TED/BRD research in the Suriname seabob fishery (2016-2017)

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Seabob Working Group
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Overview

- Introduction
- Bycatch in the seabob fishery
- Trash-and-Turtle Excluder Device
- Top-shooting TED
- Conclusions
1. Introduction

The REBYC-II LAC project

The aims of the project entitled “Sustainable Management of Bycatch in Latin America and Caribbean Trawl Fisheries” (REBYC-II LAC) are to reduce food loss and support sustainable livelihoods by improving the management of bycatch and minimizing discards, thereby transforming bottom trawl fisheries into responsible fisheries.
1. Introduction

The REBYC-II LAC project

Bycatch management in the project includes two approaches to achieve reduction of discards in trawl fisheries.

1. Reduce unsustainable bycatch
   - Endangered, Threatened and Protected species
   - Undersized commercial fish species

2. Utilize sustainable bycatch
   - Resilient fish species
   - Non-ETP
1. Introduction

The REBYC-II LAC project developed a BRD strategy

= a strategy that will be followed to implement the most suitable BRDs in Suriname’s bottom trawl fisheries, with the aim to reduce unsustainable bycatch

5 STEPS
1. Identification of the bycatch problem
2. Selection of an appropriate BRD
3. Sea trials
4. Evaluation of the BRD
5. Adoption of the BRD
1. Introduction

- Identify bycatch problem
  - Is it clear what bycatch should be excluded?
    - YES: Select BRD
    - NO: Collect information
      - NO: Modify BRD?
        - NO: Evaluation
          - Does the BRD meet the expectations?
            - YES: Adopt BRD
            - NO: Modify BRD?
              - YES: Sea trials
                - NO: Collect information
                  - NO: Modify BRD?
2. Bycatch in the seabob fishery
2. Bycatch in the seabob fishery
2. Bycatch in the seabob fishery

- Stellifer microps
- Cynoscion jamaicensis
- Macrodon ancyodon
- Dasyatis guttata
- Trichiurus lepturus
- Stellifer rastrifer
- Cynoscion virescens
- Paralichthys brasiliensis
- Paralichthys elegans
- Bagre bagre
- Nebris microps
- Larimus breviceps
- Gymnura micrura
- Anchoa spinifer
- Others
- Dasyatis geijskesi
- Paralonchurus brasiliensis
- Paralonchurus elegans
- Bagre bagre
- Nebris microps
- Larimus breviceps
- Gymnura micrura
- Anchoa spinifer
- Others
- Dasyatis geijskesi
- Paralonchurus brasiliensis
- Paralonchurus elegans
- Bagre bagre
- Nebris microps
- Larimus breviceps
- Gymnura micrura
- Anchoa spinifer
- Others
2. Bycatch in the seabob fishery

Seabob trawl fishery

Bycatch problem

- Undersized commercial fishes
  - Witwiti
  - Dagutifi
  - Kandra

- ETP species
2. Bycatch in the seabob fishery

- Identify bycatch problem: Is it clear what bycatch should be excluded?
  - YES
  - Select BRD
  - Sea trials
  - Evaluation: Does the BRD meet the expectations?
    - YES
    - Adopt BRD
    - NO
    - Modify BRD?
      - YES
        - Collect information
      - NO
2. Bycatch in the seabob fishery

Seabob trawl fishery

Bycatch reduction
2. Bycatch in the seabob fishery

Seabob trawl fishery

**Bycatch reduction**

⇒ Improvement of existing fishing gear

**BRDs**

- Importance of installation
- Optimal position, size,…?
2. Bycatch in the seabob fishery

Seabob trawl fishery

Bycatch reduction

→ Improvement of existing fishing gear

TEDs

- Reduce bar spacing: Trash-and-Turtle Excluder Devices
  - Introduced in 2014 in cooperation with WWF
  - Related to bycatch reduction requirements of MSC Certification
  - First trials in 2014-2015
  - Tested more extensively in 2016
3. Trash-and-Turtle Excluder Device

- TTED = TED with reduced bar spacing (2” or 3”) and flat bars
- Successfully tested in French Guiana and USA
3. Trash-and-Turtle Excluder Device

**GOAL of the sea-trials in Suriname**

Evaluate the performance in bycatch reduction of TTEDs with 2" and 3" bar-spacing, against the standard 4" TEDs. More specifically, the study aimed to assess whether these TTEDs are effective in reducing elasmobranch bycatch, while retaining the target seabob shrimp catch. Further, the effect of TTEDs on retained bycatch was addressed.

