IOC/WESTPAC Workshop

Fish and Shellfish Poisoning in China

Chengchu Liu, Ph D
Professor in Seafood Safety
Shanghai Ocean University
Introduction
Wide Coastal Areas

- Be located in the temperate, subtropical, and tropical regions
- With wide range of coastal areas
  - coastal areas: 3 million km²
  - coastal lines: 18000 km
- With rich marine resources
Wide Inland Water Areas

- Have rich both sea & inland water resources
- Provide varieties of aquatic food

Key:
- Water
- River
- Great Wall
- City
- Country border

- Songhua River
- Yellow River
- Yangtze River
- Pearl River
In 2009, the total aquatic production reached 51 MT.
People especially those who live in the coastal areas consume a large quantity of seafood.
Environmental Stress

- However, harmful algae and marine biotoxins represent a significant and expanding threat to human health and fisheries resources.
- Fish and shellfish can uptake and accumulate toxins from the sea through their food chain.
Consumption of marine biotoxin contaminated fish and shellfish can cause food poisonings in people and sometimes even results in death.

According to incomplete statistics, only in Hong Kong, 834 people suffered poisoning from eating ciguatera-producing groupers between 1997-2001.
Besides ciguatoxin, about 100 people suffer from puffer fish poisoning each year, with an average mortality of 20%.

451 people got sick in the last 35 years by swallowing the gall-bladder of cyprinds (freshwater fish), among which 83 people died.
Public Awareness Are Needed

- Poisoning mainly attributes to the lack of public awareness on seafood safety and good knowledge in prevention of potential risks caused by marine biotoxins.

- It is important for us to work together to enhance the public awareness on the risk of toxin contaminated fish and shellfish.

Watch out for marine biotoxins!
Seafood Poisoning Events in China (1976-2008)

According to incomplete statistics, 5000 persons were poisoned from consumption of seafood contaminated with marine toxins in China during 1976-2008.
Marine Biotoxin Intoxication and Death (1976-2008, China)

- Total Intoxication: 4980 persons (32.0%)
- Tetrodotoxin: 494 persons (83.8%)
- Ciguatoxin: 414 persons (1.4%)
- PSP toxin: 1024 persons (14.8%)
- Other toxins: 221 persons (0%)

- Total Death: 20.6% (14.8%)
Puffer Fish Poisoning (Tetrodotoxin)
### Cases of Puffer Fish Poisoning

<table>
<thead>
<tr>
<th>Years</th>
<th>Cases</th>
<th>Illness</th>
<th>Death</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952-1984</td>
<td>5</td>
<td>11</td>
<td>8</td>
<td>72.7</td>
</tr>
<tr>
<td>1985</td>
<td>43</td>
<td>178</td>
<td>42</td>
<td>23.6</td>
</tr>
<tr>
<td>1986</td>
<td>39</td>
<td>284</td>
<td>30</td>
<td>10.4</td>
</tr>
<tr>
<td>1987</td>
<td>33</td>
<td>97</td>
<td>28</td>
<td>28.9</td>
</tr>
<tr>
<td>1988</td>
<td>20</td>
<td>69</td>
<td>23</td>
<td>33.5</td>
</tr>
<tr>
<td>1989</td>
<td>23</td>
<td>201</td>
<td>17</td>
<td>8.5</td>
</tr>
<tr>
<td>1990</td>
<td>33</td>
<td>193</td>
<td>42</td>
<td>21.8</td>
</tr>
<tr>
<td>1991</td>
<td>23</td>
<td>105</td>
<td>24</td>
<td>22.9</td>
</tr>
<tr>
<td>1992</td>
<td>30</td>
<td>188</td>
<td>39</td>
<td>20.7</td>
</tr>
<tr>
<td>1993</td>
<td>—</td>
<td>—</td>
<td>147</td>
<td>—</td>
</tr>
<tr>
<td>1994-1997</td>
<td>—</td>
<td>9</td>
<td>3</td>
<td>33.3</td>
</tr>
<tr>
<td>1998-2007</td>
<td>—</td>
<td>202</td>
<td>8</td>
<td>3.9</td>
</tr>
<tr>
<td>2009-2010</td>
<td>4</td>
<td>12</td>
<td>6</td>
<td>50.0</td>
</tr>
</tbody>
</table>
Differences in the Number of Puffer Fish Poisoning among Coastal Provinces

