

Early steps in environmental risk assessment for genetic biocontrol

*As you listen, consider:
What research should be
done in the near term to
improve carrying out an
ERA in the future?*

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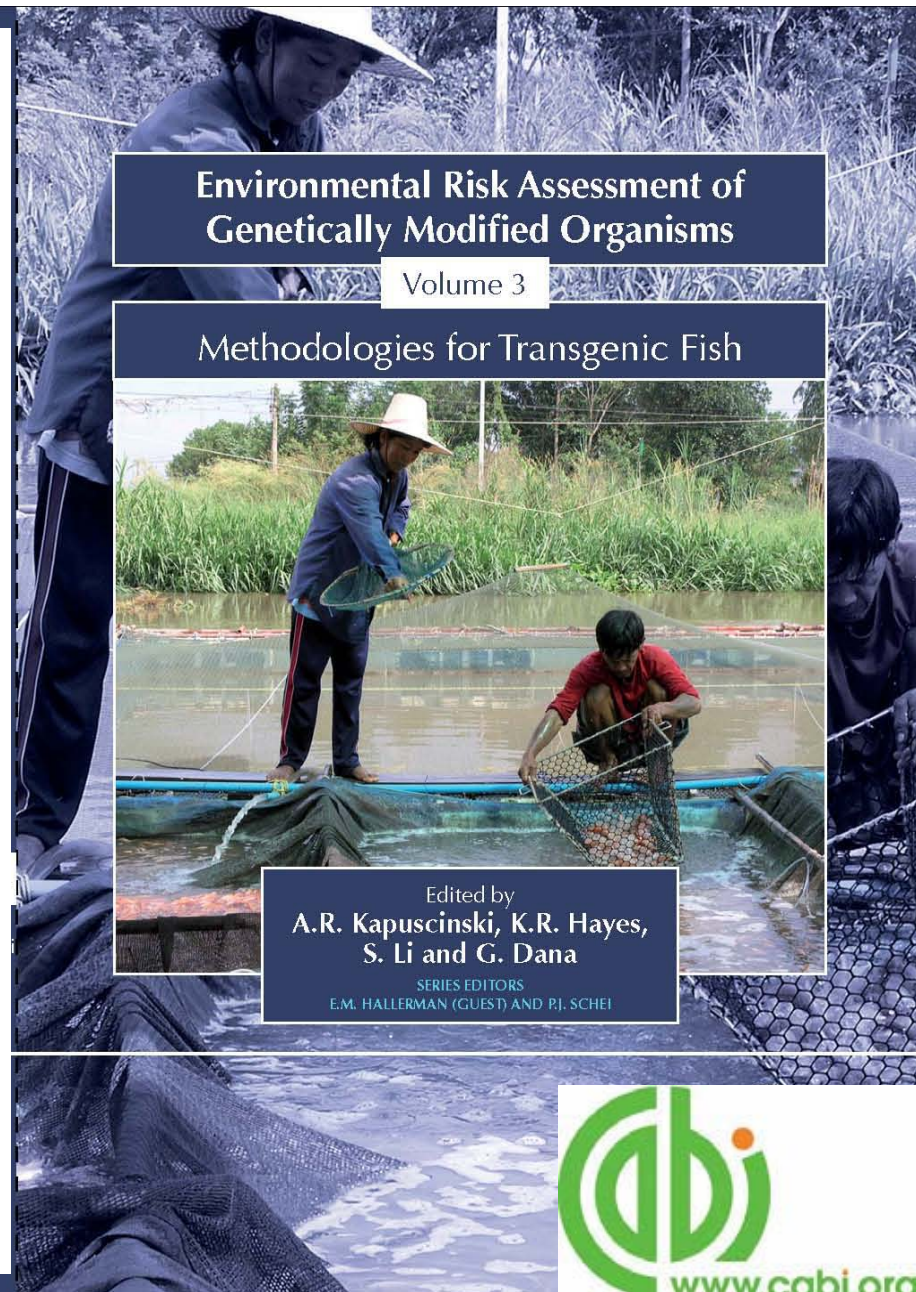


Purpose

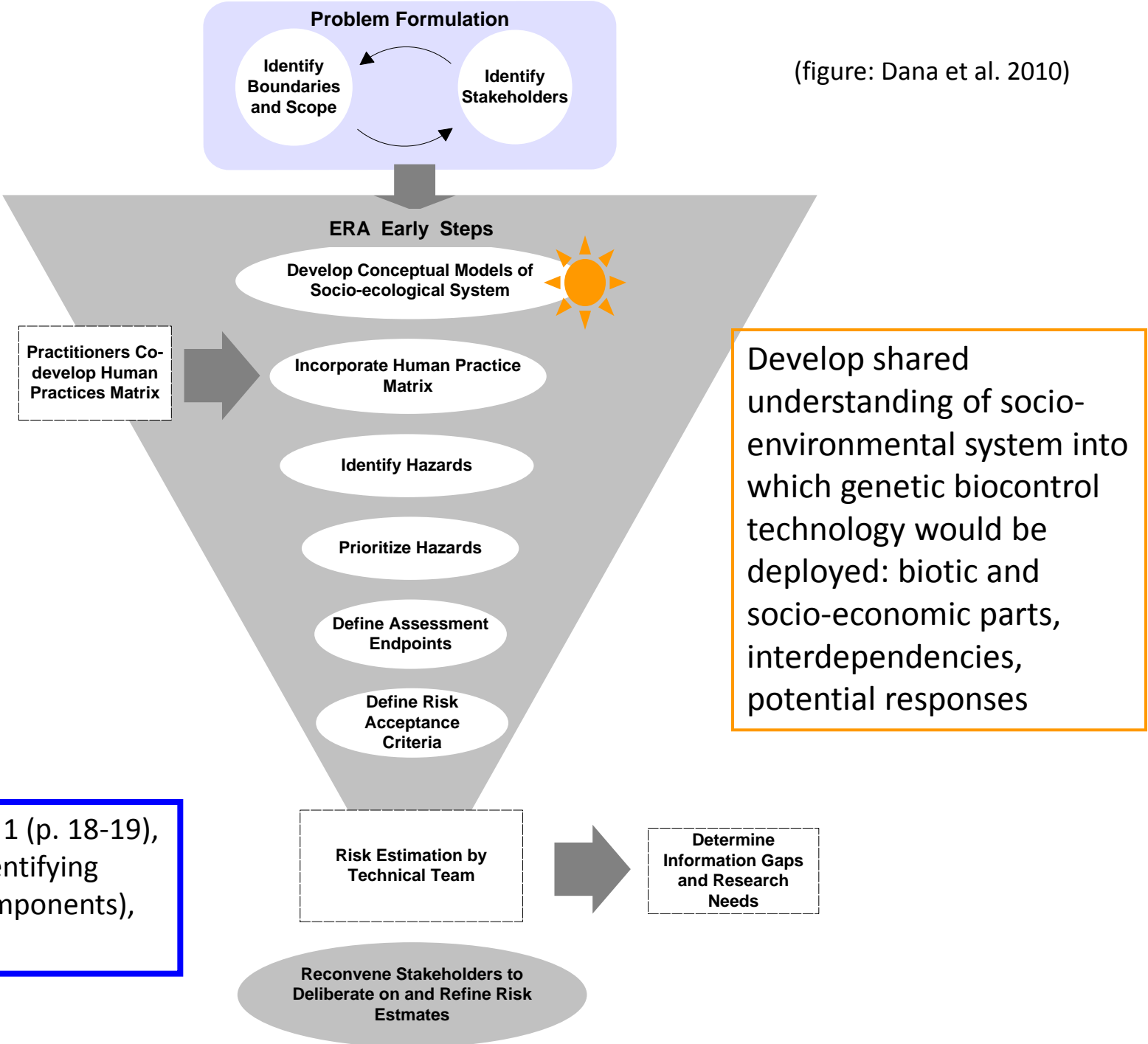
Current methodologies to conduct scientifically sound risk assessment and, when needed, design and apply appropriate risk management.

