REPORT: SPC - CONFERENCE

CIGUATOXIN
INSTITUT DE RECHERCHES MEDICALES
Papeete, Tahiti

RADIOIMMUNOASSAY RESULTS - 1977-1978

I. Report to the South Pacific Commission on radioimmunoassay testing of fishes from Tahiti and from fishes, Hawaii State Board of Health.

II. Results summarized in table of RIA testing of documented clinically confirmed ciguatera poisoning from various parts of the country.

III. Results summarized in table of fishes from National Marine Fishery Service, U.S.G.

IV. Results of fishes from Division of Fish and Game, State of Hawaii.
Report to SPC

Radioimmunoassay Testing of Fish for Ciguatoxin

This report encompasses results of two areas of study with the newly developed radioimmunoassay (1) for the detection of ciguatoxin:

1. Examination of fishes from Tahiti.
2. Routine testing of Seriola dumerili (Risso) - Kahala.

1. Tahiti fishes:

The radioimmunoassay (RIA) test results in detail on the fishes from Tahiti are listed in table 1 together with the tests (Cat, MLD, and Mu) carried out by the Institut De Recherches Medicales, "Louis Malarde" in Tahiti. Comparisons of the RIA, MLD and Mu values are shown in figures 1 and 2 respectively. The calculated coefficient of correlation values ($r = -0.545$ for RIA versus MLD, and $r = 0.564$ for RIA versus Mu) suggest moderate to good correlation between these tests. There is no doubt, however, that the RIA test has greater sensitivity which accounts for the lack of an excellent correlation. It remains to be determined whether the detected levels of ciguatoxin by the RIA test is specific. Nonetheless, the RIA test can distinguish a toxic from a non-toxic fish. The Tahiti findings are similar to the eel's from Johnston Island (see reference 1).

2. Hawaiian fishes:

The RIA results of these preliminary examination are shown in table 2 for Kahala routinely caught and sold commercially. Table 2 also include results of recent suspected cases of ciguatera toxicity in Hawaii.

Reference:

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>RIA: cpm/gm tissue</th>
<th>Cat</th>
<th>MLD</th>
<th>M.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3868</td>
<td>355,938</td>
<td>0</td>
<td>&gt;1800</td>
<td>&lt;0.75</td>
</tr>
<tr>
<td>3864</td>
<td>338,622</td>
<td>0</td>
<td>&gt;2200</td>
<td>&lt;0.85</td>
</tr>
<tr>
<td>3869</td>
<td>371,578</td>
<td>0</td>
<td>2200</td>
<td>0.77</td>
</tr>
<tr>
<td>3868</td>
<td>361,349</td>
<td>0</td>
<td>&gt;2200</td>
<td>&lt;0.90</td>
</tr>
<tr>
<td>3859</td>
<td>423,426</td>
<td>0</td>
<td>1000</td>
<td>1.48</td>
</tr>
<tr>
<td>3857</td>
<td>338,451</td>
<td>0</td>
<td>2000</td>
<td>0.95</td>
</tr>
<tr>
<td>3867</td>
<td>353,345</td>
<td>0</td>
<td>&gt;1700</td>
<td>&lt;0.81</td>
</tr>
<tr>
<td>3862</td>
<td>372,146</td>
<td>0</td>
<td>&gt;1600</td>
<td>&lt;0.81</td>
</tr>
<tr>
<td>3872</td>
<td>370,740</td>
<td>0</td>
<td>&gt;2400</td>
<td>&lt;0.84</td>
</tr>
<tr>
<td>3879</td>
<td>355,306</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3885</td>
<td>450,100</td>
<td>5A4</td>
<td>900</td>
<td>1.45</td>
</tr>
<tr>
<td>3884</td>
<td>419,868</td>
<td>1T4</td>
<td>600</td>
<td>2.08</td>
</tr>
<tr>
<td>3878</td>
<td>374,938</td>
<td>0</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>3886</td>
<td>358,043</td>
<td>5A5</td>
<td>3000</td>
<td>0.99</td>
</tr>
<tr>
<td>3863</td>
<td>378,025</td>
<td>0</td>
<td>&gt;2200</td>
<td>0.85</td>
</tr>
<tr>
<td>3842</td>
<td>520,589</td>
<td>0</td>
<td>800</td>
<td>2.26</td>
</tr>
<tr>
<td>3855</td>
<td>430,510</td>
<td>1T4</td>
<td>400</td>
<td>3.0</td>
</tr>
<tr>
<td>3873</td>
<td>390,025</td>
<td>5T5</td>
<td>1500</td>
<td>1.5</td>
</tr>
<tr>
<td>3731</td>
<td>498,768</td>
<td>5T5</td>
<td>850</td>
<td>2.7</td>
</tr>
<tr>
<td>3837</td>
<td>476,545</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3893</td>
<td>368,530</td>
<td>2T5</td>
<td>1800</td>
<td>0.88</td>
</tr>
<tr>
<td>3864</td>
<td>344,669</td>
<td>0</td>
<td>&gt;2100</td>
<td>&lt;0.85</td>
</tr>
<tr>
<td>3892</td>
<td>402,718</td>
<td>0</td>
<td>1000</td>
<td>2.29</td>
</tr>
<tr>
<td>3888</td>
<td>368,222</td>
<td>0</td>
<td>1500</td>
<td>0.80</td>
</tr>
<tr>
<td>3849</td>
<td>481,523</td>
<td>1T2</td>
<td>1000</td>
<td>2.22</td>
</tr>
<tr>
<td>3874</td>
<td>344,173</td>
<td>0</td>
<td>2400</td>
<td>0.81</td>
</tr>
<tr>
<td>3876</td>
<td>404,076</td>
<td>1T3</td>
<td>1300</td>
<td>1.5</td>
</tr>
<tr>
<td>3836</td>
<td>508,742</td>
<td>1T3</td>
<td>600</td>
<td>3.18</td>
</tr>
<tr>
<td>3858</td>
<td>328,419</td>
<td>0</td>
<td>&gt;2000</td>
<td>&lt;0.89</td>
</tr>
<tr>
<td>3865</td>
<td>405,106</td>
<td>0</td>
<td>&gt;3000</td>
<td>&lt;0.80</td>
</tr>
<tr>
<td>B-549</td>
<td>509,272</td>
<td>1T4</td>
<td>150</td>
<td>10.0</td>
</tr>
<tr>
<td>3844</td>
<td>574,241</td>
<td>2T2</td>
<td>3000</td>
<td>0.92</td>
</tr>
<tr>
<td>B-548</td>
<td>431,987 (low)</td>
<td>1T4</td>
<td>150</td>
<td>10.0</td>
</tr>
<tr>
<td>3829</td>
<td>609,793</td>
<td>0</td>
<td>200</td>
<td>6.26</td>
</tr>
<tr>
<td>3866</td>
<td>403,561</td>
<td>0</td>
<td>&gt;2000</td>
<td>&lt;0.80</td>
</tr>
<tr>
<td>E6</td>
<td>493,767</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E8</td>
<td>355,031</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E9</td>
<td>393,041</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3827</td>
<td>404,754</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3889</td>
<td>395,935</td>
<td>0</td>
<td>2800</td>
<td>0.82</td>
</tr>
<tr>
<td>3852</td>
<td>524,820</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3900</td>
<td>428,136</td>
<td>5T3</td>
<td>1300</td>
<td>0.83</td>
</tr>
<tr>
<td>3871</td>
<td>421,867</td>
<td>2T5</td>
<td>800</td>
<td>2.41</td>
</tr>
<tr>
<td>3891</td>
<td>497,450</td>
<td>5A2</td>
<td>180</td>
<td>9.22</td>
</tr>
<tr>
<td>3887</td>
<td>428,058</td>
<td>5T5</td>
<td>800</td>
<td>1.34</td>
</tr>
<tr>
<td>3882</td>
<td>443,664</td>
<td>5T5</td>
<td>600</td>
<td>2.32</td>
</tr>
<tr>
<td>3856</td>
<td>413,444</td>
<td>0</td>
<td>1500</td>
<td>1.14</td>
</tr>
<tr>
<td>3875</td>
<td>528,111</td>
<td>1T4</td>
<td>600</td>
<td>3.2</td>
</tr>
<tr>
<td>B-545</td>
<td>842,776</td>
<td>1T4</td>
<td>150</td>
<td>10.0</td>
</tr>
<tr>
<td>3831</td>
<td>484,271</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3896</td>
<td>462,928</td>
<td>0</td>
<td>1800</td>
<td>0.9</td>
</tr>
<tr>
<td>E4</td>
<td>516,589</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>632,706</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. RIA of Tahitian Fishes

