Evaluating the Risk of Pesticide Registration Actions to Threatened and Endangered Species

Water Quality Monitoring Needs

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National Monitoring Conference
Portland, Oregon
May 4, 2012

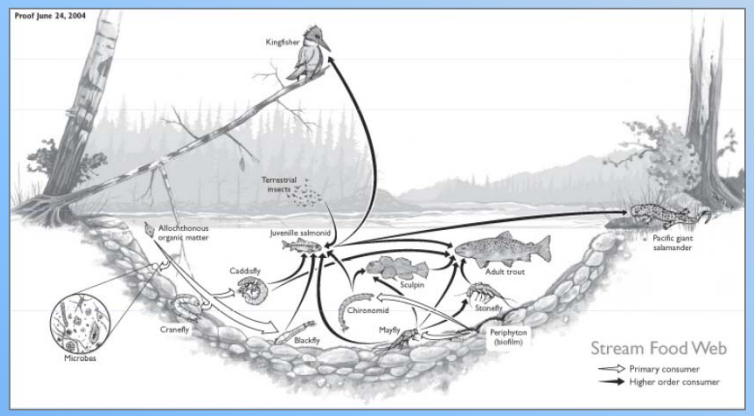
Introduction

- NMFS risk assessment framework for assessing pesticides under ESA
- NMFS use of monitoring data, Limitations
- Monitoring needs for ESA consultation

Purpose of ESA Section 7 Consultation

Each federal agency shall insure that any action authorized, funded, or carried out is not likely to:

- Jeopardize T/E species
- Result in destruction or adverse modification of designated critical habitat