Scientific methodologies, combined with stakeholder deliberation.

Also applies to other genetically improved aquatic organisms -- selectively bred fish, hybrids, other transgenic aquatic animals.



(figure: Dana et al. 2010)



Book chapter 1 (p. 18-19),
chapter 6 (identifying
ecological components),
chapter 10

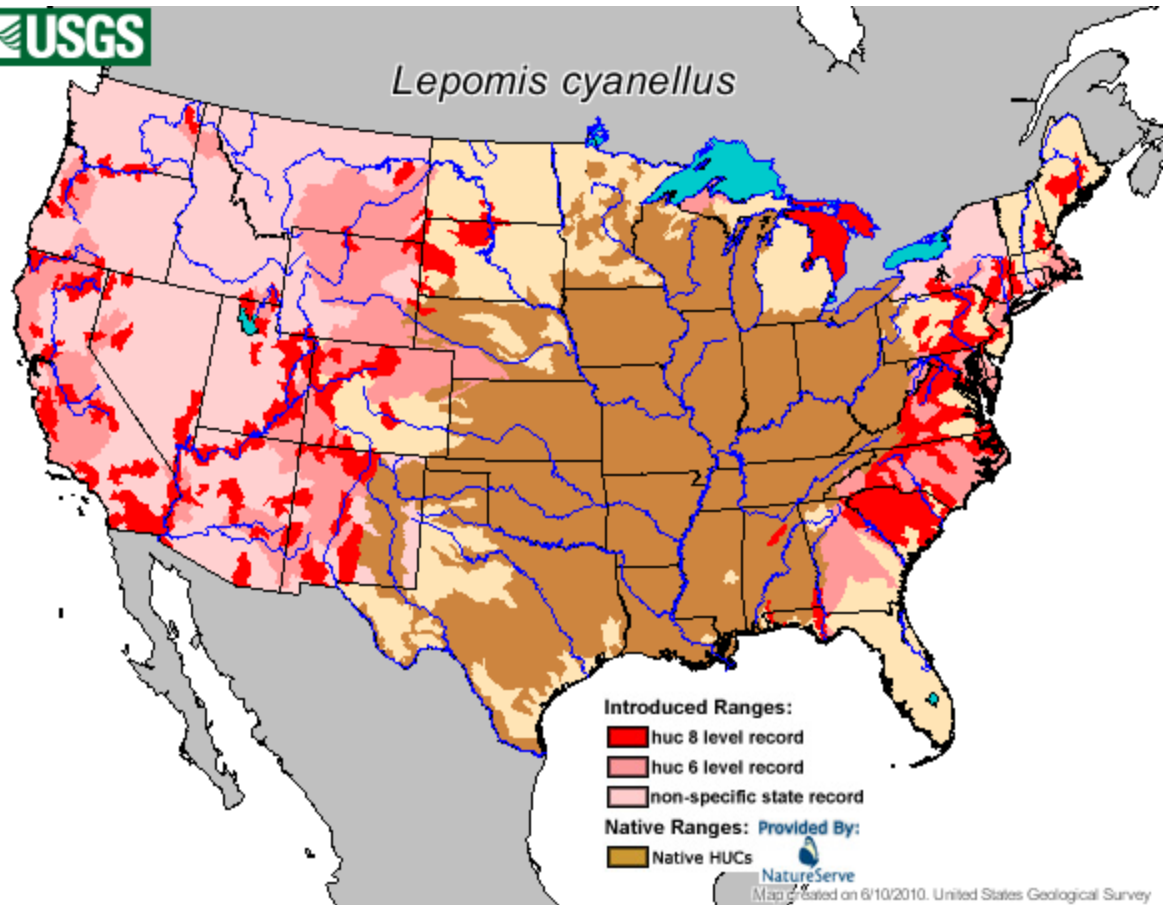


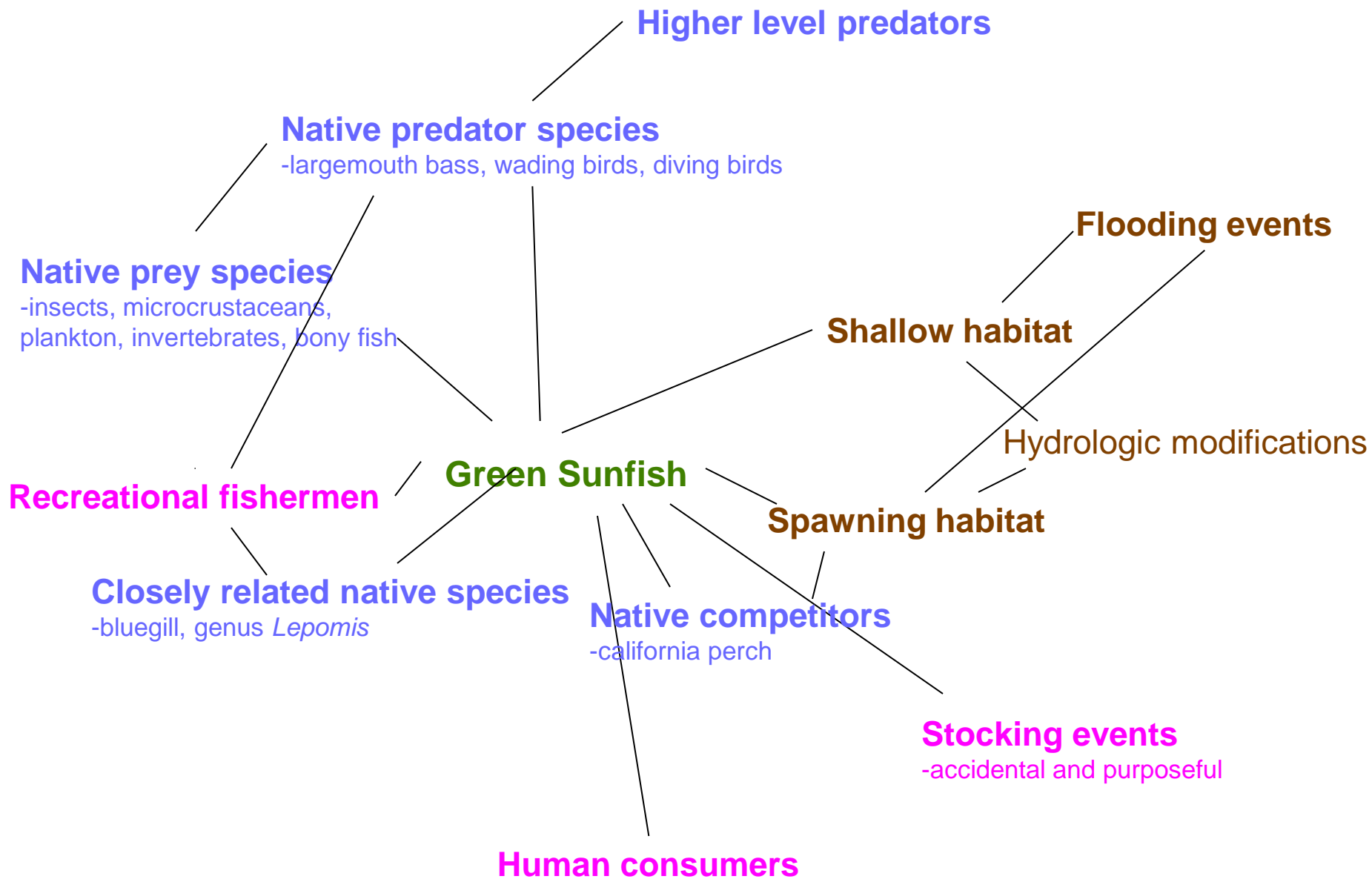
Green sunfish – example for next slides

Photo: Konrad P. Schmidt
www.fishbase.org

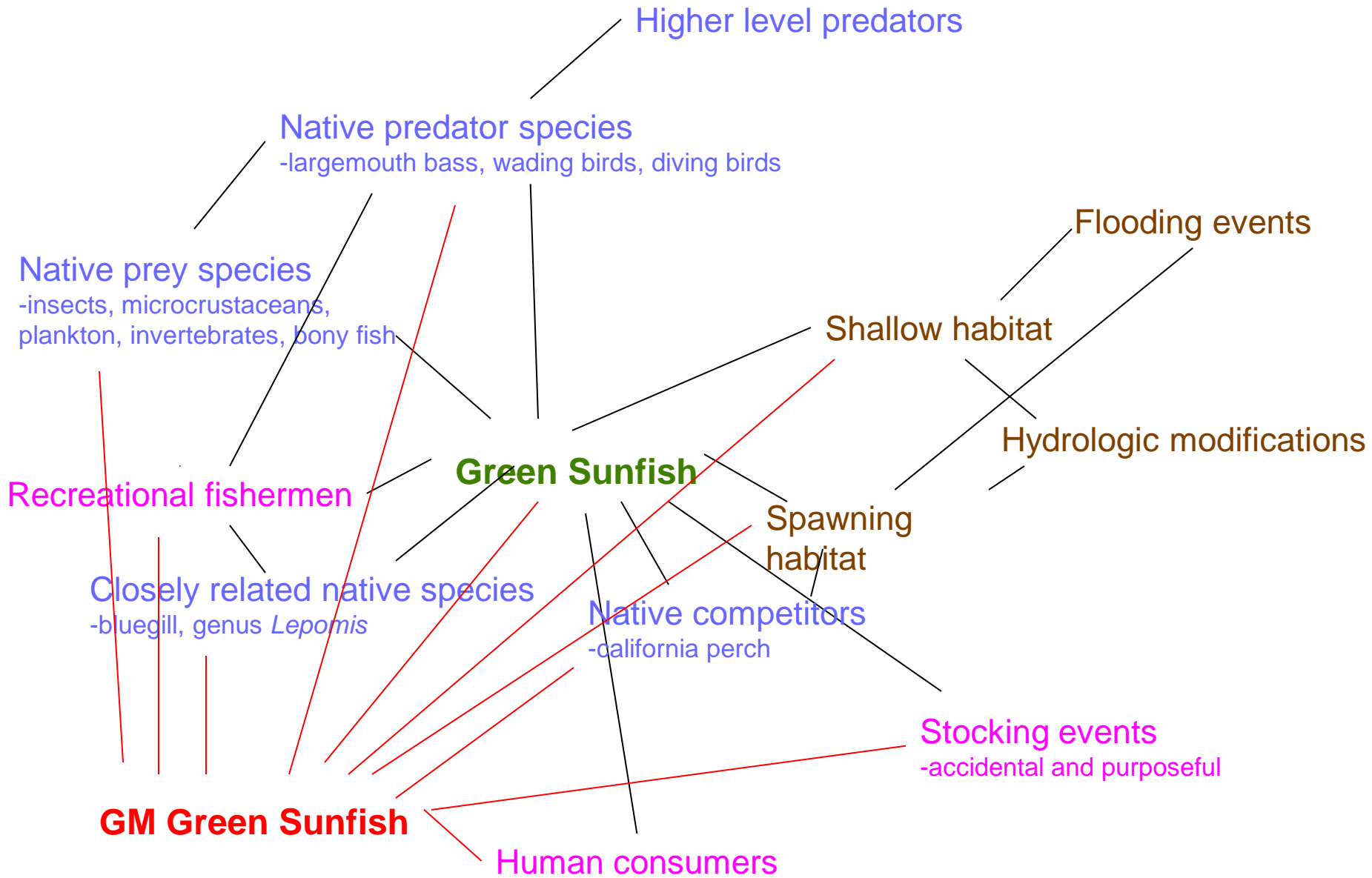


Lepomis cyanellus

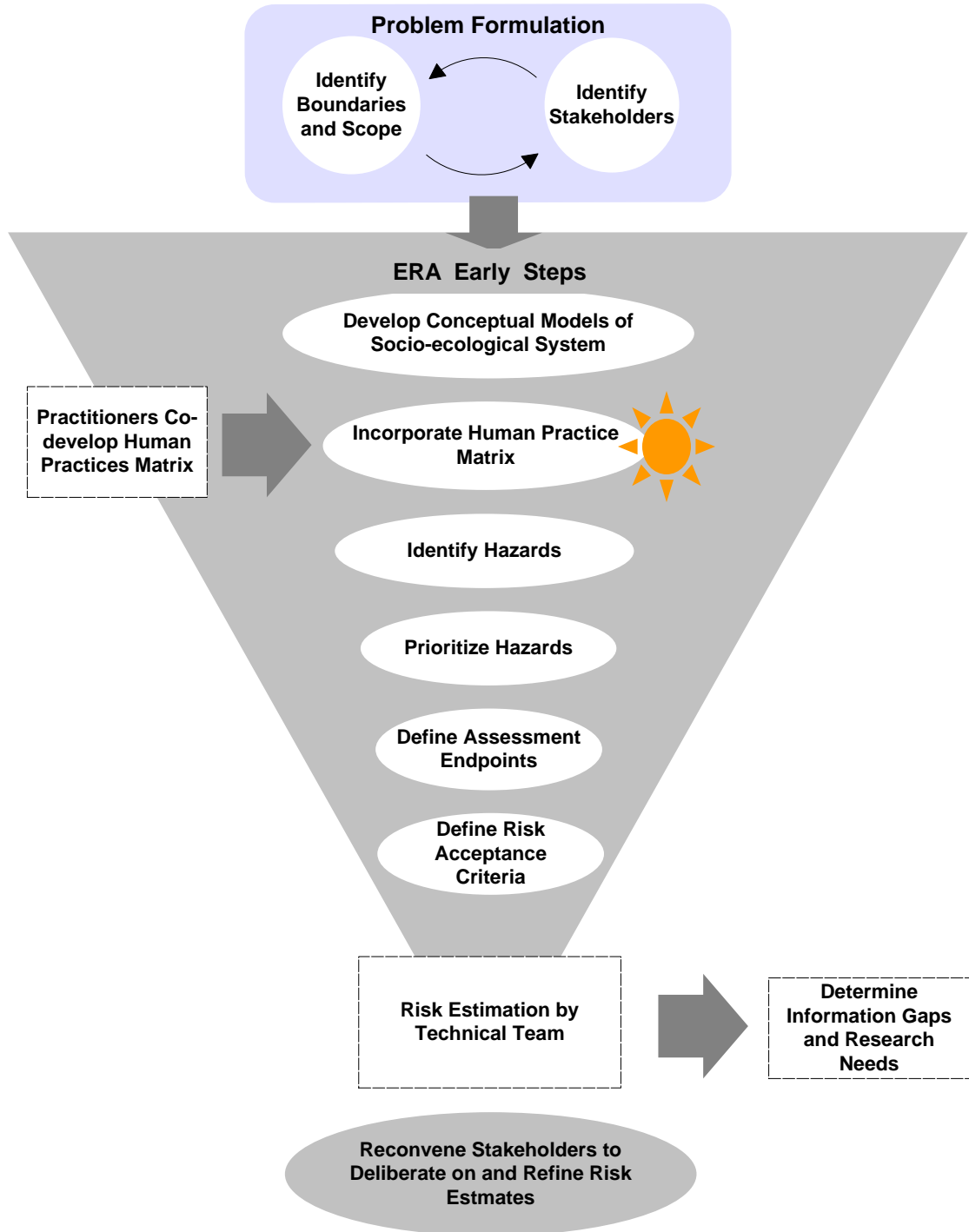




Conceptual Model – starting simple...



