NOAA FISHERIES

ALASKA FISHERIES SCIENCE CENTER

The risk-matrix approach to evaluating fisheries bycatch

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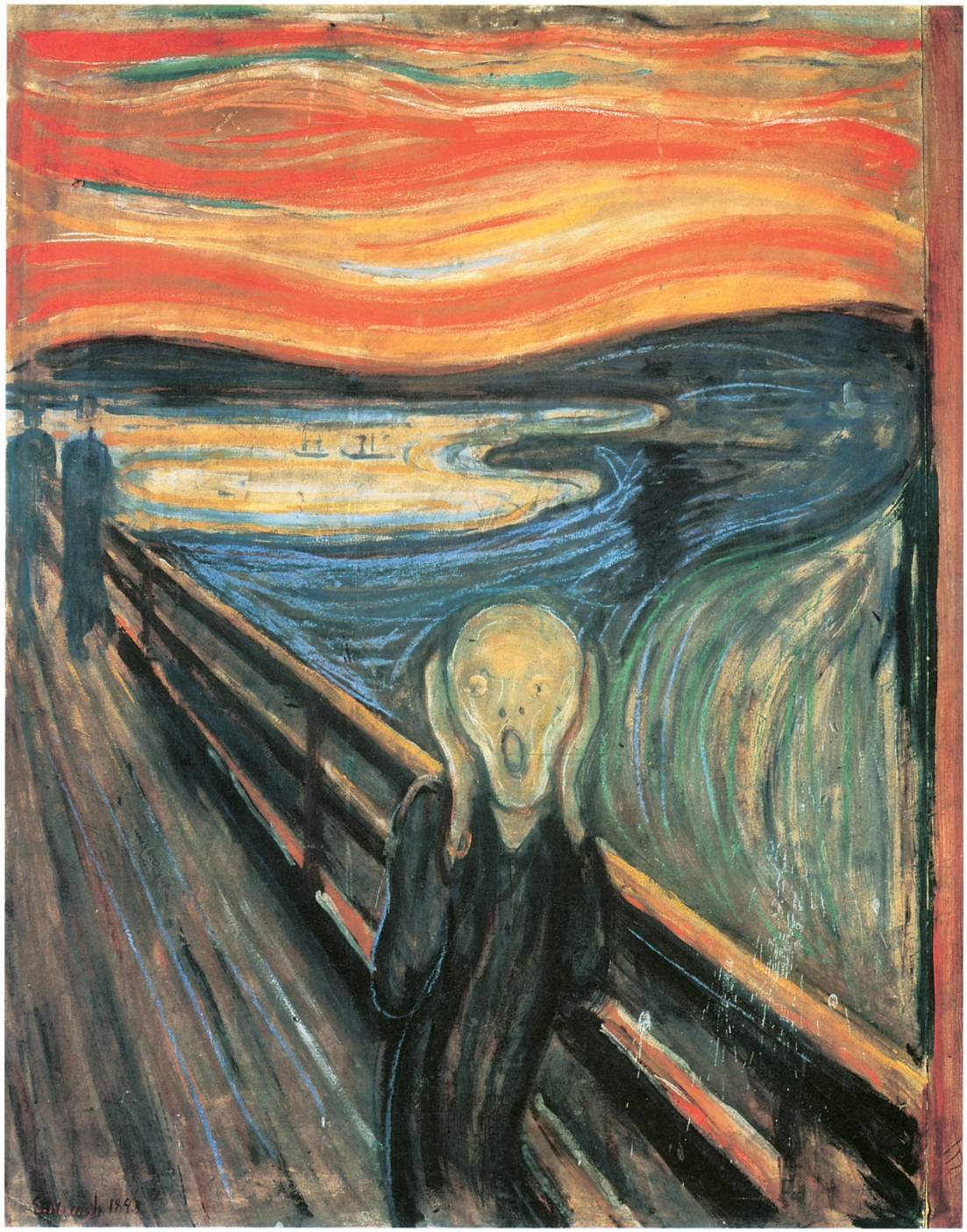

The scream of Nature.
Edward Munch. 1893.


Reebok
CrossFit

BACK STORY

WHAT SHOULD YOU REALLY BE AFRAID OF?

Fear, as FDR noted in 1933, paralyzes those who succumb to it. And yet much of what we worry about today is based on hype rather than reality. Yes, media headlines are partially to blame. But some things (sharks!) are just downright scary. Using the most recent U.S. data available, we hereby present a list of unsettling threats and their far riskier counterparts.

