

In Search of Responsible and Sustainable (R&S) Inland Recreational Fisheries (for Mahseer)

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SIMRAD

Yellowfin

MERCURY

HOOK





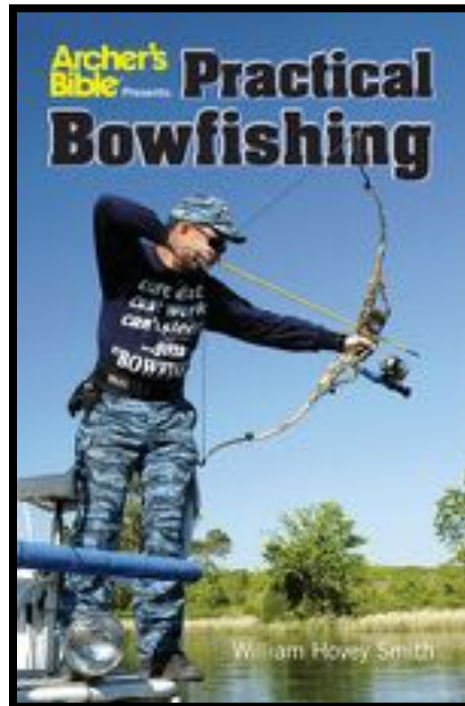


- Responsible and sustainable (R&S) recreational fisheries depend almost entirely on our ability to modify human behaviour
- What can we do to better empower rec anglers and guide them in adopting tactics and strategies that are R&S especially in the context of catch-and-release?
- Anglers are numerous so if R&S they have the potential to be a key voice for conservation
- Background of increasing recognition that rec fishing has contributed to ecological change and that the activity as a whole facing increased pressure (anti-fishing movement) based on assumption that it is unsustainable and unethical



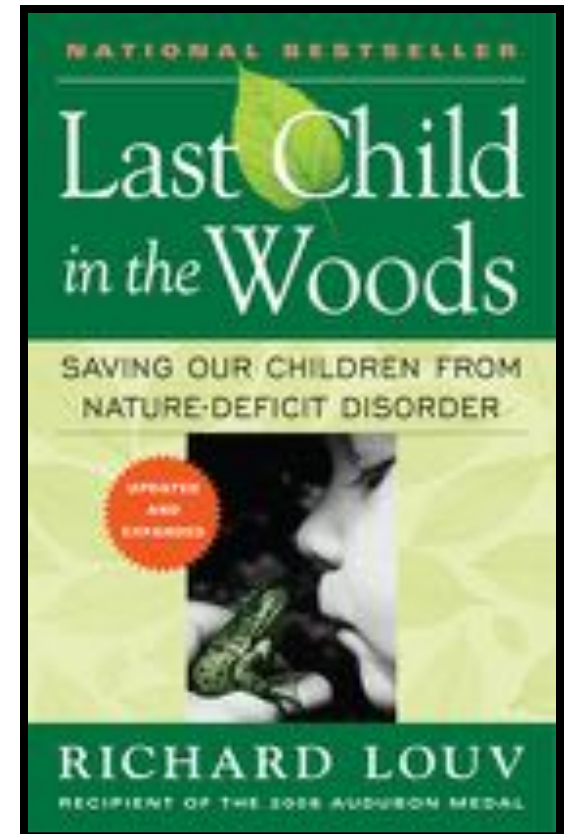
What is Recreational Fishing? (*UN FAO 2012*)

fishing of aquatic animals that do not constitute the individual's primary resource to meet nutritional needs and are not generally sold or otherwise traded on export, domestic, or black markets (fishing for fun & leisure)

