Evolution, change and revolution

Martin Hall
Inter-American Tropical Tuna Commission

To my friend
Lee Alverson
CAPTURE (in the gear)

- BYCATCH
  - Discarded dead
- RELEASE
  - Alive unharmed
- CATCH
  - Retained for Utilization

Definition of Bycatch

CAPTURE = CATCH + BYCATCH + RELEASE
Experiences in the eastern Pacific

Dolphin bycatches in the industrial tuna purse seine fishery

Sea turtle bycatches in artisanal longline fisheries

Miscellaneous bycatches in the FAD fisheries

30 years

10 years
Lesson: To reduce bycatch we have to reduce some of its components

Bycatch = Effort x Bycatch per unit effort

To reduce BPUE you need to understand its causes
Number of observed purse seine trips per year
OLD WAY: Accounting of mortality

NEW WAY: Major tool in identifying factors that cause bycatch and performance issues

In some cases also teaching crews releasing methods (e.g. de-hooking)

More and more sophisticated electronic observers with sensors for many things ......
Factors affecting bycatch in tuna purse seining on dolphins:

<table>
<thead>
<tr>
<th>Nature</th>
<th>Captains</th>
<th>Boat Owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currents</td>
<td>Crew training</td>
<td>Gear available</td>
</tr>
<tr>
<td>Visibility</td>
<td>Gear use</td>
<td>Captain motivation</td>
</tr>
<tr>
<td>Species</td>
<td>Gear deployment and retrieval</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Group size</td>
<td>Release</td>
<td></td>
</tr>
<tr>
<td>Catch</td>
<td>Decisions</td>
<td></td>
</tr>
<tr>
<td>Malfunctions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHANGE: An engineering approach rather than an emotional approach

Data: identification of problems
Interactions with fishers: Identification of solutions
Technological and operational change
Training/performance of crews
Management actions
EVOLUTION: A more systematic approach to bycatch mitigation

• Avoid capture
• Release from gear
• Release from deck
• Utilize

POPULATION ISSUES OF BYCATCH SPECIES
• OLD WAY: Numbers game

• FUTURE WAY: Assign differential value to individuals according to sex, age, reproductive condition, and other variables such as proximity to reproductive sites for long distance migrants.... $1 \neq 1$
Life histories and elasticity patterns: perturbation analysis for species with minimal demographic data
Selina S. Heppell, Hal Caswell, and Larry B. Crowder

Impacts of fisheries bycatch on loggerhead turtles worldwide inferred from reproductive value analyses
Bryan P. Wallace1,2*, Selina S. Heppell, Rebecca3 L. Lewison4, Shaleyla Kelez1 and Larry B. Crowder1

Conservation and management of exploited shark populations based on reproductive value
Vincent F. Gallucci, Ian G. Taylor, and Karim Erzini

Quantifying multiple threats to endangered species: an example from loggerhead sea turtles
Alan B Bolten1*, Larry B Crowder2, Mark G Dodd3, Sandra L MacPherson4, John A Musick5, Barbara A Schroeder6, Blair E Witherington7, Kristy J Long6, and Melissa L Snover8

Modelling impacts of long-line fishing: what are the effects of pair-bond disruption and sex-biased mortality on albatross fecundity?
Michael S. L. Mills and Peter G. Ryan†
DST Centre of Excellence at the Percy Fitz Patrick Institute of African Ornithology, University of Cape Town, Ronde bosch 7701, South Africa
(Received 15 September 2004; accepted 5 January 2005)
doi:10.1017/S1367943005002386
Why bycatches happen?

- Bad luck (wrong place, wrong time)
  - Wrong species is captured by chance or swims into gear
- Wrong size of right species
- Wrong species is associated with right species
  - Multispecies Schools
  - Predators
  - Prey
- Wrong species tries to take bait (seabirds, sea turtles)
- Wrong species tries to take the catch from net or hook
ECOSYSTEM ISSUES
Evolution: Ecosystem issues

- Slowly moving towards Ecosystem based Fisheries Management; Bycatch issues are a very high priority in this process.

- But fishery scientists, managers, and advocates have developed under single species or taxa approaches. EBFM requires a wider scope.
Solutions to bycatch problems can be:

**Specific**
- Only affect the species of interest
  - ex. backdown (dolphins) Tori lines (seabirds)

**Generic**
- Affect catchability of other species target or not. The consequences of implementation must be carefully weighed.
  - ex. Change mesh size or hook size, change fishing depth or time of day, closed areas or seasons
J vs C18 (reduced table; only significant differences Andraka et al, 2013).