Radioimmunoassay test | Tahiti Tests
<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Radioimmunoassay test</th>
<th>Tahiti Test(s)</th>
<th>Page 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RIA: cpm/gm tissue</td>
<td>Cat</td>
<td>MLD</td>
</tr>
<tr>
<td>3877</td>
<td>522,661</td>
<td>4T2</td>
<td>225</td>
</tr>
<tr>
<td>3733</td>
<td>495,490</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3833</td>
<td>629,630</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>564,316</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E7</td>
<td>579,352</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3846</td>
<td>769,621</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3826</td>
<td>803,630</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3830</td>
<td>613,268</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3839</td>
<td>468,467</td>
<td>2T5</td>
<td>100</td>
</tr>
<tr>
<td>3840</td>
<td>382,445</td>
<td>0</td>
<td>&gt;1500</td>
</tr>
<tr>
<td>B-544</td>
<td>922,774</td>
<td>1T4</td>
<td>150</td>
</tr>
<tr>
<td>B-547</td>
<td>1,056,457</td>
<td>1T4</td>
<td>150</td>
</tr>
<tr>
<td>3880</td>
<td>607,522</td>
<td>2T4</td>
<td>1000</td>
</tr>
<tr>
<td>3847</td>
<td>758,165</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3734</td>
<td>439,463</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3853</td>
<td>493,866</td>
<td>0</td>
<td>&gt;1500</td>
</tr>
<tr>
<td>3845</td>
<td>714,156</td>
<td>1T2</td>
<td>2000</td>
</tr>
<tr>
<td>3895</td>
<td>488,869</td>
<td>2T2</td>
<td>600</td>
</tr>
<tr>
<td>3899</td>
<td>487,333</td>
<td>2T4</td>
<td>800</td>
</tr>
<tr>
<td>3854</td>
<td>413,470</td>
<td>0</td>
<td>&gt;1200</td>
</tr>
<tr>
<td>3832</td>
<td>487,043</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3728</td>
<td>525,567</td>
<td>0</td>
<td>&gt;2200</td>
</tr>
<tr>
<td>3730</td>
<td>519,500</td>
<td>0</td>
<td>&gt;2200</td>
</tr>
<tr>
<td>3851</td>
<td>565,867</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3861</td>
<td>708,937</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3732</td>
<td>579,087</td>
<td>1T4</td>
<td>500</td>
</tr>
<tr>
<td>3735</td>
<td>714,442</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3835</td>
<td>737,935</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3883</td>
<td>582,344</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>3898</td>
<td>593,448</td>
<td>3T5</td>
<td>210</td>
</tr>
<tr>
<td>3828</td>
<td>719,081</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3841</td>
<td>345,278</td>
<td>0</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>3848</td>
<td>656,358</td>
<td>2T5</td>
<td>200</td>
</tr>
<tr>
<td>3736</td>
<td>457,217</td>
<td>0</td>
<td>2500</td>
</tr>
<tr>
<td>3850</td>
<td>751,119</td>
<td>1T4</td>
<td>400</td>
</tr>
<tr>
<td>3894</td>
<td>650,019</td>
<td>1T2</td>
<td>1000</td>
</tr>
<tr>
<td>3838</td>
<td>650,939</td>
<td>2T5</td>
<td>50</td>
</tr>
<tr>
<td>3881</td>
<td>507,740</td>
<td>1T4</td>
<td>40</td>
</tr>
<tr>
<td>3897</td>
<td>536,324</td>
<td>0</td>
<td>1000</td>
</tr>
<tr>
<td>3870</td>
<td>464,832</td>
<td>3T5</td>
<td>1000</td>
</tr>
<tr>
<td>3890</td>
<td>620,800</td>
<td>2T3</td>
<td>350</td>
</tr>
</tbody>
</table>
RIA vs MLD

\[ r = -0.545 \]

- = mean value
Figure 2

RIA vs M.U.

n = 0.564

CPM/gm tissue x 10^4

M. U. Tahiti
### TAHITI STUDIES

<table>
<thead>
<tr>
<th></th>
<th>Cat vs MLD</th>
<th>Cat vs M.U.</th>
<th>MLD vs M.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of correlation ($r$)</td>
<td>-0.625</td>
<td>0.41</td>
<td>-0.64</td>
</tr>
</tbody>
</table>

### Radioimmunoassay Studies

<table>
<thead>
<tr>
<th></th>
<th>RIA vs Cat</th>
<th>RIA vs M.U.</th>
<th>RIA vs MLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of correlation ($r$)</td>
<td>0.394</td>
<td>0.564</td>
<td>-0.545</td>
</tr>
</tbody>
</table>
Table 2. Radioimmunoassay Examination of Hawaiian Fishes and Clinically Suspected Ciguatera Poisoning.

