NOAA TECHNICAL MEMORANDUM NMFS-SEFC-121

ECONOMIC IMPACT OF HARD CLAM ASSOCIATED OUTBREAKS OF GASTROENTERITIS IN NEW YORK STATE

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AUGUST, 1983

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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U.S. DEPARTMENT OF COMMERCE
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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ABSTRACT

During the summer of 1982 there were 22 outbreaks of seafood-associated gastroenteritis in New York State. Investigations documented the illness in 443 people and attributed the outbreaks to ingestion of raw or lightly cooked clams. The New York State Department of Health issued a news release recommending immunoglobulin prophylaxis for hepatitis A for those persons with gastroenteritis. Because of the publicity associated with these disease outbreaks and the concomitant regulatory actions, market demand and prices for clams were adversely affected.

From an economic model of the clam market, it was estimated that, as a result of the gastroenteritis outbreaks, the price of littlenecks dropped $7.33 per bushel at the wholesale level, or approximately 9 percent. Cherrystone and chowder prices also declines comparable amounts. The total market loss from the price decreases was estimated at $1,840,000 over the five month period.

A conservative estimate of the costs of investigations, medical care, lost time, and materials was $630,000.

I. INTRODUCTION

In this paper we estimate the economic impacts of a series of gastroenteritis outbreaks, of presumed viral etiology, that occurred between May and September of 1982 in upstate New York. The outbreaks were associated with eating hard clams, Mercenaria mercenaria. The hard clam is commercially harvested from inshore waters between Maine and Florida. Because hard clams, like oysters, are filter feeders and because they are often eaten raw or lightly cooked, they can present a unique food safety concern to consumers, industry, and public health agencies. Diseases that have been associated with bivalve mollusks include cholera, infectious hepatitis type A, shigellosis, non-typhoid salmonellosis, gastroenteritis, paralytic and neurotoxic shellfish poisoning and typhoid fever. Despite the variety of such potential disease vectors, the risk of illness from eating shellfish "appears to be low" (Hughes et al., 1977).

In 1925, a large typhoid fever outbreak emphasized the unique safety concerns to the public and prompted the formation of the National Shellfish Sanitation Program (NSSP). The NSSP established four classifications for growing waters: approved, conditionally approved, restricted and prohibited

(for a more detailed description see USPHS, 1965). These classifications are based on sanitary surveys that employ tests for levels of fecal coliform bacteria as an indicator of actual fecal contamination and on the risk of sewage contamination if sewage treatment equipment breaks down. While NSSP has provided guidelines that have allowed the continued operation and development of the United States molluscan shellfish industries, the fecal coliform standard for the certification of shellfish and their waters has been controversial. One of the controversies has dealt with the appropriateness of the fecal coliform standard to serve as an indicator of enteric viruses. The Charleston Laboratory, SEFC, NMFS, has an active program to develop and transfer technology to detect enteric viruses in shellfish-growing waters and meats to aid in the resolution of this controversy and to improve the assurance of regulatory-based decisions (Richards et al., 1982 and Richards and Goldmintz, 1982.)

One principal cost that can be associated with an outbreak of foodborne illness is a decrease, either temporary or permanent, in prices and quantities due to consumer avoidance. The analysis of the hard clam market presented in section II of this paper provides a background for the estimation of the market impacts of the New York State

outbreak. These impacts are discussed in section III. Section IV includes estimates of some of the non-market costs associated with the outbreak, and section V provides a summary of the results.

II. MARKET ANALYSIS

Hard clams are usually marketed in three size categories: littlenecks, cherrystones and chowder. The size of a hard clam is the principal factor in determining its value. The littleneck is the premium size for the half-shell trade and bring the highest price. Normally, a littleneck clam is between 1-3/4 to 2-1/2 inches in its largest dimension. Littlenecks are the smallest size normally marketed. The average Fulton Market wholesale price for littleneck clams in the first six months of 1982 was $82.44 per bushel.

Intermediate in both size and price is the cherrystone clam, which normally measures between 2-1/2 and 3 inches in length. Cherrystones are considered suitable for eating both raw and cooked. The average Fulton Market wholesale price for the first six months of 1982 was $27.63 per bushel. Chowder clams are those over 3 inches in length, and they are almost always cooked, usually in strips or in chowders, hence the

name. Chowder clams have traditionally brought the lowest price in the market, and in recent years they have suffered strong competition from surf and ocean clams (Ritchie, 1977). The average Fulton market wholesale price for the first six months of 1982 was $14.01 per bushel.

The market that appears to determine the price level for the hard clam industry is the Fulton Fish Market in New York City. The Fulton Market physically handles about 10 percent of the total United States hard clam harvest (Table 1). The National Marine Fisheries Service reports daily price and quantity information for the Fulton Market in its "Green Sheet" Market News Report, which is published three times per week. The Friday issue summarizes the week's information.

The average quantity for all sizes of hard clams passing through the Fulton Market is about 2,250 bushels per week with a normal range of 1,250 to 3,250 bushels per week (Figure 1). During the 225 weeks between the first week of 1979 and the 17th week of 1983, in only 4 weeks did the volume exceed 3,250 bushels and in only 6 weeks did the volume drop below 1,250 bushels. Greater quantities pass through the market in the summer than in the winter.

The average weekly price for littlenecks at Fulton Market (Figure 2) has a pattern of sharp peaks and a basically upward

trend. These peaks in prices generally precede five holidays: New Years, Easter, Memorial Day, Fourth of July, and Labor Day. Peaks in price also follow periods of limited availability of clams, which are often associated with winter freezes.

The patterns in price and quantities are much more discernible when the data are plotted on a monthly basis. Monthly hard clam landings from 1973 to 1980 are shown in Figure 3. There is an extremely strong and regular pattern present. Hard clam landings peak in July and are at a minimum in February or March. This pattern is very similar to the pattern of mean monthly temperatures on Long Island (Figure 4).

The monthly average price of littlenecks at Fulton Market (Figure 5) does not show the individual holiday peaks that are visible in the weekly average series. What can be seen is a generally rising trend with each years' prices forming a "W" shape. The price is highest at the two ends of the year and again at the middle of the year. The price is generally low in the spring and again in the fall.

As stated in the introduction, the risks of eating raw shellfish are generally accepted as being small, and the hard

clam industry has existed in this environment for many years. When the consumers' image of risks is altered by news reports on the occurrence of foodborne illnesses, such as gastroenteritis or hepatitis A, a reevaluation of their preferences can be expected to occur. Some consumers may not purchase the suspect food, and this will be reflected by a drop in the demand curve for the food. The drop in demand will bring about a decline in price or in quantities sold in the market.

Price and quantity reflect the interaction of supply and demand in the marketplace. The market is modeled in this section as a simultaneous system of two equations (the supply and demand curves) in two endogenous variables (price and quantity). Once the equations are estimated, the determination of one variable, such as price, allows the calculation of the second variable, quantity.

Other variables in the equations determine the positions of the two curves and allow the statistical separation or identification of the two curves. The slopes of the curves allow the determination of the distribution between consumers and producers of the effects of the shift in demand. The slopes and the positions of the curves can be combined to estimate the changes in total revenue to the industry due to a

drop in price (P*Q) or a drop in quantity (Q*P) from a shift in the demand curve.