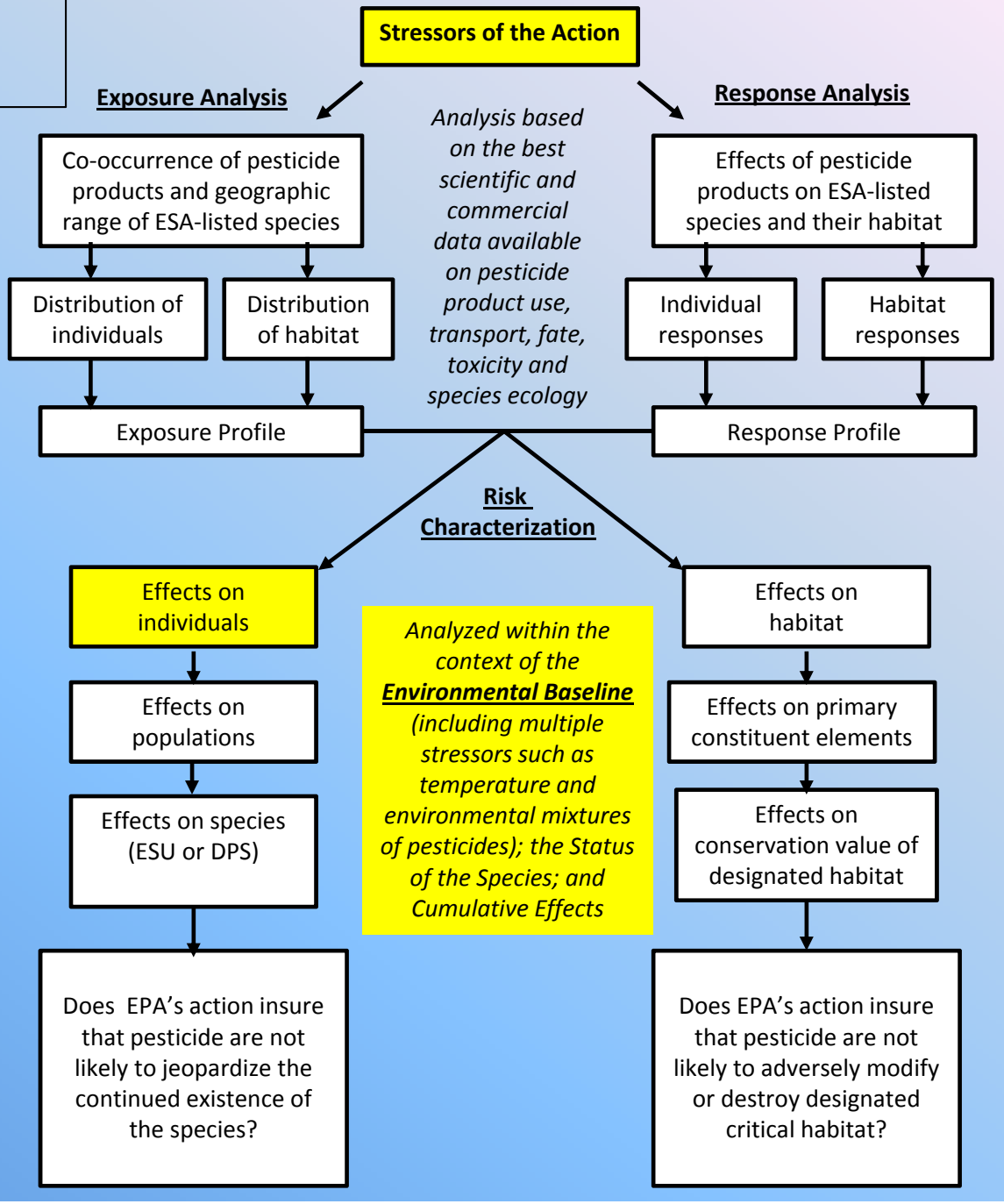


What are we evaluating?

- FIFRA Pesticide Label Restrictions
  - Where a pesticide can be applied
  - Methods of application
  - Application rates, number of applications
  - Pesticide Ingredients
  - Risk reduction measures
- 15 year Registration Review Cycle

NMFS Ecological Risk Assessment Framework

- Action Stressors we need to evaluate include: the active ingredient, other ingredients in formulation, and tank mixtures
- Baseline Stressors must also be taken into account and several have been shown to influence response
- Effects to Species must be evaluated at multiple levels of organization



How Do We Characterize Exposure?

- NMFS relies on several sources of information:
  - Ambient water quality monitoring
  - Target water quality monitoring
  - Environmental fate and transport model estimates
- Existing monitoring data not designed specifically for our assessment needs
  - Defining exposure ranges and distributions within populations of listed species

Species-specific habitat use

Important variables for defining exposure range

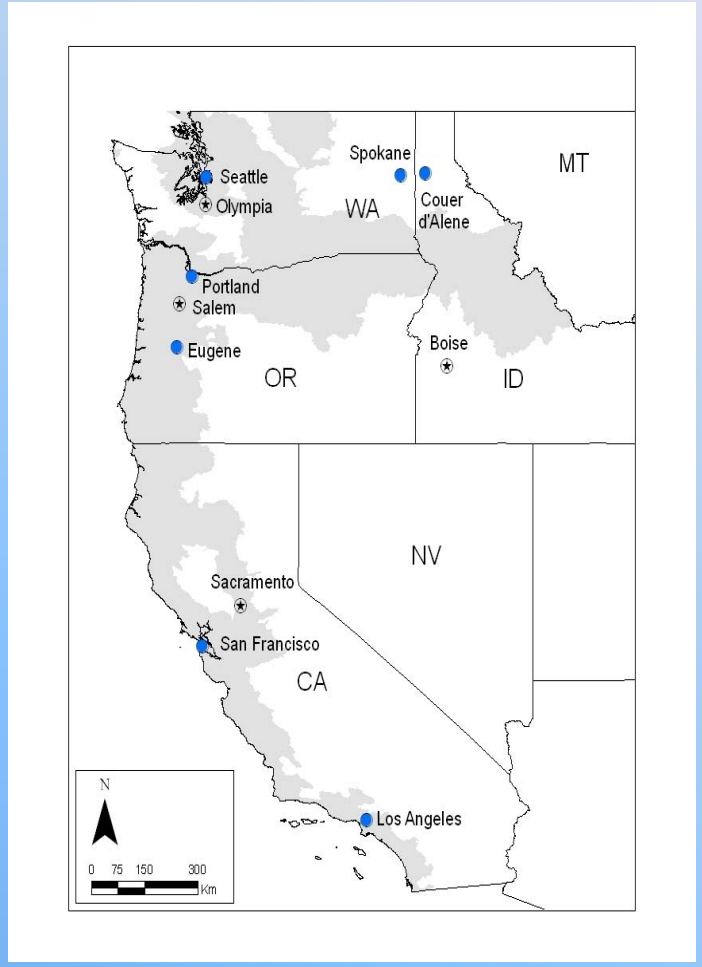
Floodplains and Small Streams

- Habitat for spawning, rearing
- Essential habitat for small fry/juveniles to rear and seek protection from high velocity flows
- Spatially and temporally variable in occurrence, flow, and size
- Restoration focus