MURDERS (2008) **14,180**	SUICIDES **33,289** (2006)
CHILDREN ABDUCTED BY STRANGERS (1999) **115**	CHILDREN WHO DROWN IN POOLS **288** (2008)
BURGLARIES (2007) **2.2 MILLION**	IDENTITY THEFTS **8.3 MILLION** (2005)
SHARK ATTACKS (2009) **28**	DOG BITES **4.5 MILLION***
AMERICANS KILLED BY TERRORIST ATTACKS AROUND THE WORLD (2008) **33**	AMERICANS WHO DIE FROM THE SEASONAL FLU **36,171***
DEATHS BY ALLERGIC REACTION TO PEANUTS **50–100***	DEATHS BY UNINTENTIONAL POISONING **27,531** (2006)
WOMEN WHO DIE FROM BREAST CANCER (2009) **40,170**	WOMEN WHO DIE FROM CARDIOVASCULAR DISEASE **432,709** (2006)
FATAL AIRLINE ACCIDENTS (2005) **321**	FATAL CAR CRASHES **34,017** (2008)
AMERICANS AUDITED BY THE IRS (2009) **1.4 MILLION**	U.S. DEATHS **2.4 MILLION** (2007)

* ANNUAL AVERAGES AND ESTIMATES

SOURCES: AMERICAN CANCER SOCIETY; AMERICAN HEART ASSOCIATION; CENTERS FOR DISEASE CONTROL AND PREVENTION; CONSUMER PRODUCT SAFETY COMMISSION; FEDERAL TRADE COMMISSION; INTERNAL REVENUE SERVICE; INTERNATIONAL SHARK ATTACK FILE; NATIONAL COUNTERTERRORISM CENTER; NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION; NATIONAL TRANSPORTATION SAFETY BOARD; NEW ENGLAND JOURNAL OF MEDICINE; U.S. DEPARTMENT OF JUSTICE

BY NUMBER 17, NYC, CLAUDIA KALB, AND ELIZABETH WHITE

"Our fear of harm ought to be proportional not only to the magnitude of the harm, but also to the probability of the event"

Antoine Arnauld and P. Nicole: Logic or the art of thinking. 1662. Edited by Jull Vance Buroker. 5th ed. 1996. Cambridge Univ. Press.

“best available science”

Copyright AMEC 2005

Circle START Criteria Used To Select Patient Triage Category

Personal Belongings Tag, Tracking Tag, Etc.

DISASTER RESPONSE TRIAGE TAG

A123456

START TRIAGE

All Walking Wounded — MINOR

Respirations 30
Perfusion 2
Mental Status Can Do

RESPIRATIONS
- YES
  - Over 30/Min. → IMMEDIATE
  - Under 30/Min.
    - Position Airway
      - YES → IMMEDIATE
      - NO → DECEASED
- NO

PERFUSION
- Radial Pulse Present
- Radial Pulse Absent
  - Capillary Refill
    - Over 2 Seconds → IMMEDIATE
    - Under 2 Seconds
      - Control Bleeding → IMMEDIATE
      - Impaired Perfusion or Hypothermia or Pre-Shock → IMMEDIATE

MENTAL STATUS
- Can't Follow Simple Commands → IMMEDIATE
- Can Follow Simple Commands → DELAYED

NERVE AGENT INDICATORS
- Salivation
- Lacrimation
- Urination
- Defecation
- Gastrointestinal Distress
- Emesis

Check Here Only If Decon Was Needed & Performed ☐

☐ OTHER FAMILY MEMBERS Are Involved In Incident
Name / Relation:

Name	M F	Age
Address		
Medical History		
Meds	Allergies	
Medical Crew		

SEX M / F | AGE | NAME | TRANSP UNIT | HOSP | TRANSP TIME | OTHER FAMILY INVOLVED

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TRANSPORTATION INFORMATION ON OTHER SIDE

ADDL TRANSPORT INFO / COMMENTS:

NOTE AREAS INJURED ON FIGURES BELOW

CHECK TYPES OF INJURIES

- ☐ SPINAL
- ☐ BLUNT TRAUMA
- ☐ BURN
- ☐ FRACTURE
- ☐ LACERATION
- ☐ PENETRATING INJURY
- ☐ HEAD INJURY
- MEDICAL PROBLEM:

TIME	PULSE	RESP	B/P	AVPU

LUNG SOUNDS:

ECG / SpO2 / OTHER:

TIME	TREATMENT/MED/DOSE/BY	TIME	TREATMENT/MED/DOSE/BY

NO. OF MARK 1 KITS ADMINISTERED: ☐ ORP1 ☐ ORP2 ☐ ORP3

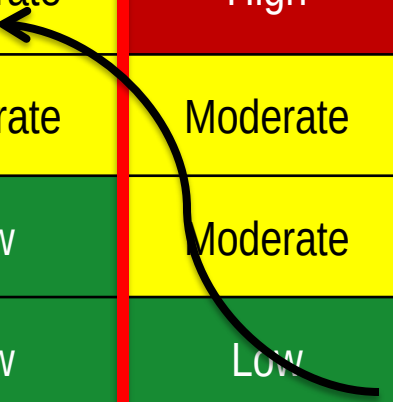
NO. OF DIAZEPAMS ADMINISTERED: ☐

PRIORITY 0	DECEASED/EXPECTANT	PRIORITY 0
PRIORITY 1	IMMEDIATE	PRIORITY 1
PRIORITY 2	DELAYED	PRIORITY 2
PRIORITY 3	MINOR	PRIORITY 3
PRIORITY 4	INVOLVED BUT NO APPARENT INJURIES	PRIORITY 4

PRIORITY 0	DECEASED/EXPECTANT	PRIORITY 0
PRIORITY 1	IMMEDIATE	PRIORITY 1
PRIORITY 2	DELAYED	PRIORITY 2
PRIORITY 3	MINOR	PRIORITY 3
PRIORITY 4	INVOLVED BUT NO APPARENT INJURIES	PRIORITY 4

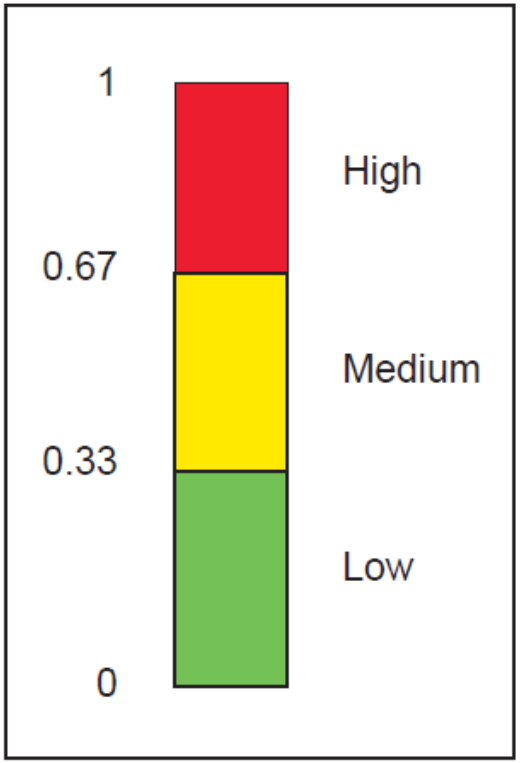
5 x 5 matrix with three levels of assessment after Cox (2009)

