PANEL DISCUSSION: ROLE AND CHALLENGES OF THE ATTENDING VETERINARIAN AND ADEQUATE VETERINARY CARE – AQUATIC SPECIES

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Attending Aquatic Veterinarian responsibility

• Understand and advise on research aquatic animal models
• Consult with researchers on appropriate techniques
• Diagnose and treat disease conditions
• Relieve pain and suffering to aquatic animals
• Consult on appropriate housing methodologies, facility design and construction

Cr. Dr. Jonathan Spears
Aquatic Animal Care

- Commonly used species
- Source
- Transportation
- Acclimation after transport
- Quarantine
- Aquatic environment
- Accommodation and management
- Food
- Health and disease control
- Identification techniques
- Handling methods

Aquatic species in Thailand

- Shrimp
  - Litopenaeus vannamei
  - Macrobrachium rosenbergii
- Fish
  - Oreochromis niloticus
  - Lates calcarifer
  - Danio rerio
  - Cyprinus carpio

https://www.rosen.com/en/articles/effect-of-
dietary-essential-oils-supplementation-on-
Litopenaeus-vannamei-improving-feed-efficiency-
in-a-fishmeal-replacement-context/

https://www.flickr.com/photos/129056679@N05/15335101323

https://sportfishin.asia/resources/fish-
species-identification/saltwater-fish/the-barramundi-lates-
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https://secondnatureaquariums.com.au/cyprinus-
carpio-assorted-koi-15cm.html

https://ffish.asia/?p=none&o=ss&id=394

https://www.biomin.net/en/articles/effect-
of-dietary-essential-oils-supplementation-on-Litopenaeus-
vannamai-improving-feed-efficiency-in-a-fishmeal-replacement-context/

https://sportfishin.asia/resources/fish-
species-identification/saltwater-fish/the-barramundi-lates-
calcarifer/
Transportation

• Must be reduce stress
• Low water temperature
• High oxygen requirement
• Density: size, weight, length and volume of water
• Long distance: container - dark and may be using anesthesia agent such as bensocaine 18-20 ppm
• International Air transport Association (IATA): Plastic (Polyethylene) bag with 1/3 water and fill with oxygen, within 48 hours.

Acclimatization

• Temperature: transportation water should be the same as laboratory water
• Food: 2-3 days after arrival
• Health and behavior inspection
Quarantine

- Separately from existing stocks
- Health monitoring
- Minimize the risk from a rise in the levels and/or virulence of pre-existing pathogens

Aquatic environment

- Microenvironment
  - The primary enclosure such as the tank, raceway, or pond.
    - Water quality
    - Illumination
    - Noise
    - Vibration
    - Temperature

- Macroenvironment
  - The physical environment of the secondary enclosure, such as a room
Facility design

- Wet room floors and walls: waterproof and easily cleaned
- Ventilation
- Electrical equipment or outlets
- Tanks: non-toxic material, non-corrosive and easily cleaned
- Water supply outlets: flexibility in the arrangement of tanks

Water quality

- pH
- Alkalinity
- Nitrogen waste products (ammonia, nitrite and nitrate)
- Dissolved oxygen/Oxidation-reduction potential
- Salinity/conductivity
- Hardness (osmolality/dissolved minerals)
- Total gas pressure
- Phosphorus/chlorine/Ion and metal content
- Temperature
Life supporting system

- Life support systems typically fall into three general categories:
  - Recirculating systems*
  - Flow-through systems
  - Static systems
- Type of water: freshwater, brackishwater, or saltwater
- *Filter system: mechanical, biological and chemical filter

Stocking densities and water flow

- Species
- Water quality
- Flow rates
- Temperature
- Excessive stocking densities: Ammonia > 0.02 ppm
  \[O_2 < 5 \text{ ppm}\]

*Filter system: mechanical, biological and chemical filter

http://www.blueridgeaquaculture.com/recirculatingaquaculture.cfm
**Illumination**

- Aquatic and Semiaquatic species Sensitive to changes in
  - Photoperiod
  - Light intensity
  - Wavelength
- Gradual changes in room light intensity are recommended.
- Rapid changes in light intensity can elicit a startle response in fish and result in trauma.
- Full-spectrum lighting may require for some aquatic and semiaquatic species.