<table>
<thead>
<tr>
<th>Provinces</th>
<th>Years</th>
<th>Cases</th>
<th>Illness</th>
<th>Death</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guangdong</td>
<td>1982-1993</td>
<td>134</td>
<td>558</td>
<td>130</td>
<td>23.3</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>1990-1997</td>
<td>34</td>
<td>187</td>
<td>49</td>
<td>26.3</td>
</tr>
<tr>
<td>Fuzhou</td>
<td>1986-1988</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>20.0</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>1990-1992</td>
<td>9</td>
<td>65</td>
<td>9</td>
<td>13.8</td>
</tr>
<tr>
<td>Shandong</td>
<td>1984-1993</td>
<td>17</td>
<td>83</td>
<td>20</td>
<td>24.1</td>
</tr>
</tbody>
</table>
Causative toxins

◆ The causative agent responsible for puffer fish poisoning is ✓ Tetrodotoxin (TTX)

◆ It is a potential neurotoxin of low molecular weight
◆ It is stable at neutral to weakly acidic solutions
◆ It does not decompose by cooking
Causative Organisms

- Puffer fish
- Porcupine fish
- Other species producing TTX
  - Goby
  - Shellfish
  - California newt
  - Parrotfish
  - Frogs of the genus *Atelopus*
  - The blue-ringed octopus

Real Origins: May be TTX producing micro-organisms???
TTX Producing Fish in China

◆ 47 species of TTX producing fish
  ✓ 45 species of puffer and porcupine fish
  ✓ 2 species of goby fish

◆ Most common species include
  ✓ Arothron hispidus
  ✓ Canthigaster rivulatus
  ✓ Lagocephalus inermis
  ✓ Takifugu faciatus
  ✓ Takifugu rubripes
  ✓ Takifugu xanthopterus
  ✓ Diodon holacanthus
  ✓ Yongeichthys criniger
Puffer & Porcupine Fish Causing Poisoning in China

Takifugu xanthopterus

Takifugu rubripes

Takifugu faciatus

Diodon holacanthu
Other Fish Species Causing TTX Poisoning in China

- Arothron hispidus
- Lagocephalus inermis
- Canthigaster rivulatus
- Yongeichthys criniger
Distribution of TTX

◆ In general, puffer fish liver contains the highest content of TTX, followed by ovaries, intestine and skin.
  ✓ liver > ovaries > intestine > skin
  ✓ The flesh is normally free of toxin.

◆ However, flesh of some toxic gobies also contains TTX.
Anatomy of *Takifugu xanthopterus*

- Liver
- Gall-bladder
- Intestine
- Spleen
- Stomach
- Gas Bladder
Seasonal variation in the toxicity of different portions of female puffer (Arakawa et al, 2010; Coastal Environmental and Ecosystem Issues of the East China Sea, Eds., A. Ishimatsu and H.-J. Lie, pp. 227–244)
Toxicity of TTX

In human, the lethal dose of TTX is around 1 to 2 mg and the minimum dose necessary to cause symptoms has been estimated to be 0.2 mg.
Onset of symptoms in patients with puffer fish poisoning

<table>
<thead>
<tr>
<th>Time (in minutes)</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>14</td>
</tr>
<tr>
<td>31 - 60</td>
<td>3</td>
</tr>
<tr>
<td>61 - 90</td>
<td>1</td>
</tr>
<tr>
<td>91 - 120</td>
<td>13</td>
</tr>
<tr>
<td>≥121</td>
<td>6</td>
</tr>
</tbody>
</table>
Relationship of Mortality and Duration of Onset of Illness

Number of cases

- <30 mins
- 30 min-1 hr.
- 1-6 hrs.
- 6-12 hrs.