Supply and demand curves were simultaneously estimated from the monthly data for the period January 1973 to December 1980. Monthly landings data were not available after December 1980. The estimated equations are presented in Table 2. The first equation is the supply function. The most significant variable in the supply equation is the weather as expressed in terms of the mean monthly temperature at La Guardia Airport on Long Island. The temperature variable is highly significant. The Fulton Market price of littlenecks was not found to have significant explanatory power in the equation. This could be because the fishermen are landing all the clams that they can given the weather conditions, because they have few other alternatives to harvesting hard clams, or because entry into the fishery occurs over a longer time period than a month.

The second equation given is that of the demand curve. There are three major factors influencing the level of demand for hard clams. The first is disposable income. A 1 percent increase in the level of disposable income is associated with a 1.1 percent increase in the price of littleneck clams at the Fulton Market.

The second factor is the quantity of hard clams landed on the East Coast. A 1 percent increase in quantity of all sizes of clams landed decreases the littleneck price by 0.56 percent. The fact that price decreases on a percentage basis within any given month less rapidly than the causative increase in quantity allows the total income from the fishery to increase as the quantity landed increases.

The third factor included in the demand analysis is the time of year. A series of eleven dummy variables was included to measure the seasonality of demand. Although few of the individual months were statistically significant, the overall pattern was much as expected. Demand is highest during June to September with the peak occurring in August. Demand is lowest in November and February. This pattern is compatible with the summer clam bake season and a second season at Christmas and New Years.

Two sets of supply and demand curves are shown in Figure 6. The demand curve shifts upward by about $20.00 per bushel from January to July, while the supply curve shifts outward by about 860,000 pounds per month or about 75,000 bushels per month. The increase in the supply overwhelms the increase in demand, and the actual price drops between January and July from $95.00 to $79.00 per bushel. Although demand

increases from winter to summer, the price thus falls instead of rising.

III. IMPACTS OF THE GASTROENTERITIS EVENTS

As mentioned earlier, supply and demand curves could not be estimated for May to December 1982, the time period in which the events of interest occurred, because information on monthly landings is not available after December 1980. This necessitated taking a different approach towards directly measuring the impact of the illnesses on the market than was used in the previous section.

Because the demand shift could not be estimated directly, nor were changes in quantity known, the price drop due to the gastroenteritis was measured. An equation was fitted to the littleneck price at the Fulton Market from January 1973 to December 1982 (Table 3). The equation contained a 0-1 dummy variable that had a zero value for all months except August to December 1982 when it had a value of 1. The coefficient of the dummy variable, Ill, in the equation forms an estimate of the difference in price for the August to December period,separate from the price that the equation would have predicted otherwise. The constant value of 1 for the dummy

variable does not allow for any measurement of a time decay for the pattern of consumer avoidance. The estimated decrease in price associated with the gastroenteritis was $7.33 per bushel below the seasonally adjusted price. The drop in price was statistically significant at the 0.019 level, indicating that there were about 2 chances in 100 that the decrease was due to a random fluctuation.

Other variables included in the equation were the months of the year, annual landings of hard clams (Figure 7), disposable personal income, and the model's estimation error from the previous month. All variables except those for February, March, August, and September were significant at the 0.05 level.

The estimate of a price decrease of $7.33 per bushel at the Fulton Market is only for the price of littlenecks. In order to relate this price change to changes in the prices of cherrystones and chowders, two more equations were estimated (Table 4). The first equation relates the cherrystone price to the price of littlenecks, and shows that a $1.00 per bushel drop in the price of littlenecks will decrease the price of cherrystones by $0.269 per bushel at the Fulton Market. Thus, the $7.33 per bushel decrease in the littleneck price would be associated with a decrease in the price of cherrystones of

$1.97 per bushel. The second equation operates similarly for the price of chowders, and it indicates that a $1.00 decrease in the bushel price of littlenecks is associated with a decrease in the price of chowder clams of $0.18 per bushel. Thus, the $7.33 decrease in littleneck price decreased the price of chowder clams by $1.32 per bushel.

Two additional factors are needed to make an estimate of the overall market impact of the gastroenteritis events under investigation. The first piece of information required is the percentage of clams marketed in each of the three size categories. An estimate of the proportions in each size group moving through the Fulton Market was provided by National Marine Fisheries Service Market News reporters from a 2 month sample of their data files. The estimate was 40% littlenecks, 30% cherrystones, and 30% chowders.

The second piece of information needed is the volume of clams harvested in the August through September 1982 period. Total hard clam landings during 1982 are reported on a preliminary basis as 12,855,000 pounds. Assuming an average conversion rate of 11.5 pounds to a bushel, the 1982 United States hard clam landings can be estimated at 1,118,000 bushels. The average percentage of landings that occurred in each month between 1973 and 1980 was calculated from the

monthly landings data. The calculated percentages and the estimated monthly landings are shown in Table 5. The total estimated landings for the period August to December 1982 was 469,300 bushels.

The estimates of the price decrease for each of the size categories, the estimate of the size distribution, and the estimate of the volume of clams affected by the price decreases can be combined to form an estimate of the total loss of revenue to the industry at the wholesale price level (Table 6). This amounts to $1,840,000 over the five month period.

The $1,840,000 estimate is an estimate of the income lost to the industry due to the drop in prices associated with the gastroenteritis events as distinct from the normal seasonal decrease in prices that would be expected during this time of year. This amount represents the income lost to the industry at the wholesale level. It does not include losses at the retail level either in direct or restaurant sales.

The loss estimate above is made on the basis of a change in price times the quantity sold. There may have also been a loss of total revenue to the industry due to a decrease in the quantity produced. This second component of the industry loss would equal the decrease in quantity times the new, lower

price. It would be mitigated in the longer run by the fact that the clams would remain in the water and could be harvested and sold at a later time. The clams remaining in the water would suffer natural mortality, and some might grow into larger, less desirable sizes. They would also add to the breeding stock and thus might add to later recruitment and harvests. The calculation of a net present value of this second quantity based component of the loss would require the use of a bioeconomic model such as presented by Conrad (1982).

The quantity decrease, however, has not been identified in this study. The joint supply and demand curves estimated in the previous section (Figure 8) give no reason to forecast a decrease in quantity because price does not affect supply. As demand drops, the intersection of supply and demand moves down a nearly vertical supply curve leaving quantity almost unchanged and decreasing only price.

There is some evidence that the industry responded differently to the events than would have been predicted by the supply and demand model. Figure 9 was drawn from a survey reported by the New York State Department of Health (1983). All three sales quantities have been standardized to 100 in May. The sales of hard clams in the Northern Health District in upstate New York show a steadily decreasing trend for the

survey period as compared to the rest of New York or the United States, the other two patterns of quantities. Assuming that the sales in the Northern Health District would normally follow a pattern similar to that of the others, then the figure would seem to indicate a quantity decrease of over 70 percent from what would have been expected in that small area.

Informal conversations with industry members at the 1983 Shellfish Institute of North America/National Shellfisheries Association Meetings indicated that there was some decrease in quantity sold. In addition, industry members indicated that the major decreases in prices occurred at the dockside level instead of at the wholesale level. These changes have not been documented and the only market effect estimated in this paper is the $1,840,000 loss from the decrease in prices.

