FOOD HABITS OF THE COHO SALMON, 
**ONCORHYNCHUS KISUTCH**, IN LAKE MICHIGAN

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**ABSTRACT**

The stomach contents of thirty-six coho salmon, *Oncorhynchus kisutch*, taken from southern Lake Michigan were examined. The contents were identified and the numerical and volumetric methods used to analyze the data. The results indicated that the coho salmon in Lake Michigan is primarily piscivorous. Fish comprised 96.9 percent by volume of the coho's diet and the alewife accounted for 62 percent of the total stomach contents. Other items included in the coho's diet were smelt, stickleback and insects.

**INTRODUCTION**

The coho salmon, *Oncorhynchus kisutch*, were stocked in Lake Michigan in the spring of 1966 by the Michigan Department of Natural Resources (Borgeson, 1970). They were stocked in the lake to serve as a predator on the alewife and to convert their fish flesh into a valuable sport fishery. Since the 1950's, the alewife population in Lake Michigan has increased dramatically. The increase in the alewife population followed the decline and virtual extinction of the lake trout as a result of changing lake conditions and to the marine lamprey. As often happens, when a top predator is lost from an ecosystem, the organism that had served as its prey increased unchecked. It was hoped that coho stocked in the lake would replace the lake trout as one of the top predators and would help to control the alewife population. The objectives of this study were to determine the food habits of the coho in Lake Michigan and to determine whether the coho were in fact preying upon the alewife.

**MATERIALS AND METHODS**

The stomach contents of thirty-six coho salmon were examined. The coho were caught by gill net in Illinois waters of Lake Michigan between March 28 and May 1, 1968. Two main collections were made, one on April 11, 1968 and the other on April 22, 1968. The stomachs were removed by severing the gullet and the intestine behind the pyloric caeca and then placed in 10% formalin. A binocular microscope was used to identify the stomach contents.
Contents rendered unrecognizable either through mastication or digestion were classed as unidentifiable. The quantitative analysis was done by water displacement in which the volume of each item of food was expressed as a percentage of total volume of stomach contents. The frequency of occurrence was recorded as the number of samples in which each food item occurred and as a percentage of the total number of specimens which contained food. The relative importance of each food item was also determined using the numerical method. The results were reported as a percentage of the total number of organisms consumed (Lagler, 1956).

RESULTS

The coho salmon in Lake Michigan was mainly piscivorous and fish comprised 96.86 percent by volume of their diet (Table 1).

![Figure 1](image)

**Figure 1.** Percent of total, by volume which each food item contributed to the diet of the coho salmon taken from southern Lake Michigan during the spring of 1968.
Alewives comprised 62 percent of the total volume followed by smelt with 17 percent (Fig. 1). Stickleback and other fishes made up an additional 18 percent whereas insects were of minor importance, less than one percent (Fig. 1). Alewives were found in 50 percent of the stomachs which contained food (Fig. 2) and accounted for the largest amount of food by volume (Table 1). They were not, however, the most numerous organism in the stomach but this was due to the fact that two coho stomachs contained many small smelt. In addition to alewife and smelt, the cohos also consumed several sticklebacks. These three species were the only species of identifiable fish found in the cohos’ stomachs.

**DISCUSSION**

It was found that 14 stomachs or 38.9 percent were empty. This was considered a rather high proportion of empty stomachs. LeBrasseur (1966) caught four species of Pacific salmon in gill nets set for 10-hour periods (overnight). He analyzed the stomach

![Graph](image)

