The crawfish industry in the Pacific Northwest has had a very erratic history, with the commercial catch fluctuating greatly from year to year. During the late 1950's and early 1960's the harvest dropped to insignificance, but since the late 1960's large quantities have been shipped to Sweden. Success of the commercial crawfishery in California and the Northwest is now tied to this foreign market. Two other regions of the United States have also had large crawfish industries. These two areas--Wisconsin and Louisiana--illustrate how one crawfish industry has succeeded and one has failed, and they may offer clues to the future of the crawfish industry that is now so dynamic in California.

Development of the Crawfish Industry in the United States

Few people in the United States realize that crawfish are good to eat. Crawfish eating is an old custom in France, Sweden, and many other parts of Europe, but apparently was never accepted by the English. The English
brought their aversion for crawfish to this country, and the trait has been accepted by most Americans.

Crawfish have been taken commercially for purposes other than for food. In early spring, young crawfish are a valued bait for sport and commercial fishing in inland waters. Crawfish are also sold to high schools and colleges for use in courses in zoology. The vast majority of crawfish landed in the United States, however, are destined for human consumption.

Crawfish have been found in American markets more or less regularly since the early 1800's. In 1817 there were individuals along the Eastern Seaboard who ate crawfish, although crawfish were "not much sought after." These consumers were probably urban dwellers recently arrived from parts of Europe that had a crawfish-eating tradition.

The commercial sale of crawfish was first reported in 1880, with New York City the major market. Their primary use was as a garnish for fish dinners in restaurants. New Orleans and San Francisco were also reported to have small crawfish markets at this time. By the early 1900's a considerable crawfish industry had developed in Wisconsin, Louisiana, and the Pacific Northwest.

Wisconsin was the major American producer of crawfish in 1908, with 350,000 pounds landed that year. Their main use was as free lunches in saloons. They were probably being consumed by persons of Swedish descent, as the eating of crawfish while consuming alcohol is an old Swedish tradition. All saloons were closed during prohibition, and this apparently dealt a death blow to the industry, for it never recovered. However, crawfish were still being sold in Swedish restaurants in 1958.

The major producing area of the United States in recent years has been south Louisiana. The first European settlers into this region were the French, who considered
crawfish an important food. Crawfish are now regarded as a delicacy in this region, and are the basis of a multi-million dollar industry. Production fluctuates greatly, depending entirely on environmental conditions. Figures for total yearly catches are greatly underestimated, but a knowledgeable researcher has estimated that since 1965 the catch has averaged about 11,000,000 pounds per year, with about half produced on crawfish farms.

The Crawfish Industry in the Northwest

The state of Washington has had a small crawfish industry, although no figures exist for early years. Prior to 1961 the state did not tabulate landings, but estimated about 1,000 pounds annually, taken mostly by school children for sale to local restaurants. In 1961 a small commercial fishery began on a tributary of the Columbia River. It initially held promise of developing into a bona-fide industry, but the fisherman involved died, ending the industry in 1963. The opening of the Swedish market restimulated the crawfish industry in 1969, and in 1970 the state produced over 30,000 pounds. However, the industry ended as quickly as it began, with less than 1,000 pounds taken in 1974 (Table 1). It is estimated that Washington could produce up to 2,000,000 pounds annually, but state regulations, combined with lack of a local market and the inability of entrepreneurs and dealers to process crawfish to fit the Swedish market, has reduced the industry to almost zero.

Oregon traditionally has had the largest crawfish production in the Northwest, with much of the catch being consumed locally. A Portland restaurant specializing in crawfish, Jake's Famous Crawfish, has been in operation since 1892. In 1899 Portland was the center of the
### Table 1

**Crawfish Production in the Northwest, 1970-76**

<table>
<thead>
<tr>
<th>Year</th>
<th>Washington</th>
<th>Oregon</th>
<th>California</th>
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<tr>
<td>1970</td>
<td>31,198</td>
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<tr>
<td>1971</td>
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<tr>
<td>1974</td>
<td>984</td>
<td>12,094</td>
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</tr>
<tr>
<td>1975</td>
<td>2,753</td>
<td>26,559</td>
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</tr>
<tr>
<td>1976</td>
<td>5,172</td>
<td>11,916</td>
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</table>

Note: This table illustrates trends in the crawfish industry in the Northwest. Particularly noteworthy has been the tremendous growth of this industry in California in the past few years. The increase in production in Oregon in 1975 was largely a result of California dealers buying crawfish for export to Sweden. These buyers were unhappy with the small average size of the Oregon crawfish, and have stopped buying them.


Oregon - Commercial Food Fish Landings in Pounds Round Weight by State of Oregon, various years; E. Case, Assistant Business Manager, personal communication, 1977.

California - D. Osborne, Junior Aquatic Biologist, personal communication, 1977.
crawfish trade. A study of the Oregon industry the same year showed that crawfish were being consumed in homes, restaurants and, as in Wisconsin, in taverns. Crawfish were also being shipped long distances to consumers in Seattle, Tacoma, San Francisco, and as far east as Salt Lake City and St. Louis. The major producing area in 1899 as in recent times, was along the lower Columbia, the Willamette, and their tributaries.