IV. NON-MARKET COSTS

During the period May to September 1982 the New York State Department of Health, in conjunction with regional, county, and local health units investigated more than 25 reported outbreaks of clam-related enteric illnesses. Twenty-two of the incidents were associated with clam consumption and 443 persons were identified as being affected.

Ten cases of hepatitis A were identified from five of these outbreaks (NYSDH, 1983). In this section some of the non-clam market costs born by the public health agencies, the persons affected and the industry are estimated.

One group of costs is directly associated with the illnesses -- lost time[1/] and medical costs. The estimate of the cost of lost time used in this analysis is $49.13 per day. This was generated by taking the 1982 per capita income for New York State, $12,328 (Survey Current Business, 1983), and dividing it by 250 working days per year. The number of lost days is estimated at one day per person (443) with gastroenteritis, 20 days per person (10) with hepatitis A, and 1/2 day per person (1,200) receiving a prophylactic immunoglobulin shot for exposure to hepatitis A (Table 7). The total number of lost days is then 1,243 days and the cost of this lost time is $61,068.

1/ Lost time in this analysis is used to estimate the value of the lost earnings due to the illness.

Only three categories of direct medical expenses are estimated, because no information is available on how many people saw their private physicians and because the public health care labor costs are combined with the estimates of the costs of investigation in the next sub-section. It is estimated that 15 people were hospitalized overnight for gastroenteritis (15 days), and that 2 people were hospitalized for 5 days for hepatitis A (10 days). At $200 per day, hospital costs would approximate $5,000. Adding the materials cost of the 1200 immunoglobulin shots ($1,800) brings the total to $6,800 of direct medical expenses, which may be a conservative estimate.

The other and larger group of public health costs are those associated with the investigation of the incidents, including the epidemiology, prevention of further spreading of the infectious hepatitis A, and containment of the clam related gastroenteritis. The state and local public health authorities spent an estimated $540,000 [1] in response to the outbreaks. The labor costs and fringe benefits associated with the epidemiology and public health care along with the additional travel and office expenses amounted to over $410,000. The New York State Department of Health also instituted a state-wide survey of clam dealers, which involved 250 people for one week, which at $520 per worker including

[1] Personal communication

fringe benefits, amounts to $130,000. In addition, there were an estimated 250 bags of clams removed from the market because of the outbreaks which, at a cost of $75.00 per bag amounts to $18,750.

Summing all these identifiable non-market costs results in a total of $626,961 (Table 7). We believe that this is a conservative estimate.

V. SUMMARY

The gastroenteritis events in upstate New York between May and September 1982 were costly. The loss to the industry due to consumer avoidance and the resulting price decrease of clams was $1,840,000. The costs due to the illnesses and the public health measures taken were at least $630,000. Thus, the 22 outbreaks resulted in social costs totaling at least 2 1/2 million dollars.

The events have touched off many reactions that, while continuing, have not been considered in this paper. A number of lawsuits have been filed, and one firm in New York has been embargoed from selling clams. The clam industry of Rhode Island has begun an advertising campaign to maintain its markets. In New York, a voluntary trademark program using sealed bags has been initiated. Measures have been proposed in the New York State legislature to raise the shellfishing

sealed bags has been initiated. Measures have been proposed in the New York State legislature to raise the shellfishing license fee from $7.50 to $35.00 in order to provide more money for law enforcement. Raising the fines for illegal harvesting to a maximum of $1,500 and forfeiture of license have also been proposed.

Clam beds are being heavily worked. As the supply of clams from approved areas declines, the likelihood of illegal harvest from polluted areas will increase. The chances of subsequent gastroenteritis outbreaks thus will also rise, without some other controlling factor.

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Table 1.

APPROXIMATE PERCENTAGE OF HARD CLAM

LANDINGS SOLD AT THE FULTON FISH MARKET*

YEAR	U.S. LANDINGS (bu./ week)	FULTON SALES (bu./ week)	PERCENTAGE SOLD AT FULTON
1979	20,230	2,234	11.0
1980	22,410	2,355	10.5
1981	30,270	2,200	7.3
1982	21,570	2,225	10.3
AVERAGE	23,620	2,253	9.8

* Uses a conversion factor of 11.5 lb./bu.

Table 2.

ESTIMATED SIMULTANEOUS SUPPLY AND DEMAND CURVES*

SUPPLY EQUATION

$$\text{Log(Landings)} = \underset{(8.20)}{2.98} + \underset{(0.68)}{0.04}*\text{Log(Neckpri)} + \underset{(18.3)}{0.97}*\text{Log(Temp)} \quad \text{(t-ratios)}$$

F RATIO = 176.5 D.W. = 1.52

DEMAND EQUATION

$$\text{Log(Neckpri)} = \underset{(-0.17)}{-0.35} \underset{(-1.98)}{-0.56}*\text{Log(Landings)} + \underset{(21.4)}{1.10}*\text{Log(DPI)} + ED_i \quad \text{(t-ratios)}$$

F RATIO = 45.44 D.W. = 2.02

Where:

Neckpri = Monthly average littleneck price at Fulton Market

Landings = Monthly landings of hard clams on the East Coast, excluding New Hampshire, Connecticut, and Delaware

DPI = Disposable personal income

Temp = Mean monthly temperature at La Guardia Field, N.Y.C.

ED_i = Monthly dummy variables (i=1 to 11), December as the base (all D_i=0)

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* Monthly model: January 1973 to December 1980, Two-stage least squares

Table 3.

LITTLENECK PRICE EQUATION*

$$\text{Neckpri} = \underset{(1.57)}{5.54} \underset{(-2.66)}{-0.000936}*\text{Anland} \underset{(26.5)}{+0.0399}*\text{DPI} \underset{(-2.38)}{-7.33}*\text{Ill} + ED_i$$

$$\underset{(-3.17)}{-0.278}*\text{Error}_{t-1} \quad \text{(t-ratios)}$$

$R^2 = 0.89$

Where:

Anland = U. S. yearly hard clam landings

Ill = A 0-1 dummy variable (equals 1 from Aug. - Dec., 1982)

Error_{t-1} = Error term from previous month

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* Monthly model: January 1973 to December 1982. Estimated using the autoregresive procedure of Statistical Analysis System, SAS Institute, Raleigh.

Table 4.

CHERRYSTONE AND CHOWDER CLAM PRICE EQUATIONS*

Cherrystone Price = 5.67 +0.269*Littleneck Price
(15.0) (35.6) (t-ratios)

F Ratio = 1270 R^2 = 0.92 D.W. = 1.08

Chowder Price = 1.01 +0.180*Littleneck Price
(3.14) (28.2) (t-ratios)

F Ratio = 770 R^2 = 0.88 D.W. = 0.83

---

* Monthly model: January 1973 to December 1980, ordinary least squares.

Table 5.