**Temperature**

- Most aquatic or semiaquatic species (fish, amphibians, and reptiles) : poikilotherms (metabolism, reproduction, and feeding behavior)
- Adjustable temperature
  - Source water temperature
  - Room temperature or macroenvironment
Humidity

- Humidity is the amount of water vapor in the air
- Absolute humidity is the amount of water vapor divided by the amount of dry air in a certain volume of air at a particular temperature.
- Relative humidity is the ratio of the current absolute humidity to the highest possible absolute humidity, which will depend upon the current air temperature.
Ventilation

• Air handling systems
  • Ensure that aquatic areas are well ventilated and humidity is controlled
  • Ensure that aerosol transfer between tanks and through the facility is minimized
  • Ensure a comfortable working environment

*Room air quality may affect water quality (i.e. gas exchange)

Consideration

• **Airborne particulates and compounds** (e.g., volatile organic compounds and ammonia) may dissolve in tank water and **affect animal health** (Koerber and Kalishman 2009).

• As the **aerosolization of water** can lead to the **spread of aquatic animal pathogens** (e.g., protozoa, bacteria) within or throughout an **aquatic animal facility**, this process should be minimized as much as possible (Roberts-Thomson et al.2006; Wooster and Bowser 2007; Yanong 2003).
Vibration and noise

- Machinery that produces noise and vibration should be isolated from areas housing fish.


Food

- Herbivorous
- Omnivorous
- Carnivorous
Identification techniques

• Depend on: species, size and type of study
• External tags: area below dorsal fin or to the operculum size fish > 12 cm.
• Internal tags: Microchip

Health and disease control

• Physical examination
• Health monitoring
• Analgesia and anesthesia
• Diagnosis
• Treatment
• Disease control
### TABLE 1. Descriptions of the stages of anesthesia and the parameters used to monitor anesthesia in fish. A number of procedures are provided as examples of what can be done to the fish under these levels of anesthesia.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Plane</th>
<th>Level of Anesthesia</th>
<th>General Demeanor</th>
<th>Activity</th>
<th>Equilibrium</th>
<th>Gill Ventilation Rate</th>
<th>Reactivity</th>
<th>Heart Rate</th>
<th>Muscle Tone</th>
<th>Examples of Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I</td>
<td>Normal</td>
<td>Normal Disoriented</td>
<td>Normal Reduced</td>
<td>Normal Normal</td>
<td>Normal Normal Reduced</td>
<td>Normal Normal</td>
<td>Normal Normal Reduced</td>
<td>Normal Normal</td>
<td>Weight; close visual inspection; external noninvasive tags; gill scrape</td>
</tr>
<tr>
<td>II</td>
<td>II</td>
<td>Excitation</td>
<td>Agitated</td>
<td>Increased Difficulty</td>
<td>Increased Decreased Reflex response</td>
<td>Increased Increased Regular</td>
<td>Increased Regular</td>
<td>Increased Regular</td>
<td>Normal Decreased</td>
<td>Invasive tags, tissue removal; injection; blood sampling; gill biopsies, lesion dressing, recovery surgery</td>
</tr>
<tr>
<td>III</td>
<td>1</td>
<td>Light Anesthesia</td>
<td>Anesthetized</td>
<td>None</td>
<td>None</td>
<td>Shallow</td>
<td>None Reduced</td>
<td>Reduced Decreased</td>
<td>Decreased</td>
<td>Nonrecovery surgery</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Surgical*</td>
<td>Anesthetized</td>
<td>None</td>
<td>None</td>
<td>Shallow</td>
<td>None Reduced</td>
<td>Reduced Decreased</td>
<td>Decreased</td>
<td>Nonrecovery surgery</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Deep</td>
<td>Anesthetized</td>
<td>None</td>
<td>None</td>
<td>Rare movements</td>
<td>None Reduced</td>
<td>Reduced</td>
<td>Relaxed</td>
<td>Nonrecovery surgery</td>
</tr>
<tr>
<td>IV</td>
<td>Overdose</td>
<td>Apparently dead</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None Cardiac failure</td>
<td>None Cardiac failure</td>
<td>None Cardiac failure</td>
<td>Nonrecovery surgery</td>
</tr>
</tbody>
</table>

