NMFS Overview of Salinity Modeling

Conceptual Framework for Estuaries

- Resilience of populations to natural environmental variation is reflected in population and life history diversity which maximizes ability to exploit estuarine rearing habitats
- A function of diverse rearing behaviors (phenotype), genotypes, and rearing habitats

Biological Factors - Conceptual Framework

- Timing of migration
- Age at migration
- Alternating periods of residence
- Variation in size at ocean entry

Conceptual Framework - Needs

- Successful estuarine ecosystem a function of genotype and habitat that allow for the full expression of salmon rearing and migration behaviors
- Point estimates or evaluation of single and independent factors will not likely provide a holistic characterization of the impact of modification of habitats affecting full expression of life history diversity

NMFS Conclusion - Modeling

- NMFS concludes most predictable impacts are changes in the physical dynamics of the estuary
- Verification documents ability to represent existing conditions - makes extrapolation (prediction) believable
- NMFS stakeholders requires best possible science achieved through regional consensus
- Conditions have changed

Modeling - NMFS Concerns

- Model verification
- Flow conditions evaluated
- Spatial resolution
- Salinity the primary physical factor characterized

Additional Issues

- ‘Averaging’ the impact vs characterizing the impact to specific habitats
- Is change more important than actual levels?
- Model less accurate at pinpointing exact location where the change occurs, it is the change that is accurate - is this OK?
- What was predicted and what happened during the last channel deepening

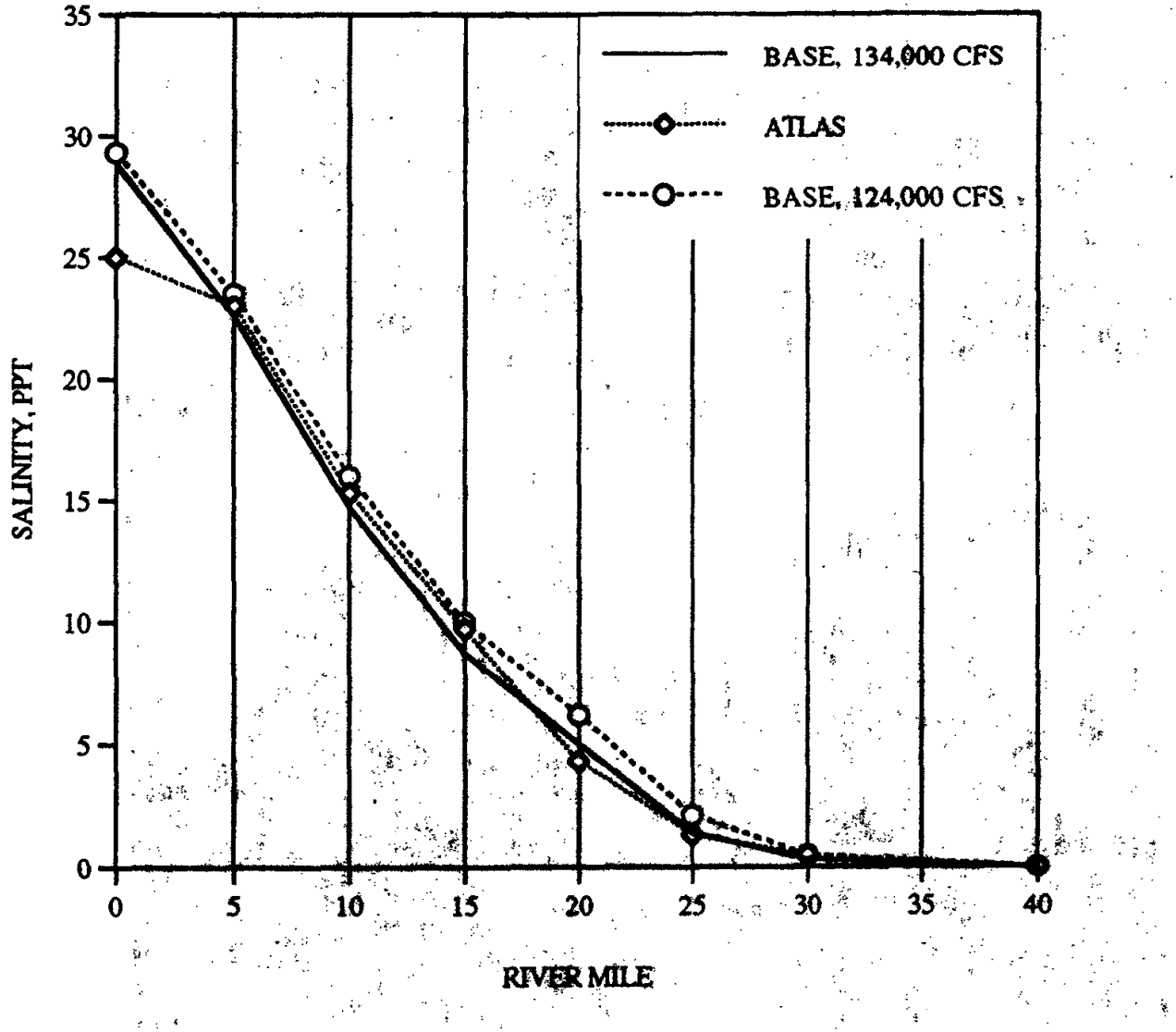
Model Verification - Approach

- “Not exactly seeking to replicate river behavior - only to get in the ballpark”
- “Full detailed verification is time extensive & requires collection of enormous amounts of field data”
- “Intent to conduct less detailed verification using preexisting data”
- Detailed data is now available