Duration between consumption of the fish and onset of illness

- dead cases
- live cases
# Symptoms

<table>
<thead>
<tr>
<th>Clinical manifestations</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perioral paraesthesia</td>
<td>24</td>
</tr>
<tr>
<td>Weakness of both lower limbs</td>
<td>22</td>
</tr>
<tr>
<td>Paraesthesia all over the body</td>
<td>18</td>
</tr>
<tr>
<td>Headache</td>
<td>15</td>
</tr>
<tr>
<td>Difficulty in respiration</td>
<td>14</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>8</td>
</tr>
<tr>
<td>Blurring of vision Vertigo</td>
<td>7</td>
</tr>
<tr>
<td>Vertigo</td>
<td>6</td>
</tr>
<tr>
<td>Dizziness</td>
<td>5</td>
</tr>
<tr>
<td>Cramping pain in the lower limbs</td>
<td>4</td>
</tr>
</tbody>
</table>
Treatments

➢ No antidote

➢ Supportive treatments
  ✓ Vomit inducing (<3h)
  ✓ Artificial respirations are extremely important if the person become paralyzed.
Preventions

 Regulation:
  ✓ It remains illegal to sell puffer fish in markets or restaurants in China.
  ✓ However, puffer fish is considered a delicacy by many people in China.
  ✓ People keep taking risks in eating puffer fish.
  ✓ Therefore, maybe it is not the best way to prevent puffer fish poisoning only by prohibition.
Japanese System
Production of non-toxic puffer fish by land culture

Seawater is thoroughly filtered before pouring into a tank to prevent toxic organisms from entering into it.

(From Arakawa et al, 2010; Coastal Environmental and Ecosystem Issues of the East China Sea, Eds., A. Ishimatsu and H.-J. Lie, pp. 227–244. © by TERRAPUB and Nagasaki University, 2010)
Ciguatera fish poisoning (Ciguatoxin)
It is an illness that people get from eating tropical reef fish contaminated with toxins.

It is the world’s most common seafood-toxin illness in the world.

Worldwide: > 50,000 people affected annually

In Hong Kong,

- 2002: 60 people
- 2003: 27 people
- 2004: 255 people
# Ciguatoxin Poisoning (1976-2006)

<table>
<thead>
<tr>
<th>Years</th>
<th>Cases</th>
<th>Illness</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976-1977</td>
<td>2</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>1980-1989</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1991</td>
<td>1</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1995</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1997</td>
<td>16</td>
<td>103</td>
<td>0</td>
</tr>
<tr>
<td>1998</td>
<td>129</td>
<td>509</td>
<td>0</td>
</tr>
<tr>
<td>1999</td>
<td>56</td>
<td>303</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>33</td>
<td>90</td>
<td>—</td>
</tr>
<tr>
<td>2001</td>
<td>16</td>
<td>57</td>
<td>—</td>
</tr>
<tr>
<td>2002</td>
<td>—</td>
<td>60</td>
<td>—</td>
</tr>
<tr>
<td>2003</td>
<td>—</td>
<td>27</td>
<td>—</td>
</tr>
<tr>
<td>2004</td>
<td>15</td>
<td>792</td>
<td>—</td>
</tr>
<tr>
<td>2005</td>
<td>12</td>
<td>221</td>
<td>—</td>
</tr>
<tr>
<td>2006</td>
<td>—</td>
<td>16</td>
<td>—</td>
</tr>
</tbody>
</table>
Causative toxins

- The causative agent responsible for ciguatera fish poisoning is
  - Ciguatoxin

- Lipid soluble polyether compounds
- Heat, acidic and basic stable
Origins of Ciguatoxin

◆ It originates from dinoflagellates (*Gambierdiscus toxicus*) which grow on coral reef.

◆ The toxins pass up the food chain and undergo biotransformation from herbivorous fish, carnivorous fish, predatory fish and man.
Accumulation in Fish & Transfer to Human

Ciguatoxin poisoning occurs through the food chain.