Earliest Oregon statistics on this industry were for the early 1890's (Figure 1). Great annual fluctuations were not a result of local crawfish populations as was the case in Louisiana, but rather economic conditions such as price paid for crawfish, other available jobs, and the like. The State of Oregon kept no figures after 1956, but crawfish production apparently began a steady decline. By 1969 only 5,266 pounds were recorded as landed. As in Washington, the industry grew rapidly after 1970 with the opening of the Swedish market. In both 1970 and 1971 almost 40,000 pounds were landed, but in 1972 the figure was only 8,730 pounds. Since then, Oregon has gathered only a few crawfish annually, and it is not directly involved in the export of crawfish to Sweden.

California has traditionally had a small crawfish industry. Some crawfish have been consumed in San Francisco since the 1880's; however, most crawfish in the early years had to be imported. There are no crawfish native to California south of the Klamath River, with the possible exception of the Del River. The two crawfish species native to California are the small *Pacifastacus nigrescens* (Stimpson), and *Pacifastacus leniusculus* (Dana). *P. leniusculus* was introduced to many streams and has been very successful in northern California. The major crawfish in north central California is *Orconectes virilis* (Hagan), introduced from the Middle west, and in southern California
Figure 1. Crawfish production in Oregon, 1893-1956.

This graph illustrates the great fluctuations in crawfish production from one year to the next in Oregon. The catch is not based on availability of crawfish, but rather on economic conditions (the price of fish, availability of jobs, etc.). Source: Miller and Van Hyning (1970), p. 83.
the major species is *Procambarus clarki* (Girard), introduced from the American South.\textsuperscript{17}

There was little commercial crawfishing in California until 1970 when over 83,000 pounds of *P. leniusculus*, destined for the Swedish market, were landed.\textsuperscript{18} The export of crawfish to Sweden grew rapidly, and was soon big business; over half a million pounds were shipped to Sweden for both 1975 and 1976 (Table 1).

**The Exportation of Crawfish to Sweden**

Sweden began importing large numbers of crawfish in the 1970's (Figure 2). The people of Sweden have a tradition of crawfish consumption. Unfortunately, the crawfish plague fungus, *Aphanomyces* astaci, native only to North America, was introduced into northern Italy in the mid 1800's.\textsuperscript{19} The fungus soon swept across Europe and decimated crawfish populations. This plague is still spreading in Europe, and even with modern methods it is proving extremely difficult to control.\textsuperscript{20} The crawfish plague reached Sweden in 1907, exterminating local crawfish, including the "noble crawfish", *Astacus* astacus.\textsuperscript{21} With the decline of local crawfish populations the people of Sweden began importing crawfish, mostly from Eastern Europe.

The crawfish native to the Pacific Northwest (*Pacifastacus*) closely resembles the crawfish native to northern Europe. Since they bring good prices in Sweden (between $1.80 and $2.40 per pound processed), Northwest crawfish producers could stand the transport cost. Several entrepreneurs entered the promising business. Exporters from Oregon and Washington were important in developing this trade, but had backed out by 1972. Since then only California has exported crawfish to Sweden, and it has developed into a major industry.
Figure 2. Importation of crawfish to Sweden in metric tons, 1965-1976.

There are several problems facing the export of crawfish to Sweden. One is that all crawfish in Sweden are consumed between August 8th and August 23rd, the annual summer festival period. Crawfish are consumed in conjunction with, or as an excuse for consumption of, aquavit. When the two-week festival is over, the Swedes no longer eat crawfish. Americans tried to convince Swedish markets to handle crawfish for a longer period of time to broaden the consuming season, but the Swedes were offended by this idea. To the Swedes, crawfish remain an item to be eaten only at a crawfish party, known as a kräftskiva, in late summer.

Another major problem is that crawfish from the Northwest reach a prime condition in mid-June, leaving only five or six weeks of fishing prior to the August 8th beginning of the summer festival. The fishing season then continues into October, long after the Swedes have stopped eating crawfish. In the early 1970's crawfish were air freighted live to Sweden, but producers faced many physical and fiscal problems in ponding crawfish to accumulate tonnage for early August shipment. In addition, the Swedes attempted to protect their local industry by prohibiting entry of live crawfish prior to August 8th (so a few minutes prior to midnight on August 7th there would be several airplanes circling airports waiting for midnight so they could land--the earliest crawfish on the market always bring the best price). Live crawfish, however, are highly perishable, and mortality rates reached 80 percent on early shipments. With experience, this figure was brought down below 10 percent.

Today only a few crawfish are air freighted to Sweden. Almost all Pacific northwest crawfish destined for
the Swedish market are now cooked, vacuum packed in one kilo plastic bags with a brine made from dill and salt, pasteurized and quick frozen, and then shipped to Sweden by container-ship. Since the crawfish producing season in the Northwest and the consuming season in Sweden do not mesh, either the American suppliers or the Swedish distributors must have enough working capital to carry large inventories of frozen cooked crawfish for 10 to 12 months, adding greatly to the cost.