**Figure 2.** Frequency of occurrence of each food item in the diet of the coho salmon taken from southern Lake Michigan during the spring of 1968.
<table>
<thead>
<tr>
<th>Item</th>
<th>% of Stomachs with Item</th>
<th>% of Total Organisms by Number</th>
<th>% of Total Volume by Volume</th>
<th>% of Fish Consumed by Volume</th>
<th>% of Fish Consumed by Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alewife</td>
<td>11</td>
<td>50.00%</td>
<td>132.4</td>
<td>21.05%</td>
<td>62.01%</td>
</tr>
<tr>
<td>Sardine</td>
<td>13</td>
<td>13.63%</td>
<td>45.61</td>
<td>8.77</td>
<td>17.14%</td>
</tr>
<tr>
<td>Stickleback</td>
<td>15</td>
<td>13.63%</td>
<td>13.1</td>
<td>8.77</td>
<td>17.14%</td>
</tr>
<tr>
<td>Smelt</td>
<td>12</td>
<td>13.63%</td>
<td>24.78</td>
<td>8.77</td>
<td>17.14%</td>
</tr>
<tr>
<td>Skeleton</td>
<td>2</td>
<td>50.00%</td>
<td>3.50</td>
<td>8.77</td>
<td>17.14%</td>
</tr>
<tr>
<td>Insecta</td>
<td>2</td>
<td>9.09%</td>
<td>9.09</td>
<td>8.77</td>
<td>17.14%</td>
</tr>
<tr>
<td>Unidentified</td>
<td>3</td>
<td>22.72%</td>
<td>22.72</td>
<td>8.77</td>
<td>17.14%</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td></td>
<td>213.5</td>
<td>99.98</td>
<td>99.98</td>
</tr>
</tbody>
</table>

**Total Number Stomachs Examined**: 36
**Stomachs Empty**: 14
**Stomachs with Food**: 22

**Volume of Fish and Fish Parts**: 206.8 cc

**Volume of Fish** and **Fish Parts**: 96.96%
contents of the four species and found that the coho had the highest incidence of empty stomachs, up to 43 percent whereas the chum salmon had the least, only three percent. LaBrasseur (1966) postulated that chum fed early in the evening as the nets were being set whereas pink, coho and sockeye tended to feed in early morning about the time the nets were being retrieved.

In Lake Michigan the principle food of the coho was fish, (96.86 percent) whereas in other studies crustaceans and insects formed a much greater share of the coho’s diet. Stanley (1937), Hasler (1938) and Hasler and Farner (1942) reported that the main foods of coho in Crater Lake, Oregon was daphnia, midges and caddis flies. The food of the coho salmon in certain Oregon streams consisted mainly of Diptera and Ephernormoptera (Rees, 1959). The principle food of the coho salmon in Cultus Lake, British Columbia (Ricker, 1946, 1952) was midges, particularly in the spring.

Most of the food studies of coho have been done on fish taken in open waters off the coast of Oregon and British Columbia. The diet of coho in the northeast Pacific consisted of squid, fish (including smelt, anchovies, herring, lantern fish, hake, whiting, other coho, black cod and rockfish) crustaceans such as amphipods, euphasids, and crab larvae, and jellyfish, (Prichard and Tester, 1943; Fraser, 1946; Oregon Fish Commission, 1949; Van Hyning, 1951; Prakash and Milne, 1958; Roos, 1960; Prakash, 1962; Reimers, 1964; LeBrasseur, 1966; Grinolds and Gilt, 1968; Manzer, 1968, 1969; Ueno, 1969).

The relative importance of each type of food depended on where the fish was caught and what was available in the environment at the time of capture. A number of the authors commented on the wide variety of food eaten by coho and expressed the idea that the coho is an opportunistic feeder, feeding upon what is available at the time (Prakash, 1962; Reimers, 1964; LaBrasseur, 1965).

LeBrasseur (1965) compared the diets of pink, sockeye, chum, coho and steelhead trout taken from different areas of the northeastern Pacific Ocean. He found more correlation of stomach contents among all species from one area than among members of one species taken from the four fishing areas. He also noted that a small change in the availability of some organisms could produce significant changes in the stomach contents.

In the present investigation, alewives made up a major portion of the stomach contents of the coho probably because they are opportunistic feeders and the alewife is the most abundant fish in Lake Michigan (Smith, 1968). Crustacea were an insignificant part of the diet of Lake Michigan coho as compared to Pacific
coho because the open lake lacks the numbers of crustacea that are present in the Pacific.

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BIBLIOGRAPHY