ESTIMATED 1982 MONTHLY LANDINGS*

	8 YEAR AVERAGE PERCENTAGE	1982 LANDINGS	MONTHLY BUSHELS
AUGUST	12.4	1,118,000 bu.	138,600
SEPTEMBER	9.5	"	106,200
OCTOBER	7.8	"	87,200
NOVEMBER	6.3	"	70,300
DECEMBER	6.0	"	67,000
			469,300

* Uses a conversion factor of 11.5 pounds per bushel.

Table 6.

ESTIMATED CLAM MARKET DECREASE IN TOTAL REVENUE:
AUGUST - DECEMBER, 1982

CLAM SIZE	PRICE DECREASE	ESTIMATED AUGUST TO DECEMBER LANDINGS	PRICE EFFECT
Littleneck	$7.33/bu.	187,720 bushels	$1,375,987
Cherrystone	1.97	140,790	277,356
Chowder	1.32	140,790	185,843
Total			$1,839,186

TABLE 7

NON-MARKET COSTS

I. ILLNESS RELATED	
A. Medical Expenses	
1. 15 people hospitalized 1 day by gastroenteritis (@ $200/day)	$ 3,000
2. 2 people hospitalized 5 days by hepatitis	2,000
3. Shots (1200 @ $1.50/ shot)	1,800
B. Lost Income	
1. Gastroenteritis: 443 people @ $49.13/day	21,764
2. Hepatitis A: 10 people @ 20 days @ $49.13/day	9,826
3. Medical Visit: 1200 people @1/2 day @ $49.13/day	29,478
II. INVESTIGATION AND MONITORING	
A. County and State Health Dept.(labor)	410,000
B. Clam Sweep (labor)	130,000
C. Clams Removed From the Market (250 bushels @ $75/bushel)	18,750
Total Estimated Costs	$626,618

Figure 1. Weekly sales of all sizes of hard clams at the Fulton Fish Market (source: "Green Sheet" Market News).

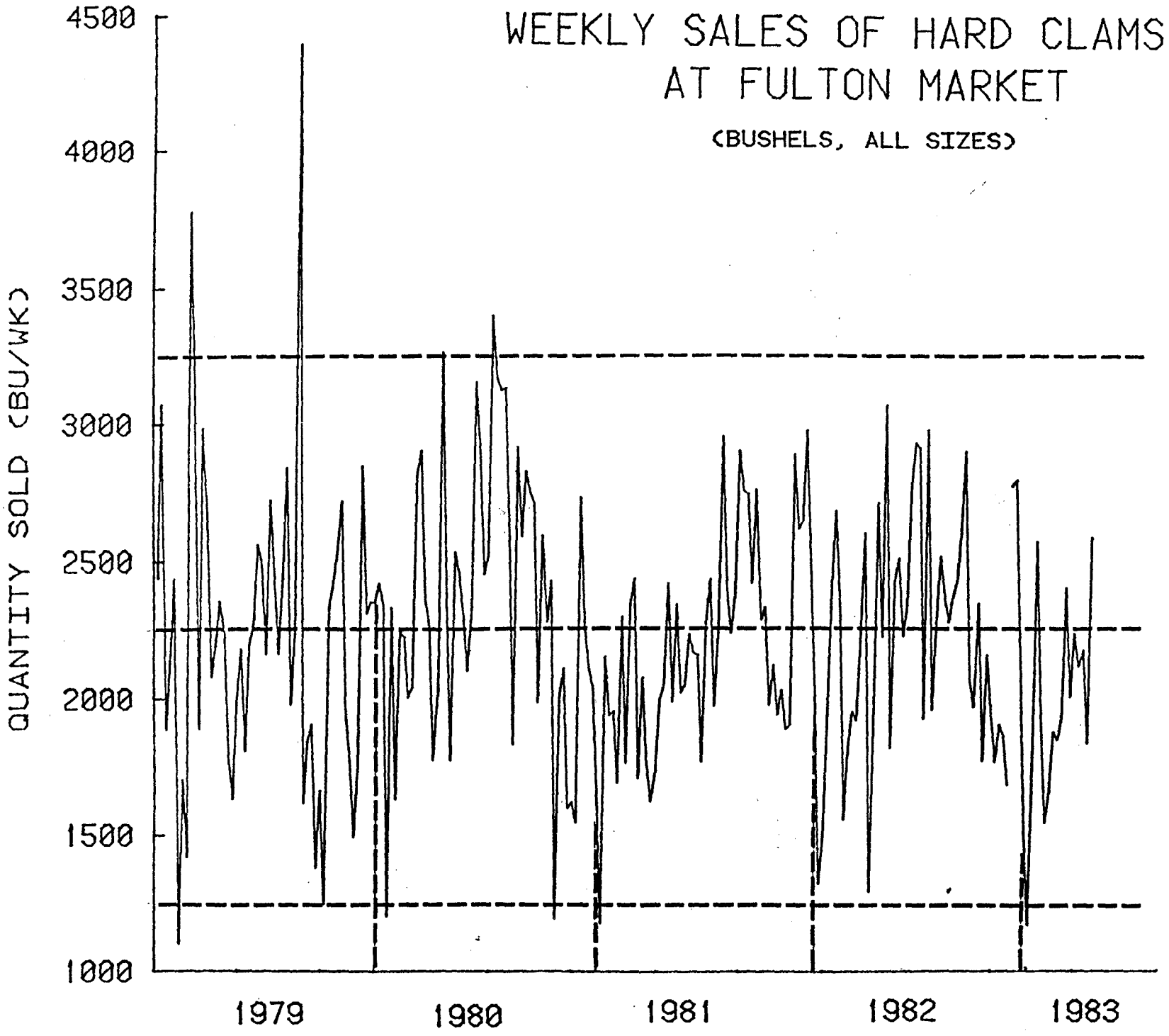
WEEKLY SALES OF HARD CLAMS
AT FULTON MARKET
(BUSHELS, ALL SIZES)
QUANTITY SOLD (BU/WK)
4500
4000
3500
3000
2500
2000
1500
1000
1979
1980
1981
1982
1983

Figure 2. Weekly average of the daily mid-points of the Fulton Fish Market wholesale littleneck prices (source: "Green Sheet" Market News). Holidays are indicated as New Years (N. Y.), Easter (E), Memorial Day (M. D.), Fourth of July (J. 4), Labor Day (L. D.).

