General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.
28990 Investigation of Environmental Change Pattern in JAPAN

A Study on Change of Environmental Condition of ISE BAY USING LANDSAT DATA

Dr. Takakazu MARUYASU
Principal Investigator

Science University of TOKYO

Noda City, Chiba Prefecture, Japan

Quarterly Report

May 10, 1976
A Study on Change of Environmental Condition of Ise Bay Using LANDSAT 2 Data

Dr. Takakazu MARUYASU
Professor
Science University of Tokyo
Noda City, Chiba Prefecture, JAPAN

1. Introduction

Ise Bay plays a very important role in the Central Japan. It is an indispensable existence for the people who live in the area centering around Nagoya.

Needless to say, the Bay has a limited space, therefore, its efficient utilization under strict restriction and order is required. As matter of fact, there have already occurred some environmental problems that must be urgently solved.

Many investigators and researchers were made mainly from the viewpoints of draining from chemical factories and power stations in and around that area, and of urban drainages from Nagoya and other cities.

Lately, however, it is recognized to be very important to observe the problem more widely in the relation to the Nobi Plain stretching behind the area, and to the three big rivers of Kiso, Nagara, and Ibi, running through the plain.

In the Nobi Plain, which is the second large plain in Japan, the natural environment has been greatly transformed by the remarkable urbanization and the change of agricultural method.

In this present circumstances, LANDSAT DATA becomes to play an important part decidedly. We have recently started investigation and analysis as to how different data we can get according to the reasons using LANDSAT 1 and 2 materials of this area.
2. Techniques

In order to promote this research, we firstly intend to collect the obtained by now, and compare them with the LANDSAT data. The outline of data obtained is following:
1. DATA OF ISE BAY

Total Area : 330 sq.km. Total Volume: Fifty Billion M (assumed average depth as 15m)

Volume of Sea Water going in and out in each Tide: Eight Billion M

This corresponds to 1/6 of total volume of Ise Bay.

2. DATA OF THE THREE PREFECTURES LOCATED AROUND ISE BAY

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Total Area</th>
<th>Forest</th>
<th>Paddy Field</th>
<th>Population</th>
<th>Industrial Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIE</td>
<td>4690</td>
<td>81.3</td>
<td>1758</td>
<td>75.6</td>
<td>633</td>
</tr>
<tr>
<td>GIFU</td>
<td>7409</td>
<td>69.9</td>
<td>6109</td>
<td>69.7</td>
<td>579</td>
</tr>
<tr>
<td>AICHI</td>
<td>5064</td>
<td>100</td>
<td>2441</td>
<td>100</td>
<td>888</td>
</tr>
<tr>
<td>TOTAL</td>
<td>17163</td>
<td>79.9</td>
<td>10308</td>
<td>76.1</td>
<td>2178</td>
</tr>
</tbody>
</table>

RATIO TO THE COUNTRY: 4.6% 24.6% 24.6 8.0%

3. Main Rivers flowing into the Ise Bay

<table>
<thead>
<tr>
<th>Name of River</th>
<th>Catchment Area KM</th>
<th>Max. Discharge M³/S</th>
<th>Droughty Discharge M³/S</th>
<th>Mean Discharge M³/S</th>
<th>Discharge per Day million t</th>
<th>Discharge per Year billion t</th>
</tr>
</thead>
<tbody>
<tr>
<td>KISO</td>
<td>5275</td>
<td>14000</td>
<td>68</td>
<td>240</td>
<td>20</td>
<td>7.5</td>
</tr>
<tr>
<td>Nagara</td>
<td>1985</td>
<td>4500</td>
<td>12</td>
<td>103</td>
<td>9</td>
<td>3.2</td>
</tr>
<tr>
<td>Ibi</td>
<td>1840</td>
<td>7000</td>
<td>16</td>
<td>108</td>
<td>9</td>
<td>3.4</td>
</tr>
<tr>
<td>Yahagi</td>
<td>1830</td>
<td>4700</td>
<td>19</td>
<td>55</td>
<td>5</td>
<td>1.7</td>
</tr>
<tr>
<td>Toyo</td>
<td>703</td>
<td>3800</td>
<td>4</td>
<td>37</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Miya &amp; Others</td>
<td>---</td>
<td>---</td>
<td>20</td>
<td>60</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>Total</td>
<td>---</td>
<td>193</td>
<td>603</td>
<td>51</td>
<td>18.8</td>
<td></td>
</tr>
</tbody>
</table>