A final problem was competition from East Europeans (Table 2). The Swedes were not especially happy with crawfish from the Northwest and preferred the local variety. East European varieties (from Turkey, Russia, Yugoslavia, etc.) more closely resemble the Swedish crawfish and were better accepted. Exporters from the Northwest were trying to break into a long-established business, and East Europeans proved to be effective competitors. Turks, who consider crawfish inedible, have aggressively moved into the market and now almost completely dominate the industry. Other regions have tried to enter this business with little success. Businessmen from Louisiana attempted to sell crawfish to Sweden but their crawfish (*Procambarus*) tastes and looks different when compared with Swedish varieties, so were unacceptable on the Swedish market. Africans also tried to enter the trade, but had problems due to a lack of infrastructure and health standards. Australians are the most recent group to enter the business, but like Louisiana, their crawfish are "different" (for example, they have too hard a shell and are difficult to crack open).

Problems of Production

Problems dealing with regulations also affect the industry in the Northwest. A minimum legal size of 3 1/2 inches from the tip of the nose (acumen) to the tip of the
### Table 2

Swedish Crawfish Imports in Metric Tons, 1967-76

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Source: Official Statistics of Sweden - Foreign Trade, various dates.
tail (telson) is in effect in Oregon and Washington, while California has a minimum legal size of 3 5/8 inches (to comply with the Swedish regulation that no crawfish shorter than 90 mm. be sold). These regulations are compatible with the growth rate of crawfish in this region which take from two to three years to reach this size and be sexually mature. A small mesh trap is used in the Northwest and many undersized crawfish must be sorted manually, or by a recently developed device attached to the fishing boat. In most other parts of the world, as in Louisiana and Russia, a large mesh trap is used, and undersized crawfish are seldom taken. There are also restrictions in California limiting the areas that can be commercially crawfished, and a crawfish permit is required.

A serious problem existed in the state of Washington, where much of the crawfishery was in lakes. Lakefront property owners resented this commercial crawfishing, and the problem threatened to break into armed violence. A bill was proposed in the Washington State Legislature which would have outlawed all commercial crawfishing, but it was finally amended to allow a controlled fishery. This bill, passed in 1971, allowed commercial crawfishing on a permit basis only. Large-scale crawfishing ended in Washington soon after the bill was passed, so whether or not this bill would have solved the problems between fishermen and landowners is now academic.

Sweden at one time exported a substantial amount of crawfish, and the Swedes have a desire to at least supply their own needs. *Pacifastacus leniusculus*, a native to the Northwest, has been introduced to Swedish waters. This crawfish is generally plague-resistant and has successfully colonized areas where introduced. There is also the possibility that the local Swedish crawfish, *Astacus astacus* Linne, may someday develop a resistance to the plague and
repopulate Swedish waters. One way or another, the Swedes plan to be able to eventually supply their domestic needs for crawfish. If and when this happens the Swedish market will be lost to the Northwest.

Conclusions

The one great hope for this industry is the creation of a large local market. At present the Northwest has only a small local trade in crawfish, and to be a healthy growing industry it should not be dependent on a distant market. Crawfish now exported to Sweden are a low profit item in a very competitive business. It is highly improbable that Americans in the Northwest will ever be able to dominate this trade and effectively compete with Turks and others, such as Africans, who may enter this trade. It may be a business to be lost in the distant future anyway; someday Swedish crawfish populations may increase to the point where they can supply their own needs. It would be best if Americans accepted crawfish as a delicacy, and developed a large local market in California and the Northwest. It is, however, very difficult to get people to change their dietary habits.

The only place Anglo-Americans have accepted crawfish as food is in French Louisiana. French culture remains strong there, and many of the thousands of outsiders who have moved into the area have adopted facets of French culture, including the eating of crawfish. As a result there is a large and growing market in south Louisiana. The exact opposite appears to have happened in Wisconsin, where crawfish consumers seem to have accepted Anglo attitudes toward crawfish. The same could happen in the Pacific Northwest. The consumers are not one strong group--some are of Russian, Swedish, or French descent, and others are "Americans" who have developed a taste for this food. Since
the 1900's, fewer crawfish have been consumed, and the industry is in danger of simply fading away if and when the Swedish market is lost.

NOTES

1 The writer is indebted to many individuals in the Northwest who contributed information on the shipment of crawfish to Sweden. Particularly helpful were Mr. Elmer Case, Fish Commission of Oregon; Mr. W. Dale Ward, Washington Department of Fisheries; Ms. Darlene Osborne, California Department of Fish and Game. Also helpful were Mr. George Esveldt, Seafoods broker of Seattle, Washington, and California crawfish exporters Mr. Mats Engstrom and Mr. Mike Turnacliffe.


7 Malcolm L. Comeaux, Atchafalaya Swamp Life, Geoscience and Man Series, No. 2 (Baton Rouge: School of Geoscience, Louisiana State University, 1972), pp. 63-64.


10 Ward, op. cit., footnote 8.


13 Miller and Van Hyning, op. cit., footnote 1, p. 84.


21 Unestam, op. cit., footnote 19, p. 140.
