COUNTRY REPORT
ON PURSE SEINE
FISHERIES IN
SARAWAK

Present By:
Jamil Musel
• The demand for fish in Malaysia is on an upward trend, and is expected to increase from 1.3 million metric tonnes in 2010 to 1.9 million metric tonnes in 2020.

• The per capita consumption is predicted to increase from 46 kg to 55 kg over the same period.

• The fishing industry has also contributed close to RM10.22 billion in 2015 and is envisaged to grow annually by 4.9% contributing close to RM 12.96 billion to the Malaysian economy by 2020.

• The industry is an important source of food for the nation, the demand for fish-based protein outstrips the supply generated by the local industry.

• To make up for the shortfall in demand, the country import fish and aquaculture from other countries in the region.
• Fish purse seine: Commercial gears in Sarawak

• Demersal fish: Largest part of marine catches

• Pelagic fish: Low catch - Low numbers of purse seiners operating in Sarawak (Witter et al., 2015; Gambang et al., 2003)

• Fishing areas: Offshore areas and productive fishing grounds (southern bays and in the north)

• Purse Seine Designed: Fine mesh & Coarser mesh
  
  Vessel Size: 40 to 70 GRT    Gear Size: 240 - 450m

• Management measures for purse seine fishery: Licensing and Regulations are provided and managed by the Head of Fisheries, located in Kuala Lumpur
INTRODUCTION
INTRODUCTION

research area
These measures were developed within the framework provided by the fisheries law, The Fisheries Act 1985 (Act 317). Among the main measures are:

- Fishing Zones
- Closed Fishing Area
- Fishing Effort Control
- Fishing Units Control
- Port & At-Sea Control
- Fishermen Registration
- Marine Habitat Conservation
- The Community-based Fisheries Management
Aquaculture & cockle

MPA
No Take Zone

0 – 1 nm

Traditional Vessels/A
PS/S
TRAWL/Pair
TRAWL

1 – above
ZONE A
< 40 GRT

3 & 5 nm
above
ZONE B
< 40 GRT

7,10 and 12
nm & above
ZONE C
> 40 GRT

Indian Ocean
ZONE C2/C3
> 70 GRT

INTRODUCTION

fishing zone

IN
TR
OD
UC
TI
ON

No Take Zone

< 40 GRT

> 40 GRT

PS/Tuna Vessel
Landings of Purse Seine Fisheries
Total Landings in Sarawak (2009-2017)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Landings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>6548</td>
</tr>
<tr>
<td>2010</td>
<td>8688</td>
</tr>
<tr>
<td>2011</td>
<td>8201</td>
</tr>
<tr>
<td>2012</td>
<td>10160</td>
</tr>
<tr>
<td>2013</td>
<td>11086</td>
</tr>
<tr>
<td>2014</td>
<td>10454</td>
</tr>
<tr>
<td>2015</td>
<td>9629</td>
</tr>
<tr>
<td>2016</td>
<td>8589</td>
</tr>
<tr>
<td>2017</td>
<td>7391</td>
</tr>
</tbody>
</table>
**Pelagics**

- **Decapterus macrosoma**  
  Shortfin scad  
  Selayang TL 20.7 cm

- **Decapterus russelli**  
  Indian scad  
  Selayang TL 21.4 cm

- **Amblygaster leioaster**  
  Smoothbelly sardinella  
  Tamban beluru TL 21.2 cm

- **Dussumieria acuta**  
  Rainbow herring  
  Tamban bulat TL 16.1 cm

- **Sardinella gibbosa**  
  Goldstripe sardinella  
  Tamban pipih TL 16.5 cm

- **Megalaspis cordyla**  
  Torpedo scad  
  Cincaru TL 25.8 cm

- **Selar boops**  
  Bigeye scad  
  Selar kuning jantan TL 21.5 cm

- **Selar crumenophthalmus**  
  Bigeye scad  
  Selar pucat TL 24.5 cm

- **Amblygaster leioaster**  
  Smoothbelly sardinella  
  Tamban beluru TL 21.2 cm

- **Scombrosorus guttatus**  
  Indo-Pacific king mackerel  
  Tonggiri papan TL 37.5 cm

- **Parastromateus niger**  
  Black pomfret  
  Bawal hitam TL 23.5 cm

---

**References**

- *Decapterus macrosoma*  
  *Decapterus russelli*  
  *Amblygaster leioaster*  
  *Dussumieria acuta*  
  *Sardinella gibbosa*  
  *Megalaspis cordyla*  
  *Selar boops*  
  *Selar crumenophthalmus*  
  *Amblygaster leioaster*  
  *Scombrosorus guttatus*  
  *Parastromateus niger*
Catch Composition in Sarawak (2009 - 2017)