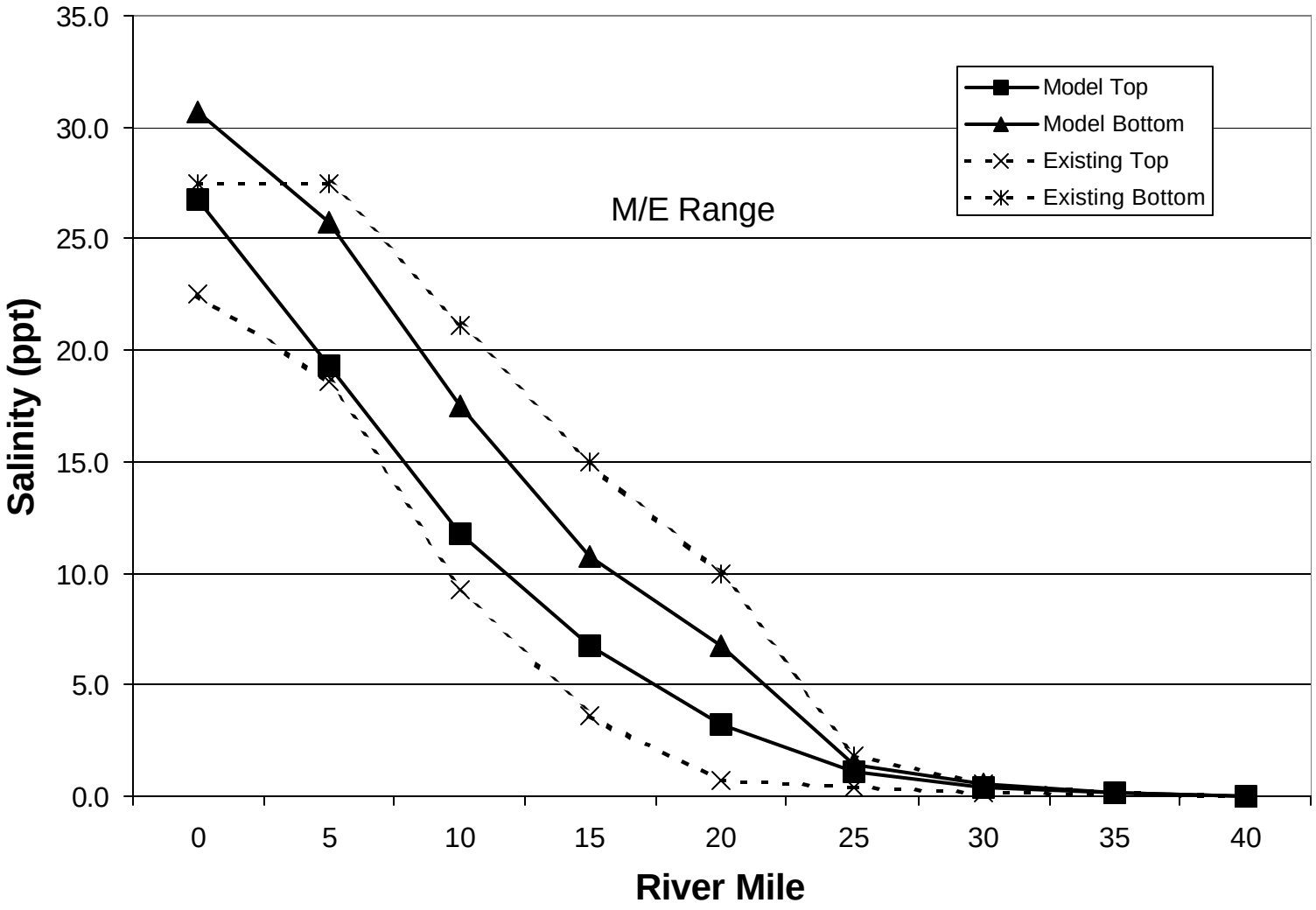
Model Verification - Conclusions

- Validated with respect to tide range, qualitative velocity, and salinity intrusion
- Model ‘reasonably’ simulated tide ranges
- Model ‘roughly’ simulated salinity ranges

Averaged Salinity Range: Modeled vs Existing



Modeled vs Existing Salinity



Flow Conditions - NMFS Concern

- Validation needs to consider model response to a broad range of flow conditions
- Salmon (both juveniles and adults) are present in the estuary throughout the year
- Flows representative of yearly variation required (65-700? kcfs)
- What flow conditions will result in the greatest and/or most biologically relevant changes after channel modification?

Spatial Resolution - NMFS Concern

- Juvenile salmon (chum & ocean-type chinook salmon) utilize peripheral area predominantly
- Validation needs to consider model response in peripheral regions of estuary
- Justification that the resolution of the model in the periphery is sufficient not provided
- What reliably changes, with respect to salinity, in the peripheral margins of the estuary after channel modification throughout the year?

Salinity Intrusion vs Salmon Habitat

- What is the appropriate question? What should be modeled
- What area of the estuary should we be concerned about? Periphery vs channel
- When should we be concerned, selected month, all year, interannual variation?
- What habitat attributes should be modeled?

Salmon Habitat Attributes

- Flow
- Depth
- Salinity
- Temperature
- Turbidity
- Landscape Connectivity
- Food Web
- Trophic relationships