CONTAMINANTS AND WILDLIFE—THE RACHEL CARSON LEGACY LIVES ON

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ECOTOXICOLOGICAL STUDIES

- Such studies need to be well-thought out with a valid plan of study. Results from some studies are relatively easy to interpret, but in others, it is extremely difficult to determine cause and effect.

ECOTOXICOLOGICAL STUDIES (2)

- Correlative data from field studies are best corroborated by experimental studies. For example, DDE-induced eggshell thinning in the field was experimentally duplicated at the Patuxent Center and at other facilities.

ECOTOXICOLOGICAL STUDIES (3)

- Residues of OCs in brains of dead birds, levels of ChE inhibition and other related measurements were determined by experimental studies at Patuxent and elsewhere; these data are invaluable for interpretation of death and other adverse effects in the field.

ECOTOXICOLOGICAL STUDIES (4)

- Design of field studies such as establishing reference and treated areas are invaluable for interpretation of results.

INTRODUCTION TO BROWN PELICAN STUDIES

- Brown pelicans found in estuarine areas
- Nest in colonies in trees or on ground
- Feed on fish near the bottom of the food chain such as menhaden and sardines
- Problems with DDT and endrin first noted in 1960s. DDE—eggshell thinning and lowered productivity; endrin—adult mortality. Both—population declines

POPULATION LEVELS

- Louisiana
  - 1920: 50-85,000 brown pelicans
  - 1963: 0 brown pelicans
  - 1990: 1330 successful nests
- Texas
  - 1920: 5,000 brown pelicans
  - 1963: 100 brown pelicans
  - 1994: 225 brown pelicans

POPULATION LEVELS (2)

- Florida
  - 1970: 5,000 pairs
  - 1994: 9200 pairs

  Recently: 8-12,000 pairs
- South Carolina
  - 1960: 5,000 pairs
  - 1970: 1,000 pairs
  - 1976: 2,500 pairs
  - 1980: 4,800 pairs
  - 1990: 6,345 pairs

POPULATION LEVELS (3)

- North Carolina
  - Early 70s less than 100 pairs
  - 1990: 2,912 pairs
- California
  - 1950s: ~ 5,000 pairs
  - 1969: a few hundred pairs
  - 1990: ~ 5,000 pairs

EGG SHELL THINNING

- All populations in North America
- First noted in brown pelicans in 1960's
- Greatest thinning--47% in CA and NW Baja, CA
- 10-17% in South Carolina
- 5-11% in Florida
- 11% in Texas and 7-14% in Louisiana

REPRODUCTIVE SUCCESS– PRE-DDT BAN

- Pelicans in CA and Northern Baja CA experienced reproductive failure from DDE
- In South Carolina, productivity and population levels were adversely affected by DDE
- Pelicans in North Carolina were apparently affected by DDE, but there are few data.
- In Florida residues of DDE were relatively low and had little effect on reproductivity

SUMMARY, BROWN PELICAN STUDIES

- DDT, through its metabolite DDE, was significantly correlated with egg shell thinning in all populations of brown pelicans in North America
- In certain populations, DDE adversely affected reproductive success and population level

SUMMARY (2)

- After the ban DDT in the early 1970's in the U.S., brown pelican populations started to recover almost immediately in the southeast as residues and eggshell thinning declined and productivity increased. The recovery in CA took longer because of the much greater DDE levels.

SUMMARY (3)

- Endrin was apparently responsible for extirpation of the brown pelican population in LA by the early 1960s, After endrin induced a die-off of brown pelicans in LA in 1974, endrin use on sugar cane was banned. Transplanted birds from FL increased in numbers due to the decrease in contaminant levels.

SUMMARY (4)

- In contrast to DDT, endrin had no demonstrated effect on reproduction; rather, the major effect was from adult mortality. Because endrin is rather short-lived in the environment, the effects were short-term.

SUMMARY (5)

- The effect level of 3 parts per million DDE in eggs was associated with total reproductive failure
- In CA mean egg shell thinning was 34% in the few intact eggs and 53% in the numerous crushed eggs. Pelicans in parts of Mexico were also affected
- Brown pelicans are the most sensitive avian species to the effects of DDE

DDT AND OTHER SPECIES

- DDE-induced eggshell thinning was noted in 18 families of birds. DDE was associated with population declines of the peregrine falcon, bald eagle, osprey, double-crested cormorant, merlin, great cormorant, Mexican free-tailed bat, and others.
- Populations of most of these species have recovered with the ban on DDT.

DDT AND OTHER SPECIES (2)

- Although many birds are sensitive to DDE-induced eggshell thinning, certain groups ,such as the gallinaceous birds, are not sensitive. Differences in species sensitivity are found throughout the realm of pesticides and other contaminants; this concept is most difficult for the general public to grasp.

DDT IN OTHER COUNTRIES

- There are little data on the use of DDT or the effects on wildlife in certain parts of the world including most of Africa, Central and South America, and most of Asia.
- DDT currently is used for mosquito control to control malaria in certain tropical countries; some species of mosquitos are resistant to DDT.

POLITICS

- There is now a movement for additional use of DDT; this is associated with the errant thinking that environmental problems from DDT are mythical.
- The advances in ecotoxicology are at some risk from the political climate in D.C. Some agencies, such as EPA, are doing a poor job of protecting the environment. The Rachel Carson legacy lives on.

OTHER ORGANOCHLORINES

- In addition to DDT and endrin, a number of other organochlorine insecticides including heptachlor, dieldrin, aldrin, toxaphene, chlordane, hexachlorocyclohexane, telodrin, and others have been associated with adverse effects in the field as well as in experiments. Many of these are related to adult mortality as well as reproductive effects. Fortunately, most of these are banned in the U.S.

PCBs

- When residues of PCBs were first detected in environmental samples, one compound similar to Aroclor 1254 or 1260 was reported.
- With refinement of analytical techniques, residue analysis printouts now run to a number of pages listing PCBs and related compounds, including furans and dioxins.

ANTICHOLINESTERASES

- The anticholinesterase compounds including organophosphorus and carbamate insecticides have been responsible for many wildlife die-offs. In contrast to the organochlorines, these compounds do not accumulate in food chains and are generally short-lived in the environment

OTHER CONTAMINANTS

- A number of metals including lead, mercury, zinc, selenium, copper, and cadmium have been associated with adverse effects on wildlife
- Other compounds include rodenticides such as anticoagulants and zinc phosphide, certain air pollutants, petroleum compounds, diclofenac (an NSAID), and others.

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Thank You!

Questions?