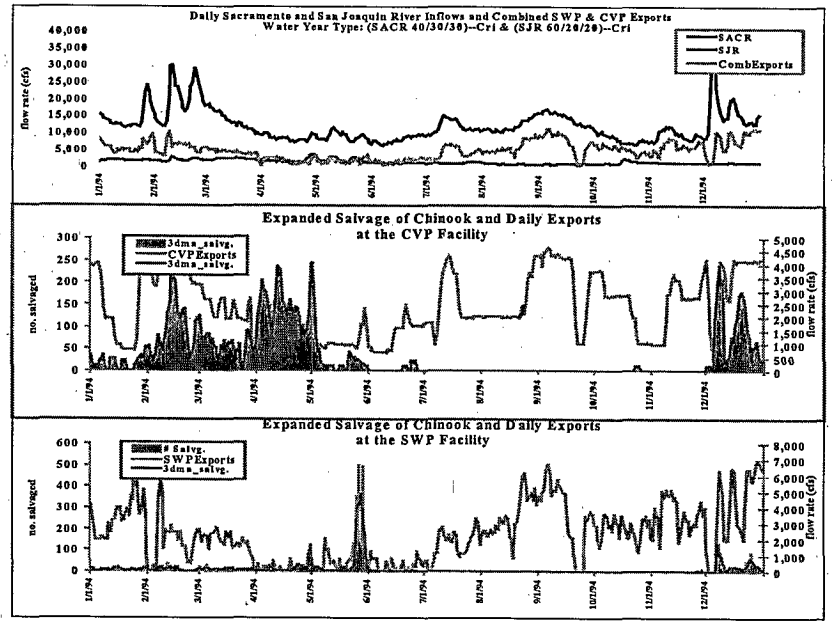

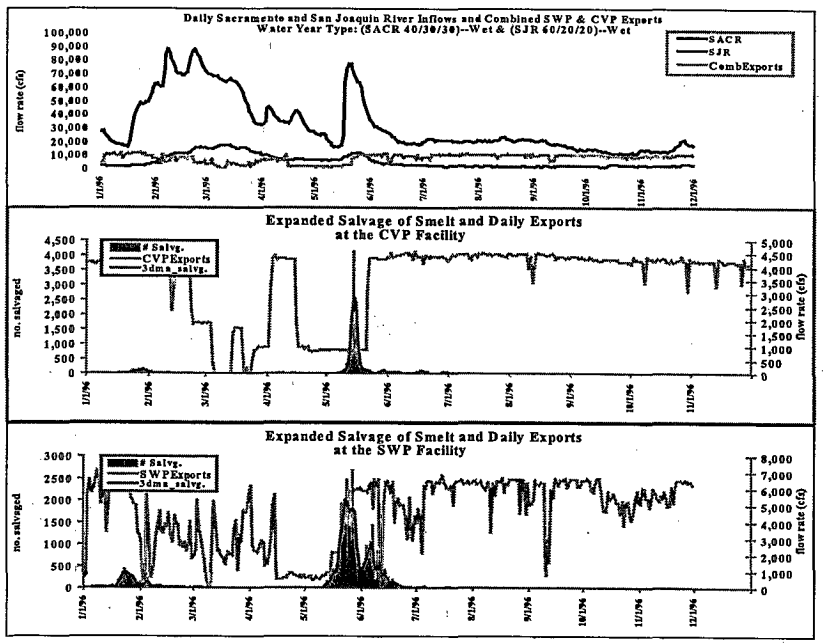

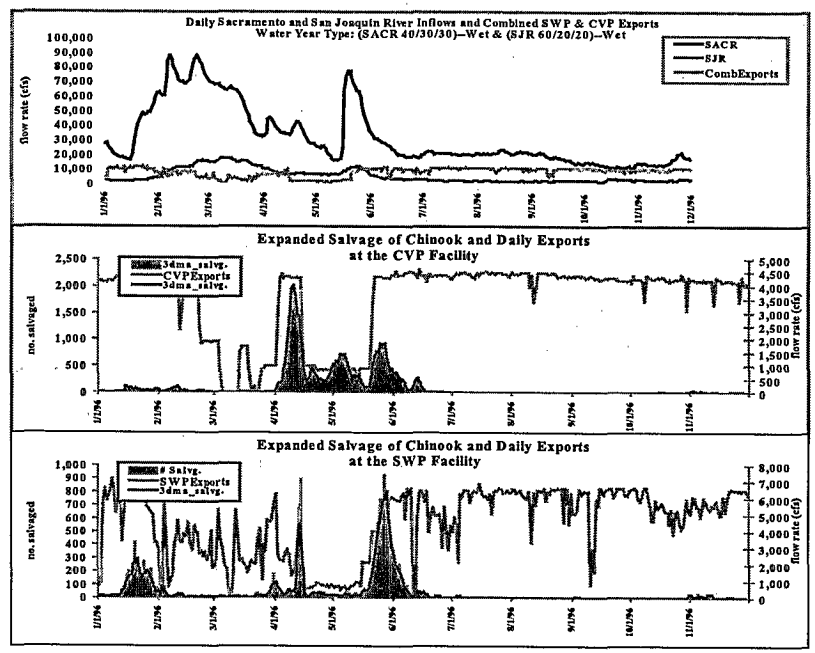

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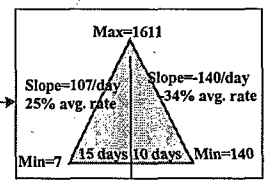
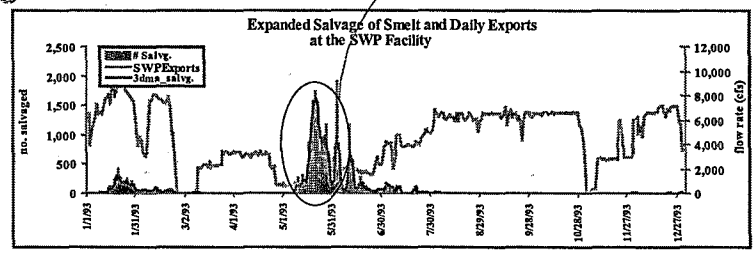
Characteristics of the Salvage Data

- They come in "waves."
- Significant differentials in frequency, magnitude timing and duration for different years and between SWP and CVP intake facilities.