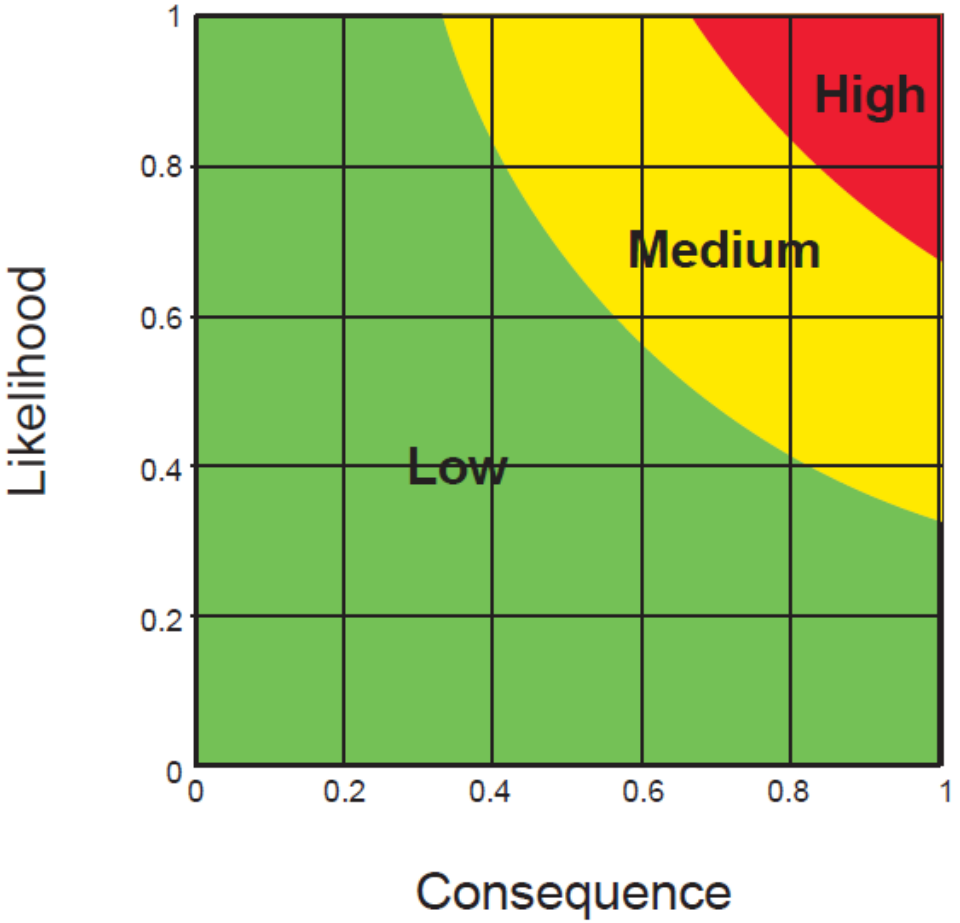
	Consequence				
Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Low	Low	Moderate	High	High
Likely	Low	Low	Moderate	Moderate	High
Possible	Low	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low	Low
Rare	Low	Low	Low	Low	Low



Cox, L.A. 2009. Risk analysis of Complex and Uncertain Systems. Springer, New York.

Risk-Matrices aim to rank risks






I DONT USUALLY DO THOUGHT EXERCISES
BUT WHEN I DO, I ALWAYS USE LOTS OF DATA
memegenerator.net