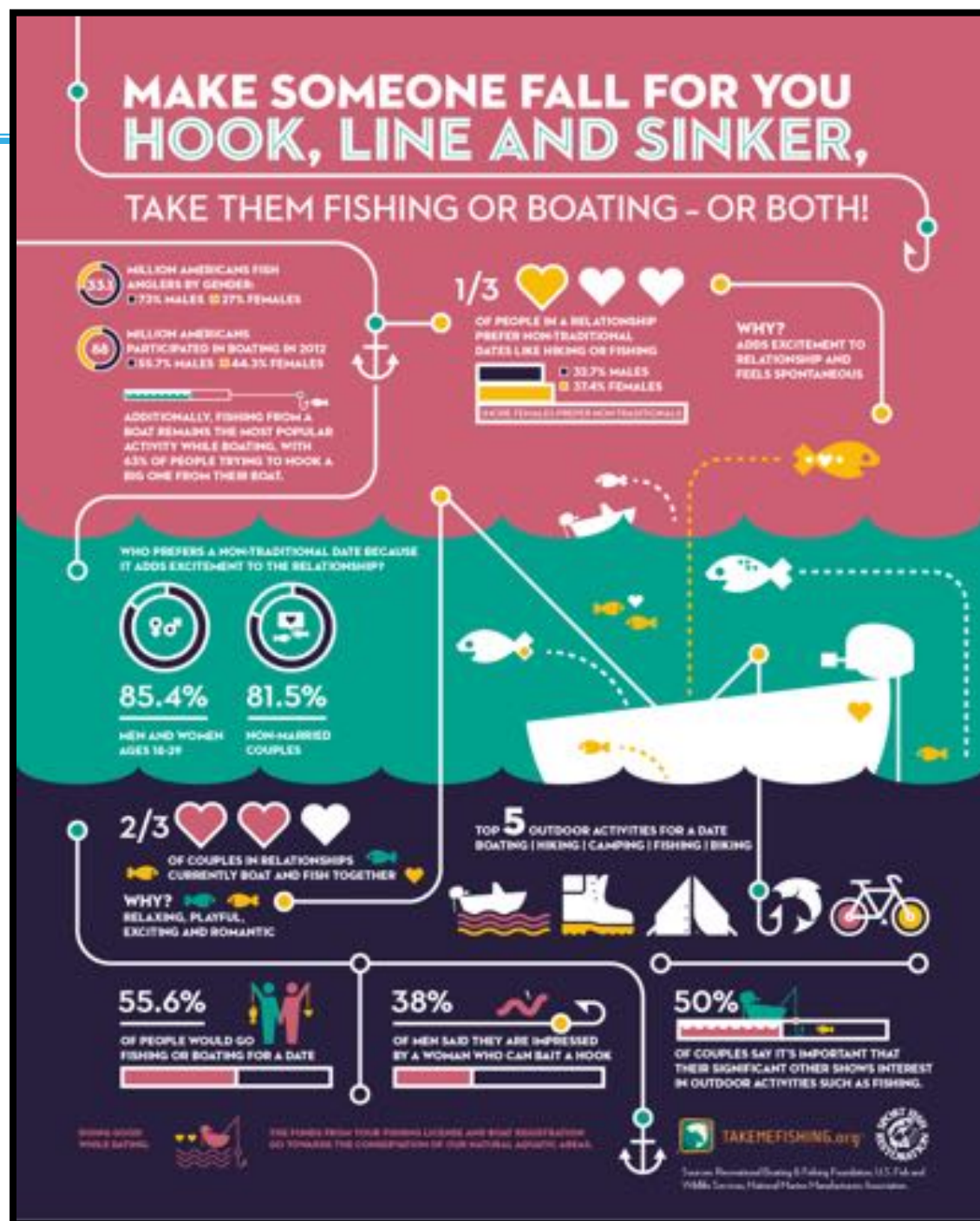




- Economic (regional and national) – Expenditures = \$190 B/yr
- Social bonding (family), satisfaction, quality of life
- Psychological stress relief, reduced negative emotions
- Reduction in crime propensity of young people
- Education about nature and wildlife
- Local “organic” food source
- Important for conservation (empowered and engaged environmental citizens)

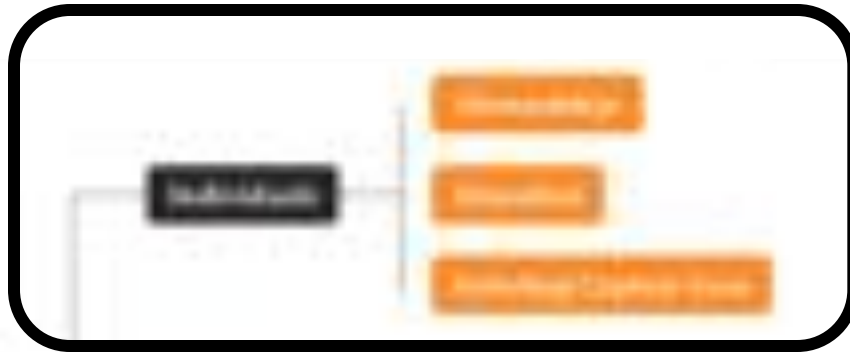


And even
romance...





- A “good Anthropocene” would involve effective management strategies and changes in human behavior that promote the responsible and sustainable use and restoration of ecosystems
- Recreational fisheries hold significant social, cultural, and economic value and can generate many benefits when conducted R & S and thus be an integral part of a “good Anthropocene”



- Ten commandments to facilitate persistence and long-term sustainability of recreational fisheries in the “good Anthropocene”

- When used singly, or in combination, these ten commandments will contribute to the harmonization of sustainable fish populations and angling practices

