

Overview on Best Available Technology in Science and Economics for Pre-Import Risk Analysis



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Alien Invasive Species

Problem:

Net Effect =
Harm > Benefit

Solution:

Risk Analysis-guided
pre-import decisions

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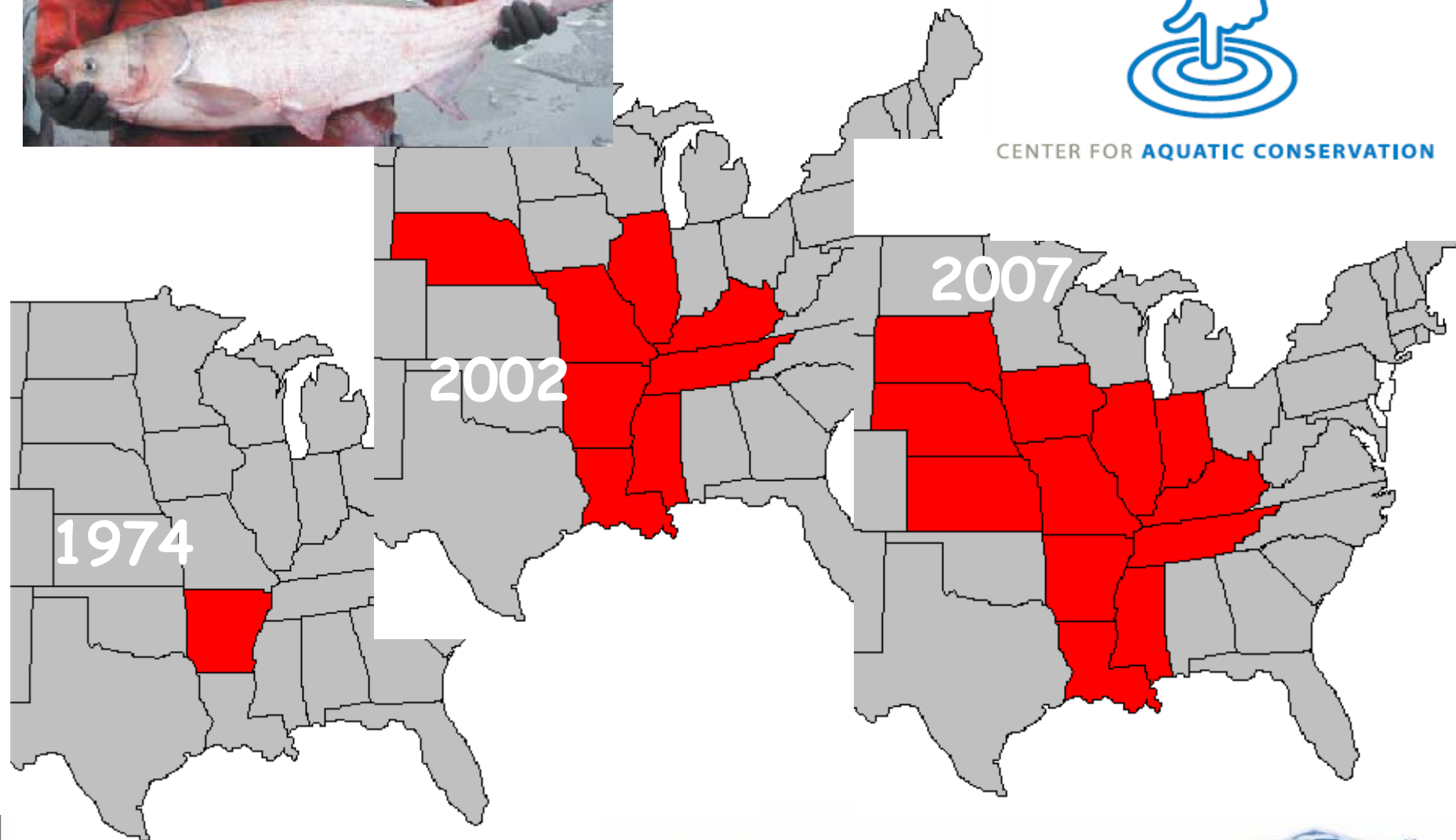
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Special Section:
Population Biology of
Invasive Species

Silver Carp



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1974

2002

2007

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Could Establishment, Spread, and Harm have been Predicted?