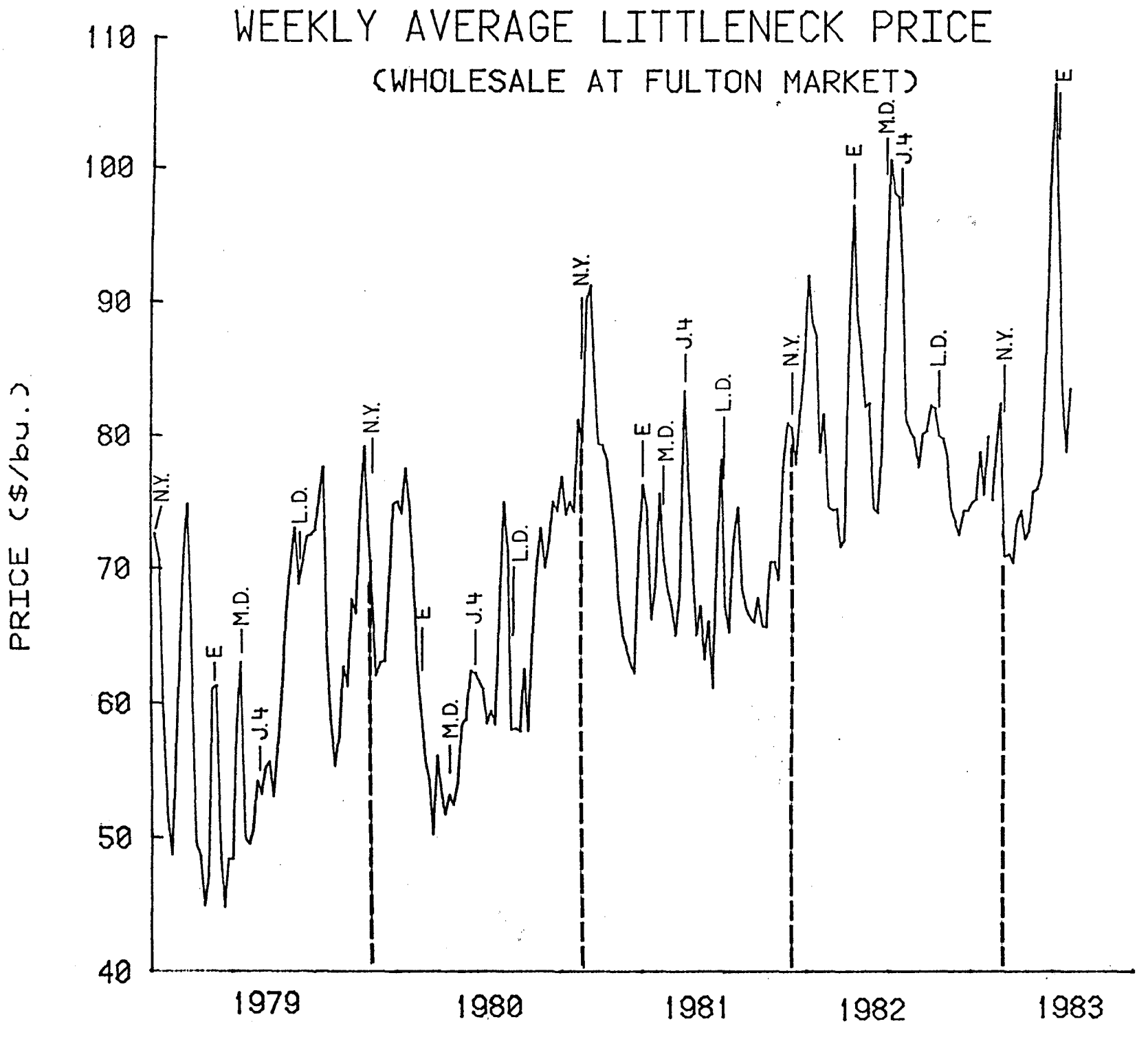
WEEKLY AVERAGE LITTLENECK PRICE
(WHOLESALE AT FULTON MARKET)
PRICE ($/bu.)
110
100
90
80
70
60
50
40
1979
1980
1981
1982
1983
N.Y.
E
M.D.
J.4
L.D.

Figure 3. Monthly East Coast hard clam landings from Maine to Georgia, except New Hampshire, Connecticut, and Delaware (source: Shellfish Market Review).

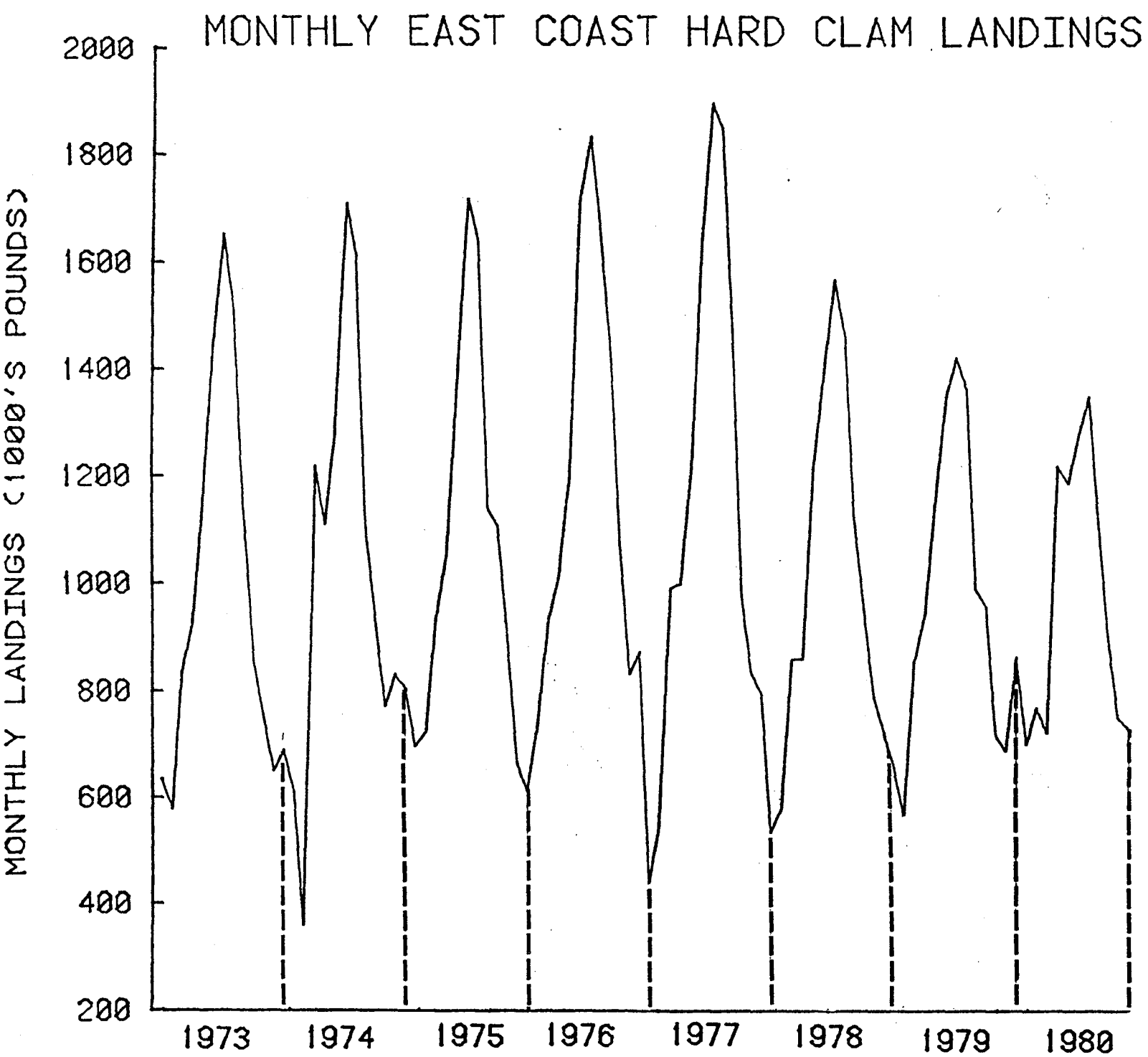
MONTHLY EAST COAST HARD CLAM LANDINGS
MONTHLY LANDINGS (1000'S POUNDS)
2000
1800
1600
1400
1200
1000
800
600
400
200
1973
1974
1975
1976
1977
1978
1979
1980

Figure 4. Average mean-monthly temperature at La Guardia Field, and average monthly East Coast hard clam landings, 1973-1980 (sources: Local Climatological Data La Guardia Field, New York, New York, and Shellfish Market Review).