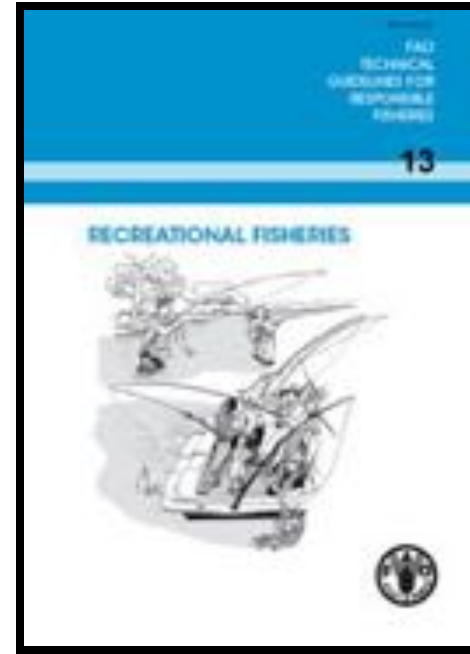
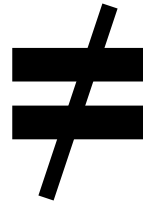
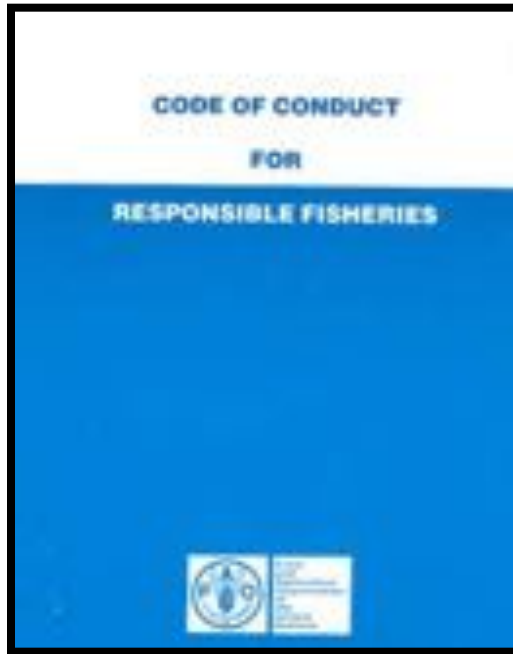




Responsible fisheries - Where the fisheries actors are involved in supporting and promoting the sector to ensure that benefits are maximized (beyond the individual) in an ethically and socially appropriate manner (e.g., in a code of conduct) – An “obligation”...

NOTE: The word “responsible” is normative and subject to interpretation based on ones individual values, beliefs and ethical perspectives (social and cultural norms)

Sustainable fisheries (UN FAO def) - Fishing activities that do not cause or lead to undesirable changes in the biological and economic productivity, biological diversity, or ecosystem structure and functioning from one human generation to the next... OR
Ability to persist in the long run




“the real purpose of the Code of Conduct is to help countries and groups of countries, develop or improve their fisheries and aquaculture, in order to reach the goal of achieving MSY...”



- Within rec fishing, managing for MSY fails to consider diverse angler motivations and satisfactions
- In rec fishing, maximizing MSY is rarely the management objective...
- To enhance user experience – may be the opposite – controlling effort not because the fishing pressure isn’t “sustainable” for the population but to maintain other aspects of the fishing experience (e.g., solitude)
- What are the social and biophysical conditions desired or appropriate for a given fishery (accounts for local cultural and socio-economic interests)? *McCool & Lime 2001 J Sust Tourism*



“Conservation (or sustainability) is primarily not about biology but about people and the choices they make” *Richard Cowling, NMU*

Conservation Biology 

Special Section Essay

Conservation Means Behavior


F. WESLEY SCHULTZ



FISH and FISHERIES, 2007, 8, 285–296

Managing fisheries is managing people: what has been learned?

Ray Hilborn

Fisheries Management and Ecology 

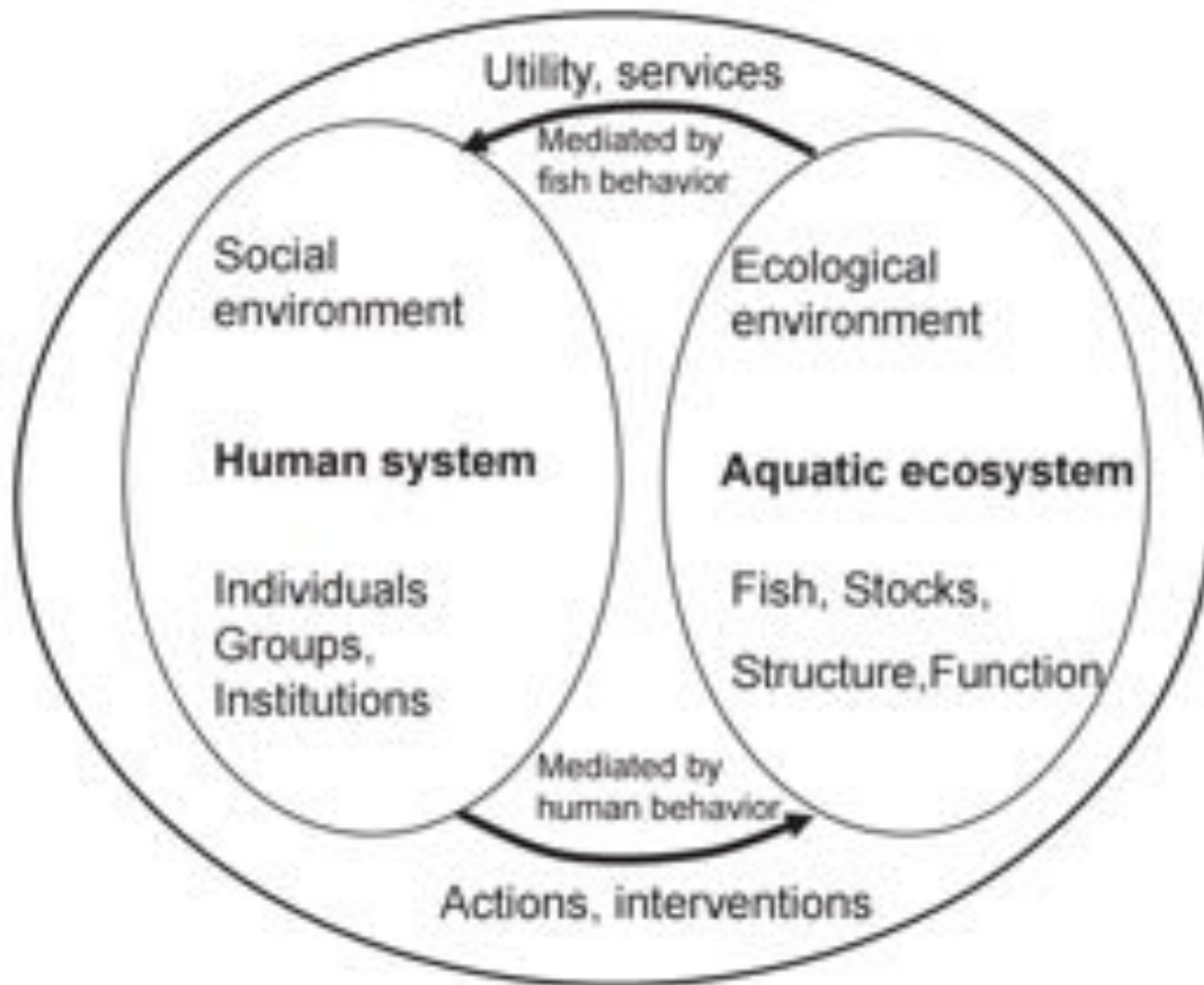
Fisheries Management and Ecology, 2013, 20, 91–98

