Distribution of Lymphosarcoma in Redfin Needlefish, *Strongylura notata* in the Indian River Lagoon (IRL)

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Redfin needlefish

- Total length usually < 380 mm (some 610 mm)
- Short lived ( <3+ years)
- Shallow water predator
- Bait fish for marlin fishing in FL
- FL coast, Bahamas, West Indies, Belize > Honduras
Tumors

- Tumor = neoplasm; disorder of cell growth
- Named by histological recognizable tissue/cell type
- Origin: mesenchymal / epithelial
- Features: benign ("good") / malignant ("bad")
- Etiologies:
  - Chemical carcinogens (e.g., PAHs, aflatoxins)
  - Radiation (e.g., UV, x-rays)
  - Viruses (DNA viruses, RNA viruses)
- Two stage induction: initiation and promotion
Lymphosarcoma

- Hematopoietic tumor (neoplasm)
- Term, “lympho” derived from lymphocytes
- Suffix “sarcoma” means malignant neoplasm of mesenchymal origin
METHODS

- Survey healthy and tumored redfin needlefish
- Routine fisheries independent monitoring (FIM)
- 1999 – 2009
  - Indian River Lagoon (IRL)
  - Tampa Bay (TB)
  - Charlotte Harbor (CH)
  - Apalachicola (AP)
  - Cedar Key (CK)
  - St. Johns River (SJR)
METHODS

- Grossly abnormal needlefish necropsied
  - Tumors (neoplastic lesions) were described
    - Grossly
    - Histopathologically (H&E, PAS, and Thionin stains)
Needlefish lymphosarcoma

Sarcoma = malignant neoplasm of mesenchymal origin
Cut appearance of tumor

Skeletal muscle

Tumor cells

Tumor cells

500 μm
Needlefish lymphosarcoma

Bar = 2 cm
## Anatomical locations of lymphosarcoma

<table>
<thead>
<tr>
<th>Location</th>
<th>IRL</th>
<th>TB</th>
<th>CH</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lymphosarcoma</strong></td>
<td>17</td>
<td>2</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Jaw</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Flank</td>
<td>8</td>
<td>1</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Trunk dorsal</td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Pectoral fin base</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Head ventral</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Histopathology

Tumor cells = abnormal lymphocytes

Megakaryocyte-like cell

Viral inclusion bodies not found
- Tumor cells metastasized in: spleen, liver, kidney
Prevalence of tumors

- IRL
- TB
- CH

Prevalence (%)

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9

1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
Monthly prevalence of tumors

Total # of fish = 22,516

Prevalence (%)
IRL needlefish: Length / frequency distribution

Clinically healthy

Tumor

Frequency (# of fish)

Standard length (mm)
Distribution of tumors

- Total number fish surveyed = 4,996 (includes Mosquito Lagoon, Banana and central/southern Indian Rivers)
- High prevalence in:
  - Banana River (n = 13)
  - St. Sebastian River (n = 3)
- Examine possible co-factors:
  - sediment thickness
  - sediment carcinogens
  - benthic dietary exposure
DISCUSSION

• High tumor prevalence in IRL
• Host specificity
• Exposure mechanisms (benthic diet?)
• Etiological agents (initiators/promoters):
  ▪ Carcinogenic contaminants (e.g. PAHs)
  ▪ Tumor-promoting biotoxins (e.g. okadaic acid)
• Seasonal occurrence/environmental mechanisms
• No cases since 2009 (dredging activities?)
• Lymphosarcoma epizootics:
  - Northern pike (*Esox lucius*) - Scandinavia & Ireland
  - Muskellunge (*E. masquinongy*) in North America

Photos: Minnesota DNR
Other reported tumor cases in the IRL

- Lymphosarcoma in hardhead catfish (*Ariopsis felis*) (J. Fournie, EPA, pers. comm.)

- Fibropapillomatosis (FP) in green turtles (*Chelonia mydas*)

- Epizootics of gonadal tumors in hard clams (*Mercenaria* spp.)

- Examine epidemiology and possible common etiological factors

Histological section through gonad of hard clam showing tumor (neoplasm) (red circle)
CONCLUSIONS

• Majority of needlefish tumors in the IRL (few in TB/CH; none in AP, CK, and SJR)
• Tumors originate in skin > deeper into skeletal muscle
• Some metastasized to spleen, liver, kidney
• Tumor classification:
  ▪ hematopoietic neoplasm (lymphosarcoma)
• No viral inclusion bodies
• Etiology unknown
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