NOAA TECHNICAL MEMORANDUM
SEFC-NMFS-264

WORKSHOP ON DEFINITION OF SHRIMP RECRUITMENT OVERFISHING

BY

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INTRODUCTION

The Gulf of Mexico Fishery Management Council requested that the Southeast Fisheries Center (SEFC) convene a small group of shrimp specialists to undertake two tasks. These tasks were (1) to draft scientific definitions of overfishing for each of the shrimp species in the management unit of the Fishery Management Plan (FMP) and (2) to recommend action that might be taken if overfishing occurred in any of these stocks.

On June 26-27, 1990, a small group of shrimp specialists convened by the SEFC Galveston Laboratory to undertake the task requested by the Gulf of Mexico Fishery Management Council. Basic data provided to the scientists at this workshop were fishery-dependent data collected by the NMFS for 1960-present. These included catch by species and directed effort by species from which a VPA analysis was utilized to estimate recruitment, parent stock and stock recruitment curves (Nance, Klima and Czapla, 1989). Dr. James Nance utilizing these data developed spawner per recruitment relationships and based all of these determinations using the same methodology as described in the stock assessment report (Nance, 1989). All shrimp stocks considered were considered as Gulf-wide stocks with the exception of the pink shrimp which was considered as a stock only in the eastern Gulf of Mexico (subareas 1-12).

This report summarizes the findings of the two day workshop and provides recommendations from the working group (List of Attendees, Attachment I). Important graphs are contained within the document and a list of these figures is provided in Attachment II.

Recommendations and Definitions of Overfishing

Brown Shrimp

Definition of Overfishing:

A parent stock level of 125 million shrimp should be the lower limit used to define overfishing for brown shrimp. This value is slightly lower than the 1983

level of parent stock which is the lowest observed value since 1960.

Rationale:

- Parent stock is presently the best index to use in defining overfishing for brown shrimp. Currently, recruitment is a reflection of environmental conditions.

- 1980's data should be used to set lower limits for parent stock because fishing intensity and environmental conditions were different during the 1980's when compared to the 1960's and 1970's.

- Catch, effort (nominal days fished) and recruitment have increased from 1960-89.

- Annual catch per effort has fluctuated around 600 pounds per day for the past 25 years. The decline since 1985 is similar to other declines in the 1960's and 1970's.

- Parent stock levels have shown no trend during the 1960's-1980's.

- Habitat and environmental conditions have changed since 1960; nursery areas have gradually increased during this time span.

- If habitat/environment changes rapidly, the parent stock may be reduced. Presently, the observed levels of parent stock can sustain the population.

- There is no indication of recruitment overfishing for brown shrimp as evidenced by high levels of recruitment.

- There is no potential for an increase in brown shrimp yield (pounds) with an increase in effort.

- Reasonably reliable parent stock data are available for brown shrimp via virtual population analysis and resource surveys.

<u>White Shrimp</u>

Definition of Overfishing:

A parent stock level of 600 million shrimp should be used as the lower limit for defining overfishing in white shrimp.

Rationale:

- Parent stock is presently the best index to use in defining overfishing for white shrimp. Currently, recruitment is a reflection of environmental conditions.

- Fishing intensity and environmental conditions were different during the 1980's when compared to the 1960's and 1970's. However, since 1960, parent stocks of 615 million and above have resulted in adequate recruitment. Low recruitment levels were observed when parent stock decreased below 500 million shrimp.
- Catch, effort (nominal days fished), and recruitment have increased from 1960-86. However, there has been a downward trend in production (catch) over the last three years (1987-89).

- Catch per effort has fluctuated around 400 pounds per day. The decline since 1986 is similar to other declines in the 1960's and 1970's.

- Parent stock levels have increased during the 1960's-1980's.
- Habitat and environmental conditions have changed since 1960; nursery areas have gradually increased during this time span.

- If habitat/environment changes rapidly, the parent stock may be reduced. Presently, the observed levels of parent stock can sustain the population.

- Since 1960, recovery of white shrimp populations was observed even after parent stock levels decreased below 500 million shrimp.

- There is no potential for an increase in white shrimp yield (pounds) with an increase in effort.

<u>Pink Shrimp</u> (Eastern Gulf of Mexico, Stat. Areas 1-12)

Definition of Overfishing:

A minimum of 100 million shrimp is set as the lower limit for parent stock in the pink shrimp fishery.

Rationale:

- Parent stock is presently the best index to use in defining overfishing for pink shrimp. Currently recruitment is a reflection of environmental conditions.

- There has been a shift in the fishery to more northern areas since 1972-73; thus, parent stock estimates for the 1960's may be underestimated.

- Since parent stock values for the 1960's may have been underestimated, the 1970's-1980's data should be used to set the lower limit for pink shrimp parent stock. The lowest parent stock level observed since 1970 was slightly greater than 100 million shrimp and had no adverse effect on recruitment.

- Catch and recruitment have remained steady during 1960-85 but they exhibit a downward trend over the last three years (1986-88). Effort (nominal days fished) has increased beginning in 1972. Effort and catch per effort declined sharply during 1986-88.

- Parent stock levels showed no trend during the 1960's and slightly higher levels in the 1970's and 1980's except for a sharp peak in 1984-85.

- Hypotheses regarding the recent decline in the pink shrimp fishery include:

    1. Habitat degradation/seagrass die-off in Florida Bay.
    2. Lack of freshwater inflow, precipitation, hurricanes.
    3. Use of pesticides for mosquito control in S. Florida.

- In Cuba, pink shrimp landings have also declined in the late 1980's. Hypothesis is that the decline is due to a decrease in precipitation.

- There is no potential for an increase in pink shrimp yield (pounds) with an increase in effort.

Royal Reds

Definition of Overfishing:

Overfishing is defined as fishing greater than optimal yield (OY) as defined in the Council's plan.

Rationale:

Royal red shrimp continue to be an underexploited resource due to low demand. Historically, the annual MSY was estimated to be 392 thousand

pounds of tails at a level of 1290 days fished. OY was set at MSY.

Rock Shrimp (both species combined)

The highest catch was 2 million pounds in 1986. Rock shrimp is a mixture of a directed and incidental fishery off of Florida and is an incidental by-catch elsewhere in the U.S. Gulf. In addition to being a by-catch and/or a directed fishery, there is a low number of interviews which make the fishing effort estimates unreliable. The Fishery Management Plan states that, "For rock shrimp, MSY was estimated at 1.1 million pounds of tails using a Schafer model. This estimate is a very poor one because most landings are incidental catch, making effort estimates unreliable." Since 1980, rock shrimp MSY has been exceeded three times, with a high of 2 million pounds in 1986.

Recommendation:

MSY for rock shrimp should be re-evaluated.

Seabobs

The FMP didn't provide an estimate of MSY because of a lack of effort directed data. Seabobs have been treated as an incidental catch to the white shrimp fishery. The FMP describes an average of 4.3% of the total catch of white shrimp (e.g., 1.4 million pounds of seabob tails) between 1959-1975. The FMP used the 1.4 million pound estimate as the best MSY. In recent years, catch peaked in 1986 at approximately 900,000 pounds.

Recommendation:

MSY for seabobs should be re-evaluated.

Recommended Action to be Taken if Overfishing Occurs

Brown, White and Pink Shrimp

Presently, we have point estimates of the index of the minimum spawning stock that should be maintained. That number is 125 units for brown shrimp, 600 units for white shrimp, and 100 units for pink shrimp. If this level is reached then the following action should be taken:

1) Scientists will forecast recruitment for the coming year-class and determine the amount of fishing effort that will allow the parent stock to exceed the minimum index value. Scientists will also project the expected fishing effort to be expended on that year-class and its effect on the parent stock. The differences between the amount of fishing effort required to increase the parent stock and the expected fishing effort will be compared to see if further action is necessary.

2) If fishing effort needs to be reduced, there are multiple options to do so such as (1) reducing fishing effort at the start of the season, (2) reducing fishing effort at the end of the season, or (3) some combination of both.

Royal Reds

Fishing will cease when OY is reached as provided for in the current FMP.

Rock Shrimp

MSY for rock shrimp should be re-evaluated.

Seabobs

MSY for seabobs should be re-evaluated.

SUMMARY

Parent stock is defined for brown shrimp as the number of age 7+ (months) shrimp during the November-February time frame. White shrimp parent stock is defined as the number of age 5+ (months) shrimp during the April-August time frame, and pink shrimp parent stock is defined as the number of shrimp 5+ (months) shrimp during the July-June period. Recruitment is defined as the number of age 0 shrimp (45 mm tail length) which entered the fishery during the entire year. Recruitment for all three stocks is considered to be a reflection of environmental conditions and therefore may not be the best indicator of overfishing. Parent stock was considered by the group to be the best indicator of overfishing. The level of the parent stock selected for the three major species differed significantly because in the manner of calculating the number of parent stock. For example, brown shrimp parent stock age 7+ were counted from November-February, white shrimp number age 5+ were estimated from April-August, and pink shrimp age 5+ were an annual number.

The group agreed that nonfishery-dependent data such as resource survey information should be considered in estimating the parent stock. Presently, this cannot be done because the time series is short, and there has not been any estimates of correlation between the VPA values of parent stock and resource survey data, but it was recommended that this be done in the future.

The scientific group indicated that additional workshops may need to be convened under two conditions:

(1) when additional information, such as using resource survey information, is available to develop another index for parent stocks. The development of an additional or secondary index needs to be discussed and linked to the present index so that there is a clear relationship between the two; and

(2) if new information is available which necessitates changes in the definition and level of the overfishing index value. Furthermore, the group agreed that if overfishing is observed in any of the major species and that fishing effort is reduced in these fisheries, consideration must be given to the mobility of the shrimp fleet and its ability to switch target species to other fisheries within the Gulf and Atlantic Ocean. Economic and social considerations must be examined and impact analyses developed which relate to these other fisheries.