<table>
<thead>
<tr>
<th>Sample no.</th>
<th>cpm/gm tissue</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kahala (United Fish Agency) weight(lbs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H-1</td>
<td>291,833</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>297,391</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>320,124</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>306,124</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>348,481</td>
<td>41</td>
</tr>
<tr>
<td>6</td>
<td>378,139</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>341,599</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>332,535</td>
<td>22</td>
</tr>
<tr>
<td>9</td>
<td>266,951</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>359,798</td>
<td>19</td>
</tr>
<tr>
<td>11</td>
<td>332,829</td>
<td>16</td>
</tr>
<tr>
<td>12</td>
<td>278,931</td>
<td>15</td>
</tr>
<tr>
<td>13</td>
<td>363,460</td>
<td>16</td>
</tr>
<tr>
<td>14</td>
<td>323,668</td>
<td>12</td>
</tr>
<tr>
<td>15</td>
<td>334,140</td>
<td>20</td>
</tr>
</tbody>
</table>

Fish from Hawaii State laboratory

<table>
<thead>
<tr>
<th></th>
<th>cpm/gm tissue</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-4977</td>
<td>463,039</td>
<td>suspected ciguatera poisoning (Uhu)</td>
</tr>
<tr>
<td>Anjo</td>
<td>524,106</td>
<td>suspected ciguatera poisoning (fish?)</td>
</tr>
<tr>
<td>H-16</td>
<td>463,636</td>
<td>suspected ciguatera poisoning (rainbow fish)</td>
</tr>
<tr>
<td>Kuroda</td>
<td>375,781</td>
<td>suspected ciguatera poisoning (grouper?)</td>
</tr>
</tbody>
</table>
### RIA RESULTS OF FISHES FROM CLINICALLY CONFIRMED CIGUATERA POISONING

<table>
<thead>
<tr>
<th>No. of Samples</th>
<th>CPM/GM Tissue</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>370,597 - 711,346 (483,455 ± 79,830)</td>
<td>Positive</td>
</tr>
</tbody>
</table>

**Fishes:** Cheilinus rhodochrous, parrot fish, rainbow runner, Caranx cheilios, Seriola dumerili, amberjack, Epinephelus mario.

**Sources:** Hawaii State Health, California State Health (Midway fishes); Virgin Islands, and State Health, Florida.
Table 2. Clinical confirmed Ciguatoxin poisoning

<table>
<thead>
<tr>
<th>Source</th>
<th>no. individuals</th>
<th>fish</th>
<th>cpm/gm. tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Health Department (Kona)</td>
<td>8(2 cats)</td>
<td>C. rhodochrous (po'ou)</td>
<td>1. 583,422</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wrasse</td>
<td>2. 429,489</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. 419,822</td>
</tr>
<tr>
<td>State Health</td>
<td>family</td>
<td>parrot fish (uhu)</td>
<td>463,039</td>
</tr>
<tr>
<td>State Health</td>
<td>family</td>
<td>?</td>
<td>524,106</td>
</tr>
<tr>
<td>State Health</td>
<td>family</td>
<td>Rainbow</td>
<td>463,636</td>
</tr>
<tr>
<td>State California</td>
<td>8-9 persons</td>
<td>Carnx Cheilio</td>
<td>497,406</td>
</tr>
<tr>
<td>fishes caught</td>
<td></td>
<td></td>
<td>711,346</td>
</tr>
<tr>
<td>near Midway samples</td>
<td></td>
<td></td>
<td>370,597</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>505,779</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>492,634</td>
</tr>
<tr>
<td>State Health</td>
<td>family</td>
<td>Uhu</td>
<td>421,064</td>
</tr>
<tr>
<td>State Health</td>
<td>family</td>
<td>kahala</td>
<td>415,870</td>
</tr>
<tr>
<td>State Health</td>
<td>family</td>
<td>kahala</td>
<td>549,938</td>
</tr>
<tr>
<td>West Indies</td>
<td>6</td>
<td>Seriola dumerili</td>
<td>545,534</td>
</tr>
<tr>
<td>Midway</td>
<td>4</td>
<td>amberjack</td>
<td>447,045</td>
</tr>
<tr>
<td>Miami, Florida: Dade County</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dept. Public Health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sample 1</td>
<td>6</td>
<td>Epinephelus mario</td>
<td>479,339</td>
</tr>
<tr>
<td>2*</td>
<td>15</td>
<td></td>
<td>375,189</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td></td>
<td>490,392</td>
</tr>
</tbody>
</table>
* These individuals ate stew prepared from several grouper heads and backbones (weighing 20-30 lbs.). Question is whether all the fishes were toxic or not and whether the fish tissue (flesh) we received came from a toxic fish head or backbone is uncertain.
<table>
<thead>
<tr>
<th>No. of Samples</th>
<th>Tissues Examined Side (Fillet)</th>
<th>Percentage</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>189,067 - 348,256</td>
<td>92.5</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>(274,738 ± 38,195)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>356,993 - 382,338</td>
<td>5.0</td>
<td>Borderline</td>
</tr>
<tr>
<td></td>
<td>(364,892 ± 11,998)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>400,794 - 406,436</td>
<td>2.5</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>(403,615 ± 3,989)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Samples</td>
<td>Tissues Examined</td>
<td>Bell Area</td>
<td>Percentage</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>------------</td>
</tr>
<tr>
<td>58</td>
<td>168,467 - 350,333</td>
<td>(298,429 ± 25,907)</td>
<td>92.0</td>
</tr>
<tr>
<td>2</td>
<td>373,111 - 383,981</td>
<td>(378,546 ± 7,686)</td>
<td>3.2</td>
</tr>
<tr>
<td>3</td>
<td>414,157 - 511,500</td>
<td>(459,511 ± 49,009)</td>
<td>4.8</td>
</tr>
</tbody>
</table>
### RIA RESULTS OF FISH TISSUES
**SURVEY OF LEEWARD ISLANDS**
**NATIONAL MARINE FISHERY SERVICE**