Adapted from Bell, 1987; Burke et al., 1997; McFarland, 1959; McFarland and Klonz, 1969; Summerfelt and Smith, 1990.

*Some authors suggest there is an intermediate stage between light and surgical termed medium plane anesthesia.

Usual example of a reflex response is the fish swimming in response to a tail pinch.

(Usually accompanied by the use of artificial ventilation where the gills are irrigated with fresh or anesthetic dosed water.)

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### TABLE 2. Summary of selected anesthetic agents used in fish showing the range of doses, used in a variety of species and the resultant side effects (see Neiffer and Stamper, 2009 for species-specific information and also the citations in text).

<table>
<thead>
<tr>
<th>Anesthetic Agent</th>
<th>Dose (mg/L-1)</th>
<th>Initial</th>
<th>Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS-222</td>
<td>50-400</td>
<td>Tachycardia</td>
<td>Decreased cardiovascular responses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased respiration</td>
<td>Hypoglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hyperglycemia</td>
<td>Increased lactate, hematocrit, and catecholamines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Erythrocyte swelling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreased cardiovascular responses</td>
<td>Hypoglycemia</td>
</tr>
<tr>
<td>Benzocaine</td>
<td>25-150</td>
<td>Tachycardia</td>
<td>Increased lactate, hematocrit, and catecholamines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased respiration</td>
<td>Hyperglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hyperglycemia</td>
<td>Suppressed immune function</td>
</tr>
<tr>
<td>Clove Oil</td>
<td>4-150</td>
<td>Tachycardia</td>
<td>Decreased ventilation and cardiovascular responses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased respiration</td>
<td>Increased catecholamines and hematocrit</td>
</tr>
<tr>
<td>Eugenol</td>
<td>20-200</td>
<td>Hyperglycemia</td>
<td></td>
</tr>
<tr>
<td>Isoeugenol</td>
<td>3.6-120</td>
<td>Hyperglycemia</td>
<td></td>
</tr>
<tr>
<td>Metomidate</td>
<td>0.06-10</td>
<td>Hyperglycemia</td>
<td></td>
</tr>
<tr>
<td>2-Phenoxyethanol</td>
<td>0.25-600</td>
<td>Hyperglycemia</td>
<td></td>
</tr>
<tr>
<td>Quinaldine</td>
<td>10-50</td>
<td>Tachycardia</td>
<td>Decreased heart rate and respiratory function</td>
</tr>
<tr>
<td>Quinaldine sulphate</td>
<td>5-100</td>
<td>Hyperglycemia</td>
<td></td>
</tr>
</tbody>
</table>

These doses are not appropriate for all species or under all conditions (e.g., temperature, body size, and physiological state must be investigated before use). When working with unfamiliar species or agents, use the lowest doses and low numbers of fish to test anesthetic efficacy.

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Handling Methods

- Physical restraint
- Chemical restraint
- Euthanasia

https://www.7seasproshopthai.com/categories/accessories.net.html?___store=th&___from_store=en
References

  • https://www.ccac.ca/Documents/Standards/Guidelines/Fish.pdf

• Guide for the Care and Use of Laboratory Animals (NRC 2011)
  • https://www.aaalac.org/resources/theguide.cfm

• Guide for the Care and Use of Laboratory Animals (Thai version)
  • https://www.aaalac.org/resources/theguide.cfm