More records on the tripletail, *Lobotes surinamensis* (Bloch, 1790) from the Aegean Sea

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**Lobotes surinamensis** (Bloch, 1790)

**Common name:** Tripletail  
**One of two members Family:** Lobotidae

- Marine species
- **Cosmopolitan** - Widely distributed - Atlantic, eastern Pacific, Indo-West Pacific - (tropical and subtropical waters of all oceans)
- Reaches a maximum of 110 cm (TL) - Mediterranean ⇒ max 60 cm
- Excellent and valued food fish
- Despite its extensive range ⇒ not very abundant in any particular location to be of importance in the fisheries

**Mediterranean Sea**

Very rare fish  
Atlantic origin
**Five specimens**

- Thermaikos Gulf (Mediterranean, N. Aegean Sea)
- 2005 to 2010 (April to August)

<table>
<thead>
<tr>
<th>Morphometric data (cm)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length</td>
<td>45</td>
<td>38.5</td>
<td>27.8</td>
<td>34</td>
<td>49</td>
</tr>
<tr>
<td>Standard length</td>
<td>37.2</td>
<td>31.5</td>
<td>21.5</td>
<td>27.6</td>
<td>42</td>
</tr>
<tr>
<td>Maximum body height</td>
<td>17</td>
<td>15</td>
<td>11.8</td>
<td>13.6</td>
<td>20</td>
</tr>
<tr>
<td>Head length</td>
<td>11.8</td>
<td>10</td>
<td>7.7</td>
<td>9</td>
<td>14.2</td>
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<tr>
<td>Total weight (g)</td>
<td>1908</td>
<td>1300</td>
<td>494</td>
<td>788</td>
<td>3162</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Meristic data</th>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dorsal fin rays</td>
<td>XII+1 6</td>
<td>XII+16</td>
<td>XII+1 6</td>
<td>XII+16</td>
<td>XII+1 6</td>
</tr>
<tr>
<td>Ventral fin rays</td>
<td>I+5</td>
<td>I+5</td>
<td>I+5</td>
<td>I+5</td>
<td>I+5</td>
</tr>
<tr>
<td>Pectoral fin rays</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Anal fin rays</td>
<td>III+12</td>
<td>III+12</td>
<td>III+12</td>
<td>III+12</td>
<td>III+12</td>
</tr>
<tr>
<td>Ctenoid scales on tail</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Lateral line scales</td>
<td>48</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>49</td>
</tr>
<tr>
<td>Gill rakers (lower limb)</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Gill rakers (upper limb)</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Total Length $\Rightarrow$ 27.8 - 49 cm
Total Weight $\Rightarrow$ 494 - 3162 g.

**Fishing gears**
- Long-line
- Permanent fishing trap (thynio)
- Set-nets
Results

Length - Weight relationship

North & Central Aegean Sea

N = 5 - Thermaikos (N. Aegean Sea)

\[ W = 0.0112 \times TL^{3.193} \]

\( R^2 = 0.98, SE_b = 0.265 \)

Isometric growth (\( P > 0.05 \))

Total Length \( \Rightarrow 27.8 - 49 \text{ cm} \)
Total Weight \( \Rightarrow 494 - 3162 \text{ g.} \)

N = 6 - Thermaikos + Maliakos (N. & C. Aegean Sea)

\[ W = 0.0117 \times TL^{3.179} \]

\( R^2 = 0.98, SE_b = 0.2322 \)

Isometric growth (\( P > 0.05 \))

Total Length \( \Rightarrow 27.8 - 49 \text{ cm} \)
Total Weight \( \Rightarrow 494 - 3162 \text{ g.} \)
N = 3 - Adriatic Sea

\[ W = 0.0001 \times TL^{4.512} \]
\( (R^2 = 0.90, SE_b = 1.5129) \)

Isometric growth (\( P > 0.05 \))

Total Length \( \Rightarrow \) 34.2 - 39 cm

Total Weight \( \Rightarrow \) 845 - 1620 g.