Methods

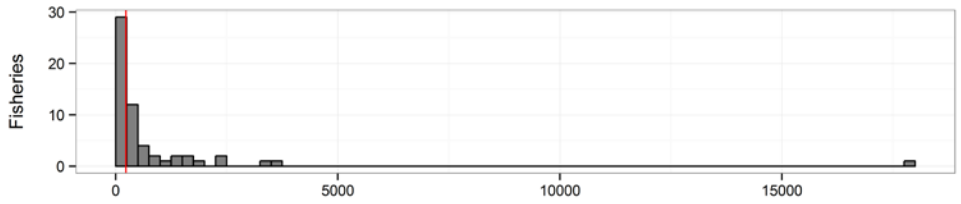
National Bycatch Report Database System

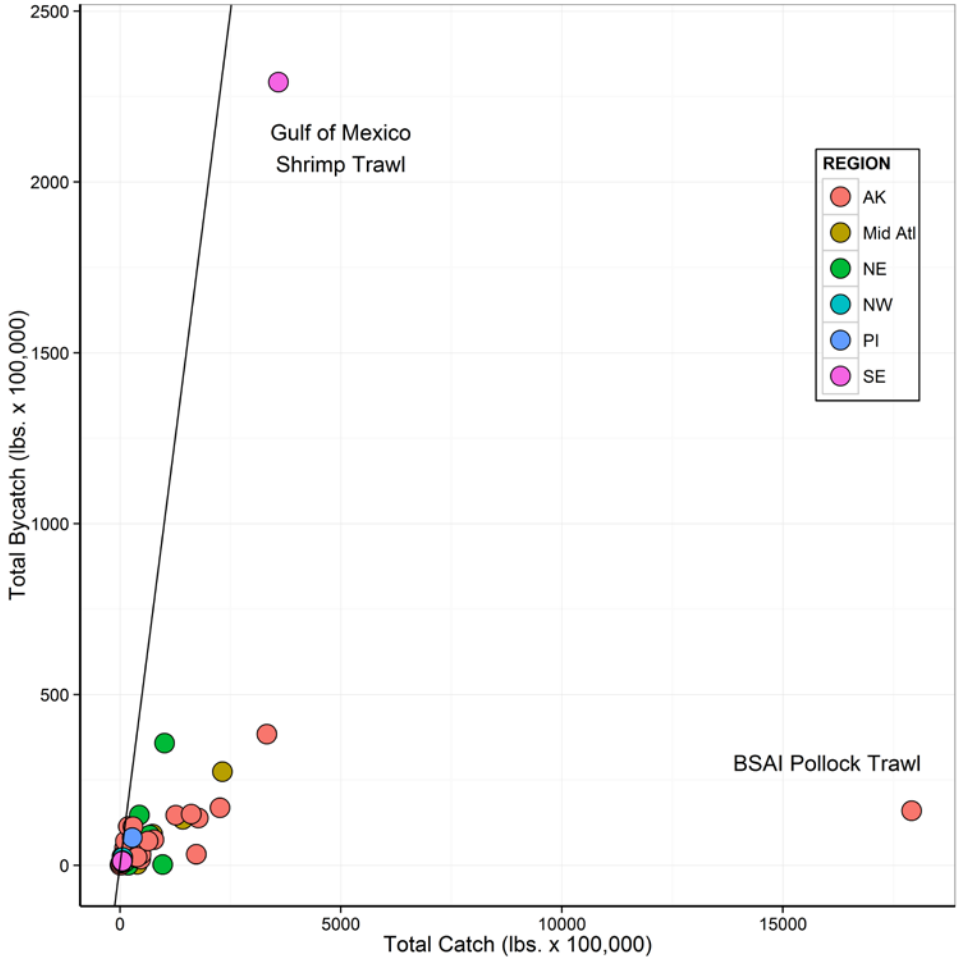
- First Edition Update 1

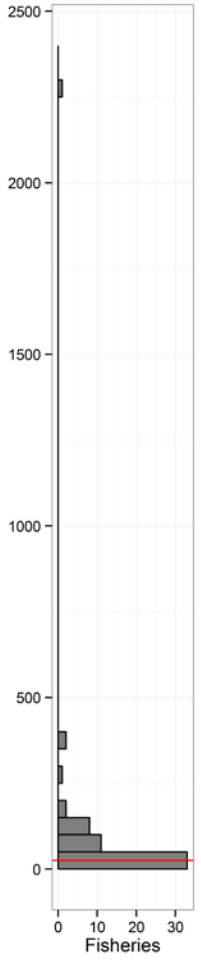
http://www.st.nmfs.noaa.gov/observer-home/first-edition-update-1

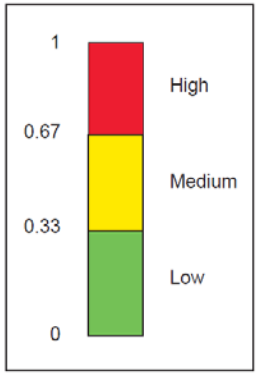
  - Bycatch amounts (fishery impact or magnitude)
  - Bycatch ratios (fishery efficiency)