— Potentially Different Relationship



Problem Formulation

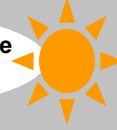
Identify Boundaries and Scope

Identify Stakeholders

ERA Early Steps

Develop Conceptual Models of Socio-ecological System

Incorporate Human Practice Matrix



Identify Hazards

Prioritize Hazards

Define Assessment Endpoints

Define Risk Acceptance Criteria

Practitioners Co-develop Human Practices Matrix

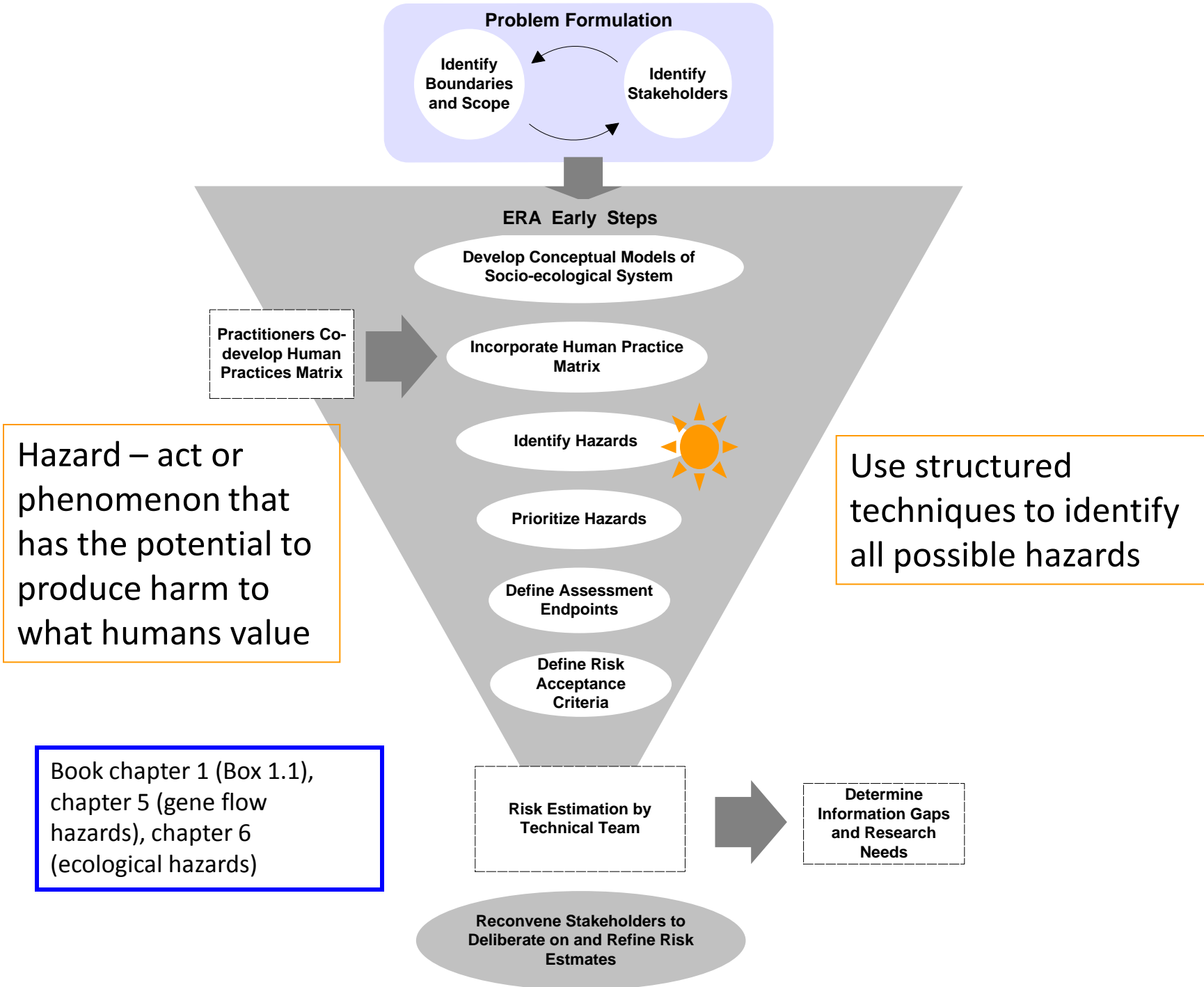
Risk Estimation by Technical Team

Determine Information Gaps and Research Needs

Reconvene Stakeholders to Deliberate on and Refine Risk Estimates

Human Practices Matrix – a start...

Practice	Recreational Fishermen	Fisheries Managers	Boaters
Stocking (accidental, purposeful)	X	XX	X
Catching & eating green sunfish	X		