Arlinghaus, Cooke & Potts

Towards resilient recreational fisheries on a global scale through improved understanding of fish and fisher behaviour



Recreational Fisheries are Coupled Social-Ecological Systems





Extrapolations from Canada to the World

Using data from DFOs 2000 Survey of Recreational Fishing in Canada

- recreational capture rates = 47 billion fish
- Represents about 10 to 15% the biomass of the commercial fishery

Cooke & Cowx 2004 BioScience





Some fish are harvested and consumed...





But even more are released... Catch-&-Release

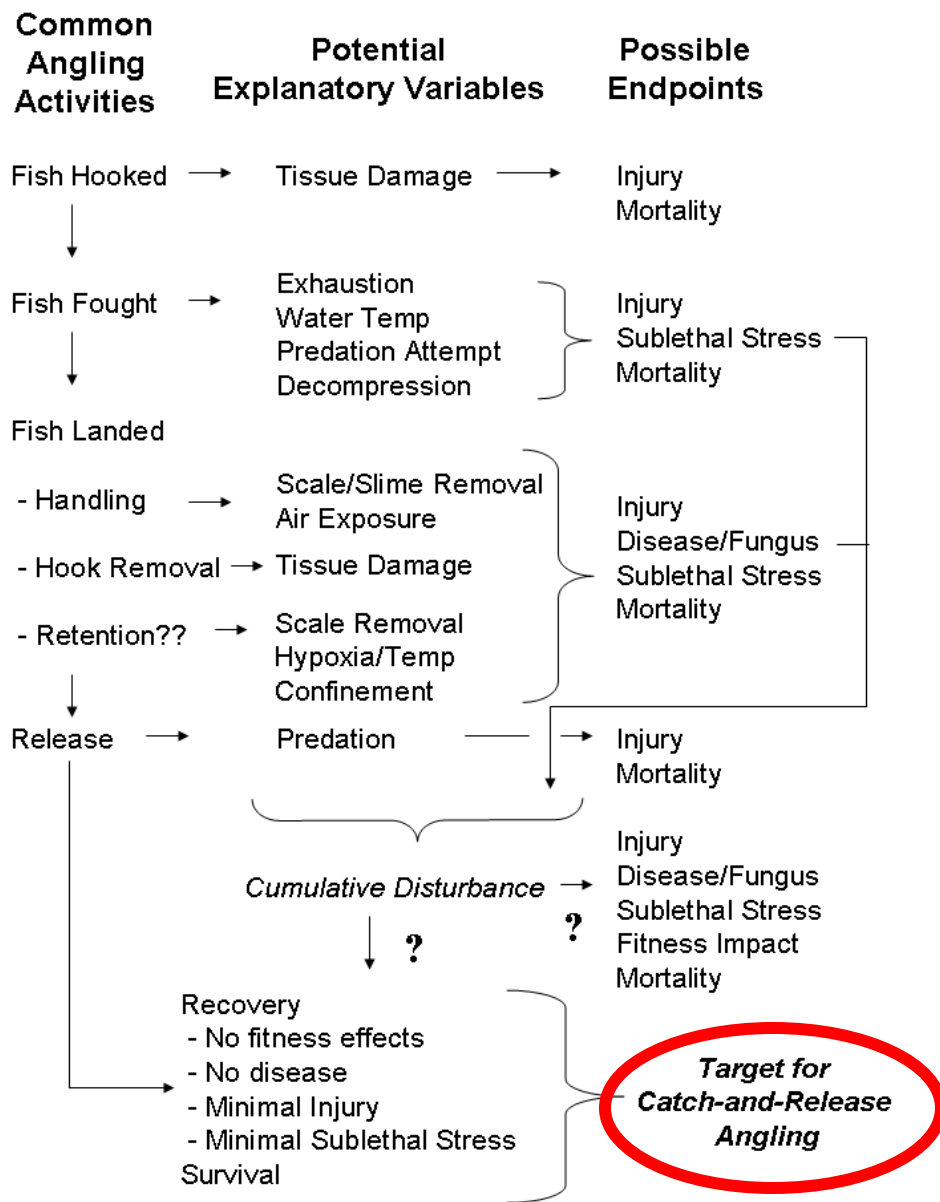
- **Mandated**
- **Voluntary**
- **Discouraged**
- **Verboten**