Attachment I

Overfishing Workshop Attendees

NAME	AFFILIATION	PHONE
Edward Klima	NMFS, Galveston	409-766-3500
Eduardo Martinez	NMFS, Galveston	409-766-3500
James Nance	NMFS, Galveston	409-766-3500
Scott Nichols	NMFS, Pascagoula	601-762-4591
Joseph Powers	NMFS, Miami	305-361-4284
Wade Griffin	TAMU, College Station	409-845-8048
Steve Heath	Al. Dept. Conserv.	205-861-2882
Claude Boudreaux	La. Dept. Wild. & Fish.	504-765-2373
Philip Bowman	La. Dept. Wild. & Fish.	504-765-2401
Robert Muller	Fl. Marine Research Inst.	813-896-8626
Terrance Leary	Gulf Council Staff	813-228-2815
C. E. Bryan	Tx. Parks & Wildlife	512-389-4863
Julius Collins	Gulf Council	512-831-2211
Richard Condrey	LSU	504-388-6456

Attachment II

List of Figures

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Figure 3. Brown shrimp catch per day.
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Figure 5. Brown shrimp parents (age 7+ months, November-February).
Figure 6. Brown shrimp parent stock-recruitment relationship.
Figure 7. White shrimp landings.
Figure 8. White shrimp directed nominal fishing effort.
Figure 9. White shrimp catch per day.
Figure 10. White shrimp recruitment.
Figure 11. White shrimp parents (age 5+ months, April-August).
Figure 12. White shrimp parent stock-recruitment relationship.
Figure 13. Pink shrimp landings.
Figure 14. Pink shrimp directed nominal fishing effort.
Figure 15. Pink shrimp catch per day.
Figure 16. Pink shrimp recruitment.
Figure 17. Pink shrimp parents (age 5+ months, July-June).
Figure 18. Pink shrimp parent stock-recruitment relationship.
Figure 19. Royal Red shrimp landings.
Figure 20. Rock shrimp landings.
Figure 21. Seabob shrimp landings.