Catching & eating predators or hybrids of green sunfish	X		
Live well transport	XX	X	XX



Problem Formulation

Identify Boundaries and Scope

Identify Stakeholders

ERA Early Steps

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Identify Hazards



Prioritize Hazards

Define Assessment Endpoints

Define Risk Acceptance Criteria

Use structured techniques to identify all possible hazards

Hazard – act or phenomenon that has the potential to produce harm to what humans value

Book chapter 1 (Box 1.1), chapter 5 (gene flow hazards), chapter 6 (ecological hazards)

Risk Estimation by Technical Team

Determine Information Gaps and Research Needs

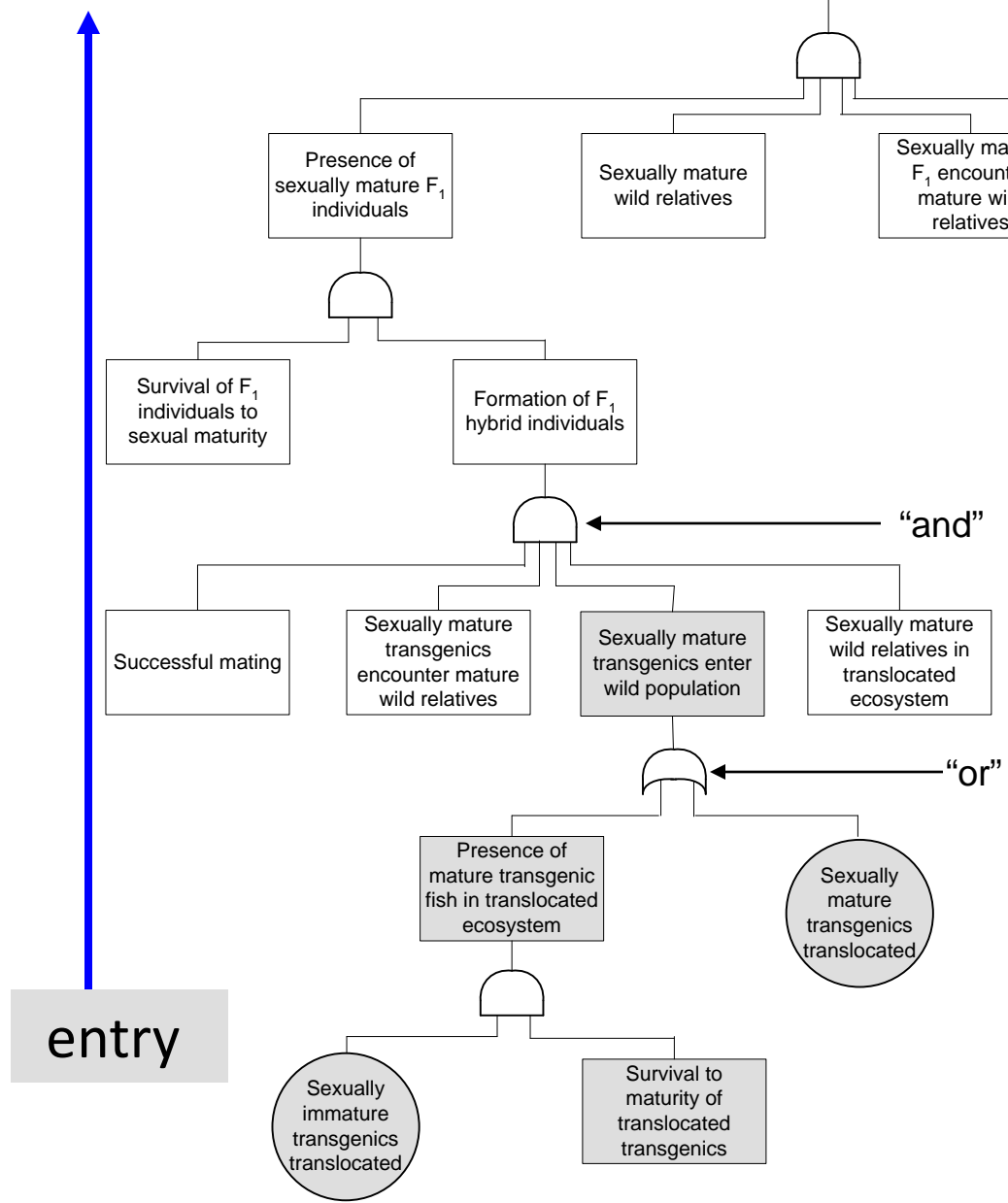
Reconvene Stakeholders to Deliberate on and Refine Risk Estimates

Hazard Identification Matrix – a start...