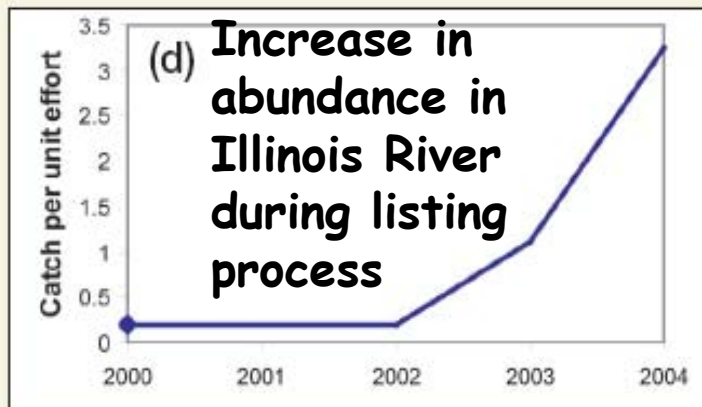


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Potential or demonstrated harm:

- Biodiversity
- Fisheries
- Human safety

(Fowler, Lodge & Hsia 2007)



Bighead carp



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Pathways of Nonindigenous Species in the US

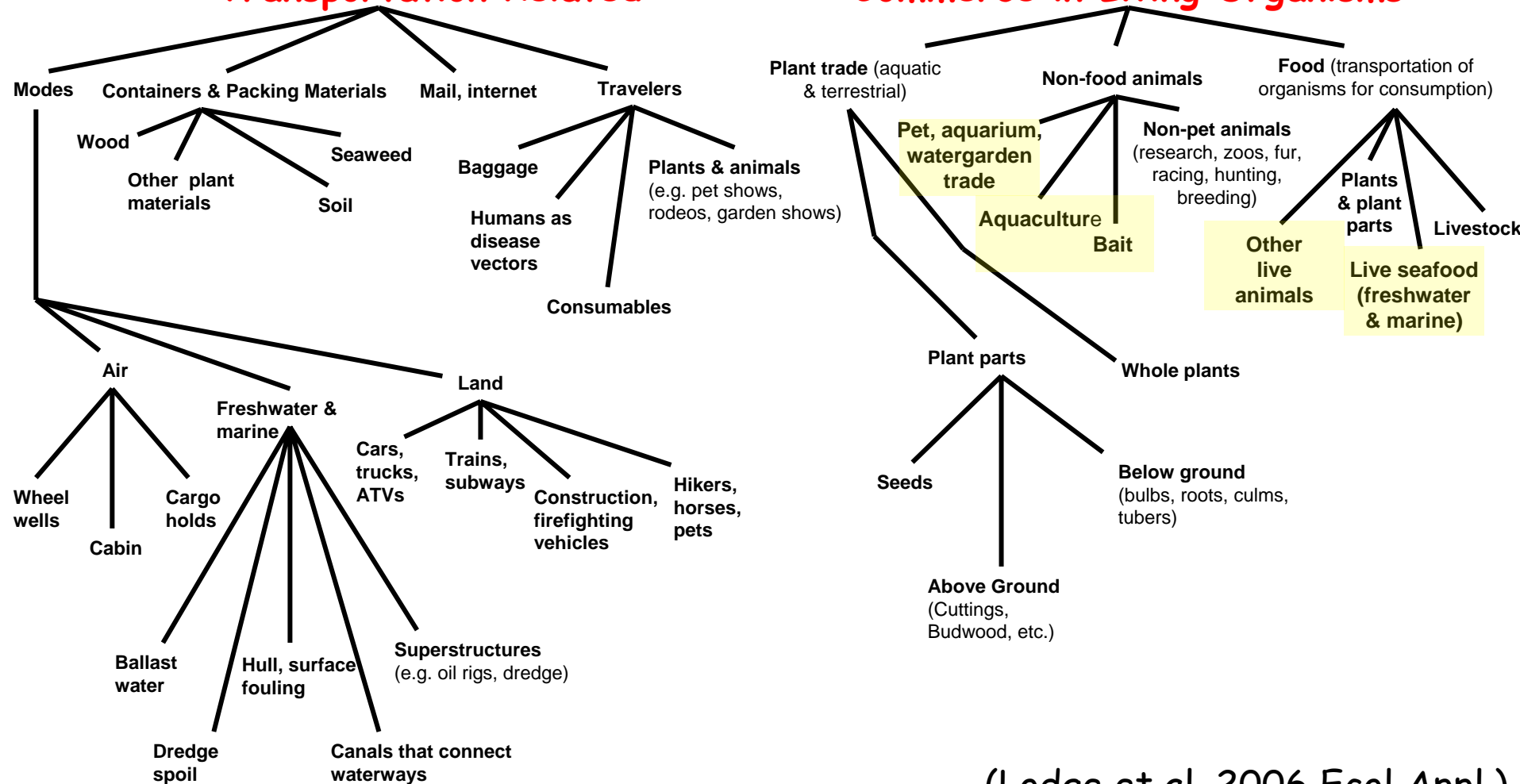


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Pathways

Transportation Related

Commerce in Living Organisms



(Lodge et al. 2006 Ecol Appl.)

Invasion Process

Species in
Pathway



Transported and
Released Alive



Population
Established



Spread



Ecological,
Human Health,
or Economic
Impact

Invasion Process

Risk Assessment

Species in
Pathway



Transported and
Released Alive



Population
Established



Spread



Ecological,
Human Health,
or Economic
Impact

$P = 1$ if allowed in
trade

X

$P = ?$

X

$P = ?$

X

$P = ?$

=

Probability of the
undesirable occurring

Invasion Process

Species in
Pathway



Transported and
Released Alive



Population
Established



Spread



Ecological,
Human Health,
or Economic
Impact

Risk Assessment and Risk Management

$P = 1$ if allowed in
trade

X

$P = ?$

- Limit numbers in trade
- Limit locations
- Genetically modify to reduce survival

X

$P = ?$

- Specify containment protocols to prevent escape

X

$P = ?$

- Consider costs relative to benefits
- Decide on acceptable risk = decision threshold
- Decide how to enforce

=

Probability of the
undesirable occurring

Invasion Process

Risk Assessment

Best Available Technology

Species in
Pathway



Transported and
Released Alive



Population
Established



Spread



Ecological,
Human Health,
or Economic
Impact

$P = 1$ if allowed in
trade

X

$P = ?$

Environmental niche modeling
(Simon Barry talk)

X

$P = ?$

Spread modeling