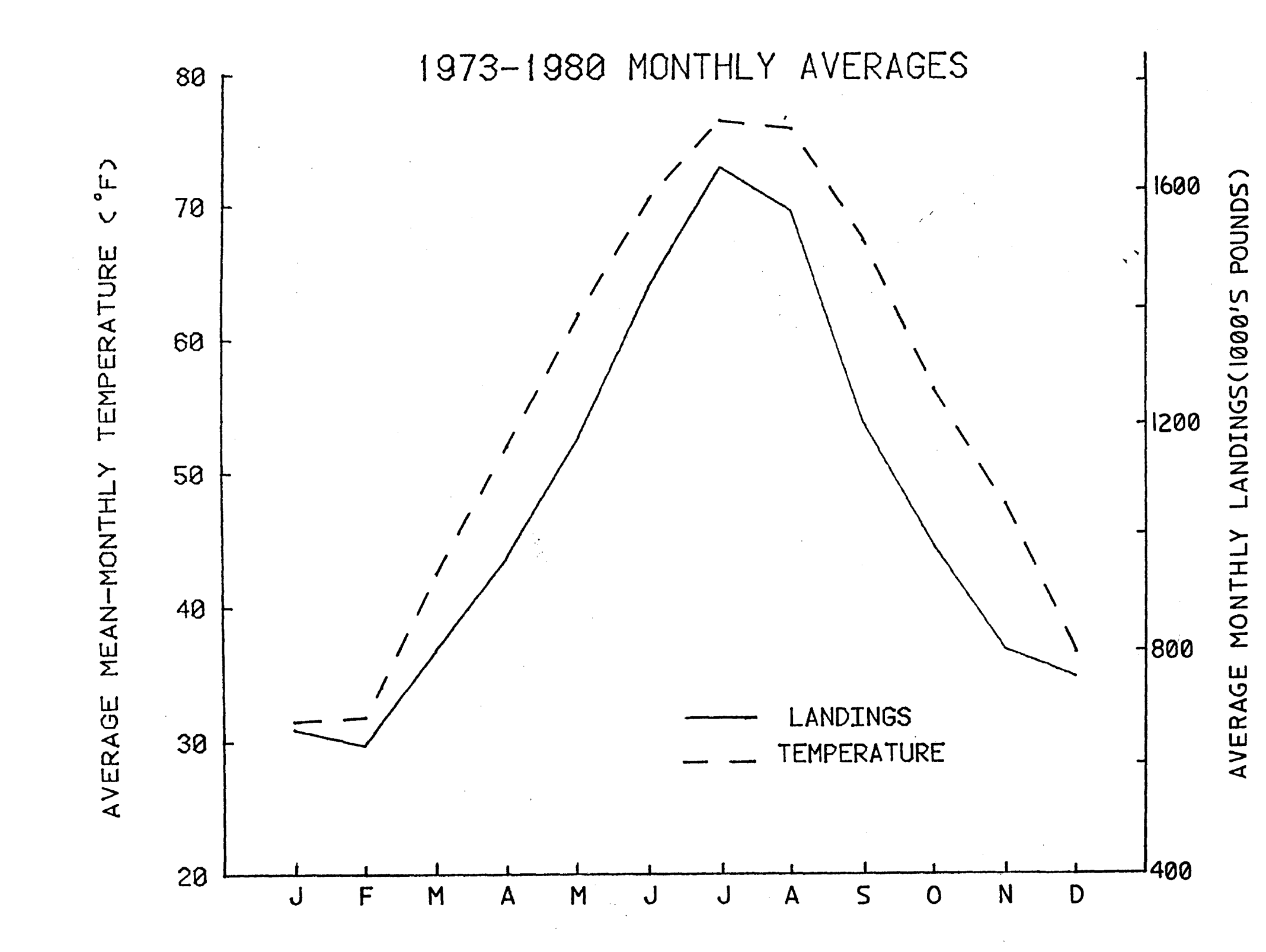
1973-1980 MONTHLY AVERAGES
AVERAGE MEAN-MONTHLY TEMPERATURE (°F)
AVERAGE MONTHLY LANDINGS(1000'S POUNDS)
80
70
60
50
40
30
20
1600
1200
800
400
J
F
M
A
M
J
J
A
S
O
N
D
LANDINGS
TEMPERATURE

Figure 5. Monthly average of the daily mid-points of the Fulton Fish Market wholesale littleneck prices (source: Shellfish Market News).

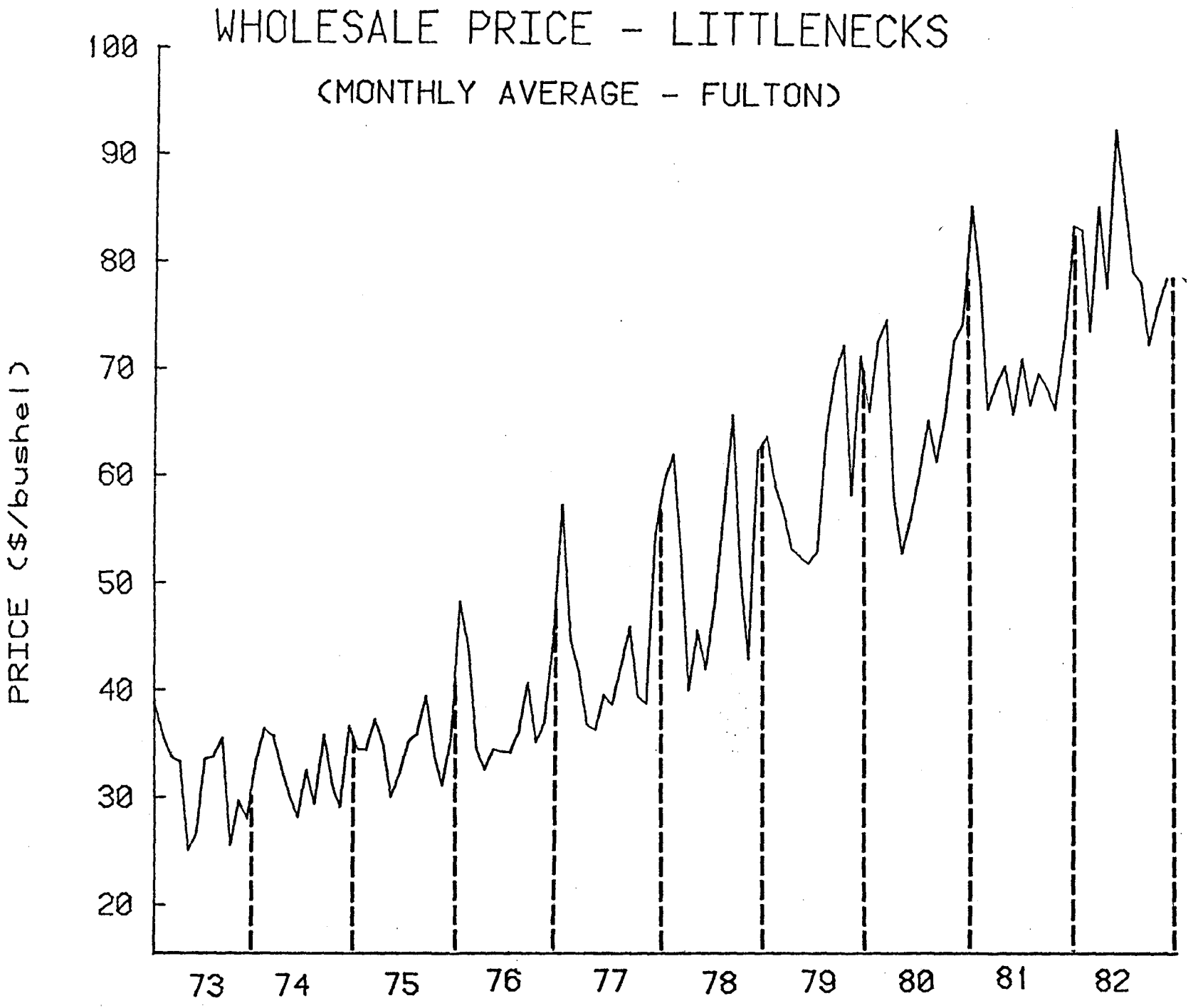
WHOLESALE PRICE - LITTLENECKS
(MONTHLY AVERAGE - FULTON)
PRICE ($/bushel)
100
90
80
70
60
50
40
30
20
73
74
75
76
77
78
79
80
81
82