- Neritic Tuna: 18%
- Round scad: 17%
- Mixed fish: 8%
- Anchovies: 13%
- Sardines: 10%
- Other pelagic fishes: 13%
- Trash fish: 6%
- Squids: 1%
- Crustacean: 1%
- Hardtail scad: 4%
- Indian mackerel: 4%
- Indo-pacific mackerel: 4%
- Selar scad: 1%
- Mixed fish: 8%
- Other pelagic fishes: 13%
- Squids: 1%
- Crustacean: 1%
- Hardtail scad: 4%
- Indian mackerel: 4%
- Indo-pacific mackerel: 4%
- Selar scad: 1%
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>SEX</th>
<th>LENGTH [cm]</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Decapterus maruadsi</em></td>
<td>Male</td>
<td>21.72</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>22.67</td>
</tr>
<tr>
<td><em>Decapterus macrosoma</em></td>
<td>Male</td>
<td>12.81</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>19.5</td>
</tr>
<tr>
<td><em>Decapterus ruselli</em></td>
<td>Male</td>
<td>12.98</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>11.44</td>
</tr>
<tr>
<td><em>Rastrelliger brachysoma</em></td>
<td>Male</td>
<td>22.46</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>22.46</td>
</tr>
<tr>
<td><em>Rastrelliger kanagurta</em></td>
<td>Male</td>
<td>21.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>18.5</td>
</tr>
</tbody>
</table>

*Note: Research by Mr Jamil Musel (2013) & Mr Hadil Rajali (2006)*
**Spawning Season**

<table>
<thead>
<tr>
<th>Species</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decapterus maruadsi</td>
<td>May – June</td>
</tr>
<tr>
<td>Decapterus macrosoma</td>
<td>Sep – Oct</td>
</tr>
<tr>
<td>Rastrelliger kanagurta</td>
<td>July - Sep</td>
</tr>
</tbody>
</table>

*Note: Year 2003 - 2005*
## Estimation of Growth & Mortality

<table>
<thead>
<tr>
<th>TARGETED SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
</tr>
<tr>
<td><strong>R. kanagurta</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>R. brachysoma</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>D. maruadsi</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

*Note: Year 2003 - 2005
Fishing Effort for Purse Seine Fisheries
No. of Licensed Vessel in Sarawak by Territory (2009 - 2017)

Territory I Kuching  | Territory II Sibu  | Territory III Miri

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Territory I</th>
<th>Territory II</th>
<th>Territory III</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>28</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>2010</td>
<td>24</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>2011</td>
<td>24</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>28</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>26</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>2014</td>
<td>26</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>2015</td>
<td>25</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>2016</td>
<td>25</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>2017</td>
<td>29</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Fishing Effort in Sarawak By Territory (2009 - 2017)

- Cumulative Effort by GRT
- 40-69.99 GRT

- Total Vessel Numbers
- Trip Landings

YEAR:
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017

Numbers:
- 0
- 200
- 400
- 600
- 800
- 1000
- 1200
- 1400

Total Vessel:
- 200
- 400
- 600
- 800
- 1000
- 1200
- 1400
- 1600
- 1800
- 2000

Trip Landings:
- 0
- 200
- 400
- 600
- 800
- 1000
- 1200
- 1400
- 1600
- 1800
- 2000

Legend:
- Total Vessel
- Trip
- Landings
CUMULATIVE EFFORT OF PURSE SEINE IN SARAWAK ≥70 GRT (2009-2017)

YEAR

- **Total Vessel**
- **Trip**
- **Landings**

Year | CPUE
--- | ---
2009 | 2.33
2010 | 3.63
2011 | 3.18
2012 | 3.57
2013 | 4.38
2014 | 4.13
2015 | 3.91
2016 | 5.76
2017 | 4.96

Landings/Total GRT

- Total Landings
- No. of Vessels
- No. of Trips
- No. of Days
- No. of Hauls
- No. of Hours
Fishing Effort in Sarawak (2009 - 2017)

<table>
<thead>
<tr>
<th>Year</th>
<th>GRT 40 - 69.99</th>
<th>GRT 70</th>
<th>Total GRT</th>
<th>Total Landings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>2010</td>
<td>7</td>
<td>10</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>2011</td>
<td>8</td>
<td>12</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>2012</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>2013</td>
<td>15</td>
<td>20</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>2014</td>
<td>12</td>
<td>18</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>2015</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>2016</td>
<td>7</td>
<td>10</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>2017</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>
Status of Pelagic Fish Stock
<table>
<thead>
<tr>
<th>ITEMS</th>
<th>UNIT</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>km2</td>
<td>150,627</td>
</tr>
<tr>
<td>Average Density (D)</td>
<td>tonnes/km²</td>
<td>3.46</td>
</tr>
<tr>
<td>Total Biomass (Q)</td>
<td>MT</td>
<td>521,169</td>
</tr>
<tr>
<td>Current Yield (Y)</td>
<td>MT</td>
<td>46,777</td>
</tr>
<tr>
<td>Potential Yield (MSY)</td>
<td>MT</td>
<td>79,192</td>
</tr>
<tr>
<td>Surplus</td>
<td>MT</td>
<td>32,415</td>
</tr>
</tbody>
</table>
Status Analysis of Pelagic Fish Stock via Kobe Plot (2009-2017)
The table showed the landings and CPUE standardisation of pelagic fish from 3 types of gears (purse seine, trawl net and drift net) for the period of 2009-2017