Figure 1. Brown Shrimp Landings

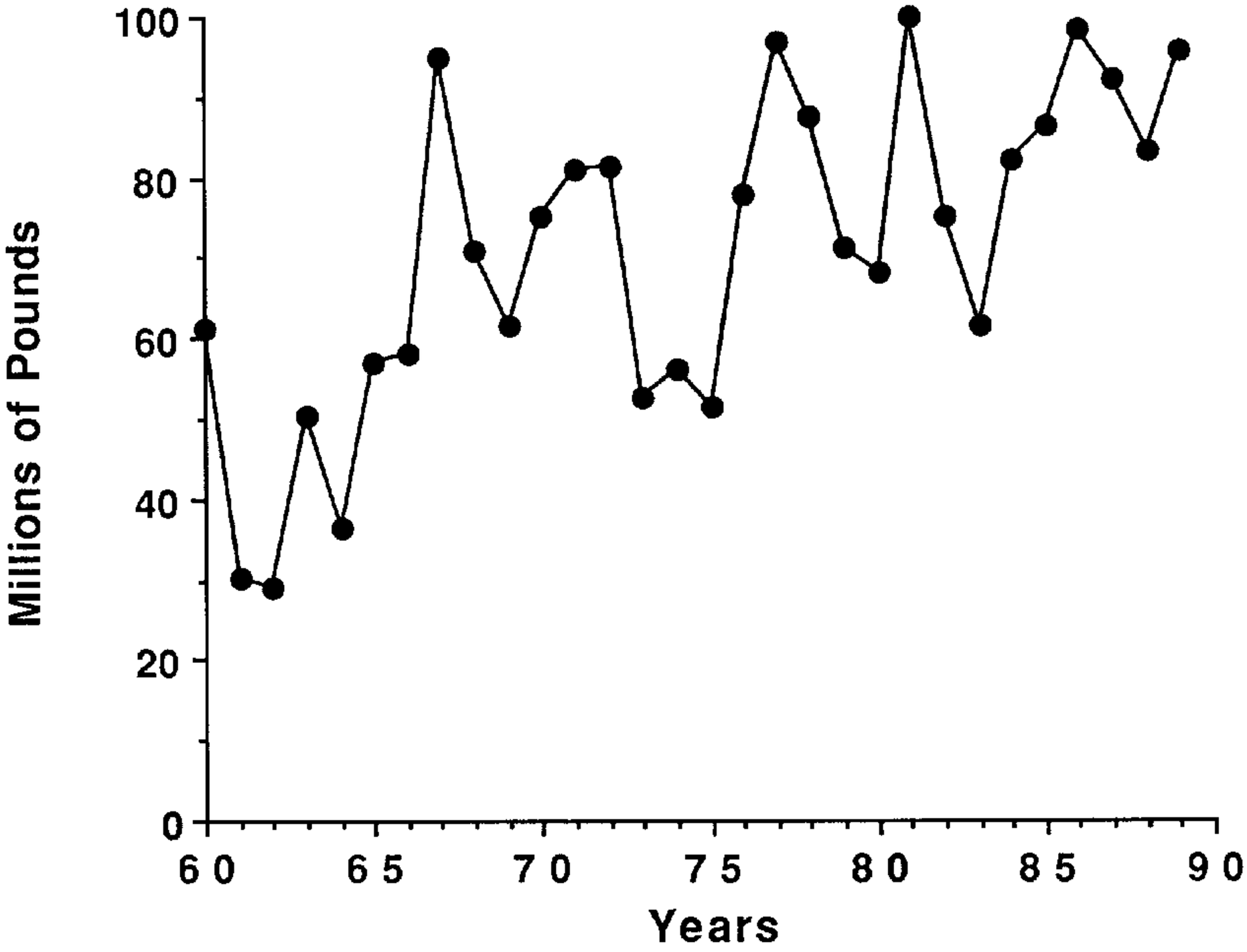


Figure 2. Brown Shrimp Directed Nominal Fishing Effort

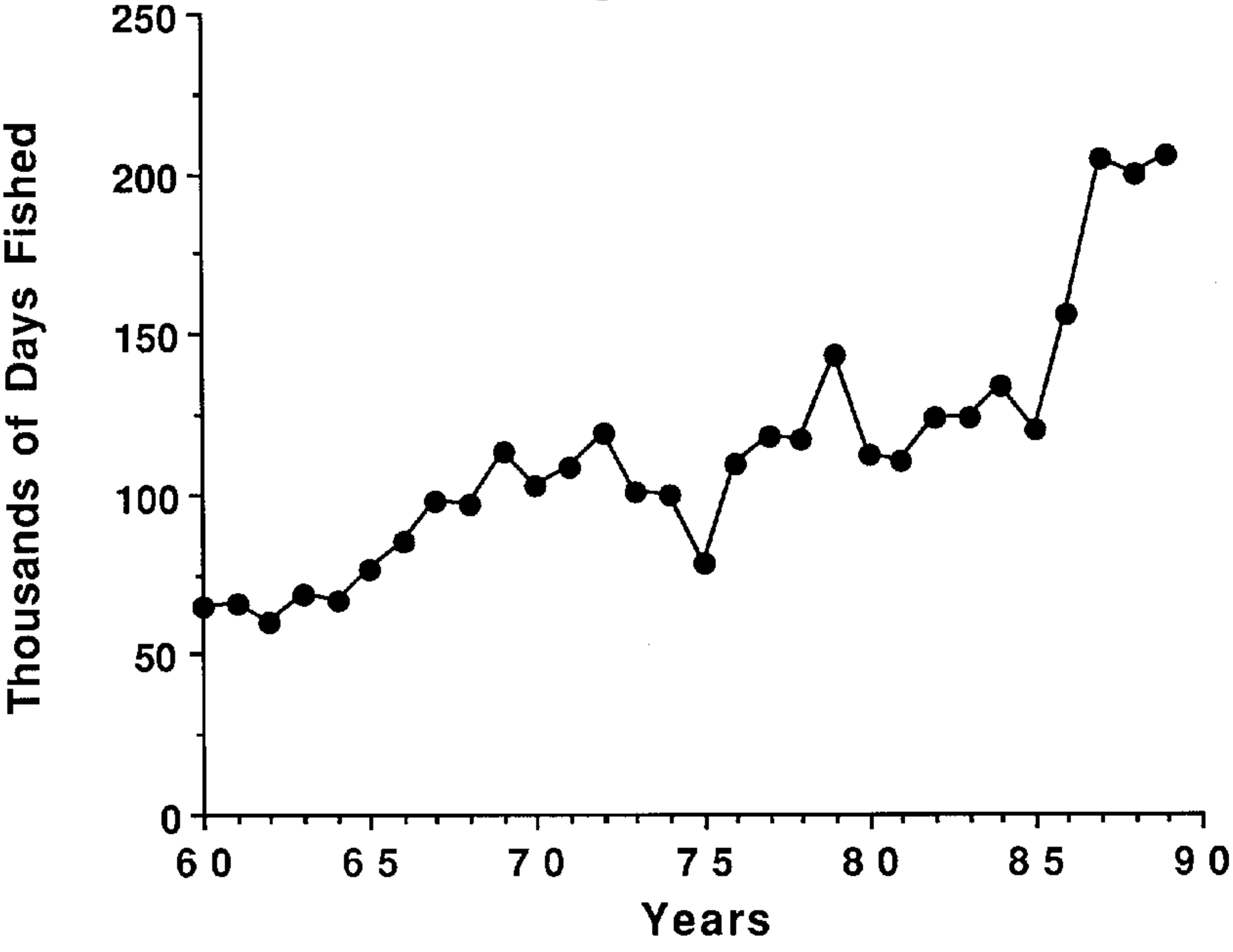


Figure 3. Brown Shrimp Catch per Day

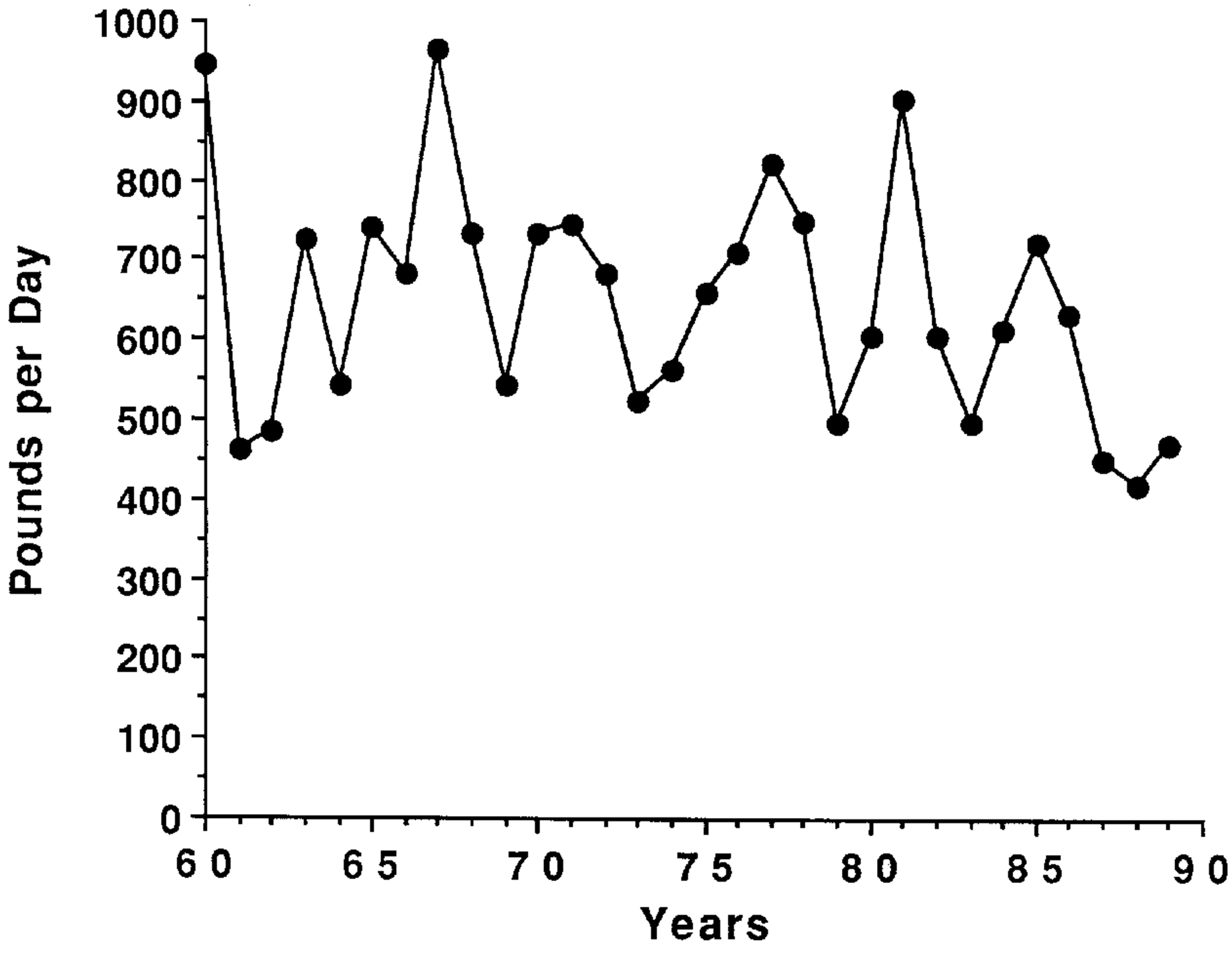


Figure 4. Brown Shrimp Recruitment

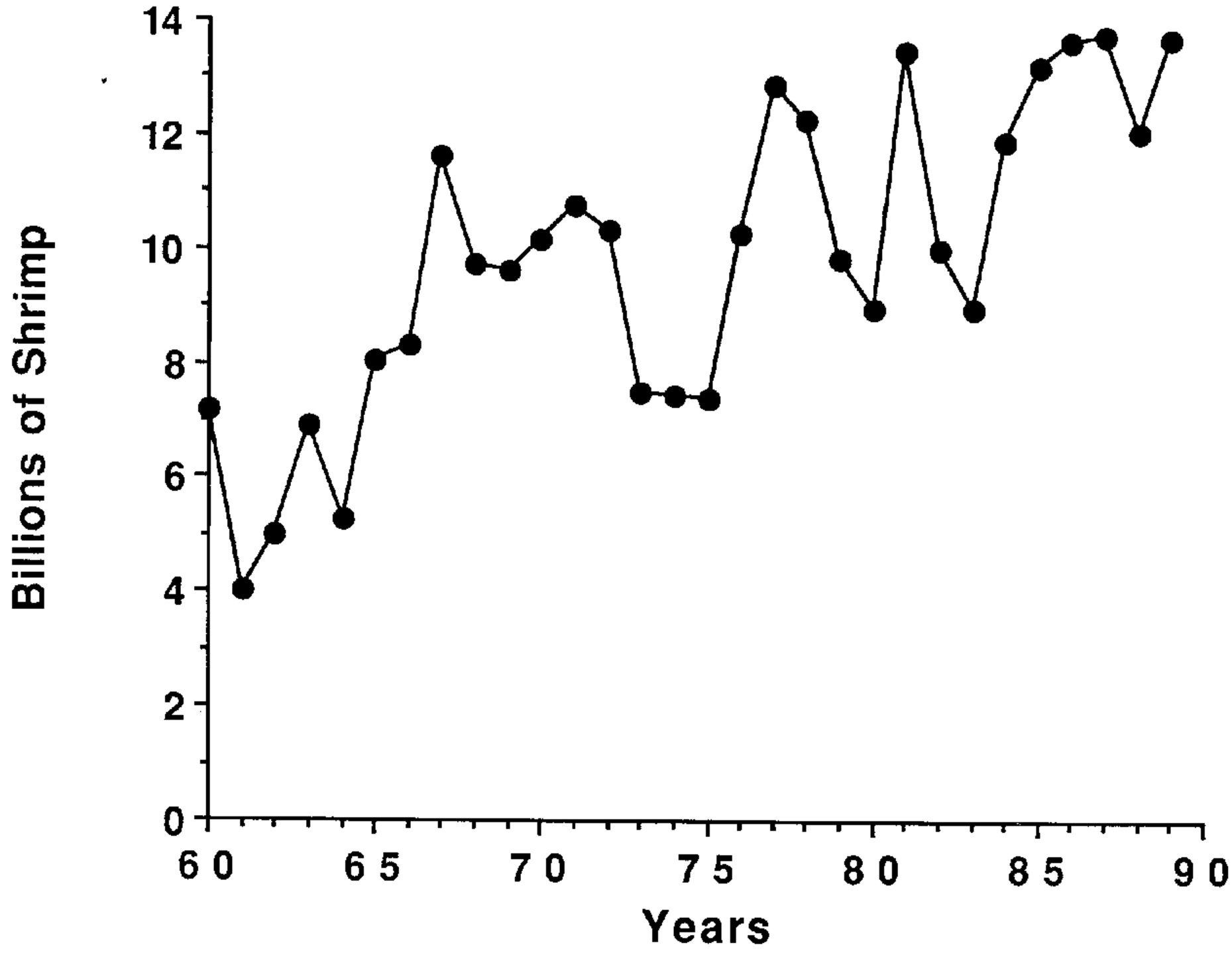


Figure 5. Brown Shrimp Parents (age 7+ months, November-February)