Site-specific conditions

Important variables for defining exposure range

- Precipitation
- Wind
- Soil type
- Slope
- Barriers to drift/ runoff
- Land use/crops
- Pesticide use



Sampling distribution

Important variables for defining exposure range

NAWQA 1991-2009 sampling for 12 OP pesticides

Coho ESU	Kilometers of stream inhabited	Sites in spawning and rearing habitat	Sites in freshwater migration corridor
Central California Coast	1,288	0	0
Lower Columbia River	3,308	17	0
Southern Oregon and Northern California Coast	5,620	0	0
Oregon Coast	10,220	0	0

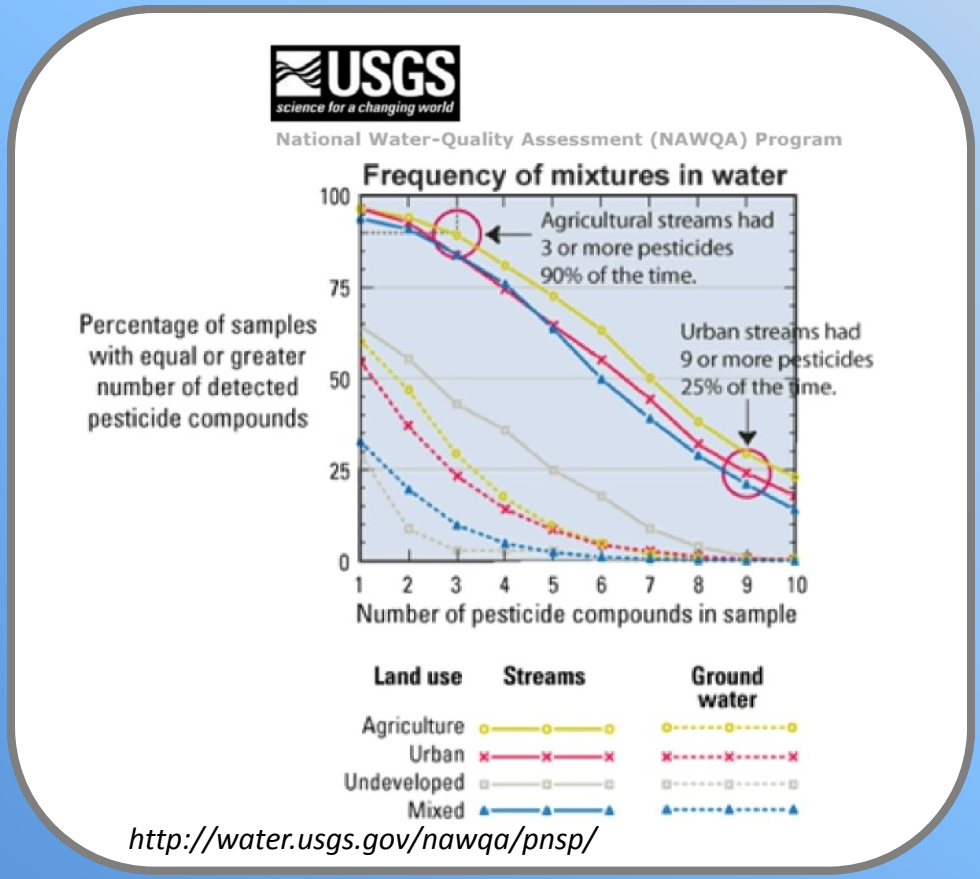
SAMPLES FROM CA, ID, OR, &WA

- 5,200 samples – 1+ analyte
- 350 stations/ 11 NAWQA Basins
- ~1/3 stations sampled 1 time
- 75% of data from 35 sites

- Several species no samples
- Temporal/spatial differences between sampling distribution and distribution of species

Monitoring data helps us identify trends

Pesticide mixtures in aquatic habitats: the rule vs. the exception



http://water.usgs.gov/nawqa/pnsp/

- Agricultural streams had three or more pesticides 90% of the time.
- Urban streams had nine or more pesticides 25% of the time.