Fish Triggers

- The contemporaneous salvage count*
- The rate of change (increase or decrease) in the salvage count (slope on the curve)
- The duration (uprising and recessing limbs)





* If there are data reflecting the timing and quantity of fish arriving at the intake that are relatively independent of exports, they can be used in place or in support of the salvage data.

Fish-Triggers Operating Strategy for Reducing Fish Risk while Maintaining Export Targets

Step 1-Setup
Set Annual/ Monthly Export Targets
Estimated maximum allowable daily exports from predicted hydrologic conditions, Delta standards (water quality, X2, E/I, etc.) and other operational requirements (storage, flood control, temperature control, etc.)

Step 2-Operations

On day one

- **Operate to export up to maximum allowable or the preset monthly export target.**
- **Record fish densities (salvage/export would be used as a proxy) at the intake facilities for selected species (Smelt, Chinook, Splittail, and others).**

On day two

- **Observe the contemporaneous fish density at the intake and the rate of change from previous day. If the contemporaneous density is greater than a preset trigger level or the rate of increase in the density from previous day is greater than 10%, reduce export from the currently operating level by 25%. If neither condition exists, continue exporting at the same level or even increase up to the maximum allowable limit.**
- **Record the resulting fish densities and export surplus or deficit (difference between actual and the target export.**

On day three
Similar steps as for day two, except that if the rate of increase over three days in the density persists (5% or 10%), reduce the export further by 50% from the initial level back in day two, but no less than some minimum level that represents a shutdown. Again record resulting densities and export surplus and deficit.

On day four
Same as day three, except if the rate of increase over four days in the fish density continues, reduce export by 75% from the initial level back in day two. Again, it can not be lower than the shutdown condition.

On day five
Same as day four, except that if rate of increase in the fish density continues, export would move into the "shut-down" mode—zero or some minimum level (2000 cfs combined CVP/SWP).

Climbing-out (of the slow-down or shut-down) mode

- **When the observed rate of change in the fish density becomes negative (by –5% or –10%), increase export by 25% from current export level on second day of the climb-out, 50% on third day and so on.**
- **Either the contemporaneous density is below a preset level or the rate of change continues on a negative trend, increase export back up to maximum allowable levels.**

Make-up mode

- **Any opportunity to make up for the recorded cumulative export deficit when conditions are ideal (surplus water available and fish not around), export up the daily maximum allowable and make use of available capacity at Banks or Tracy.**
- **If the annual export target is reached, job is done. It could even be done early in the year.**
- **If there is still a significant amount of export deficit to erase coming towards the end of the year due to a great deal of slow-downs and shut-downs earlier in the year, a decision would have to be made either to increase export by lifting the fish density triggers at some point in the year to close the export gap for the current year or try to make it up from subsequent year.**

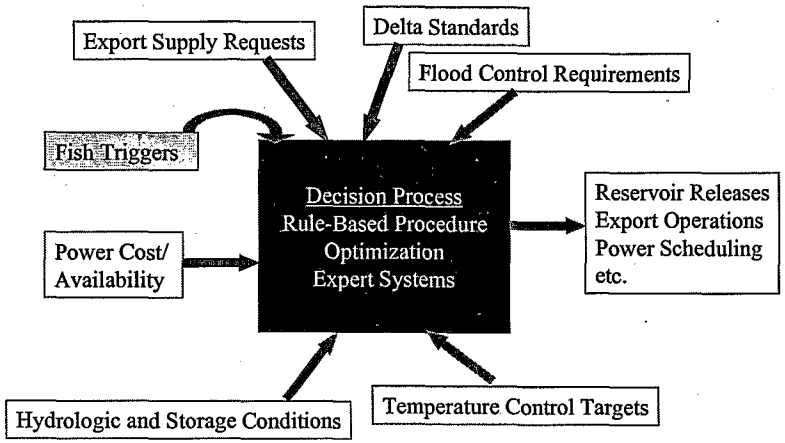
Comparison of Fish Triggers to Actual Exports

	Exports (in maf)			Fish Risk Index (unweighted)			
	Banks	Tracy	Total	Banks	Tracy	Combined	
1984	2.18	2.60	4.78	179,583	92,537	272,120	Actual Export
	2.19	2.61	4.80	26,962	27,975	54,937	Fish Triggers
1989	3.79	2.94	6.73	138,011	21,149	159,160	Actual Export
	3.90	2.26	6.16	48,172	30,793	78,965	Fish Triggers
1993	3.22	2.68	5.90	88,944	51,642	140,586	Actual Export
	3.51	2.35	5.86	41,039	6,766	47,805	Fish Triggers
1996	3.24	2.60	5.84	76,626	36,707	113,333	Actual Export
	3.26	1.57	4.83	66,837	9,893	76,730	Fish Triggers

Concluding Remarks

- Salvage data can serve as triggers to establish quicker response from project operations to reduce fish mortality.
- These triggers would also provide greater flexibility for project operations to recover export opportunities.
- We need to consider other operational requirements-- reservoir operations, power scheduling, flood control and others.

Integration of Fish Triggers into CVP/SWP Systems Operations



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