- **63% of captured fish are released (= 30 billion fish)**
- **Provides opportunity to consider issues around rec fishing R&S that directly connect angler and fish**







- ~425 catch-and-release studies to date
- Many fish are released and some die... (avg of ~10%)
- Sublethal effects also possible
 - injury, disease, fitness, stress, behaviour, growth, etc
- Outcome of angling event influenced by...
 - biology of fish (size, species, sex, life-stage)
 - environment (temp, depth, predators)
 - **angler behaviour (air exposure, handling, when/what to fish for)**
 - **gear choice (hook type, line strength)**
 - **angler experience and knowledge**



Integrative and Comparative Biology

Integrative and Comparative Biology, volume 55, number 4, pp. 554-576
doi:10.1093/ich/icy088

Society for Integrative and Comparative Biology

SYMPOSIUM

Fishing for Effective Conservation: Context and Biotic Variation are Keys to Understanding the Survival of Pacific Salmon after Catch-and-Release

Graham D. Raby,^{1*} Michael R. Donaldson,[†] Scott G. Hinch,[‡] Timothy D. Clark,^{1,‡}
Erika J. Eliason,^{*†} Kenneth M. Jeffries,[§] Katrina V. Cook,[‡] Amy Teffer,^{1,†} Arthur L. Bass,[‡]
Kristina M. Miller,^{||} David A. Patterson,[#] Anthony P. Farrell^{**} and Steven J. Cooke^{*}

- **So - context and biotic variation matter...**
- **But angler behaviour (including gear choice) is mediator**



Deep hooking is single biggest factor influencing fate...

Best option is to minimize deep hooking in the first place!

So what influences deep hooking (general trends from lit)?

Bait/Lure Type (organic = deeper)

Bait/Lure Size (smaller = deeper)

Fishing Style/Method (passive = deeper)

Experience (novice = deeper)

Hook Type/Style (conventional J-style = deeper)





KEEPEMWET
FISHING

THE KEEPEMWET MOVEMENT

Elsevier Research 2017 (2017) 1-10

Contents lists available at ScienceDirect

 **Fisheries Research** 

journal homepage: www.elsevier.com/locate/fishres

Keepemwet Fishing—An emerging social brand for disseminating best practices for catch-and-release in recreational fisheries[®]

Andy J. Dzuyichuk^{a,b,c}, Sascha Clark Dzuyichuk^{b,c}, Andrew Kosiarski^d, Steven J. Cooke^{b,c,d}, Bryan Huskey^e





Three SIMPLE Principles (with scientific basis)