Toxic coral containing toxic precursor

Toxic reef fish feeding on and around corals

Toxic carnivore from feeding on toxic reef fish

Eaten by humans
Common Tropical Reef Fish Causing Ciguatoxin Poisoning

- Barracudas
- Groupers
- Moray eels
- Wrasse
- Snappers
- Trevallies
- Surgeonfish
- Triggerfish
- Parrotfish
- Hogfish
Distribution of Ciguatoxin

- In general, the toxins accumulate in viscera, skin and head.
- As a rule, within species,
  - The larger, the more poisonous
- Larger fish (>2 kg) can contain enough toxins to trigger human poisoned.
Symptoms

◆ Gastrointestinal symptoms
◆ Neurological symptoms
  ✓ reversion of hot-cold perception
◆ Cardiovascular symptoms
◆ Onset time: several hours
  ✓ 30min-24h
Treatments

- No antidote

- Supportive treatment
  - Vomit inducing
  - Stomach washing
  - 20% mannitol infusion
Preventions

- Avoid eating big coral reef fish and eat small amount at each meal.
- Do not eat roe, liver, guts, head and skin of coral reef fish.
- Avoid alcohol, nut or seed products when consuming coral reef fish.
- Buy coral reef fish from reputable and licensed shops.
Seafood Traders

- Comply with the requirements stipulated in the Code of Practice on the Import and Sale of Live Marine Fish for Human Consumption*, for example:
  - Importers are required to report to the Food and Environmental Hygiene Department for every import of live coral reef fish.
  - Importers, wholesalers and retailers should avoid importing, purchasing and selling fish known to have a high risk of carrying ciguatoxin, and coral reef fish from unknown or suspicious sources.
- Importers, wholesalers and retailers should keep accurate records of the supplies and distribution of all live marine fish for source tracing if any problem arises.
- Keep coral reef fish of different sources or suppliers in different fish tanks or zones.


Pictures adopted from "Grant’s Guide to Fishes", "Fishes of the Great Barrier Reef and Coral Sea" and "World Wide Fund Nature Hong Kong"
Photographer: Jo Ruxton

Published by the Centre for Food Safety, Food and Environmental Hygiene Department
Printed by the Government Logistics Department (07/06)
Ciguatera fish poisoning is a food intoxication caused by consumption of fish containing ciguatoxin.

The ciguatoxin originates from dinoflagellates, a marine micro-organism, which attach and grow on dead coral reef and marine algae. The toxin passes up the food chain from herbivorous fish, carnivorous fish, predatory fish and finally to man. The toxin load becomes more concentrated as it moves up the food chain. The larger the fish, the higher the concentration of toxin.

Toxin accumulates more in the fish roe, liver, guts, head and skin. Ciguateric fish do not have any symptoms and therefore cannot be identified by inspection, appearance, smell, taste and texture.

Usually, fish that feed and dwell at coral reef are more likely to contain ciguatoxin. Common ones are: Moray Eel, Potato Grouper, Speckled Blue Grouper, Tiger Grouper, High Fin Grouper, Hump Head Wrasse, Areolated Coral Grouper, Black Saddle Coral Grouper, Lyretail, Black Fin Red Snapper, Flowery Grouper and Leopard Coral Grouper.

Ciguatoxin causes gastrointestinal and neurological symptoms several hours after consuming toxic fish. Lasting for several days to weeks, the principal symptoms include: vomiting; diarrhoea; numbness of extremities, mouth and lips; reversal of hot and cold sensation, as well as muscle and joint aches. Cardiovascular symptoms such as bradycardia and hypotension, though less common, may also appear.

The intoxication does not confer immunity but would rather sensitise the patient when he/she is exposed again to the toxin of an even lower concentration. Patients are advised not to drink alcoholic beverages and eat nut or seed products as these foods will increase the severity of the symptoms.