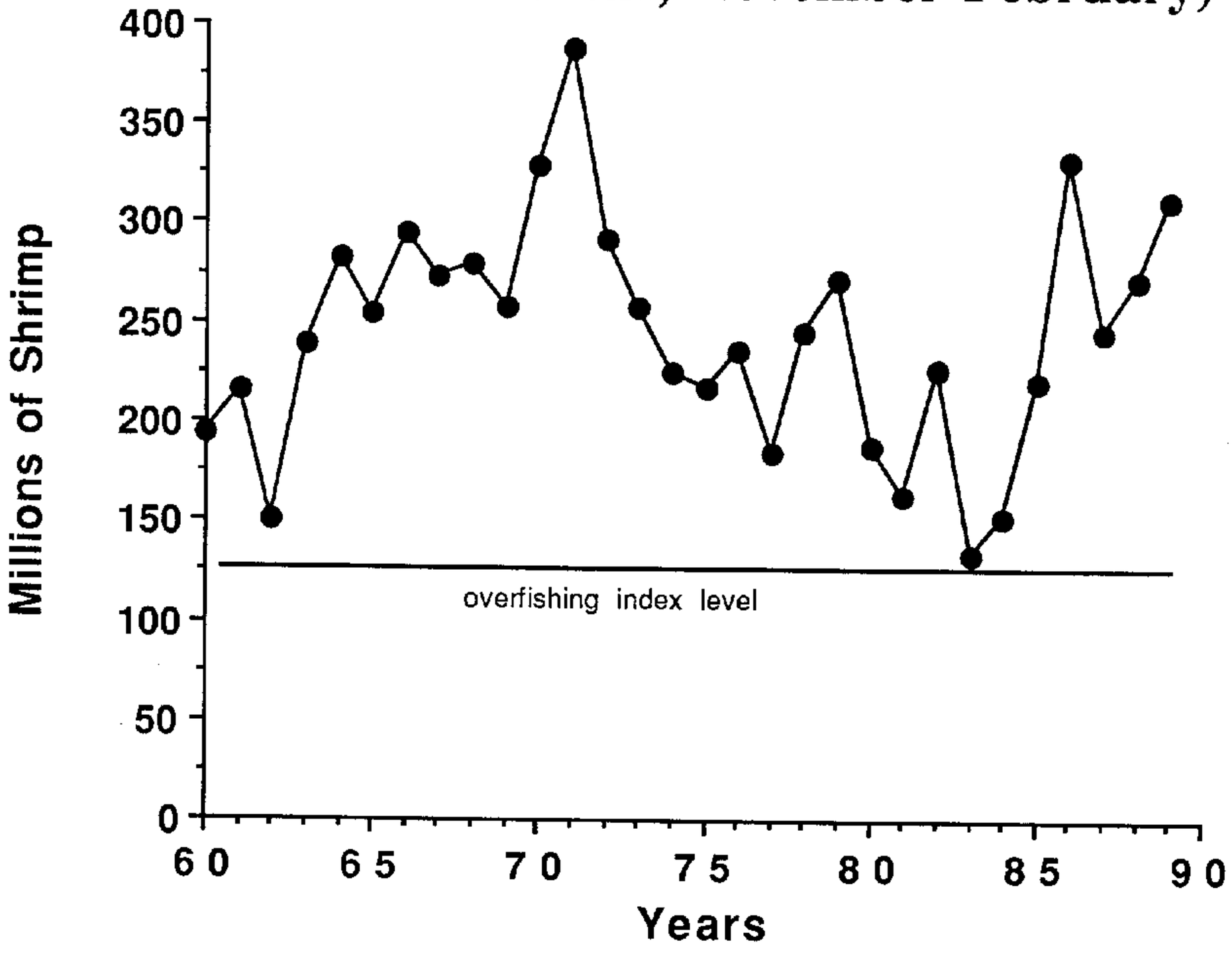


Figure 6. Brown Shrimp Parent Stock - Recruitment Relationship

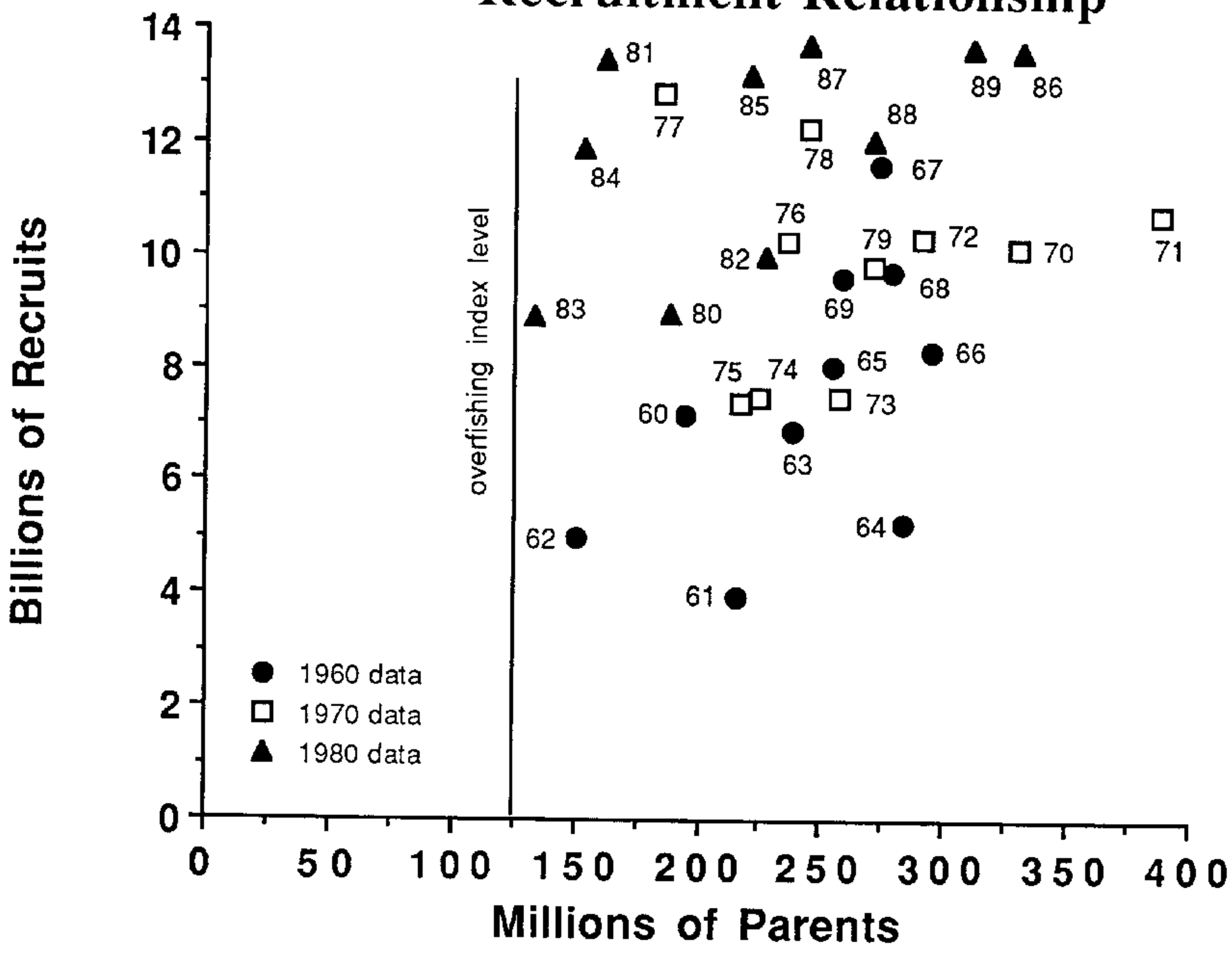


Figure 7. White Shrimp Landings

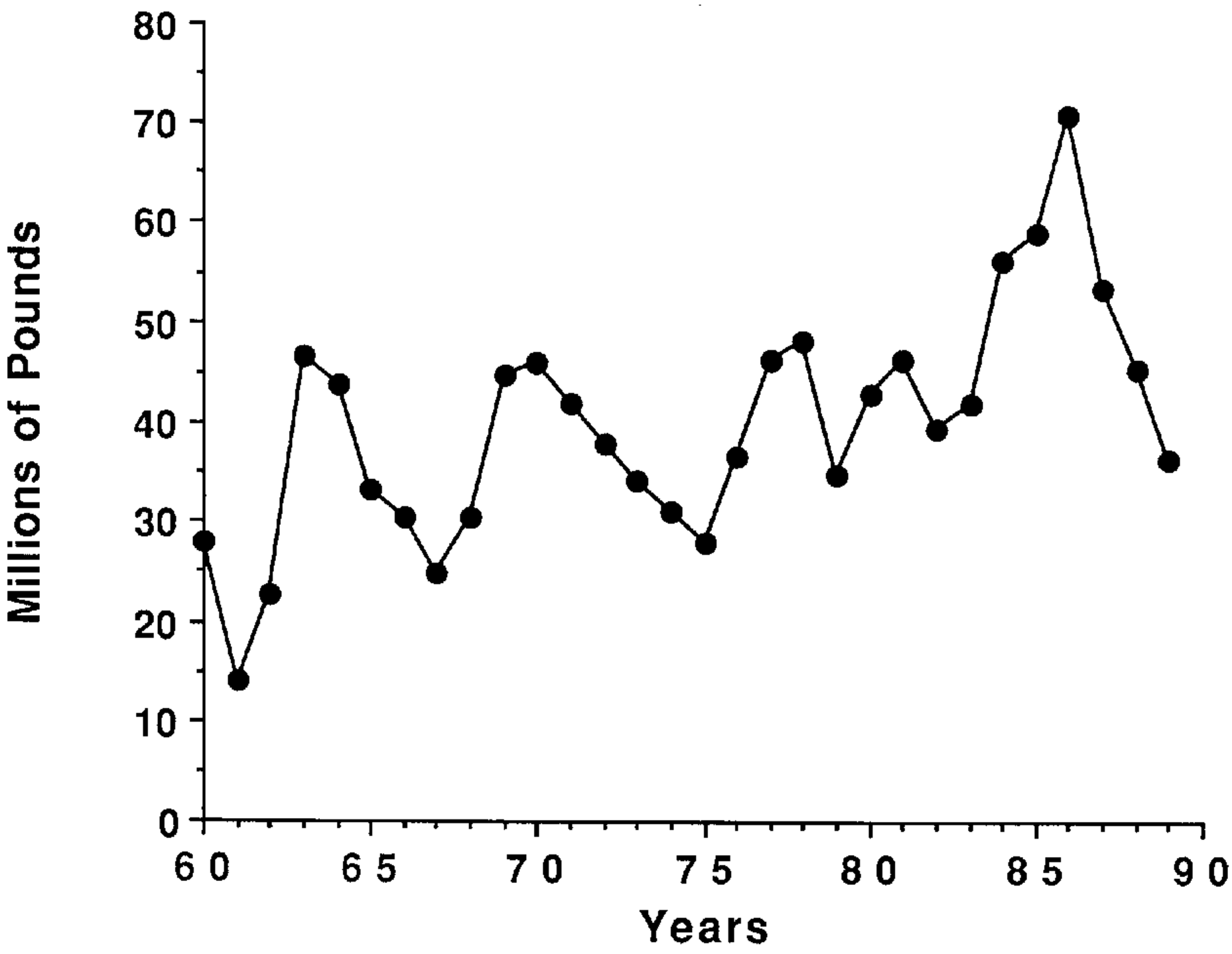


Figure 8. White Shrimp Directed Nominal Fishing Effort