(Jon Bossenbroek talk)

X

$P = ?$

Trait-based impact modeling
(Jon Bossenbroek talk)

=

Probability of the
undesirable occurring

Cost:benefit analyses of RA
(Reuben Keller, Jamie
Reaser talks)

Pre-Import Risk Assessment Framework

1. Species proposed for importation into Country X

2. Species invasive in ecosystems like any in Country X? YES → PROHIBIT

NO ↓

3a. Habitat suitable anywhere in Country X? NO → 3b. Parasites/pathogens?
 NO → ALLOW
 YES → PROHIBIT

YES ↓

4a. Quantitative tool exists that predicts impact? YES → USE TOOL
 HIGH → PROHIBIT
 LOW IMPACT ↓

NO ↓

4b. Parasites/pathogens? NO → ALLOW
 YES → PROHIBIT

5a. What is the probability of impact? (develop new quantitative tool) HIGH → PROHIBIT

LOW → 5b. Parasites/pathogens? NO → ALLOW
 YES → PROHIBIT

Qualifications/rationale for RA framework



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- As much as possible, RA should be peer-reviewed, quantitative, transparent, and repeatable
- Questions ordered from least to most demanding of data, expertise, time, and resources
- Decision rules at the points of **allow/prohibit** would be more complicated than diagram suggests, depending, e.g., on acceptable level of risk
- Risk management at some of the steps could change the answers, e.g., steps for removing parasites/pathogens, containment procedures
- Economic analysis could guide policy choice on how to balance accuracy vs. cost of RA

Recent Advances in Risk Assessment



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1. Recent scientific advances allow 80-90% accuracy for some risk assessment tools.
2. Importation can be banned only for harmful species, increasing net benefit of trade in benign species.
3. Screening can provide environmental *and* economic benefits (Keller, Lodge & Finnoff 2007).