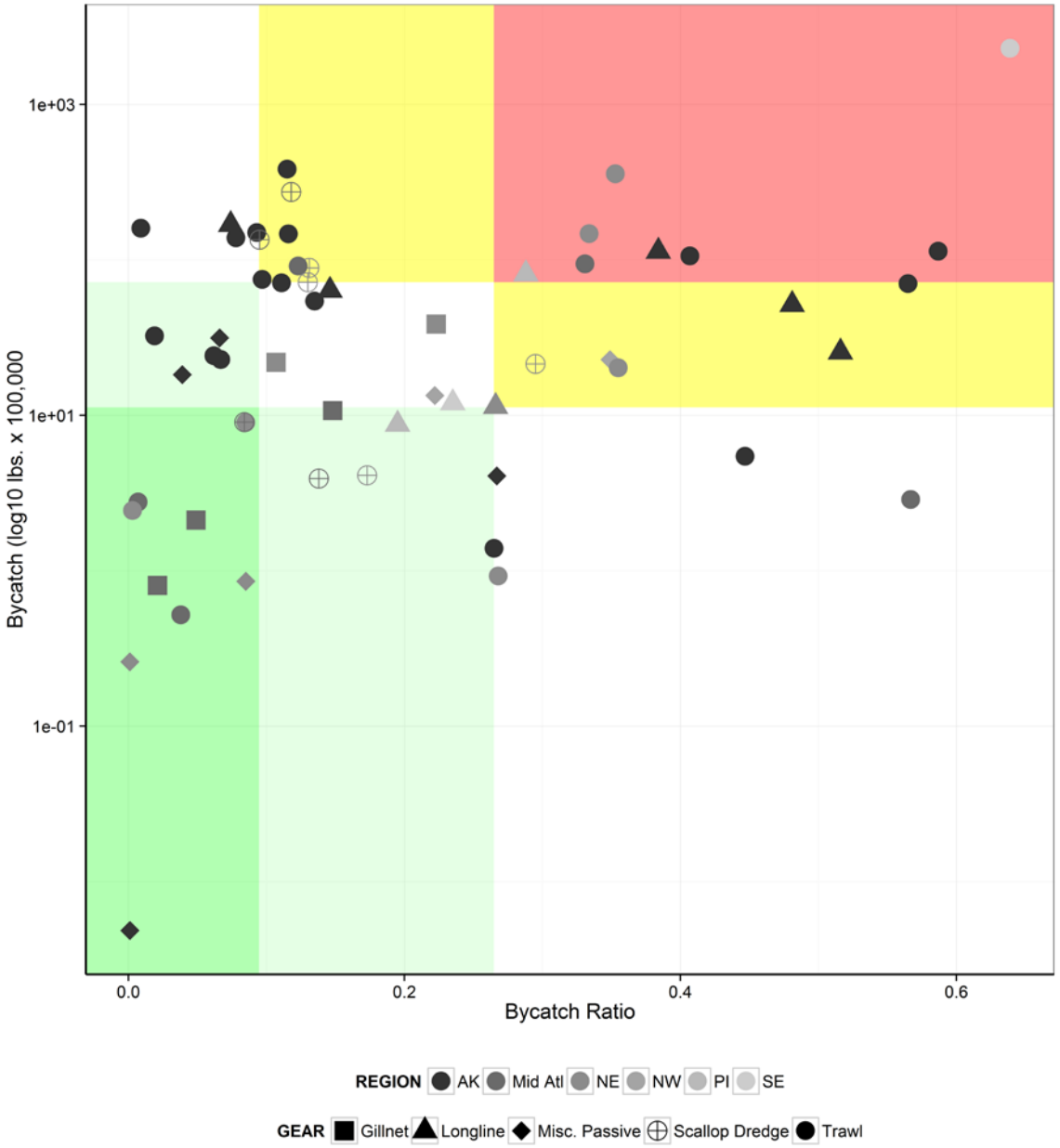
- Illustrate approach to evaluating fisheries bycatch using more than one metric following a “risk-matrix approach”


Fisheries
30
20
10
0
0
5000
10000
15000


Gulf of Mexico
Shrimp Trawl
BSAI Pollock Trawl
REGION
AK
Mid Atl
NE
NW
PI
SE
Total Bycatch (lbs. x 100,000)
Total Catch (lbs. x 100,000)
2500
2000
1500
1000
500
0
0
5000
10000
15000


2500
2000
1500
1000
500
0
0
10
20
30
Fisheries


1
0.67
0.33
0
High
Medium
Low


1e+03
1e+01
1e-01
Bycatch (log10 lbs. x 100,000
0.0
0.2
0.4
0.6
Bycatch Ratio
REGION AK Mid Atl NE NW PI SE
GEAR Gillnet Longline Misc. Passive Scallop Dredge Trawl

Are two-axes too many? How about one?