**RESEARCH QUESTIONS:**

- Do TTEDs cause a reduction in overall bycatch?
- Do TTEDs cause a reduction in bycatch of elasmobranch species?
- Do TTEDs affect catches of seabob shrimp?
- Do TTEDs affect catches of commercially valuable bycatch species?
3. Trash-and-Turtle Excluder Device

**METHODS**

- 2 commercial fishing trips
  - 1-6 July 2017: 3” TTED – Neptune 6 (Heiploeg Suriname)
  - 8 – 13 August 2017: 2” TTED – Sechong 29 (SAIL)
- **Catch comparison: comparing catch of trawl 1 and 4: TED versus TTED**
3. Trash-and-Turtle Excluder Device

- METHODS
  - Catch comparison: comparing catch of trawl 1 and 4: TED versus TTED
    - 31 hauls 4"TED – 3"TTED
    - 31 hauls 4"TED – 2"TTED
3. Trash-and-Turtle Excluder Device

METHODS

Per haul, for net 1 and 4:

- MAIN CATCH (MC)
- TOTAL CATCH (TC)
- SUBSAMPLE (SS)
3. Trash-and-Turtle Excluder Device

 METHODS

Per haul, for net 1 and 4:

- TC weight
- Weight and number of elasmobranchs in the MC
- Weight and number of four commercial fish species (adults) in the MC
- Weight of seabob, prawns and trash in SS
- Number and length of elasmobranchs and commercial fishes (all sizes) in SS
3. Trash-and-Turtle Excluder Device

**RESULTS: 3” TTED**

**AVERAGE CATCH COMPOSITION (3”)**

- **Seabob**: 47%
- **Adult commercial fishes**: 4%
- **Prawns**: 6%
- **Juvenile commercial fishes**: 9%
- **Trash**: 33%
- **M. ancyldodon**: 1%
- **N. microps**: 1%
- **C. virescens**: 2%
# Results: 3” TTED

<table>
<thead>
<tr>
<th></th>
<th>Control 4” TED (kg/h)</th>
<th>Experimental 3” TTED (kg/h)</th>
<th>p</th>
<th>test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
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<tr>
<td>Total catch</td>
<td>51.5</td>
<td>20.9</td>
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<tr>
<td>Total bycatch</td>
<td>27.4</td>
<td>14.2</td>
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<td>12.4</td>
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<tr>
<td>Discarded bycatch</td>
<td>21.7</td>
<td>12.3</td>
<td>18.6</td>
<td>9.8</td>
</tr>
<tr>
<td>Retained bycatch</td>
<td>5.7</td>
<td>9.3</td>
<td>4.0</td>
<td>5.3</td>
</tr>
<tr>
<td>Seabob</td>
<td>20.6</td>
<td>8.9</td>
<td>24.0</td>
<td>10.8</td>
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<tr>
<td>Prawns</td>
<td>3.3</td>
<td>8.9</td>
<td>1.9</td>
<td>4.6</td>
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<tr>
<td>Trash</td>
<td>16.7</td>
<td>8.9</td>
<td>14.3</td>
<td>7.7</td>
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<tr>
<td>Discarded bycatch</td>
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<td>0.8</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Retained bycatch</td>
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<td>2.3</td>
<td>0.5</td>
<td>1.0</td>
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<tr>
<td>Commercial fish species</td>
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<td>11.1</td>
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<tr>
<td>ALL SIZES</td>
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<td>8.9</td>
<td>4.6</td>
<td>9.1</td>
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<tr>
<td>M. ancylodon</td>
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<td>1.7</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>N. microps</td>
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<td>2.3</td>
<td>0.5</td>
<td>1.0</td>
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<tr>
<td>C. virescens</td>
<td>2.2</td>
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<td>2.1</td>
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<td>C. jamaicensis/similis</td>
<td>M. ancylodon</td>
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<td>3.2</td>
<td>2.2</td>
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<td>Commercial fish species</td>
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<td>ALL SIZES</td>
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<td>0.2</td>
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<td>C. jamaicensis/similis</td>
<td>1.8</td>
<td>2.1</td>
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</tr>
</tbody>
</table>
3. Trash-and-Turtle Excluder Device