Mediterranean Sea

N = 17 - Mediterranean Sea

\[ W = 0.0127 \times TL^{3.161} \]
\( (R^2 = 0.99, SE_b = 0.0587) \)

Allometric growth (\( P < 0.05 \))

Total Length \( \Rightarrow \) 8.3 - 60 cm

Total Weight \( \Rightarrow \) 9.6 - 5400 g.
Western Atlantic Ocean

\( W = 0.0229 \times TL^{3.003} \)

\( (R^2 = 0.99, SE_b = 0.0758) \)

**Isometric growth** (\( \beta > 0.05 \))

Total Length \( \Rightarrow 19 - 70.6 \) cm

Total Weight \( \Rightarrow 168 - 8399 \) g.

*Recalculated from original row data from Merriner & Foster (1974).*

\( W = 0.0374 \times TL^{2.876} \)

\( (R^2 = 0.99, SE_b = 0.0583) \)

**Isometric growth** (\( \beta > 0.05 \))

Total Length \( \Rightarrow 3.3 - 73.8 \) cm

Total Weight \( \Rightarrow 1.2 - 11350 \) g.

**Recalculated from original row data of Gudger (1931) presenting in Merriner & Foster (1974).**
**N 21 - Merriner & Foster (1974) & Gudger (1931)***

\[ W = 0.0349 \times TL^{2.894} \]
\[ (R^2 = 0.99, SE_b = 0.0367) \]

Allometric growth \((P < 0.05)\)

Total Length \(\Rightarrow\) 3.3 - 73.8 cm

Total Weight \(\Rightarrow\) 1.2 - 11350 g.

***Recalculated from combined original row data of Gudger (1931) and Merriner & Foster (1974).

**N 843 - Armstrong et al. (1996)****

\[ W = 0.0107 \times TL^{3.182} \]
\[ (R^2 = 0.98) \]

Total Length \(\Rightarrow\) 28 - 80 cm

****Recalculated from Armstrong et al. (1996)
### Length - Weight relationship

<table>
<thead>
<tr>
<th>Location</th>
<th>Authors</th>
<th>n</th>
<th>TL (cm)</th>
<th>a</th>
<th>b</th>
<th>R²</th>
<th>SE_b</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mediterranean Sea (N. Aegean Sea, Greece)</td>
<td>Present work</td>
<td>5</td>
<td>27.8-49</td>
<td>0.0112</td>
<td>3.193</td>
<td>0.98</td>
<td>0.2655</td>
<td>&gt;0.05</td>
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<tr>
<td>Mediterranean (N. &amp; C. Aegean Sea, Greece)</td>
<td>Present work - Kavadas &amp; Bekas (2014)</td>
<td>6</td>
<td>27.8-49</td>
<td>0.0117</td>
<td>3.179</td>
<td>0.98</td>
<td>0.2322</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Mediterranean Sea (Adriatic Sea, Croatia)</td>
<td>Dulcic &amp; Dragicevic, (2011); Dulcic et al. (2014a); Dulcic et al. (2014b)</td>
<td>3</td>
<td>34.2-39</td>
<td>0.0001</td>
<td>4.512</td>
<td>0.90</td>
<td>1.5129</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Mediterranean Sea</td>
<td>All references except Hemida et al. (2003).</td>
<td>17</td>
<td>8.3-60</td>
<td>0.0127</td>
<td>3.161</td>
<td>0.99</td>
<td>0.0587</td>
<td>&lt;0.05</td>
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<tr>
<td>Indian Ocean (South Africa, East)</td>
<td>van der Elst (1993)</td>
<td></td>
<td></td>
<td>0.0428</td>
<td>2.84</td>
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<tr>
<td>Western Atlantic (North Carolina)</td>
<td>Merriner &amp; Foster (1974)</td>
<td>14</td>
<td>19-70.6</td>
<td>0.0229</td>
<td>3.003</td>
<td>0.99</td>
<td>0.0758</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Western Atlantic - Florida</td>
<td>Armstrong et al. (1996)</td>
<td>843</td>
<td>28-80</td>
<td>0.0107</td>
<td>3.182</td>
<td>0.98</td>
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</tr>
<tr>
<td>Western Atlantic</td>
<td>Gudger (1931)</td>
<td>7</td>
<td>3.3-73.8</td>
<td>0.0373</td>
<td>2.876</td>
<td>0.99</td>
<td>0.0583</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Western Atlantic</td>
<td>Merriner &amp; Foster (1974) - Gudger (1931)</td>
<td>21</td>
<td>3.3-73.8</td>
<td>0.0349</td>
<td>2.894</td>
<td>0.98</td>
<td>0.0367</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Most cases ⇒ **Isometric** growth ($\alpha$<0.05)  