$$Risk = LC$$

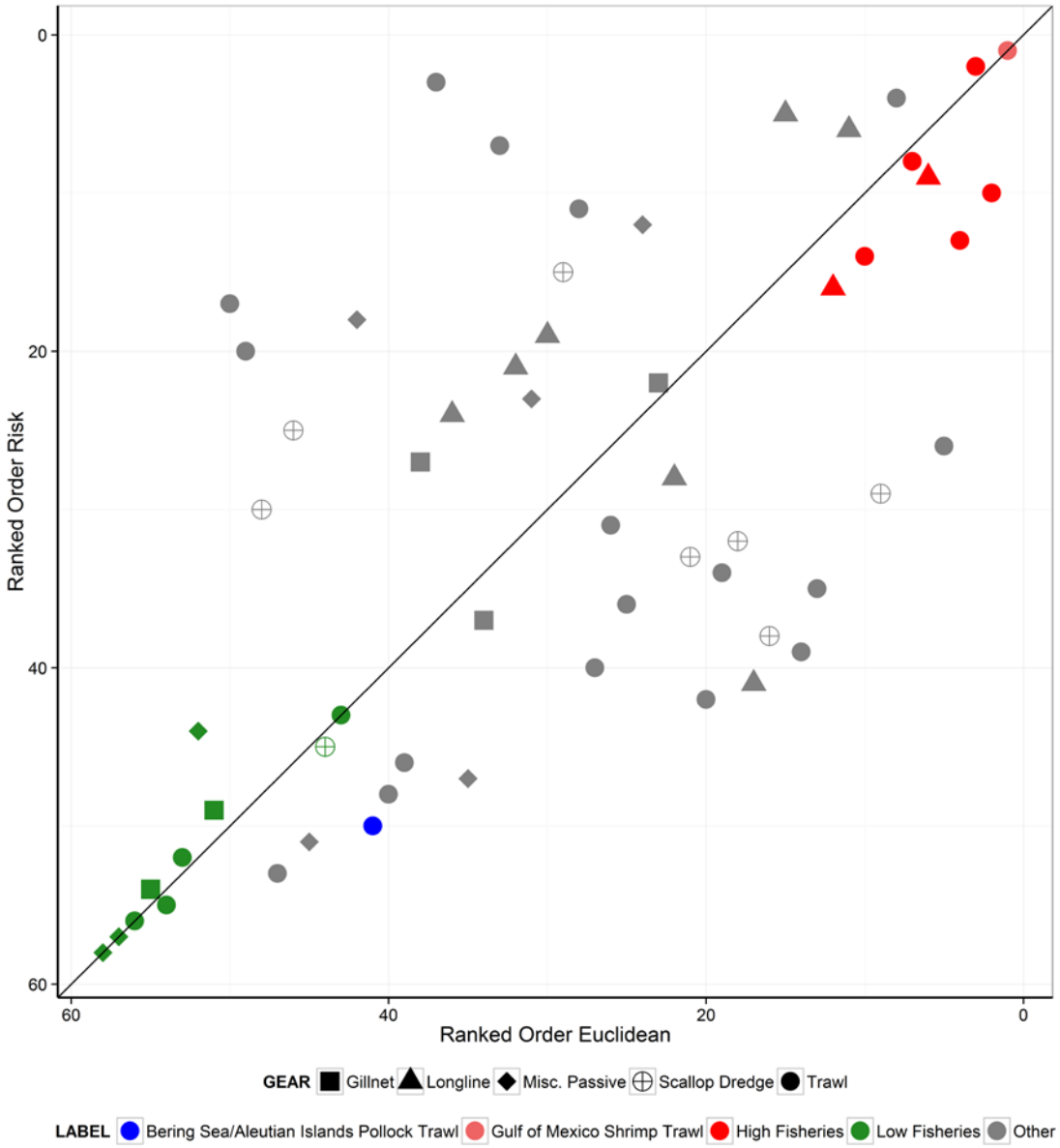
$$Risk = \left(\frac{r_i}{r_{\max}} \right) x \left(\frac{b_i}{b_{\max}} \right)$$

r is the bycatch ratio; b is the bycatch amount

Pickering, A. and S.P. Cowley. 2010. Risk Matrices: implied accuracy and false assumptions. Journal of Health and Safety Research and Practice: 9-16

$$Euclidean = \sqrt{\left(\frac{r_i}{r_{\max}} \right)^2 + \left(\frac{b_i}{b_{\max}} \right)^2}$$

Ormseth, O.A. and P.D. Spencer. 2011. An assessment of vulnerability in Alaska groundfish. Fisheries Research:127-133.


0
20
40
60
Ranked Order Risk
60
40
20
0
Ranked Order Euclidean
GEAR
Gillnet
Longline
Misc. Passive
Scallop Dredge
Trawl
LABEL
Bering Sea/Aleutian Islands Pollock Trawl
Gulf of Mexico Shrimp Trawl
High Fisheries
Low Fisheries
Other

How to allocate limited resources?

- There are separate components of bycatch similar to those used to define risk
- A single metric is possible...
- ...Robust and simple solutions remain elusive..
- Paradox: attempt to provide scorings to make decisions about what is important require those very decisions- (as soon as you decide a performance standard, you have decided what is important)

The risk-matrix approach to evaluating fisheries bycatch

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