A NEW ERA FOR SEA FANS?

Michael P. Janes
What are Gorgonians?

Octocorals

Sclerites
Gorgonian Groups

Holaxonia (gorgonin)

Scleraxonia
Calcaxonia
Morphology

Holaxonia

After Grasshoff & Bargibant 2001

Calcaxonia
Scleraxonia

Acabaria sp.

Node

Internode
Similar Invertebrates

- *Plumularia sp.*
  Delicate Hydroid

- *Carijoa sp.*
  Clove Polyp Relative

- *Paratelesto sp.*
  No Central Axis
Stichopathes sp.
Black Coral Whip
### Popular Aquarium Species

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muricea pinnata</td>
<td>Silver Gorgonian</td>
</tr>
<tr>
<td>Diodogorgia nodulifera</td>
<td>Yellow / Red Sea Rod</td>
</tr>
</tbody>
</table>
**Scientific Name**

*Petrogorgia sp.*

*Menella sp.*

*Eunicea sp.*

**Common Name**

Ribbon Gorgonian

Colorful Sea Fan

Candelabrum
Habitats

Shallow water environments
1. An oscillating water flow.
2. Turbidity / Photosynthetic species
3. Elevated nutrients.

Deep water environment
1. Laminar water flow.
2. Clear water / Non-photosynthetic species
3. Low nutrient levels.
Sea Fans in Captivity

- Mounting
- Feeding
- Flow
Mounting

- Secure attachment to substrate
- Least invasive as possible
- Adjustable
Rubber band

Plastic / Rock base buried in substrate

Glued rock base or aquacultured
Peg Method

1. Power Drill
2. Wire Cutter
3. 3/16” Rigid Tubing
4. Sea Fans in saltwater
Drill 3/16” hole in sea fan base

Drill same size mounting holes in live rock for placement
Peg coral in place
Flow
To determine water flow velocity

\[ d = \text{Distance (cm)} \]
\[ t = \text{Time (sec)} \]
\[ v = \text{Velocity} \]

\[ d / t = v \text{ (cm/s} \ -1) \]
Flow Measurement
Small version of the Flow Meter for Aquariums
# Water Flow Values for Selected Corals

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>FLOW RESPONSE cm / sec⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hard Coral</strong></td>
<td></td>
</tr>
<tr>
<td>Favia favus</td>
<td>10 15</td>
</tr>
<tr>
<td>Porites porites</td>
<td>9 11</td>
</tr>
<tr>
<td>Meandrina meandrites</td>
<td>6 10</td>
</tr>
<tr>
<td>Madracis decactis (massive/encrusting)</td>
<td>6 8</td>
</tr>
<tr>
<td>Madracis mirabilis (wild)</td>
<td>10 30</td>
</tr>
<tr>
<td>Madracis mirabilis (tank)</td>
<td>10 15</td>
</tr>
<tr>
<td>Montastrea cavernosa</td>
<td>4 6</td>
</tr>
<tr>
<td><strong>Soft Coral</strong></td>
<td></td>
</tr>
<tr>
<td>Alcyonium siderium</td>
<td>10 12</td>
</tr>
<tr>
<td><em>Dendronephthya hemprichi</em> (polyp number)</td>
<td>12 16</td>
</tr>
<tr>
<td><em>Dendronephthya hemprichi</em> (polyp size)</td>
<td>25 32</td>
</tr>
<tr>
<td>Xenia sp.</td>
<td>4 7</td>
</tr>
<tr>
<td>Anthelia sp.</td>
<td>3 4</td>
</tr>
<tr>
<td>Klyxum sp.</td>
<td>5 9</td>
</tr>
<tr>
<td>Briarium asbestinum</td>
<td>6 12</td>
</tr>
<tr>
<td>Acanthogorgia vegae</td>
<td>8 10</td>
</tr>
<tr>
<td>Plexaura homomalla</td>
<td>6 10</td>
</tr>
<tr>
<td>Plexaurella dichotoma</td>
<td>6 12</td>
</tr>
<tr>
<td>Eunicea tournefortis</td>
<td>6 12</td>
</tr>
<tr>
<td>Psuedopterogorgia americana</td>
<td>6 12</td>
</tr>
<tr>
<td>Melithea ochracea</td>
<td>6 15</td>
</tr>
<tr>
<td>Subergorgia suberosa</td>
<td>6 15</td>
</tr>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
</tr>
<tr>
<td>Electra pilosa (bryozoan)</td>
<td>2 4</td>
</tr>
<tr>
<td>Metridium senile (anemone)</td>
<td>10 17</td>
</tr>
</tbody>
</table>
Average Flow Rates for Selected Corals