RESULTS: 3” TTED

- 35.00
- 30.00
- 25.00
- 20.00
- 15.00
- 10.00
- 5.00
- 0.00
Seabob
Prawns
Rays
Adult commercial fishes
Juvenile commercial fishes
Trash

CONTROL
EXPERIMENTAL
3. Trash-and-Turtle Excluder Device

**RESULTS: 3” TTED**

- M. ancylodon: -21.4% ns
- N. microps: -6.0% ns
- C. virescens: -8.9% ns
- C. jamaicensis/similis: -76.5% ns

![Graph showing results for different species with control and experimental groups.](image-url)
3. Trash-and-Turtle Excluder Device

**RESULTS: 3” TTED**

- **M. ancyodon**
- **N. microps**
- **C. viriscens**
- **C. Jamaicensis/similis**
- **Rays**
3. Trash-and-Turtle Excluder Device

RESULTS: 2” TTED

![AVERAGE CATCH COMPOSITION 2”](chart.png)

- Seabob: 43%
- Adult commercial fishes: 7%
- Trash: 33%
- Ray: 1%
- Prawn: 2%
- Juvenile commercial fishes: 14%
- N. microps: 2%
- C. virescens: 2%
- M. aenylodon: 3%
### 3. Trash-and-Turtle Excluder Device

#### RESULTS: 2” TTED

<table>
<thead>
<tr>
<th></th>
<th>Control 4” TED (kg/h)</th>
<th>Experimental 2” TTED (kg/h)</th>
<th>p</th>
<th>test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>SD</td>
<td>Average</td>
<td>SD</td>
</tr>
<tr>
<td>Total catch</td>
<td>38.4</td>
<td>28.3</td>
<td>39.2</td>
<td>26.2</td>
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<tr>
<td>Total bycatch</td>
<td>23.1</td>
<td>28.1</td>
<td>20.0</td>
<td>21.8</td>
</tr>
<tr>
<td>Discarded bycatch</td>
<td>19.5</td>
<td>27.0</td>
<td>17.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Retained bycatch</td>
<td>3.6</td>
<td>2.6</td>
<td>3.0</td>
<td>3.2</td>
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<tr>
<td>Seabob</td>
<td>14.9</td>
<td>13.9</td>
<td>17.9</td>
<td>19.2</td>
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<tr>
<td>Prawns</td>
<td>0.8</td>
<td>1.5</td>
<td>0.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Trash</td>
<td>13.9</td>
<td>20.2</td>
<td>11.0</td>
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<tr>
<td>Rays</td>
<td>0.6</td>
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<td></td>
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<tr>
<td>ALL SIZES</td>
<td>7.9</td>
<td>10.8</td>
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<td>12.8</td>
</tr>
<tr>
<td>M. ancylodon</td>
<td>4.6</td>
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<td>6.4</td>
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<td>N. microps</td>
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<td>0.6</td>
</tr>
<tr>
<td>C. virescens</td>
<td>0.6</td>
<td>1.4</td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>C. jamaicensis/similis</td>
<td>1.9</td>
<td>8.6</td>
<td>2.9</td>
<td>10.3</td>
</tr>
<tr>
<td>ADULTS</td>
<td>2.8</td>
<td>1.9</td>
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<tr>
<td>M. ancylodon</td>
<td>0.9</td>
<td>1.2</td>
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<td>N. microps</td>
<td>0.7</td>
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<td>0.5</td>
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<tr>
<td>C. virescens</td>
<td>1.1</td>
<td>0.8</td>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>C. jamaicensis/similis</td>
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<td>0.2</td>
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<td>JUVENILES</td>
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<td>M. ancylodon</td>
<td>3.1</td>
<td>4.5</td>
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<td>N. microps</td>
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<tr>
<td>C. virescens</td>
<td>0.0</td>
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<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>C. jamaicensis/similis</td>
<td>1.6</td>
<td>7.5</td>
<td>2.4</td>
<td>8.0</td>
</tr>
</tbody>
</table>
3. Trash-and-Turtle Excluder Device

- RESULTS: 2” TTED
3. Trash-and-Turtle Excluder Device

RESULTS: 2" TTED

- M. aculodon: +14.5% (ns)
- N. nicrops: -34.4%
- C. virescens: -41.1%
- C. jamaicensis/similis: -57.9% (ns)
3. Trash-and-Turtle Excluder Device