Figure 6. Monthly supply and demand curves for January and July. The demand curves are calculated at a disposable income level of $2,200 billion, and the supply curves are calculated for a temperature of 31.5° F in January and 76.3° F in July.

January and July Supply and Demand Curves

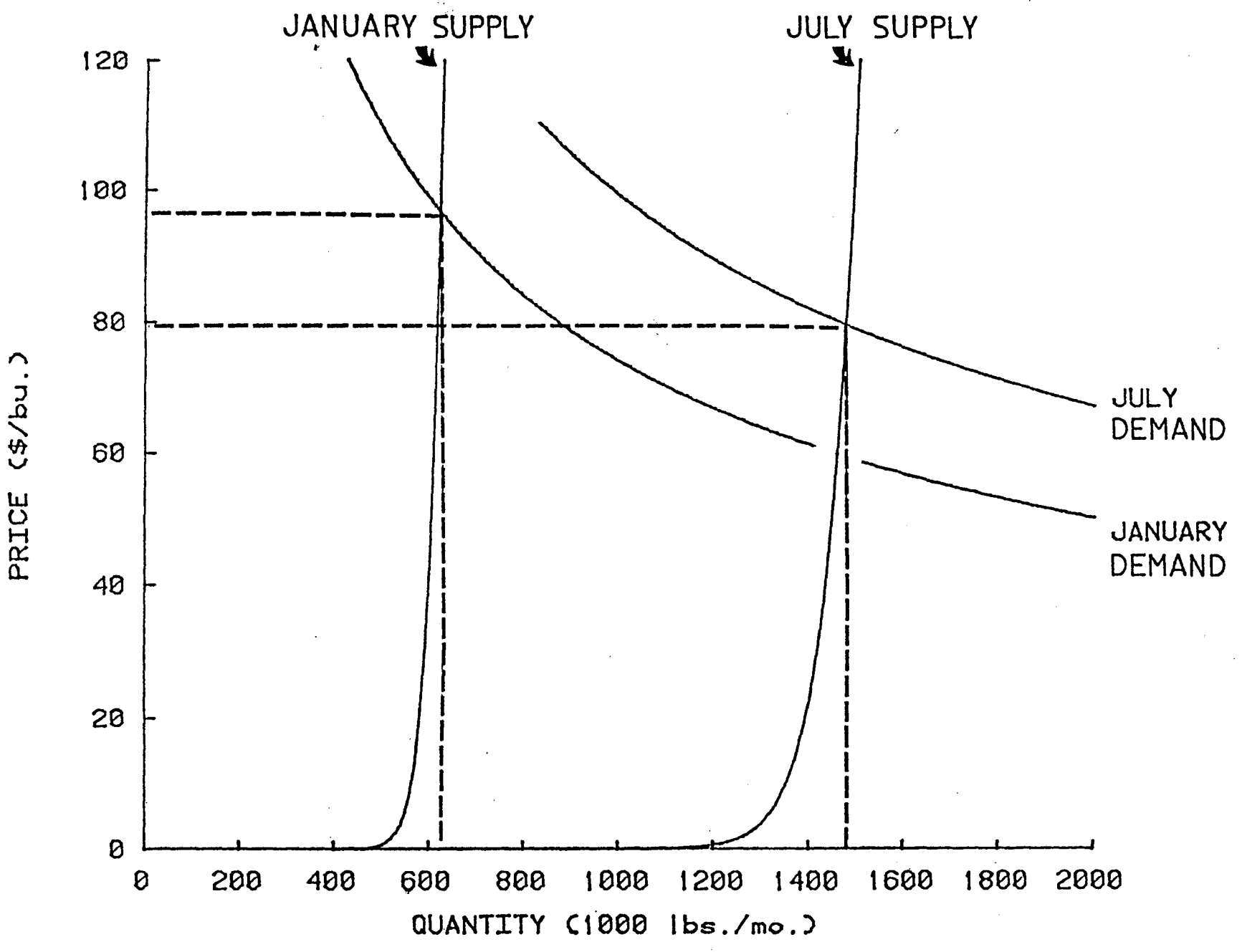

Figure 7. Annual United States hard clam landings (source: Fisheries of the United States).