Mean of Total Discharge per Day is 5.1 million tons per Day

This corresponds to 1.0% of the total volume of ISE BAY

Mean of total annual discharge is about 18.8 billion tones and this is 38% of the volume of Ise Bay.
VECTOR OF THE STRONGEST STREAM TOWARD NORTH-WEST THROUGH THE IRAKO CHANNEL
VECTOR OF THE STRONGEST STREAM TOWARD SOUTH-EAST THROUGH IRAKO CHANNEL

LEGEND
- MEASURED
- ESTIMATED
UNIT: MI./hr
Source of Pollution

**Domestic Drainage**

- Sewage: N 11g/day, P: 0.9 g/day
- Synthetic Detergent: 15 g/day for each person
- Estimated P content in detergent is 6%. Total sewage of one person will be N: 11g/day, P: 1.8 g/day.
- As a population along Ise Bay is about 7.72 million, total sewage will be N: 85 ton/day, P: 14 ton/day

**Cattle**

- Cow: N: 280g/day, P: 56g/day
- Pig: N: 31g/day, P: 20 g/day

In case of cow, 90% of P will be restored and used as a compost.

**Forest**

Due to the deterioration of all living things, N and P are produced and drained into the river.
- N: 1.9kg/day/km, P: 0.05 kg/day/km
- Total area: 13500 km

**Industrial Drainage**

Pollutant materials largely vary with the kind of works:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Processing work of farm products</th>
<th>Slaughterhouse work</th>
<th>Leather work</th>
<th>Beer work</th>
<th>Paper work</th>
<th>Dyed work</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD ppm</td>
<td>200-300</td>
<td>838</td>
<td>296</td>
<td>611</td>
<td>2500</td>
<td>1020</td>
</tr>
<tr>
<td>N ppm</td>
<td>20-80</td>
<td>145</td>
<td>57</td>
<td>156</td>
<td>50</td>
<td>7</td>
</tr>
<tr>
<td>P ppm</td>
<td>1-80</td>
<td>8</td>
<td>--</td>
<td>20</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Industrial sewage is estimated totally 17 million ton/day.

**Paddy Field**

Annual consumption of fertilizer is annually:
- MIE Prefecture: 180 thousand ton
- Gifu Prefecture: 165 thousand ton
- Aichi Prefecture: 255 thousand ton
- Total: 500 thousand ton

Suitable fertilization: Kalium perphosphoric acid and Nitrogen compound each 100kg/ha, Kalium compound 90kg/ha

Due to these fertilizers, content of N in each ha will be 20 kg/ha and P will be 40 kg.

In a early time, nitrogen will remain as Nitrigan acid state, thereafter these change to Ammonium state and will be absorbed to bacterial algae.

Loss of fertilizer is estimated N: 25%, P: 5%.
EQUAL THICKNESS LINE OF SLUDGE SEDIMENTATION

RIVER OF KISO

NAGOYA

YOKKAICHI

AICHI PREF.

CHITA PEN.

RIVER OF KIKAI

MIKAWA BAY

ATSUMI PEN.

PACIFIC OCEAN

MEASRED POINT

I'SE BAY

ISE

SHIMA PEN.
RECORD OF RED TIDE

Red tide appeared about 214 times within a period of 1971-74, and distinctly concentrated near Nagoya harbour, Yokkaichi and Tsu, Kinuura bay and coast of Gamagori. And red tide occurred at all season except a very short period of winter, but much occurrence can be seen in a season of high temperature and low water.

DISTRIBUTION OF FREQUENCY OF RED TIDE

1972.3.18-11.20.

- MORE THAN 20 TIMES
- 10-20 TIMES
- 5-9 TIMES
- 1-4 TIMES
DISTRIBUTION OF RED TIDE IN ISE BAY (1972)

Early of APRIL

Nagoya
Yokkaichi
Suzuka

Gamagori
Toyohashi
Mikawa Bay

MIDDLE OF MAY

Nagoya
Yokkaichi
Suzuka

Gamagori
Toyohashi
Mikawa Bay