1. Minimize air exposure



2. Eliminate contact with dry surfaces

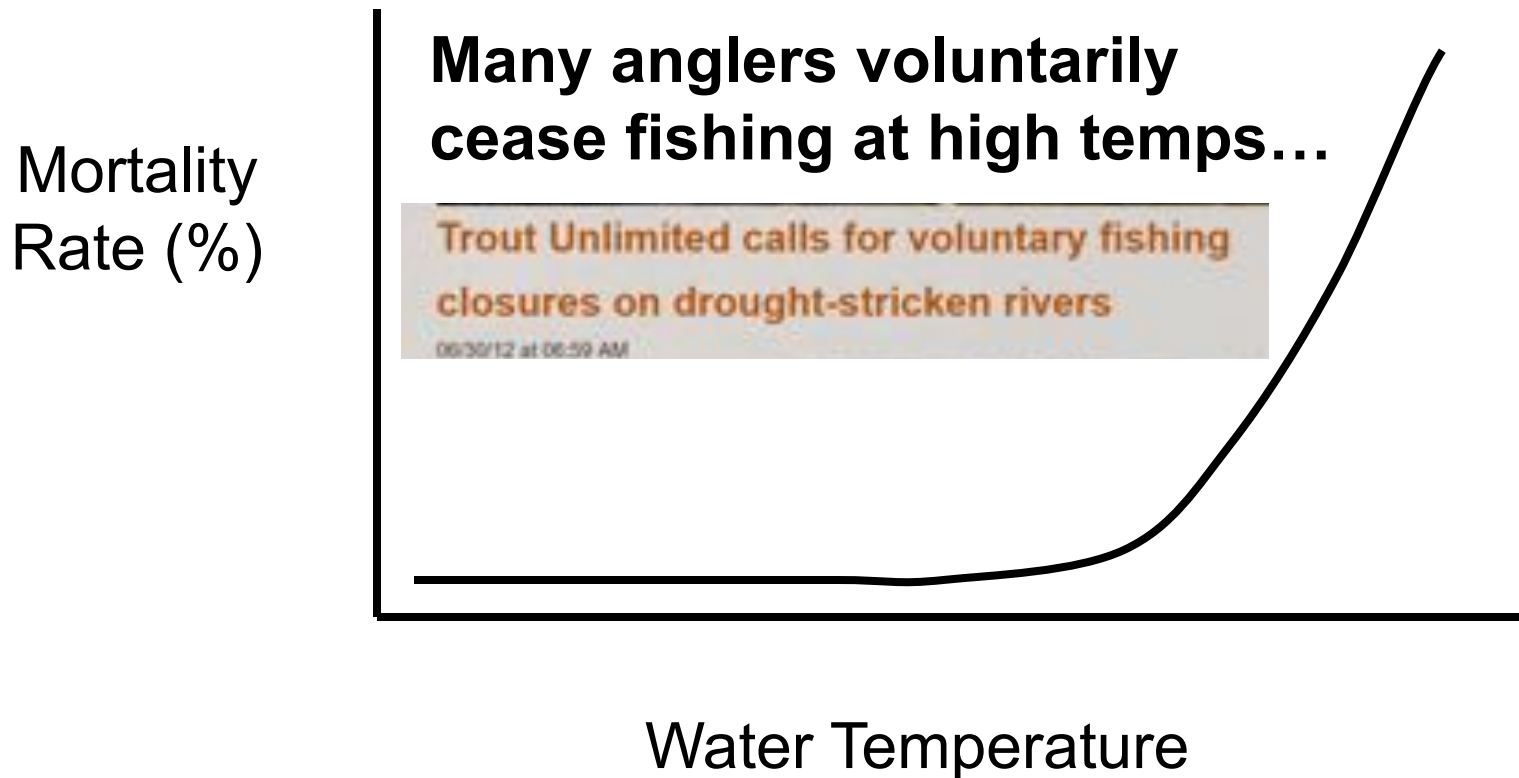
3. Reduce handling





Fishing at Warmer Temps

Mortality rates increase at higher water temperatures



Data for largemouth bass, striped bass,
and Atlantic salmon

Wilde 1998 Fisheries
Wilde et al. 2000 Fisheries
Thorstad et al. 2003. Fish. Res.
Lennox et al. 2018. Biol Cons.

What about when no info on C&R?

- Emerging fisheries mostly in LMICs
- Rec fisheries that target Endangered spp



FISH and FISHERIES

FISH and FISHERIES, 2016, 17, 249-265

Ghoti

Angling for endangered fish: conservation problem or conservation action?

Steven J Cooke¹, Zeb S Hogan², Paul A Butcher³, Michael J W Stokesbury⁴, Rajeev Raghavan⁵, Austin J Gallagher^{6,7}, Neil Hammerschlag^{6,7,8} & Andy J Danylchuk⁹

IUCN White Paper almost done!

Difficult to extrapolate given inter-specific variation & fisheries characteristics





What do we know about C&R of Mahseer?



What do we know about C&R of Mahseer?

Dr. Shannon Bower
Carleton U – Now Uppsala U





Blue-finned mahseer

Cauvery River

N= 49 fish angled at 25 to 29°C

Bower et al. 2016 FME

- **Robust mouth area with minimal perfusion**
- **Few fish bled from hooking site and those that did showed rapid clotting**
- **No evidence of major hook damage**
- **4% of fish “deeply hooked” but none in esophagus**
- **90%+ of fish were vigorous at time of landing**
- **No immediate mortality but one fish failed to swim away for 3+ min and may be a potential mortality**
- **Short term mortality estimated using net pen**
- **7/8 fish jumped out of pen**



Golden mahseer
Ganges River
N=41 angled at 16 to 18°C

Bower et al. Unpublished

- **Level of hook injury influenced by hook type**
- **Time required to remove hook (which is air exposure) influenced by hook type**
- **Fish “inhale” lures but inside mouth is robust**
- **Barbless J hooks the best – barbed treble hooks the worst**
- **Fish vigorous at time of landing and release (exception when extended air exposure >60 sec or when treble hooks “close” mouth)**
- **No immediate mortality**



When is C&R Rec Fishing Sustainable?