Using data from a wide range of length  
(3.3-73.8 cm) - W. Atlantic Ocean  
(8.3 - 60 cm) - Mediterranean Sea  

tripletail appear  

↓  

**Allometric** growth ($\alpha$<0.05)
Presence of Tripletail

**Aegean Sea** ⇔ sporadically reports in some places

**South Aegean Sea**
First report in Aegean ⇐ 1943 (Rhodes Island, South Aegean Sea, Greece)

**North Aegean Sea**
One record - September 1969 (Athos peninsula, Greece)
Second ⇐ August 2005 (Thermaikos Gulf, Greece)
Third ⇐ April 2009 (Thermaikos Gulf, Greece)
Fourth & Fifth ⇐ July 2009 (Thermaikos Gulf, Greece)
Sixth ⇐ June 2010 (Thermaikos Gulf, Greece)

**Central Aegean Sea**
One record - October 2011 (Evoikos Gulf, Greece)
Two records - June-July 2012 (Izmir Bay, Turkey)
One record - September 2014 (Maliakos Gulf, Greece)
Presence in other areas close to Mediterranean

Red Sea – Arabian Sea – Sea of Oman – N. Indian Ocean

**Red Sea** ⇒ (Golani & Bogorodsky, 2010)
  ⇒ Southern part, Djibouti (Bouhlel, 1988)

South Arabian Peninsula (Manilo & Bogorodsky, 2003)

**Northern Indian Ocean region**
- Somali coast (Sommer et al., 1996)
- Sea of Oman
  - Iranian coasts, Iran
    (Assadi & Dehghani, 1997; IFC & IFRO, 2000)
  - Arabian Peninsula, Oman
    (Jawad et al., 2015)
- Karachi (Bianchi, 1985)
1. "**Floating fish**". Individuals of *L. surinamensis* are often seen floating on their side near the surface, under or in close vicinity to floating objects.

2. "**Current Drifter**". Drift with the currents by passive transfer by sea waves and/or currents ⇒ mechanism of transport individuals to the coasts.

3. "**Environmental change**". Possibly related to changes in environmental factors (e.g. increase in the sea surface temperature).

4. "**Food forager**". Occasional movement in searching for food.

5. "**Lack of ichthyologic surveys**". Lack of ichthyological expeditions and fishery surveys might delay the recording of this species in its new habitat.
Tripletail & Surface currents

Tripletails (small size <8 cm, medium size <33 cm) ⇒ strange habit

- turn to the side
- float at the surface of the water
- transport by the currents

Brazil ⇒ quite common species ⇒ called Peixe folha (leaf fish)

Tripletail ⇒ quite lazy in its movements

Perhaps tripletail

utilize the surface currents for dispersing to new areas
Taking into consideration:
- Reports from different parts on the Mediterranean
- Atlantic origin of the species
- Mediterranean must be considered as part of the native range

Tripletail appears to be a *seasonal dweller* (seasonal resident) of the *warmest parts* of the Mediterranean Sea
- using *sea currents/waves* to transfer
**MEDITERRANEAN SEA**

**ADULTS**
Solitary / Pairs / Small groups ⇒ around man-made structures, bays, harbours, passes, rivers, mouths of small freshwater streams

**Southern Mediterranean** (Algeria, Tunisia)
⇒ Tripletail reports during winter (December)

**Northern Mediterranean** (Greece, Croatia, Italy, Turkey, Spain)
- Mature tripletail individuals from late Spring (mainly summer) to Autumn

**Seems to perform seasonal movements**

**Northwards** ⇒ during summer (foraging, disperse to new areas, spawning?)

**Southwards** ⇒ during late autumn, winter (higher temperatures, overwintering)

**JUVENILES (<100 mm)**
Enter estuaries - form schools

Enter in
- Rhodes island, Greece (74 mm)
- Malta (83 mm, September)
- Barcelona, Spain (76 mm, November)

36° Parallel
**Mediterranean**

Ripe / Post-spawning individuals appear ⇒ **Summer** (June - September)  
(Minos & Economidis, 2007; Present study: Riera et al., 1999)

Spawning period ⇒ **Summer** ??