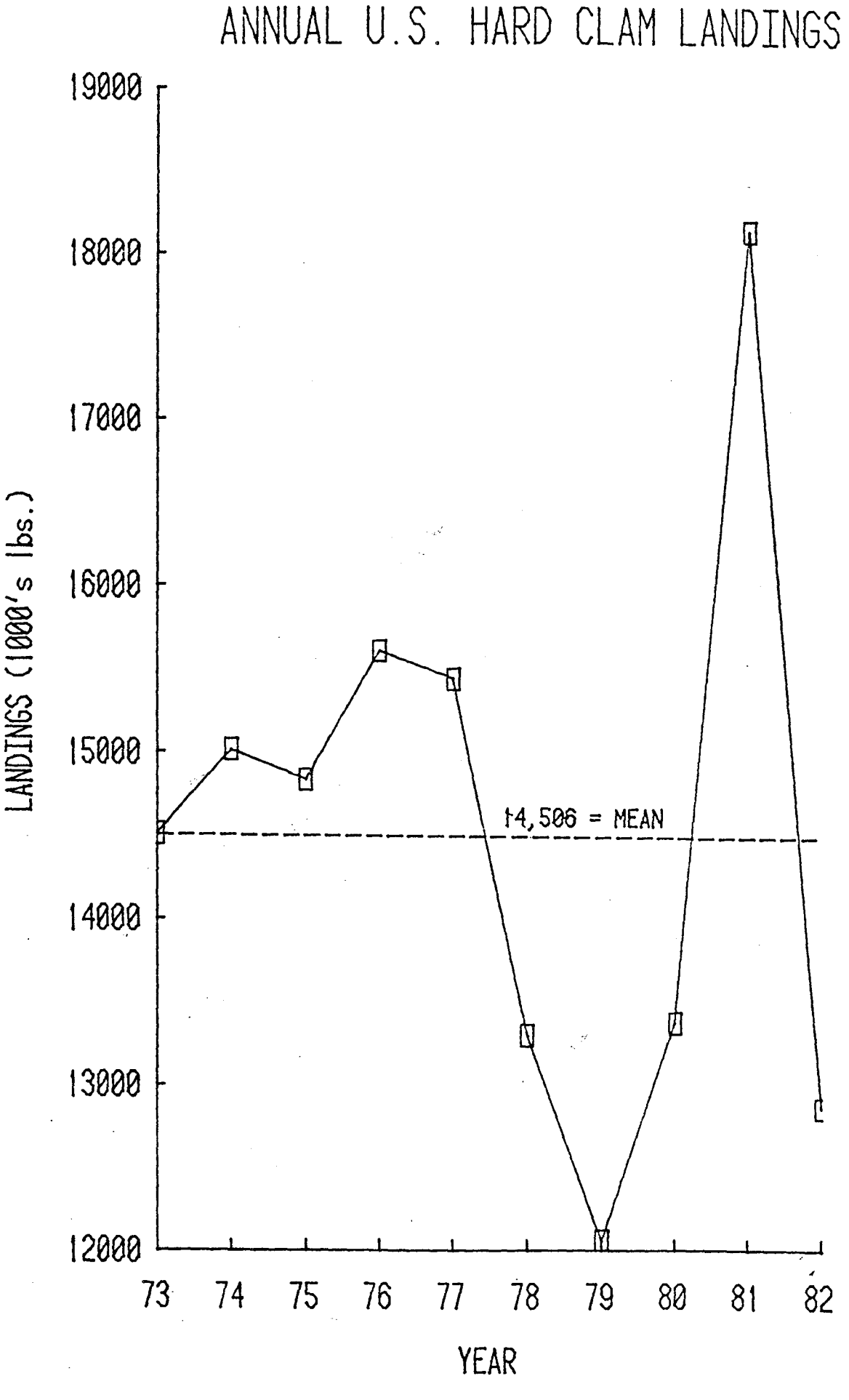
ANNUAL U.S. HARD CLAM LANDINGS
19000
18000
17000
16000
15000
14000
13000
12000
LANDINGS (1000's lbs.)
14,506 = MEAN
73
74
75
76
77
78
79
80
81
82
YEAR

FIGURE 8. The effect of a downward shift in demand upon price and total industry revenue (estimated from the drop in littleneck clam price).

The Effect of Consumer Avoidance Upon Price and Total Revenue

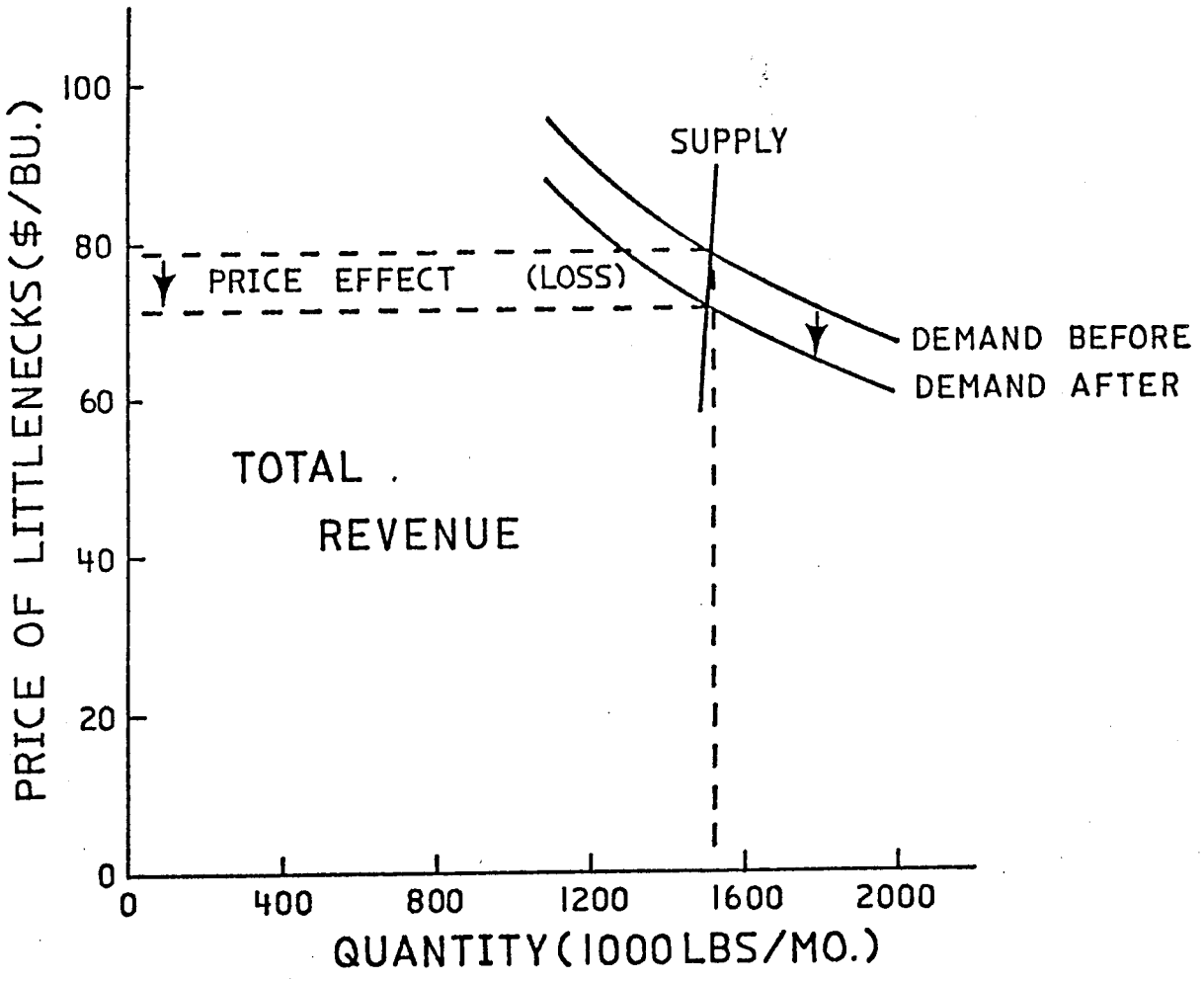

Figure 9. Hard clam sales pattern in New York (1982) as compared to United States averages. All three curves are standardized to a value of May = 100 for comparability (source: N.Y.S.D.H., 1983 and Shellfish Market Review).

HARD CLAM SALES PATTERN IN NEW YORK (1982) AS COMPARED TO U.S. AVERAGES