- Hard coral
- Soft Coral
- Invertebrate
<table>
<thead>
<tr>
<th>Color</th>
<th>Flow Rate (cm/s(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>19.0</td>
</tr>
<tr>
<td>Yellow</td>
<td>12.7</td>
</tr>
<tr>
<td>Orange</td>
<td>10.0</td>
</tr>
<tr>
<td>Blue</td>
<td>7.6</td>
</tr>
<tr>
<td>Green</td>
<td>6.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Color</th>
<th>Flow Rate (cm/s(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>12.0</td>
</tr>
<tr>
<td>Yellow</td>
<td>9.5</td>
</tr>
<tr>
<td>Orange</td>
<td>7.6</td>
</tr>
<tr>
<td>Blue</td>
<td>4.7</td>
</tr>
<tr>
<td>Green</td>
<td>4.2</td>
</tr>
</tbody>
</table>
Aquarium Design

Flow Criteria

- Provide flow type necessary for specific gorgonian groups.
- Substrate surface access for mounting and orientating gorgonians.
- Limit obstructions for measuring flow.
Pseudo-Kreisel provides laminar flow
Laminar Flow Tank Design

Top View

Front View
Laminar Flow Tank
Add a Protein Skimmer, Sea Fans and Fish
Oscillating Flow Tank Design

Top View

Front View
Feeding
Cyclop-eeze frozen copepods work well for larger polyp gorgonians

800 μm
Smaller foods are necessary for most non-photosynthetic gorgonians.

Rotifers
90-240 µm

(What We Have)

Oyster Eggs
25-50 µm
What's Missing

Meiofauna 100-1000 μm
- Foraminifera
- Nematodes
- Gastotrichs
- Isopods
- Turbellarians
- Clam Larvae
Phytoplankton

Microfauna <100 μm

Nanoflagellates < 10
Ciliates 10-50
Dinoflagellates 8-20
Diatoms 20+
Drip Feeding

Combine foods.
Feed for a period of hours.
Polyp extension increases.
Polyp Density

How many mouths to feed?

When is enough food enough?
How Many Mouths to Feed? **A Lot!**

![Graph showing polyps per cm² (Avg.) for different species.](image)

- **Diodogorgia nodulifer**
- **Echinomuricea sp.**
- **Menella sp.**
- **Pseudopterogorgia**
- **Swifta exserta**
- **Guaiagorgia anas**

Polyps per cm² (Avg.)
When is Enough Food Enough?

**Unknown!**

<table>
<thead>
<tr>
<th>Feeding Trial</th>
<th>Phytoplankton</th>
<th>Zooplankton</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>250 cells / ml</td>
<td>25 pc. / ml</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>500 cells / ml</td>
<td>50 pc. / ml</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>1000 cells / ml</td>
<td>100 pc. / ml</td>
</tr>
</tbody>
</table>
Feeding / Polyp Count Results

- Take into account polyp densities when developing a husbandry plan.
- Larger polyps can be sustained on fewer 800+ μm food particles.
- High food densities may impact water quality without regular water changes.
Summary

Typical reef tanks can house photosynthetic large polyp gorgonians. Provide both zooplankton & phytoplankton foods.
A simple flow measuring device may \textit{(should)} be used to determine flow rates around sessile invertebrates &
Most gorgonians can be categorized into laminar flow or oscillating flow environments. House accordingly with new flow devices.
Food particle size, nutrition and density appear to be the most important limiting factors in successfully maintaining non-photosynthetic gorgonians.
Project updates available at
www.aquatouch.com