**Prevention of Ciguatera Fish Poisoning:**

**Consumers**

- Eat fewer coral reef fish:
- Eat small amount of coral reef fish at any one meal:
- Avoid consuming the roe, liver, guts, head and skin of coral reef fish:
- Avoid consuming alcoholic beverages, nut or seed products when consuming coral reef fish or when suffering from ciguatera fish poisoning:
- Buy coral reef fish from reputable and licensed seafood shops; and
- Seek medical advice and treatment immediately if you have ciguatera fish poisoning symptoms.
Paralytic Shellfish Poisoning (PSP)
<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
<th>Illness</th>
<th>Death</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>1983-1985</td>
<td>24</td>
<td>94</td>
<td>7</td>
<td>7.5</td>
</tr>
<tr>
<td>1985-1992</td>
<td>17</td>
<td>61</td>
<td>20</td>
<td>32.8</td>
</tr>
<tr>
<td>1992-1997</td>
<td>26</td>
<td>128</td>
<td>4</td>
<td>3.1</td>
</tr>
<tr>
<td>1998</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>1999</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>2000</td>
<td>7</td>
<td>11</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2001</td>
<td>1</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2002</td>
<td>19</td>
<td>102</td>
<td>6</td>
<td>5.9</td>
</tr>
<tr>
<td>2003</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>2004</td>
<td>—</td>
<td>600</td>
<td>29</td>
<td>4.8</td>
</tr>
<tr>
<td>2008</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>1.7</td>
</tr>
</tbody>
</table>
The causative agent causing PSP is

- Saxitoxins

- Water-soluble with no color, no odor, no taste.
- Heat-stable and cannot be destroyed by cooking.
Causative Organisms

◆ Red tide algae

✓ *Alexandrium* spp.,
✓ *Gymnodinium* catenatum
✓ *Pyrodininium* bahamense
Accumulation & Distribution

- PSP toxins can be accumulate in the tissues of bivalve shellfish.
- The concentration of PSP toxins is generally higher in the viscera of contaminated shellfish.
Transfer to Human
Affected Seafood-Most shellfish

- Oysters
- mussels
- surf clams
- soft shell clams
- butter clams
- sea scallops
- lobsters
- crabs
- ocean quahogs
- gastropods
Affected Seafood—Some Fish

◆ Some fish

✓ Herring
✓ Salmon
✓ Menhaden
✓ Sandlance
✓ Mackerel
✓ Squid
Symptoms of PSP

◆ Purely neurological
  ✓ Tingling
  ✓ Numbness
  ✓ Ataxia
  ✓ Giddiness
  ✓ Drowsiness
  ✓ Burning (perioral region)
  ✓ Fever
  ✓ Rash
  ✓ Staggering

◆ Rapid onset time
Treatments

- No antidote
- Supportive therapy
Preventions

- Large-scale proactive monitoring programs
  - Assess toxin levels in shellfish
  - Regulation: in shellfish <80µg PSP toxins /kg
  - Rapid closure of toxic harvest areas

- International program, coordination and cooperation

Culture Conditions and Water Environment Risk Assessment of Red Tide Monitoring areas (Chin, 2005)
Consumer Education

✓ Remove viscera and gonads of shellfish before cooking
✓ Eat a small amount of shellfish per meal
✓ Seek medical advice immediately if symptoms occur after consuming shellfish.
Anatomy of Scallop

- Digestive Gland
- Adductor Muscle
- Gills
- Gonad

Images of Scallop shells are also shown.
Poisoning Caused by Grass Carp Gall Bladder
Chinese people, especially those in southern China, believe that fish gall bladder will brighten eyes and make fever and asthma to subside.

Therefore, poisoning due to ingestion of fish gall bladder is commonly reported in China.
In China, the first case of fish gallbladder poisoning was documented in 1965.

According to incomplete statistics, 451 persons was intoxicated during 1965 -1999.

- 83 persons died
- Mortality: 18%
Seven persons were reported poisoned by fish gall bladder in Nagasaki and Kagoshima in Japan.
Causative toxin

◆ The causative agent responsible for fish gall bladder poisoning is
  ✓ Cyprinols
    (Cyprinol sulphate)

◆ It is table and not be destroyed by cooking.
◆ Either the raw or cooked can be poisoned.
Anatomy of Grass Carp

- Gall-bladder
- Liver
- Gill
Fish Gall Bladder

Grass carp gallbladder (40g)
Gallbladder Poisonous Fish

- Grass carp
- Wuchang fish
- Common carp
- Black carp
- Mud carp
- Crucian carp
Symptoms