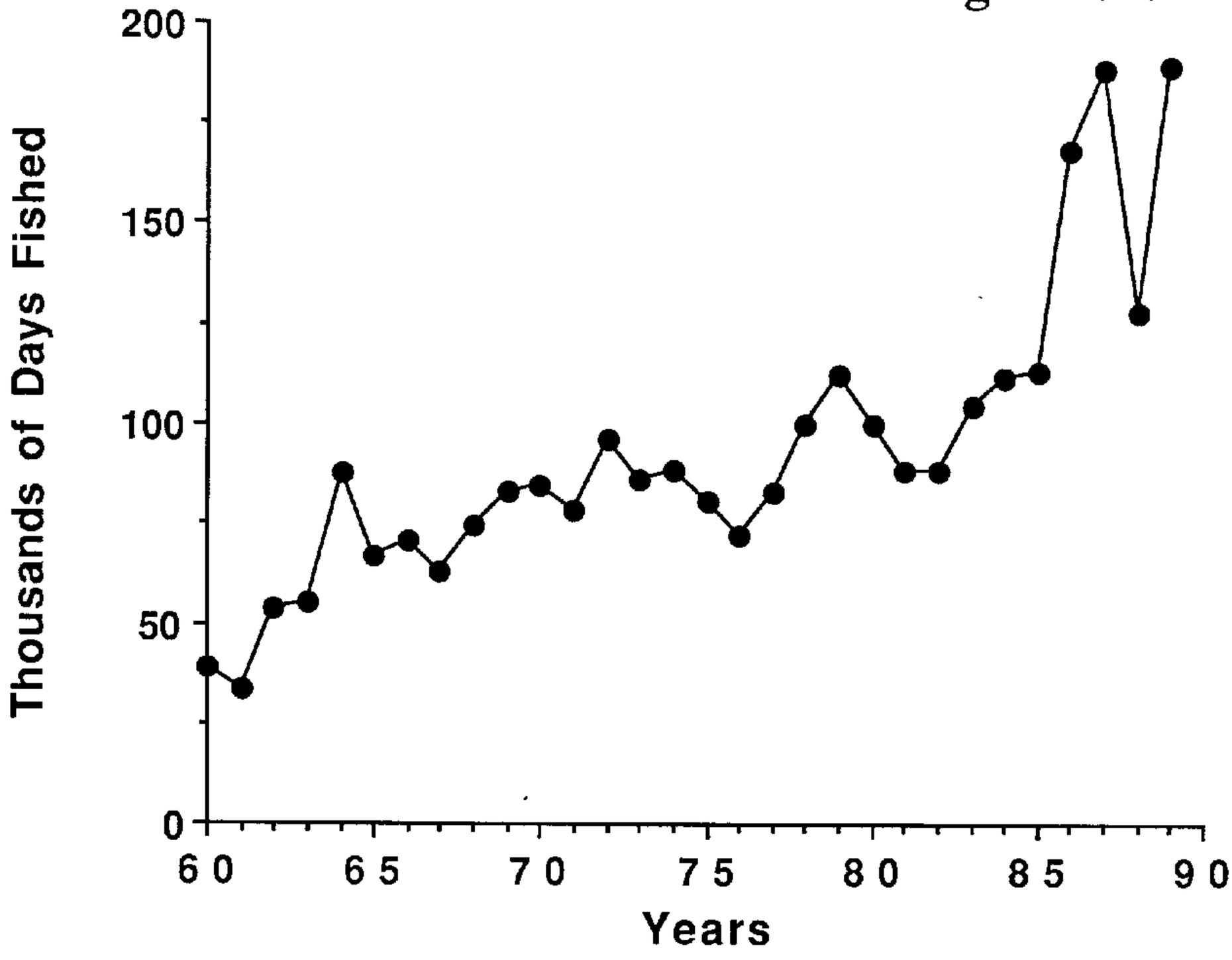


Figure 9. White Shrimp Catch per Day

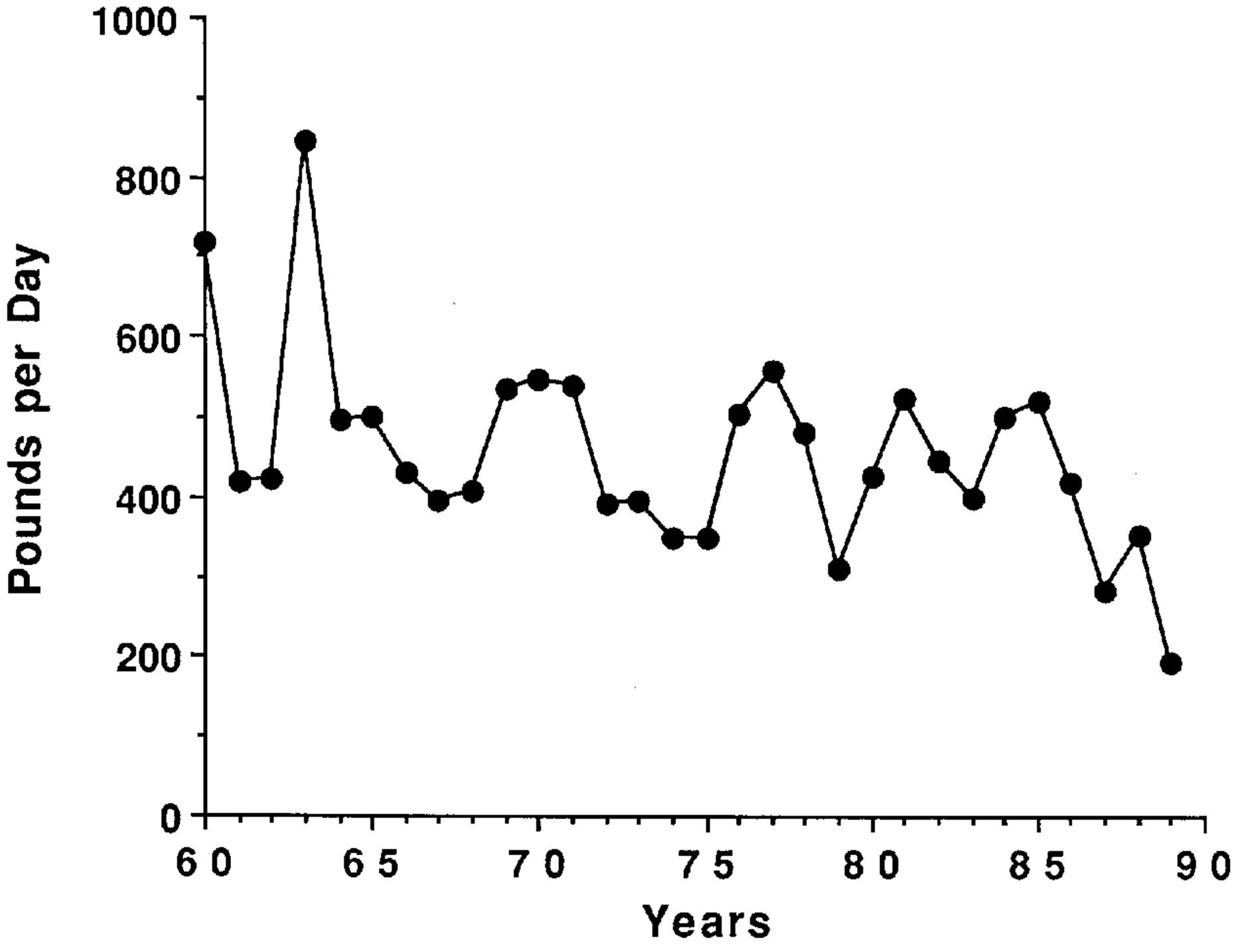


Figure 10. White Shrimp Recruitment

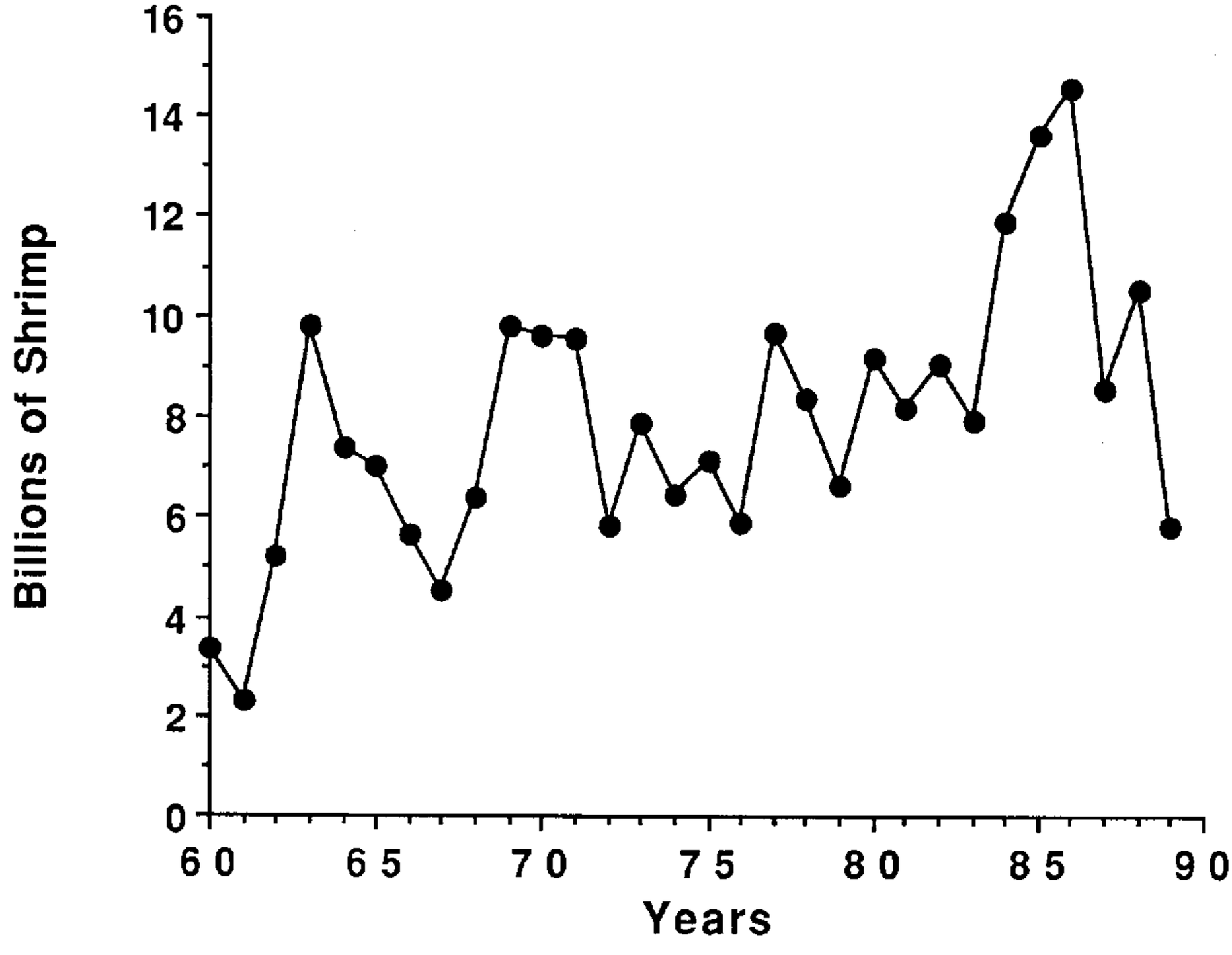


Figure 11. White Shrimp Parents (Age 5+ months, April-August)