<table>
<thead>
<tr>
<th>No. of Samples</th>
<th>Tissues Examined</th>
<th>Percentage</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>138,267 - 326,067</td>
<td>67.2</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>(240,639 ± 45,422)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.7</td>
<td>357,333 - 399,966</td>
<td>12.1</td>
<td>Borderline</td>
</tr>
<tr>
<td></td>
<td>(376,368 ± 15,893)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>410,143 - 720,489</td>
<td>20.7</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>(475,116 ± 84,938)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RIA RESULTS OF *CARANGOIDES AJAX*
Obtained from French Frigate, Maro Reef, Laysan, Lisianski, Pearl and Hermes

DIVISION OF FISH AND GAME, STATE OF HAWAII

<table>
<thead>
<tr>
<th>No. of Samples</th>
<th>CPM/G Tissue Range</th>
<th>Results</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>204,034 - 344,253</td>
<td>Negative</td>
<td>78.4</td>
</tr>
<tr>
<td>5</td>
<td>356,996 - 392,110</td>
<td>Borderline</td>
<td>16.1</td>
</tr>
<tr>
<td>2'</td>
<td>404,050 - 433,000</td>
<td>Positive</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Weight of samples from 2.5 to 85.0 lbs.
### R1A RESULTS OF CHEILINUS RHODOCHROUS ROUTINELY OBTAINED

**DIVISION OF FISH AND GAME, STATE OF HAWAII**

<table>
<thead>
<tr>
<th>No. of Samples</th>
<th>CPM/GM Tissue Range</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>297,051 - 320,987</td>
<td>Negative</td>
</tr>
<tr>
<td>2</td>
<td>351,254 - 376,084</td>
<td>Borderline</td>
</tr>
<tr>
<td>10</td>
<td>402,450 - 549,758</td>
<td>Positive</td>
</tr>
</tbody>
</table>

Weights of fishes 0.2 to 2.2 lbs.; samples from French Frigate, Lisianki, Maro Reef and the majority from Pearl and Hermes (8).
COEFFICIENT OF CORRELATION VALUES
AS DETERMINED BY LINEAR REGRESSION
ANALYSIS FOR CHEILINUS RHODOCHROUS*

<table>
<thead>
<tr>
<th>No. of Fishes</th>
<th>Source</th>
<th>Length vs. RIA</th>
<th>Weight vs. RIA</th>
<th>Coefficient of Correlation=R</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Lisianski</td>
<td>0.41</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Pearl and Hermes</td>
<td>0.79</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>12 (total)</td>
<td></td>
<td>0.66</td>
<td>0.61</td>
<td></td>
</tr>
</tbody>
</table>

*Though the number of fishes are small from each source, a fairly good correlation exists between RIA vs. length and RIA vs. weight of fish in the total cumulative analysis.
### RIA RESULTS OF OUTBREAK OF KAILUA-KONA CIGUATERA POISONING FROM CHEILINUS RHODOCHROUS

**STATE HEALTH DEPARTMENT**

<table>
<thead>
<tr>
<th>No. of Samples</th>
<th>CPM/G Tissue Range</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>330,000 - 350,000</td>
<td>Negative</td>
</tr>
<tr>
<td>5</td>
<td>354,000 - 394,155</td>
<td>Borderline</td>
</tr>
<tr>
<td>3</td>
<td>419,822 - 583,422</td>
<td>Positive</td>
</tr>
</tbody>
</table>

Weight of fishes ranged from 1/2 to 5 lbs. All caught in the same location - Kawaihae. Eight individuals (ate body and head) and two cats (ate stomach and other organs) were affected.