◆ Gastrointestinal symptoms
  ✓ Abdominal pain
  ✓ Vomiting
  ✓ Water diarrhea

◆ Hepatotoxicity/hepatic dysfunction

◆ Acute renal failure

◆ Onset duration: 5-6h
Treatments

- No antidote
- Supportive therapy
  - Vomit inducing
  - Stomach washing
  - Glucose fluid (protect the liver)
Preventions

- Enhance public awareness
  - Recognize gallbladder poisonous fish
  - Avoid swallowing fish gallbladder
A Rare Case: Recent Crawfish Related Poisoning in Nanjing, China (July, 2010)
Case Report (July, 2010)

- 23 persons in Nanjing fell sick after eating crayfish
  - Male: 6 persons
  - Female: 17 persons
    - 8 persons: ate at 4 different restaurants
    - 15 persons: ate at 8 different homes

- Symptoms
  - Muscle/joint pain without a fever
  - Neural paralysis
Result of Clinical Analysis

➢ All patients developed rhabdomyolysis
  ✓ swelling & breakdown of muscle mass

◆ But what the disease is?
◆ What toxin is?
The Disease

- **Haff disease**
  - is the development of rhabdomyolysis (swelling and breakdown of skeletal muscle, with a risk of acute kidney failure) within 24 hours of ingesting aquatic products.
The disease was first detected in 1924 at Haff Beach on the Baltic coast, and more than 1,000 patients have been identified with having contracted it since then.

In 1997, six cases of Haff disease were reported in California and Missouri, all after the consumption of buffalo fish.
### TABLE 1. Symptoms of Haff disease cases, Amazon, Brazil, 2008

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Number of reports</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myalgia</td>
<td>27</td>
<td>100</td>
</tr>
<tr>
<td>Chest pain</td>
<td>19</td>
<td>70.4</td>
</tr>
<tr>
<td>Neck pain</td>
<td>17</td>
<td>62.9</td>
</tr>
<tr>
<td>Muscular stiffness</td>
<td>13</td>
<td>48.1</td>
</tr>
<tr>
<td>Pain upon light touch</td>
<td>12</td>
<td>44.4</td>
</tr>
<tr>
<td>Weakness</td>
<td>11</td>
<td>40.7</td>
</tr>
<tr>
<td>Nausea</td>
<td>11</td>
<td>40.7</td>
</tr>
<tr>
<td>Muscle contracture</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Dark urine</td>
<td>9</td>
<td>33.3</td>
</tr>
<tr>
<td>Vomiting</td>
<td>9</td>
<td>33.3</td>
</tr>
<tr>
<td>Malaise</td>
<td>8</td>
<td>29.6</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>4</td>
<td>14.8</td>
</tr>
</tbody>
</table>
The causative toxin is still unknown.

- It was previously suspected that the cause of the poisoning was excessive residue of a chemical called oxalic acid, which is believed to be illegally used to clean crayfish.

- However, China CDC did not find any suspected chemical from both crayfish sold in the market or blood sample of the patients.
<table>
<thead>
<tr>
<th>TABLE 5. Fluid administration strategy in patients with impending or ongoing traumatic rhabdomyolysis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Find a vein in arm or leg even if the patient is still trapped</td>
</tr>
<tr>
<td>- Administer fluid as early as possible: start with 1 L before extrication</td>
</tr>
<tr>
<td>- Preferable fluid combination (for 2 L)</td>
</tr>
<tr>
<td>1 L of isotonic saline</td>
</tr>
<tr>
<td>1 L of glucose 5% glucose 1100 mmol bicarbonate</td>
</tr>
<tr>
<td>- Administer at least 3–6 L/d (in emergencies when supervision is not guaranteed) or up to 10 L/d or more if continuous supervision is available</td>
</tr>
<tr>
<td>- Add 10 ml of mannitol per hour if urine output is greater than 20 ml/h</td>
</tr>
</tbody>
</table>
Second Announcement

9th Asian Fisheries and Aquaculture Forum (9AFAF)
21st – 25th April 2011, Shanghai, China

Organized by the
Asian Fisheries Society & Shanghai Ocean University
Welcome to Shanghai, China

THANK YOU!

Welcome to Shanghai, China
THANK YOU!