<table>
<thead>
<tr>
<th>Year</th>
<th>CPUE STD</th>
<th>Catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2.81</td>
<td>38112</td>
</tr>
<tr>
<td>2010</td>
<td>2.87</td>
<td>42634</td>
</tr>
<tr>
<td>2011</td>
<td>2.95</td>
<td>39839</td>
</tr>
<tr>
<td>2012</td>
<td>2.85</td>
<td>45025</td>
</tr>
<tr>
<td>2013</td>
<td>3.54</td>
<td>55915</td>
</tr>
<tr>
<td>2014</td>
<td>3.72</td>
<td>52254</td>
</tr>
<tr>
<td>2015</td>
<td>3.20</td>
<td>38444</td>
</tr>
<tr>
<td>2016</td>
<td>3.06</td>
<td>41908</td>
</tr>
<tr>
<td>2017</td>
<td>2.97</td>
<td>40436</td>
</tr>
</tbody>
</table>

The graph showed the landings of pelagic fish in Sarawak waters for the period of 2009-2017
The value of $F$ showed quite a distant from $F_{\text{msy}}$, therefore the amount of $F$ could be increased for pelagic fishery.

The TB line is higher than the $TB_{\text{msy}}$ line which indicated that the biomass of pelagic fish in Sarawak is still high.
The graph showed the landings and the MSY line. The landings of pelagic fish was exceeding MSY in 2012-2014 and later started to decreased in 2015-2017.
The Kobe Plot revealed the status of pelagic fish in Sarawak for 2009-2017. The latest status of pelagic fishery is within the **GREEN** area.
Based on risk assessment, the current catch level (40,263 tonnes, 3 years average in 2015-2017) can be increased by 14% to the MSY level (45,850 tonnes). Even when the catch is increased to MSY level, the probabilities violating MSY (TB & F) are less than 35% in 10 years (2027).

Note: (*)The current catch levels the average catch in 3 recent years (2015-2017)

<table>
<thead>
<tr>
<th>Risk levels</th>
<th>Low risk</th>
<th>Medium low risk</th>
<th>Medium high risk</th>
<th>High risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0 - 20%</td>
<td>20 - 50%</td>
<td>50 - 80%</td>
<td>80 - 100</td>
</tr>
<tr>
<td>Medium</td>
<td>60%</td>
<td>70%</td>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10 catch scenarios (tons)</th>
<th>24,158</th>
<th>28,184</th>
<th>32,210</th>
<th>36,237</th>
<th>40,263</th>
<th>44,289</th>
<th>45,850</th>
<th>48,316</th>
<th>52,342</th>
<th>56,368</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current catch (*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TB2020 &lt; TBmsy</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>23</td>
<td>33</td>
</tr>
<tr>
<td>F2020 &gt; F MSY</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>30</td>
<td>71</td>
<td>94</td>
<td></td>
</tr>
<tr>
<td>TB2027 &lt; TBmsy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2027 &gt; F MSY</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Note: (*)The current catch levels the average catch in 3 recent years (2015-2017)
Next 10 Years

Projection

TB & B (New 10 Years)

TB/TBmsy

-100%
-80%
-60%
-40%
-30%
-20%
-10%
0%
+10%
+20%
+30%
+40%
+50%
+100%
+150%
+200%

The figure showed the status of landings and MSY for pelagic fish in Sarawak (in terms of total biomass):

1. Green Area (next 10 years) – if no increase in landings from 2017
2. Yellow Area (year 2021) – if 40% increase in landings from 2017
3. Overfishing (next 10 years) – if continuously increase in landings more than about 20%
The figure showed the status of landings and MSY for pelagic fish in Sarawak (in terms of fishing mortality):

1. Green Area (next 10 years) – if no increase in F (same as 2017)
2. Yellow Area (year 2020) – if increase about 10% of landings from 2017
Existing Management Strategies
• Joint venture program, close season management is not yet applied due to Sarawak have more than enough available resource

• According to our latest survey in 2015 (Fisheries Resource Survey in Malaysian Waters 2013-2016), the surplus of production is 32,415 MT.

• Kobe plot analysis could be utilized to facilitate the pelagic fisheries management.

• According to the research in 2015 and the analysis via kobe plot until 2017, it is showed that the resources in Sarawak waters is underexploited. Therefore, the management could introduce a plan to increase the fishing effort with precautionary approach (eg: increase fishing vessels).
Thank You