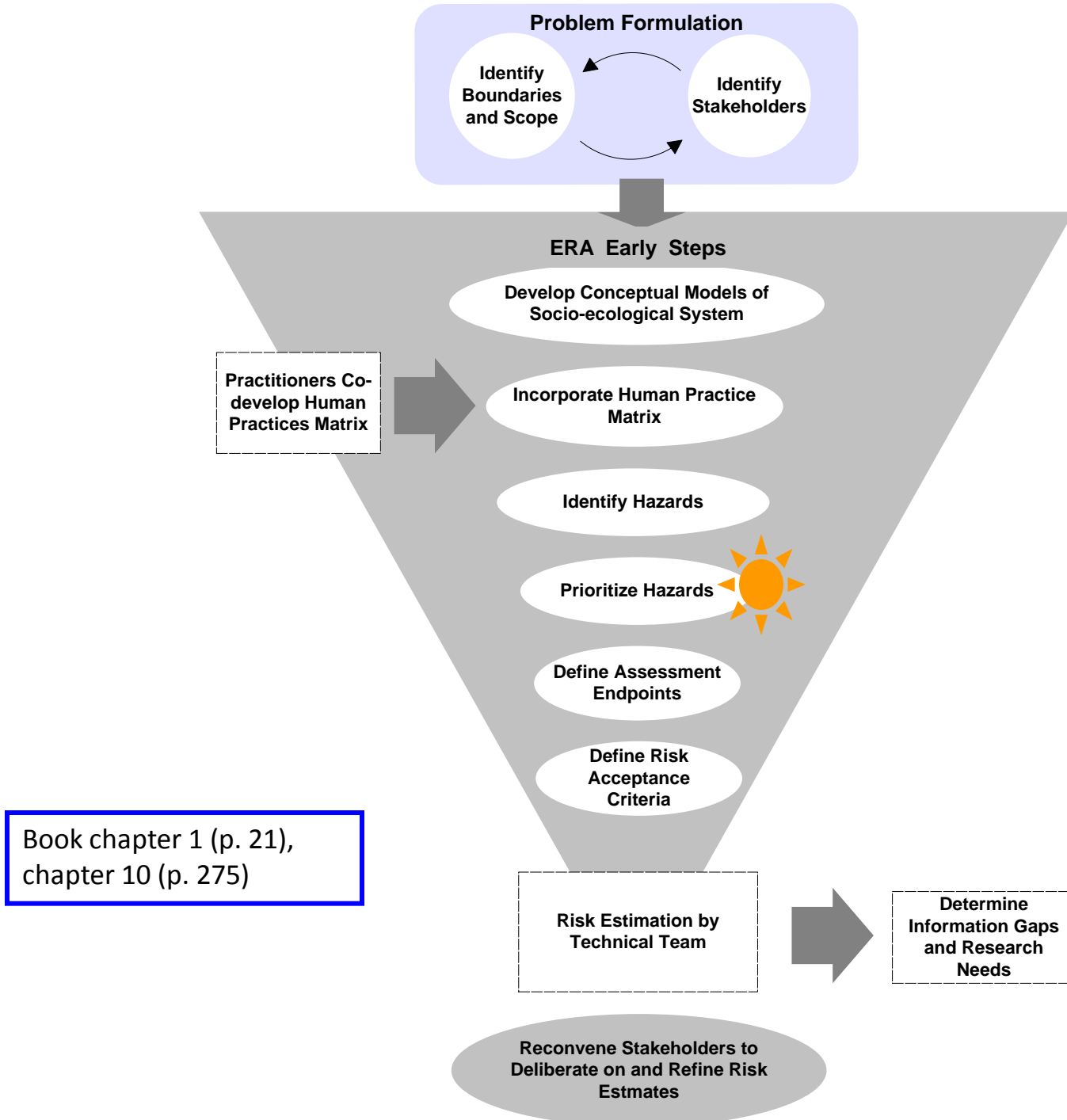
	Stressors			
Potentially Affected Entity	Transgenic Fish (entire phenotype)	Transgene	Transgenic Protein	Removal of green sunfish
Prey species	X interaction posing hazard			X
Predator species	X		X	X
green sunfish in native range		X	X	X
Hybridizing fish species		X	X	
Competing fish species	X			X
Scavengers			X	
Decomposers		X	X	
Human consumers			X	X
Recreation industry	X (“yuck” factor)			X
Other invasive fish species				X

One hazard ID tool: fault tree (shown for gene flow)

introgression



Book Chapter 5: methods, utility and limits of lab tests and simulation models



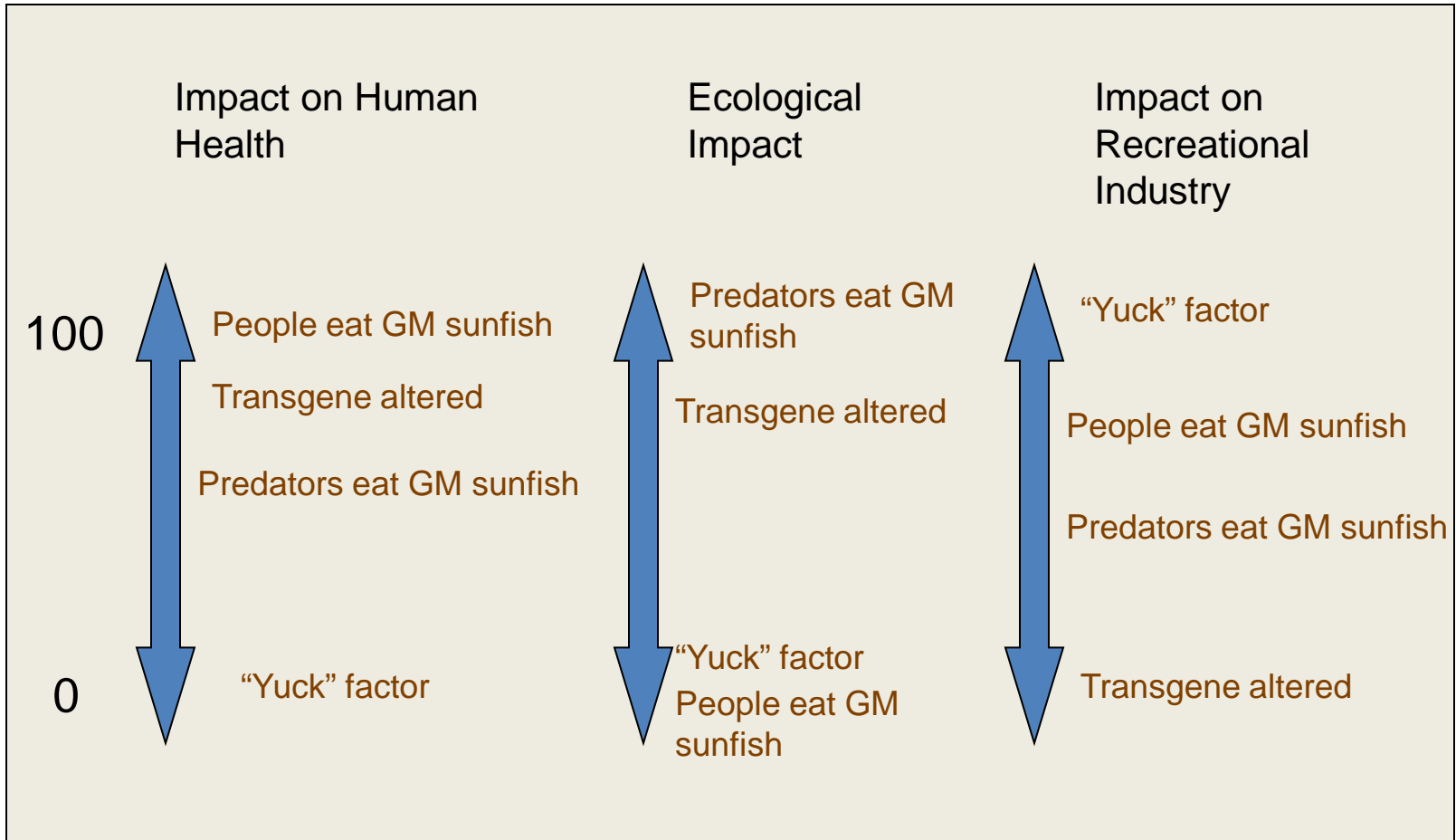
Hazard Prioritization – structured, transparent, values-based