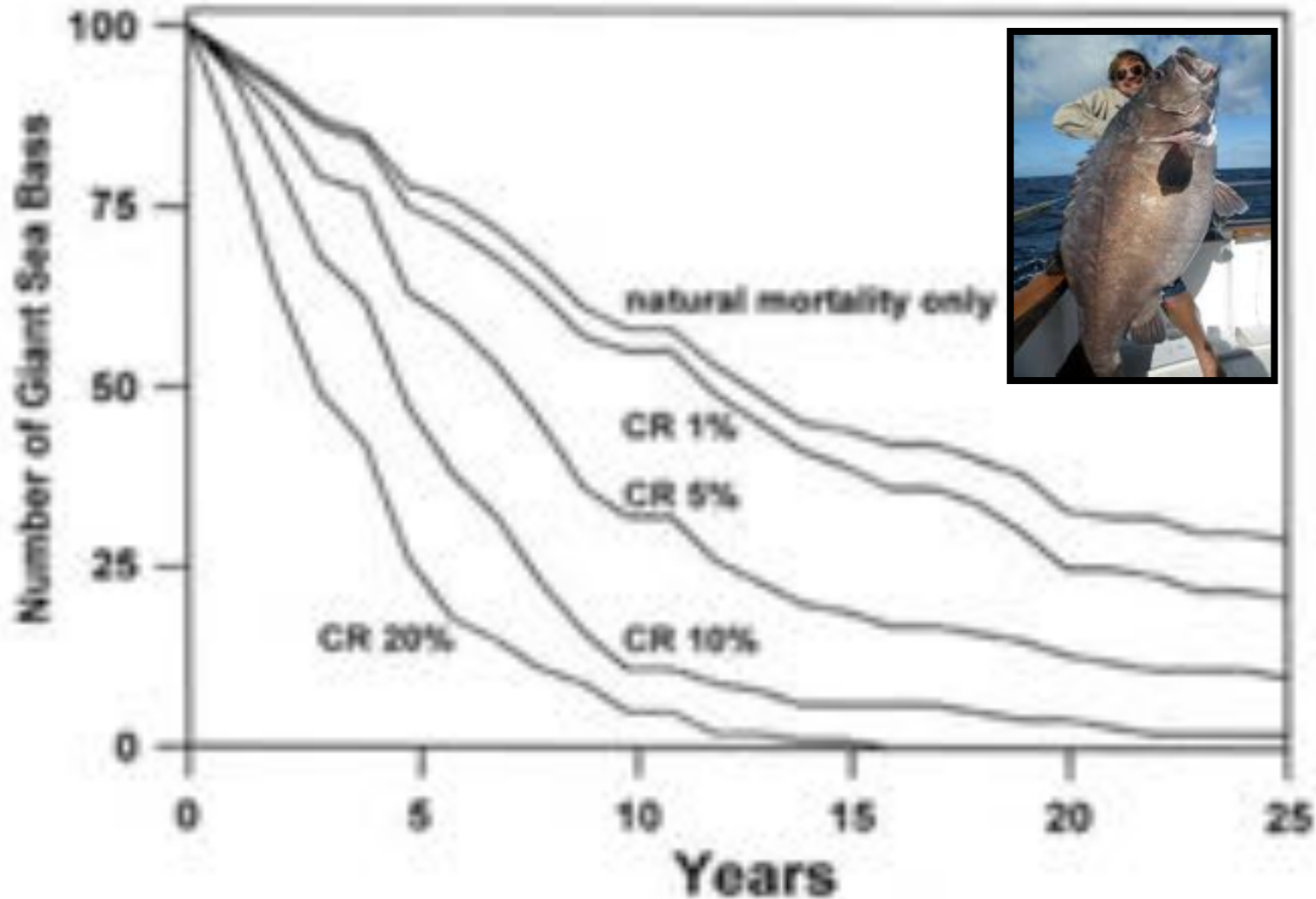
Assessment needs...

- Population size
- Life-history info
- Natural mortality
- Human-related mortality
- C&R mortality

- Need for more (high quality) “traditional” assessment data
- Actual C&R mortality %’s not overly informative without broader biological context



Population Trajectories w Various C&R Mort Levels





FISH and FISHERIES



FISH and FISHERIES, 2013, 14, 439-457

Voluntary institutions and behaviours as alternatives to formal regulations in recreational fisheries management

Steven J Cooke¹, Cory D Suski², Robert Arlinghaus^{3,4} & Andy J Danylchuk⁵

Empower anglers to modify their behaviours

**Depends on IDENTIFYING best practices
and SHARING them effectively with anglers**

We are part way there...