RESULTS: 2” TTED
3. Trash-and-Turtle Excluder Device

- RESULTS: SUMMARY

Statistically significant results

- **3” TTED:**
  - 17% reduction in total bycatch
  - 44% reduction in ray bycatch
  - 16% increase in seabob catch

- **2” TTED**
  - 23% reduction in commercial fish bycatch
3. Trash-and-Turtle Excluder Device

- **RESULTS: SUMMARY**

<table>
<thead>
<tr>
<th>Research question</th>
<th>TTED 3 inch</th>
<th>TTED 2 inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do TTEDs cause a reduction in overall bycatch?</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Do TTEDs cause a reduction in bycatch of elasmobranch species?</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Do TTEDs affect catches of seabob shrimp?</td>
<td>yes, positively</td>
<td>no</td>
</tr>
<tr>
<td>Do TTEDs affect catches of commercially valuable bycatch species?</td>
<td>no</td>
<td>yes, negatively</td>
</tr>
</tbody>
</table>
3. Trash-and-Turtle Excluder Device

**DISCUSSION**

**Bycatch reduction by TTED**

- All bycatch components reduced by both 3” and 2” TTED, although many ‘trends’ not statistically significant

**RAYS**

- 3”: reduction of ray bycatch
- 2”: reduction non-significant (but too few rays captured during trials for good results?)
3. Trash-and-Turtle Excluder Device

DISCUSSION

- Bycatch reduction by TTED
  - All bycatch components reduced by both 3” and 2” TTED

FISH

- 3”: no effect on fish bycatch
- 2”: reduction of bycatch of commercial sized fish
DISCUSSION

Target catch increase by TTED

- 3” TTED: +16% seabob (sign.)
- 2” TTED: +20% seabob (non-sign.)
DISCUSSION

- Target catch increase by TTED
- Shrimp loss through regular 4" TED
- Potentially caused by excessive floatation on 4" TED
3. Trash-and-Turtle Excluder Device

**CONCLUSIONS TTED RESEARCH**

- Positive results for bycatch reduction with both TTEDs
  - Reduction of elasmobranchs with both TTEDs
  - 2” TTED affects commercial fish bycatch

- Positive results for target catch retention
  - Both TTEDs cause increase in seabob catch
  - Mechanism to be further studied

- 3” TTED currently best balance between reduction of elasmobranch bycatch and retention of fish bycatch
Overview

- Introduction
- Bycatch in the seabob fishery
- Trash-and-Turtle Excluder Device
- Top-shooting TED
- Conclusions
4. Top-shooting TED

- Many shrimp fisheries use **top-shooting TEDs**
  - No floatation required
  - Better shrimp retention?
  - Bottom shooting TEDs mainly used on bottoms with debris, rocks, etc.
4. Top-shooting TED

- Exploring potential of Top-shooting TEDs in seabob fishery
  - 21-27 September 2017
  - Neptune-5 (Heiploeg Suriname)
  - 18 hauls
  - Visual evaluation of the catch
4. Top-shooting TED

- Exploring potential of Top-shooting TEDs in seabob fishery
  - Seabob catches similar or slightly better in top-shooter
  - Ray bycatch increased in the top-shooter
4. Top-shooting TED

- Exploring potential of Top-shooting TEDs in seabob fishery

CONCLUSION

- Similar results in TED trials in finfish fishery:
  “Suriname is a bottom shooting country” (N. Hopkins – NOAA)

- Bottom shooting TEDs are the best option for the fishery
4. Top-shooting TED
5. Next steps

The main CONCLUSIONS from the research are:

- **3” TTED** caused good reduction of bycatch, and retention of valuable fish
- attention to **floatation** and net design to improve target catch
- **bottom-shooting** TEDs are the best option for the fishery
5. Next steps

Proposed next steps:

1/ Further trials with 3” TEDs

- Evaluate 3” TEDs further under commercial circumstances and over longer time period

- Develop a suitable 3” TED
  - TTED heavy + expensive
  - Other designs (round bar?)
5. Next steps

Proposed next steps:

2/ Review of the trawl net design and TED floatation

- Current net design probably not optimal (turn-over shrimp trawl net)
- This might cause the need for excessive floatation
- Expert to review the nets
5. Next steps

Proposed next steps:

3/ Underwater recordings for better understanding
- Need to do in offshore areas
Thank you!

Questions?

Suggestions?