Example

SMART: Simple Multi-Attribute Rating Technique

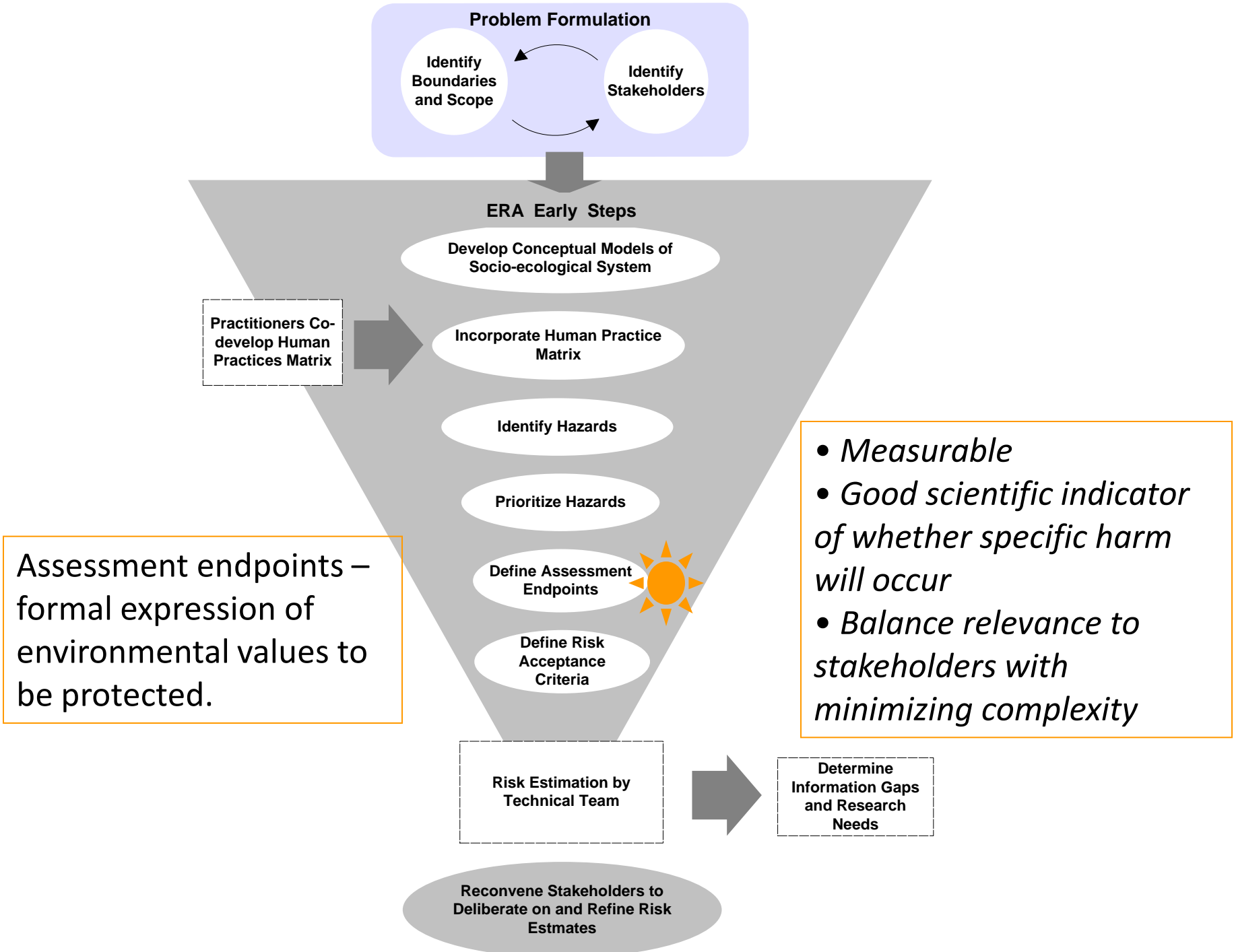
- Stakeholders rank hazards for relevant potential harms
- Stakeholders rank the relative importance of those potential harms

SMART



Green sunfish example using SMART

(SMART Excel spreadsheet)



Example: GM fish eaten by predators

Easier to
connect to
hazard

Negative impact on
predator physiology

Reduced growth
(e.g. size at age)