Define Baseline conditions

- Temperature, pH
- Environmental mixtures of pesticides

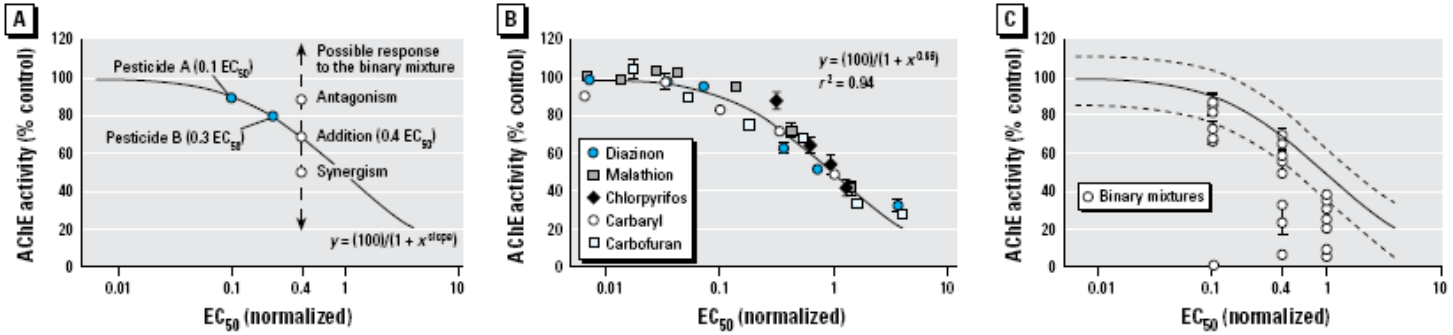


Figure 2. Binary pesticide mixtures cause additive or synergistic AChE inhibition. (*A*) Hypothetical plot describing the three possible toxicologic responses after exposure to a binary mixture of anticholinesterase pesticides. The curve represents a single regression fit to the EC_{50}-normalized data from single pesticide exposures. (*B*) Plot of the concentration–response data from five single pesticide exposures after normalization to their respective EC_{50} concentrations and collectively fitting with a nonlinear regression. This curve was used to evaluate the toxicologic response of subsequent binary mixtures (*C*). Values are mean ± 1 SE ($n = 8$). (*C*) Plot of the brain AChE activities of fish exposed to the five pesticides in all possible binary combinations. Based on a default assumption of concentration addition, the pairings were predicted to yield AChE inhibitions of 10% (0.1 EC_{50}), 29% (0.4 EC_{50}), and 50% (1.0 EC_{50}). Values are mean and SE ($n = 8$); dashed lines indicate the 95% prediction band (where 95% of the data should fall based on the regression).

Laetz et al. 2009. The synergistic toxicity of pesticide mixtures: Implications for risk assessment and the conservation of endangered pacific salmonids. Environmental Health Perspectives. 117(3):348-353.

Address uncertainties associated with application methods/ formulations/ and use site

Evaluate Effectiveness of Risk Reduction Measures

- Pesticide Stewardship Partnership- Oregon
  - Since 1999; Adaptive management
- Rice Pesticide Program- California
  - Since 1990; Adaptive management
- NMFS Biological Opinions
  - Floodplain habitats
  - Environmental mixtures of compounds known to have additive and synergistic effects in salmon

Conclusions

(1) EPA pesticide registrations are complex federal actions and a variety of tools are needed to assess exposure to listed species at multiple levels of biological organization;

(2) Monitoring data contributes to the exposure characterization but inherent limitations prevent complete reliance on monitoring data sets;

(3) Additional monitoring that may improve the accuracy of assessments and contribute to species protections include focused investigations that:

- Define baseline conditions in species habitat
- Address specific areas of uncertainty
- Verify the adequacy of protection measures