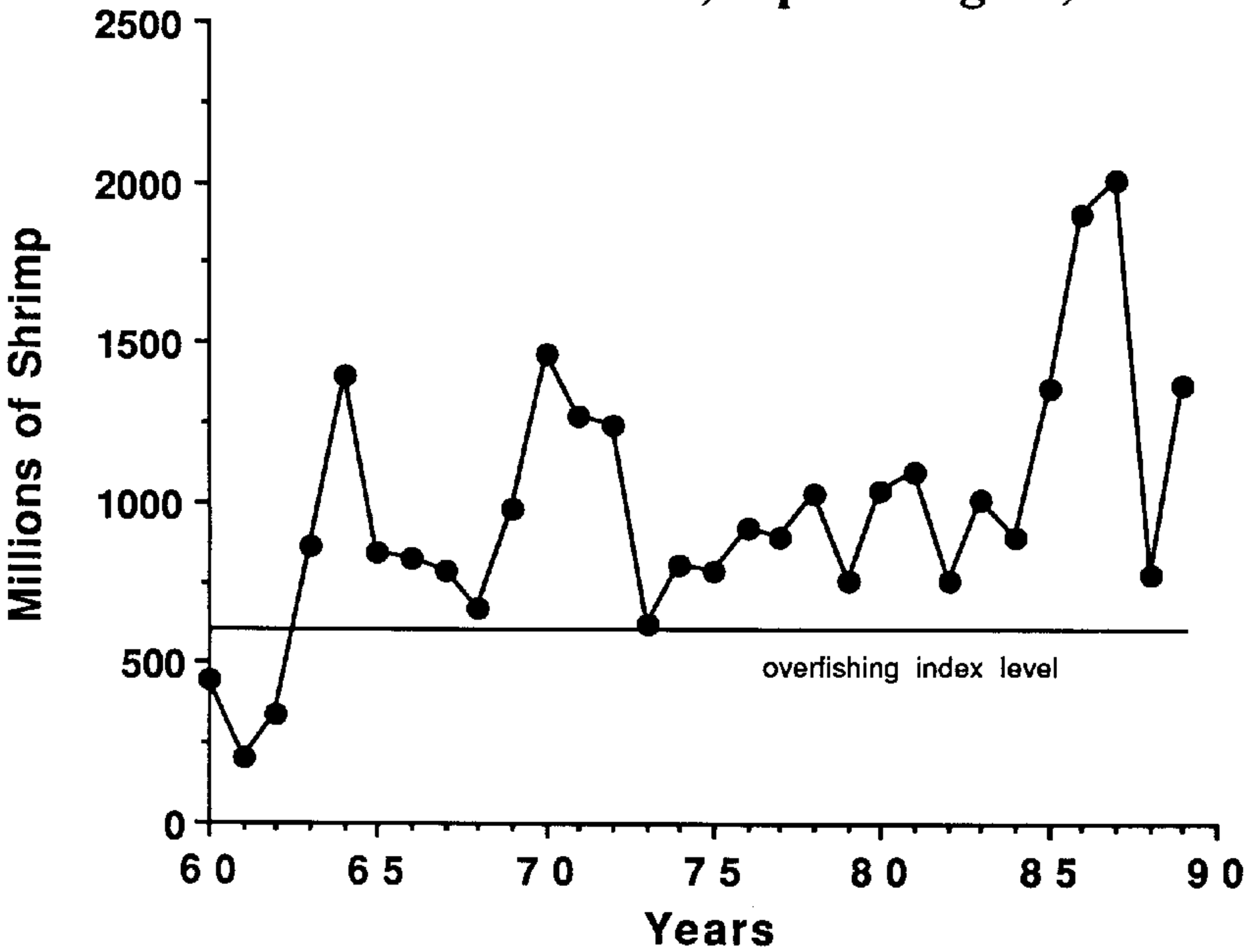


Figure 12. White Shrimp Parent Stock - Recruitment Relationship

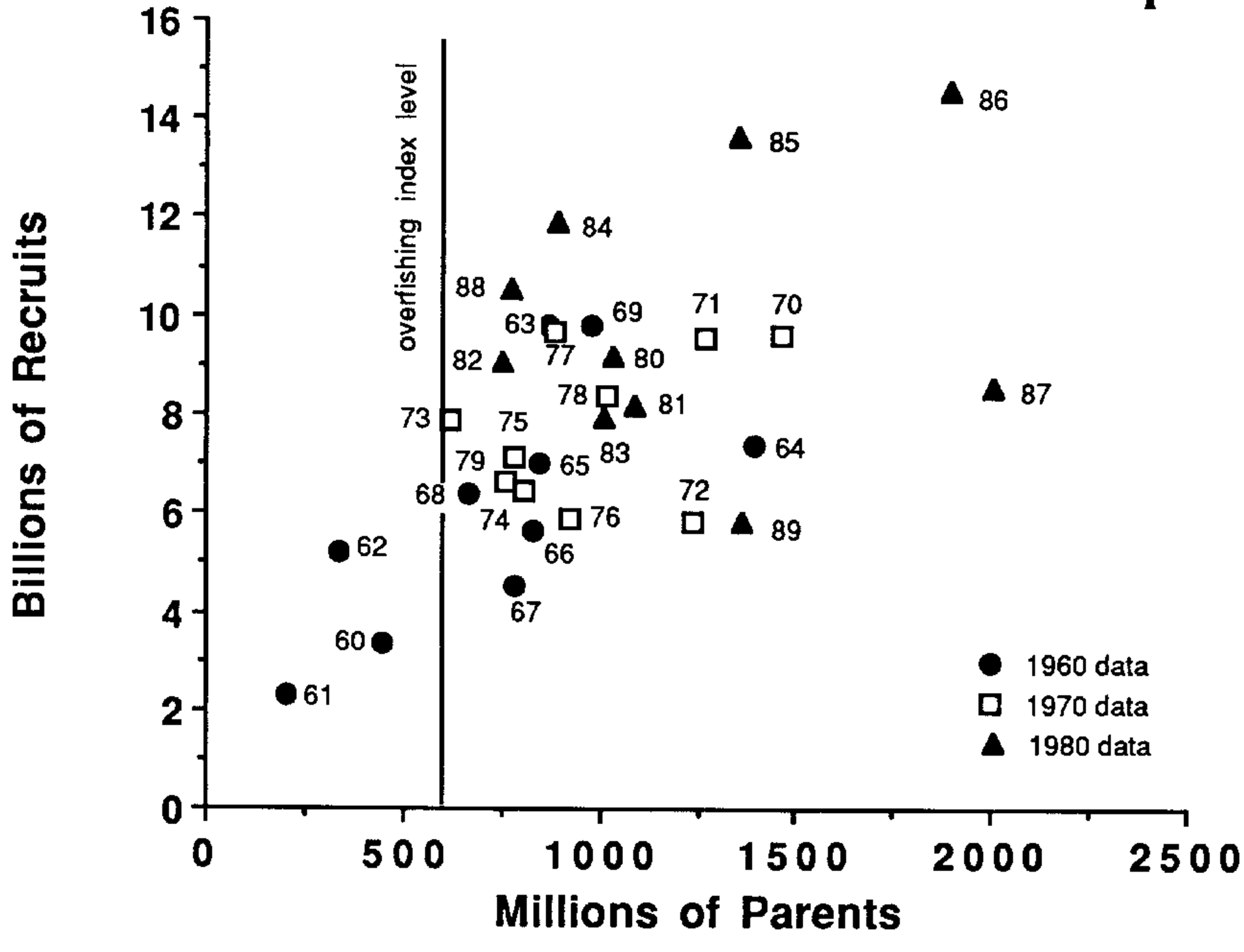


Figure 13. Pink Shrimp Landings

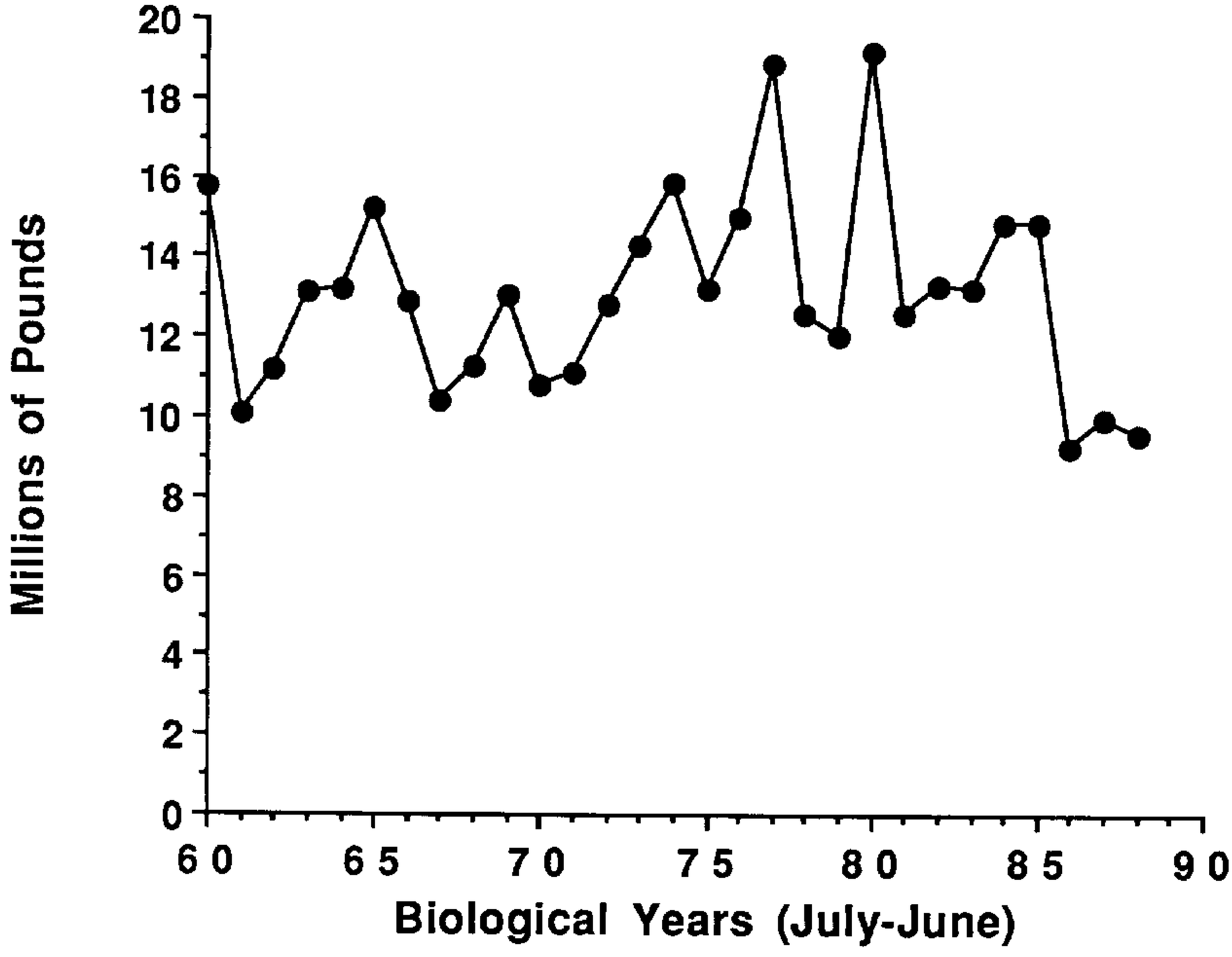


Figure 14. Pink Shrimp Directed Nominal Fishing Effort