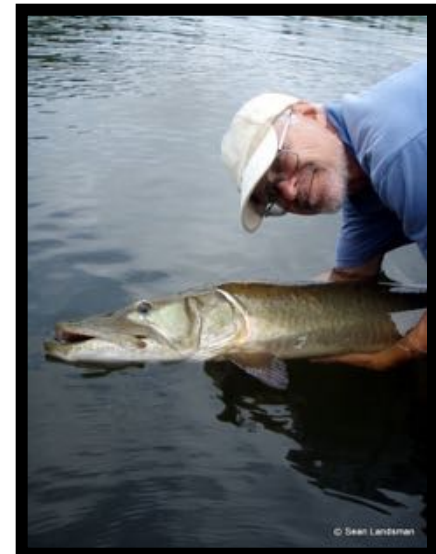
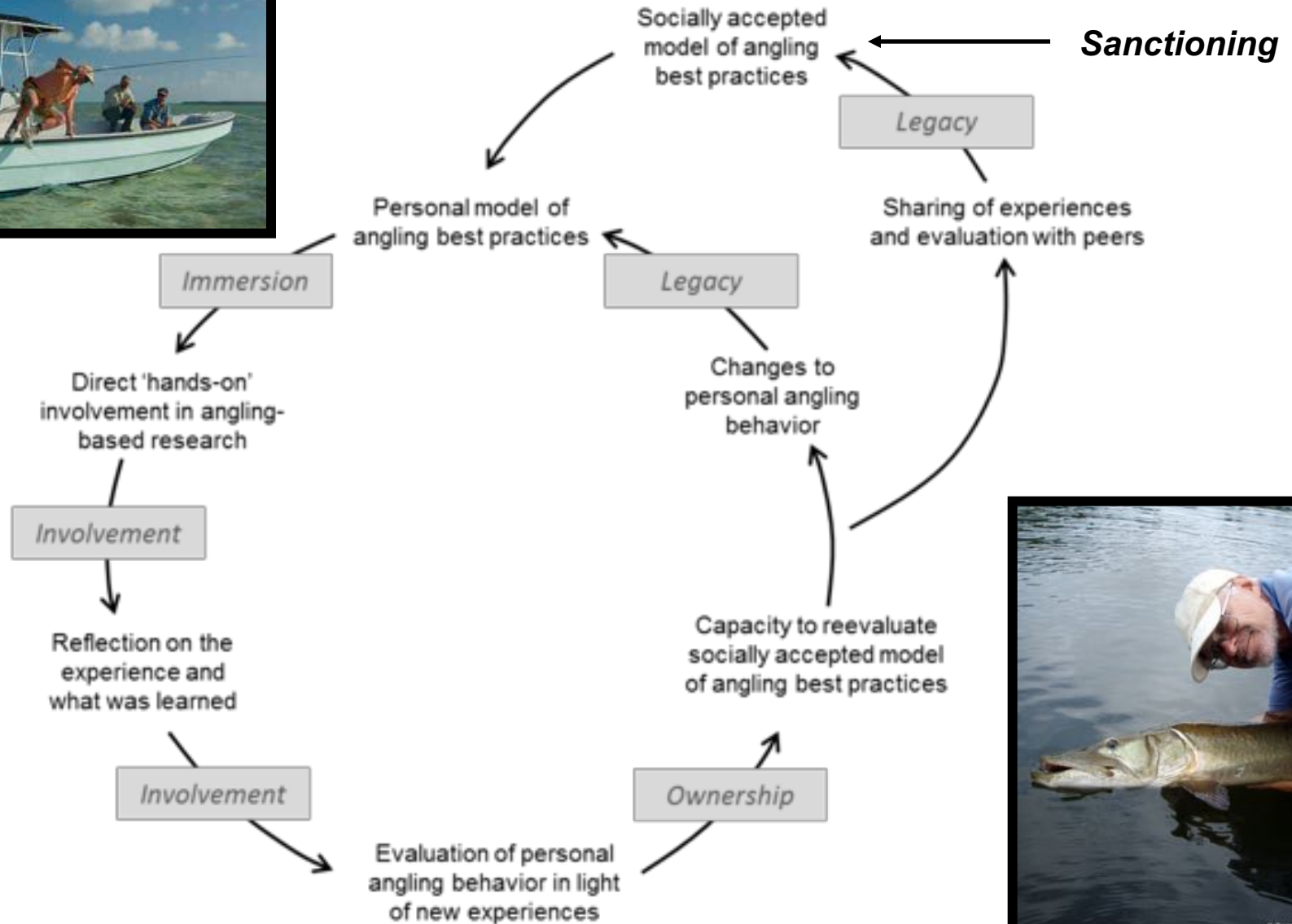
- Opportunity for members of the trade engaged in direct marketing (e.g., product packaging, ads) or have direct interaction with anglers (e.g., fishing guides & outfitters) to promote best angling practices *Danylchuk, Cooke et al. 2017 Fish. Res.*
- Similar opportunity for angling media & “celebrity” anglers
- Potential for formal training & angler sanctioning to improve C&R outcomes for fish *Delle Palme, Cooke et al. 2016 KAE; Guckian, Cooke et al. 2018.*



Environ Manage (2007) 39:760–773
DOI 10.1007/s00267-006-0173-2

Do Catch-and-Release Guidelines from State and Provincial Fisheries Agencies in North America Conform to Scientifically Based Best Practices?

Christine Pelletier · Kyle C. Hanson ·
Steven J. Cooke





- **Workshops to identify research needs/priorities with key stakeholders**





- Really about the angler... the individual who interacts directly with the fish and the environment
- Regulations can be used to guide but compliance requires understanding
- Enabling voluntary actions and modifying behaviour in creative ways (sanctioning, angler involvement) will be key
- Still some (many?) science needs to determine potential sustainability of C&R fisheries for mahseer
- Sustainability within the sector and its continued persistence requires anglers willing to engage in responsible behaviours

It is almost entirely about people!



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