<table>
<thead>
<tr>
<th>Species or group of species</th>
<th>CPUE J hook</th>
<th>CPUE C18 hook</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Xiphias gladius</em></td>
<td>0.52</td>
<td>1.03</td>
<td>0.037</td>
</tr>
<tr>
<td><em>Carcharhinus falciformis</em></td>
<td>15.55</td>
<td>25.36</td>
<td>0.002</td>
</tr>
<tr>
<td>Sphyrnidae</td>
<td>0.71</td>
<td>0.92</td>
<td>0.036</td>
</tr>
<tr>
<td><em>Chelonia mydas mydas/ agassizii</em></td>
<td>0.50</td>
<td>0.03</td>
<td>0.000</td>
</tr>
<tr>
<td><em>Lepidochelys olivacea</em></td>
<td>0.79</td>
<td>0.33</td>
<td>0.012</td>
</tr>
<tr>
<td>All turtles</td>
<td>1.31</td>
<td>0.35</td>
<td>0.000</td>
</tr>
</tbody>
</table>
• How to compare ecosystem impacts of different gears, managing regimes, etc.?

• The famous “apples and oranges” question that needs to be answered.
<table>
<thead>
<tr>
<th>Dayton L. Alverson</th>
<th>Natural Resources Consultants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paul K. Dayton</td>
<td>Scripps Institution of Oceanography</td>
</tr>
<tr>
<td>Robert C. Francis</td>
<td>Fisheries Research Institute, University of Washington</td>
</tr>
<tr>
<td>Marco Garcia</td>
<td>Inter-American Tropical Tuna Commission</td>
</tr>
<tr>
<td>Martin A. Hall (conv.)</td>
<td>Inter-American Tropical Tuna Commission</td>
</tr>
<tr>
<td>Ray Hilborn</td>
<td>Fisheries Research Institute, University of Washington</td>
</tr>
<tr>
<td>James Kitchell</td>
<td>Center for Limnology, University of Wisconsin</td>
</tr>
<tr>
<td>Marsha L. Landolt</td>
<td>School of Fisheries, University of Washington</td>
</tr>
<tr>
<td>Steven A. Murawski</td>
<td>National Marine Fisheries Service, Northeast Center</td>
</tr>
<tr>
<td>Gordon H. Orians</td>
<td>Department of Zoology, University of Washington</td>
</tr>
<tr>
<td>Ana Parma</td>
<td>International Pacific Halibut Commission</td>
</tr>
<tr>
<td>Daniel Pauly</td>
<td>Fisheries Centre, University of British Columbia</td>
</tr>
<tr>
<td>Ellen Pikitch</td>
<td>Fisheries Research Institute, University of Washington</td>
</tr>
</tbody>
</table>
On bycatches

MARTIN A. HALL

1. A fishery may take its prey high in the food web (e.g. sharks, tunas) or at much lower levels (e.g. anchovies) within a region, in which case, they will be subject to differences in the trophic levels. Is it the same time?

2. Fisheries usually are selected, but the gear, the nature of the ecosystem being exploited and the habitat. In general, the selectivity of fisheries is different from that of natural predators. How does a predator’s selectivity influence its impact on the system? From the point of view of ecosystem stability, is a selective fishery better than a non-selective one? Should our management systems aim to achieve ‘proportional’ utilization of the different levels of a food chain rather than putting all the pressure on a narrow size range of one or a few species?
Balanced harvesting: Can it reconcile fisheries and conservation objectives, and how can it be done?


Balanced Harvesting

Putting the Cat Amongst the Pigeons?

Implications for the development of a new framework for technical measures in the reformed CFP

Malcolm MacGarvin

April 2014
A developing revolution

“OLD WAY OF THINKING”

Species and size selectivity are objectives of a well-managed fishery

“NEW WAY OF THINKING”  
(UNDER EXPLORATION)

Maybe not
TECHNOLOGY ISSUES
The missing revolution

“OLD WAY OF FISHING”

kill a bunch of things and then decide what you want to keep

“NEW WAY OF FISHING”

capture a bunch of thing and only kill what you mean to use
Shrimp trawls in shallow water without codends ???
Patrolling gear?
Activating release mechanisms?

April 7, 2014

UW startup creates underwater robotics with a human touch
CHANGE: Direct actions replaced by consumer pressures

Earth Island Institute

Dolphin Safe logo, a registered trademark.

SHARK VS MERMAID DEATH SQUAD

Chicken of the Sea: STOP RIPPING UP THE SEA
Fisheries students and others planning to work on bycatch need to know the fisheries gear, operations, locations, targets, markets, etc....