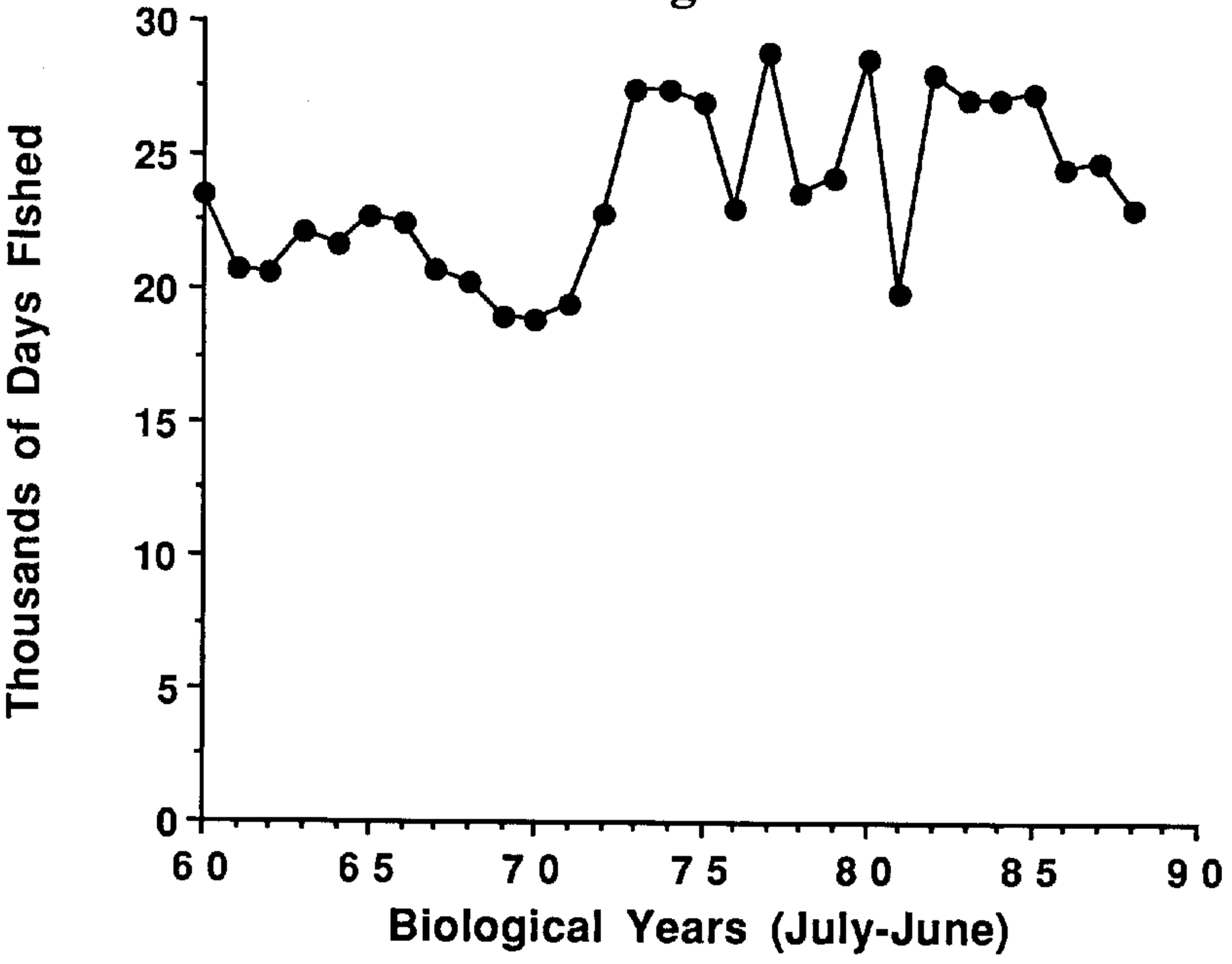


Figure 15. Pink Shrimp Catch per Day

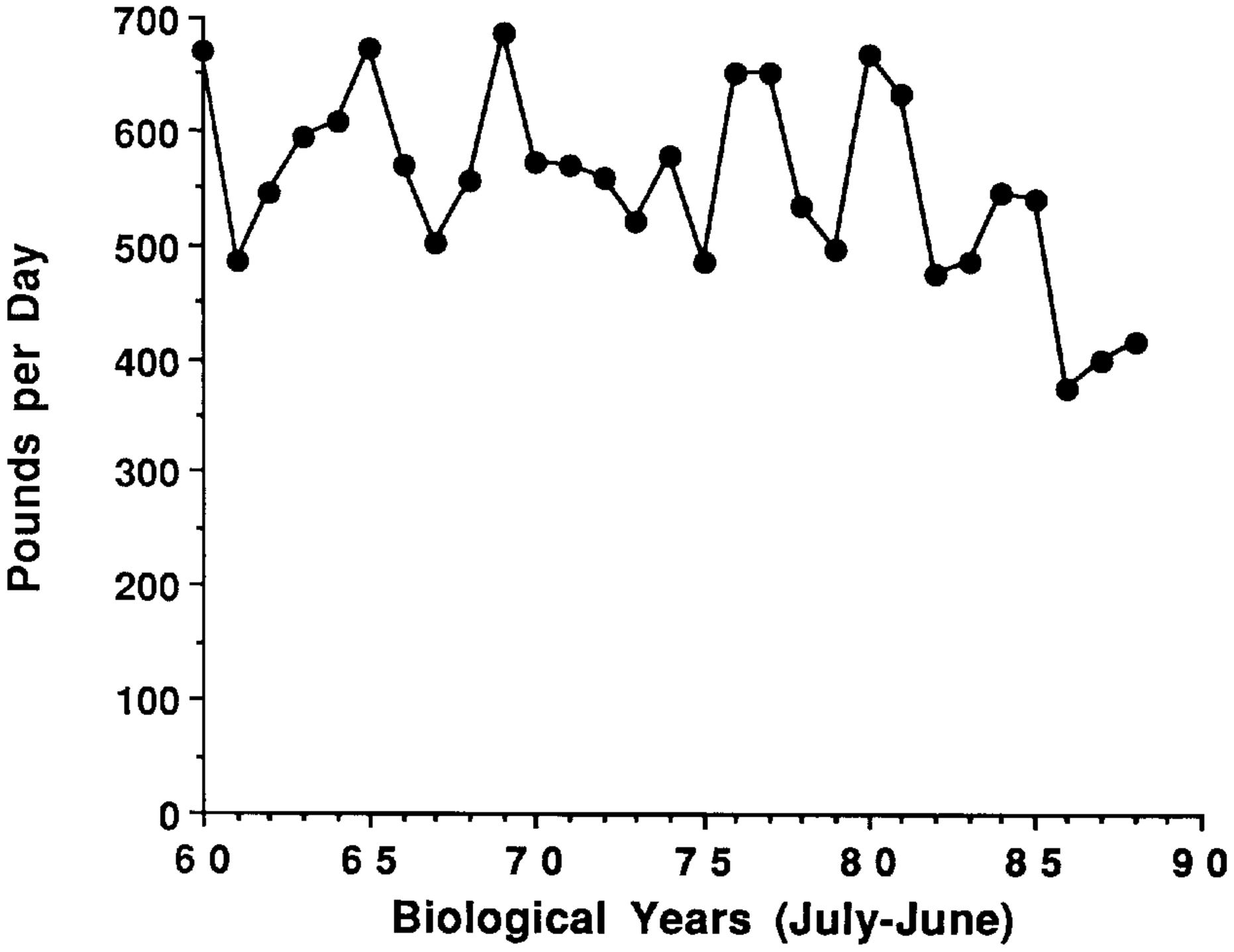


Figure 16. Pink Shrimp Recruitment

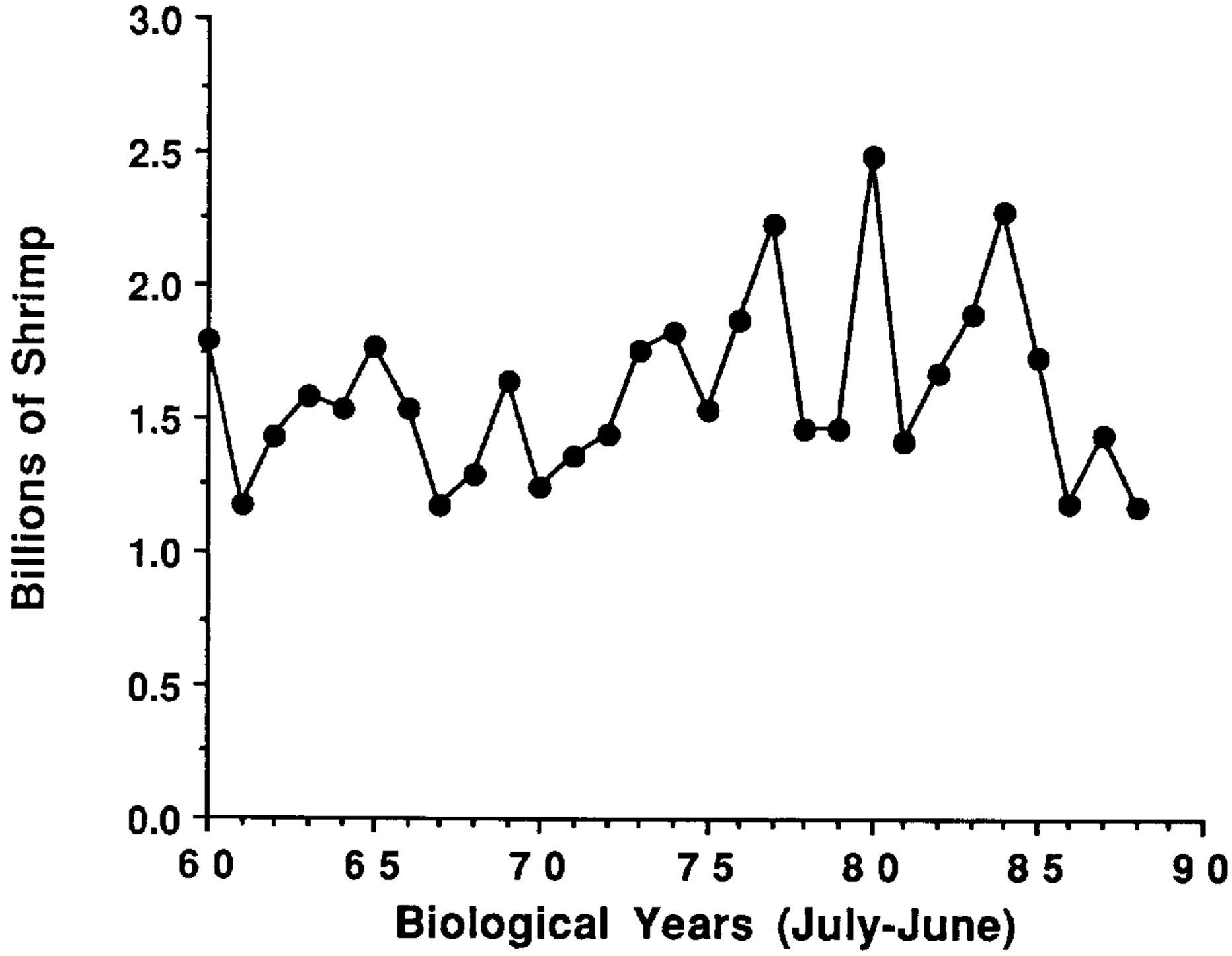


Figure 17. Pink Shrimp Parents (Age 5+ months, July-June)