**North Atlantic Ocean (Gulf of Mexico)**

**Spawning season** ⇒ **Summer** (May - September, peak July-August)  
(Gudger, 1931; Baughman, 1941; Merriner & Foster, 1974; Ditty & Shaw, 1994; Ditty, 2001; Brown-Peterson & Franks, 2001; Cooper, 2002; Strelcheck et al., 2004).

**Place of spawning** ⇒ in offshore waters (Ditty & Shaw, 1994)

**Smallest sexually mature**  
Male = 29 cm TL  
Female = 44 cm TL  
(Brown-Peterson & Franks, 2001).

**Age at first maturity** = 1+ (Ditty, 2001)
Atlantic Ocean

Merriner & Foster (1974)
- **Northerly** transport or migration ⇒ with increasing temperatures
- **Southern** movement ⇒ during Fall - Winter

Matthew *et al.* (2013)
Tripletail Tagging program (acoustic transmitter) - Estuarine - Wild individuals

**Departure** ⇒ early October ⇒ Water temperature = 24 °C.
Most fish leave estuary during Fall

Final detection recorded ⇒ water temperatures dropped to 21 °C.
Decreases in daily residence ⇒ declines in mean daily water temperature.

**Arrivals** ⇒ 80% percent of the occurred in late March or early April when water temperatures reached 21 °C.

Daily residence ⇒ No correlation with changes in photoperiod or lunar phase.

Water temperature is an important proximate cue influencing both the timing and duration of estuarine residence of tripletail.

Seasonally abundant: April - October

Strong relationship between Atlantic Tripletail movement and the **tidal cycle**
Sea Water Temperature - Thermaikos Gulf

Sea Water Temperature (Degrees C)

May - October > 21 °C
June - September > 24 °C

Thermophilic fish species
Findings of *L. surinamensis* probably a consequence of:
- increased abundance of this species in the S. Mediterranean waters amplified by the
- changes in hydrological conditions in the area.

**Adriatic Sea** (Dulčić *et al.*, 2014a, b; Dulčić & Dragičević, 2011)

**Maltese islands** (Deidun *et al.*, 2010)

- September: Presence of numerous juveniles (60-90mm) of *L. surinamensis* at the surface in association with entangled floating ropes in shallow (<5m) water
- Repeated sightings of the species in Maltese coastal waters

Species established population in the area
Relation between (Hemida et al., 2003; Dulcic et al., 2014):
- sudden rise in sea surface water temperature and
- presence of *L. surinamensis*

Perhaps northern parts of the Mediterranean
- Adriatic
- N. Aegean Sea

are related to the Environmental changes (rise of the water temperature).

**Important** ⇒ Tripletail appears mainly during *Summer – Autumn* (rise of the water temperature) in Northern Mediterranean

Since species appears in the Mediterranean since 1874

Generally no relation to Environmental change
**CONCLUSION**

*L. surinamensis* must be characterized as a very **rare** fish in the Aegean Sea seawaters

**LIMIT:** Sea Water Temperature (>24°C).

The **rarity** of the species generally in the Mediterranean may be attributed to:
- small number of individuals living rather than
- a lack of research or restricted commercial fishing activities.

In our opinion **tripletail** is:

- **Drifter:** Using **surface currents** enters the Mediterranean and spreads eastwards from N. African coasts (Algeria, Tunisia, Egypt) to Middle East (Israel, Lebanon, Syria) to Turkey, moving up to Aegean Sea.

- **Seasonal resident** in particular waters of Mediterranean

- **Seasonal movements** (Atlantic, Mediterranean)
  - Northwards (adults) ⇒ Summer (disperse to new areas, foraging, spawning?)
  - Southwards (young - adult) ⇒ **late autumn, winter** (higher temp., overwintering)

In near future will **not increase** the number of the population in the northern part of the Mediterranean.
Thank you