Reduced reproductive
success, e.g.- mean
no. fry/female

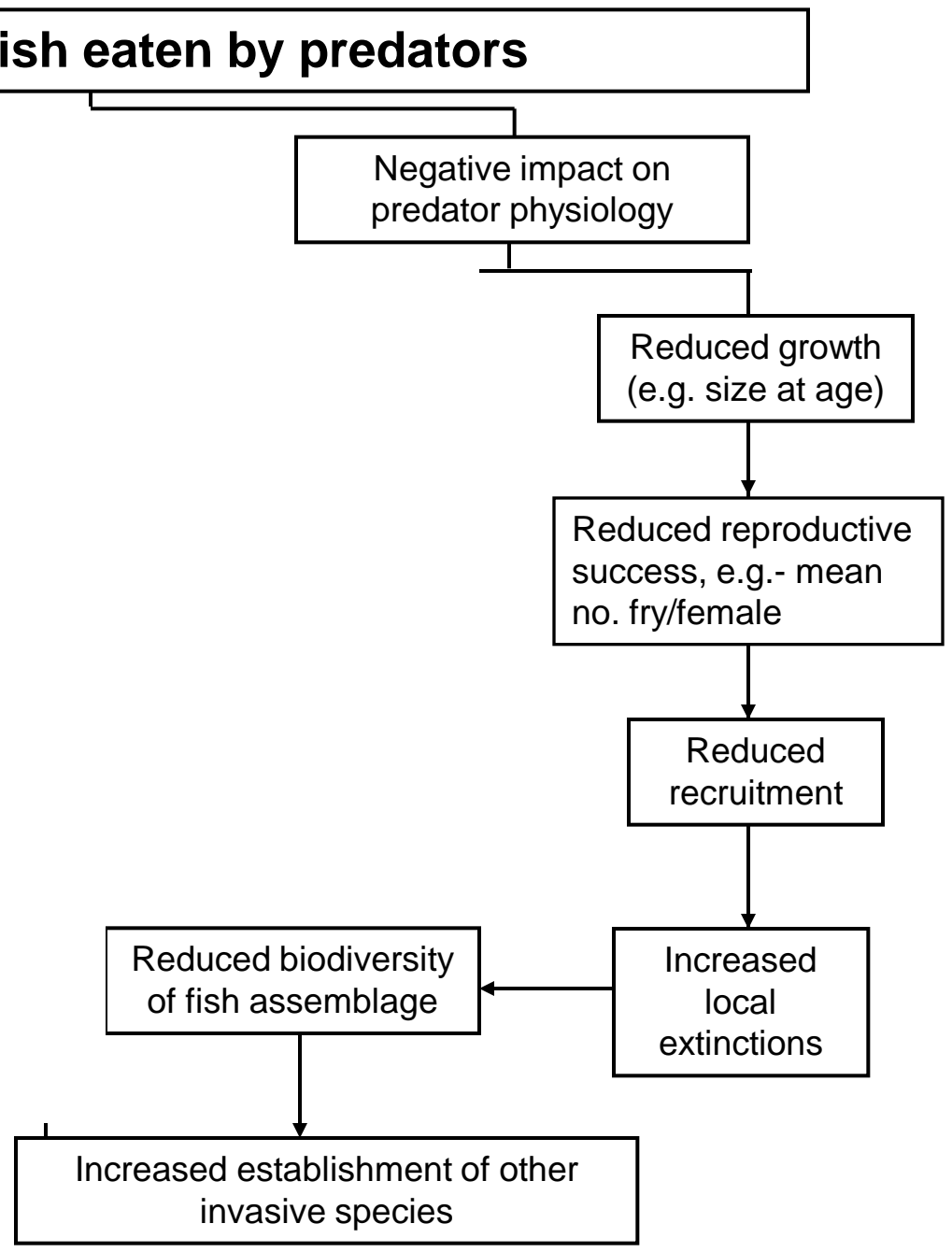
Reduced
recruitment

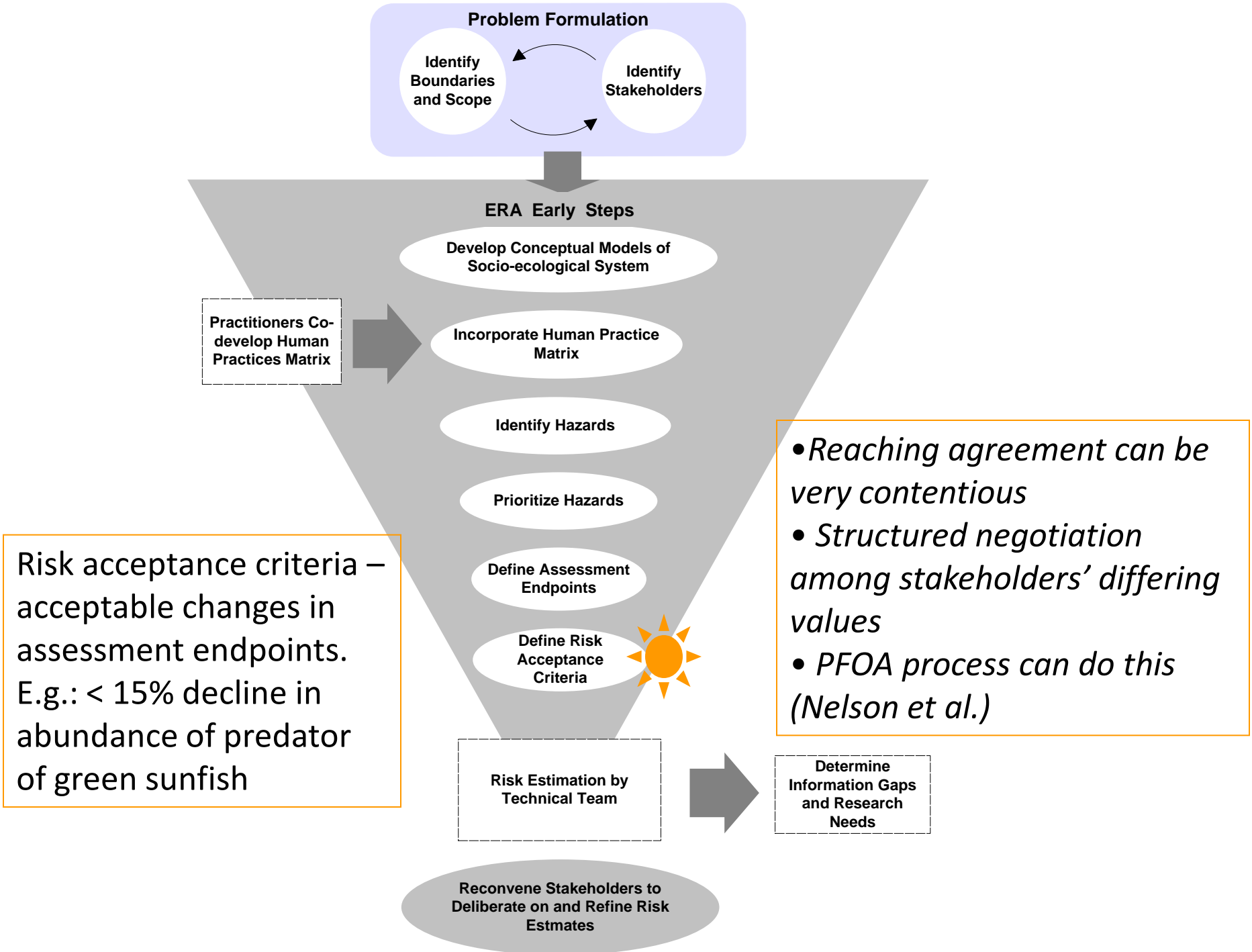
Increased
local
extinctions

Reduced biodiversity
of fish assemblage

Increased establishment of other
invasive species

Harder to
connect to
hazard





“I just don’t think we should be having to make this choice. I think that as other folks have been saying that if we were – if we were just more responsible to control this problem from happening, we wouldn’t have to make these difficult decisions. I also think it’s a silver bullet mentality. We are very sensitive to ideas that some white knight or some bass pro is going to come to town and save everything.”

A: “I don’t know, but like I said, when I read the background material, my first reaction was very knee jerk. It was, ‘Why are we even thinking about this?’ Really, honestly, reading the background material, that actually made me start to see some potential in things under very controlled circumstances.”

B: “I was kinda opposite actually. When I first read the title, my knee jerk reaction was, “Hell, yes.” Then you think about it for a little while, then I backed off.”

(Quotes from Great Lakes focus groups conducted by Leah Sharpe)

Risk assessment in parallel with development