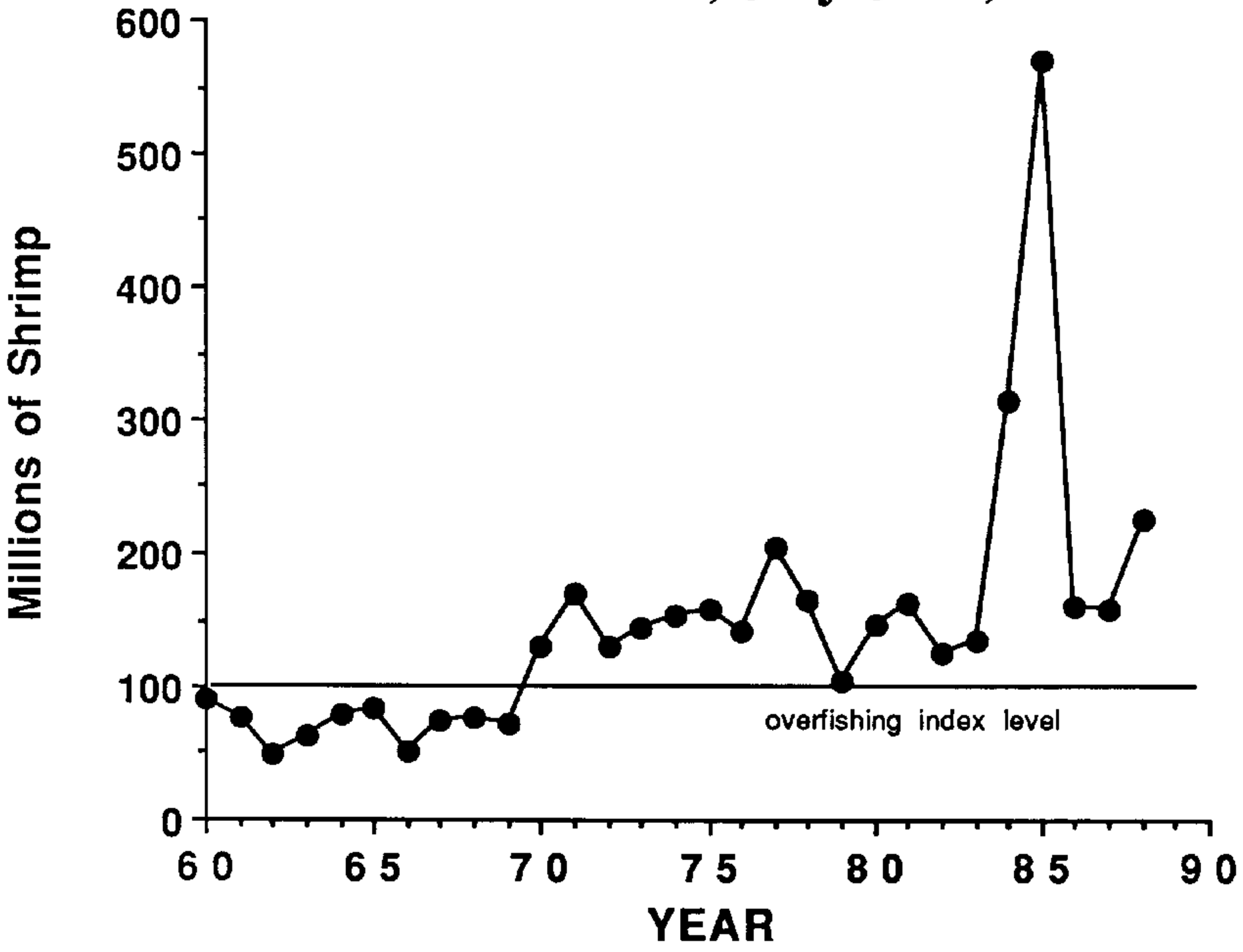


Figure 18. Pink Shrimp Parent Stock - Recruitment Relationship

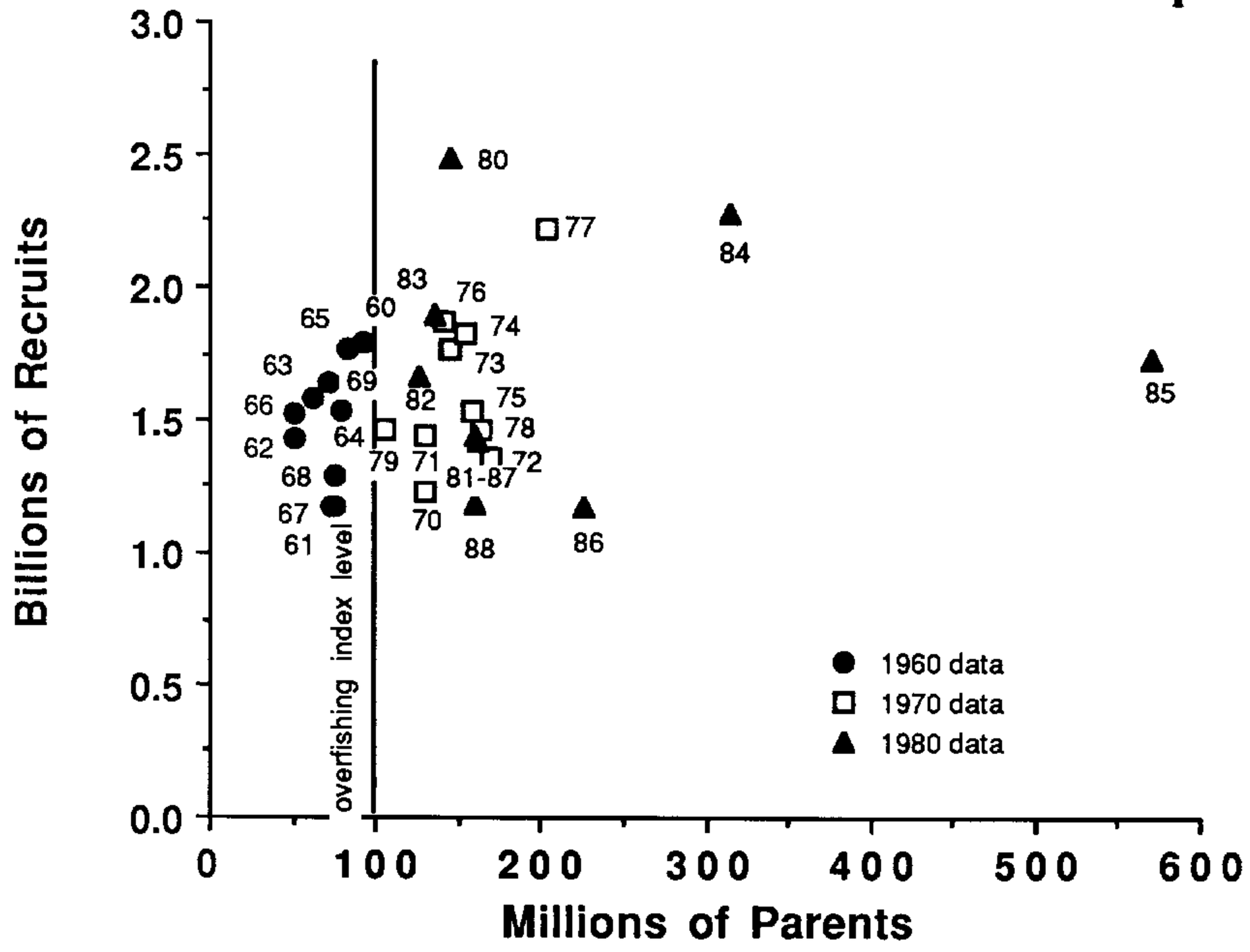


Figure 19. Royal Red Shrimp Landings

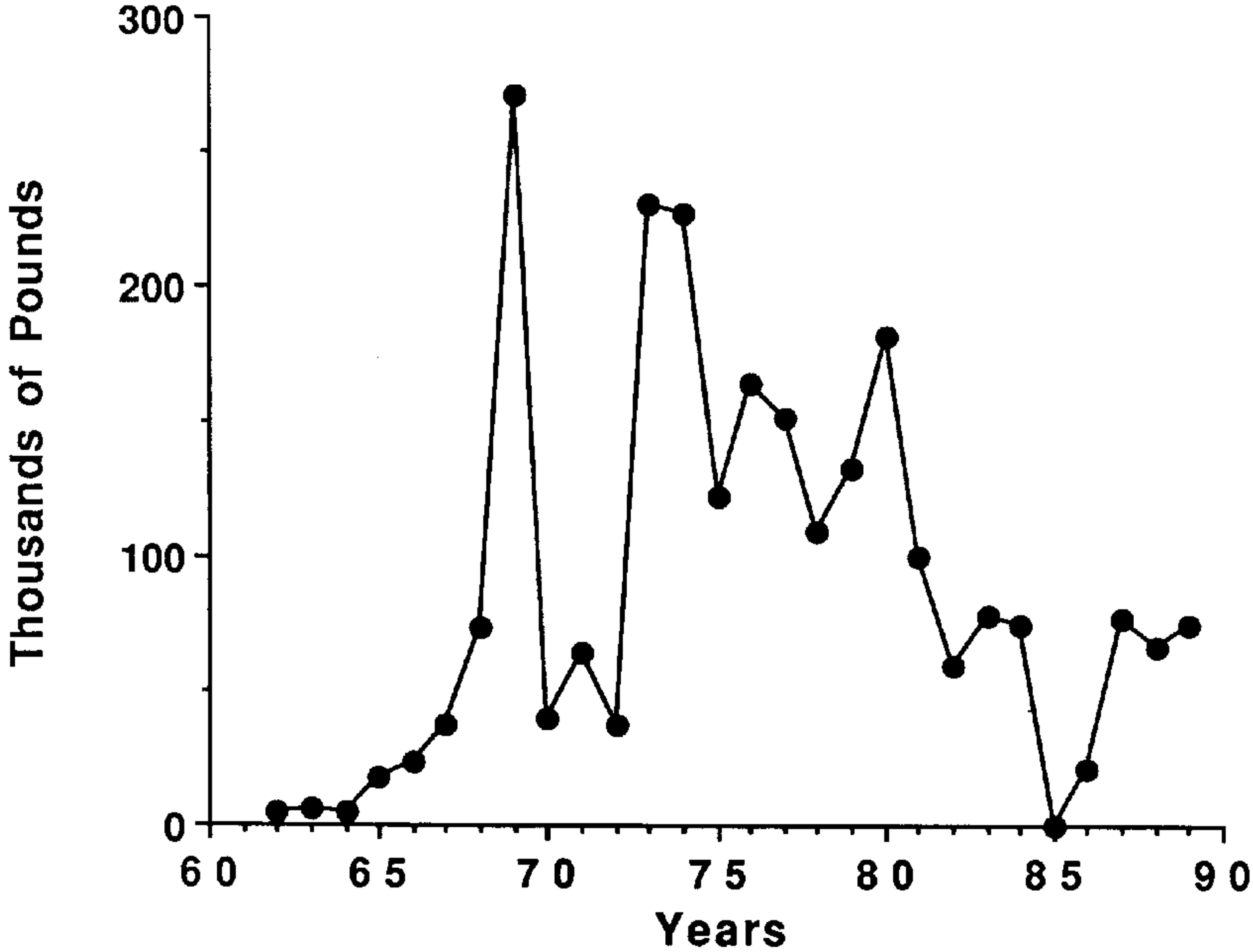


Figure 20. Rock Shrimp Landings

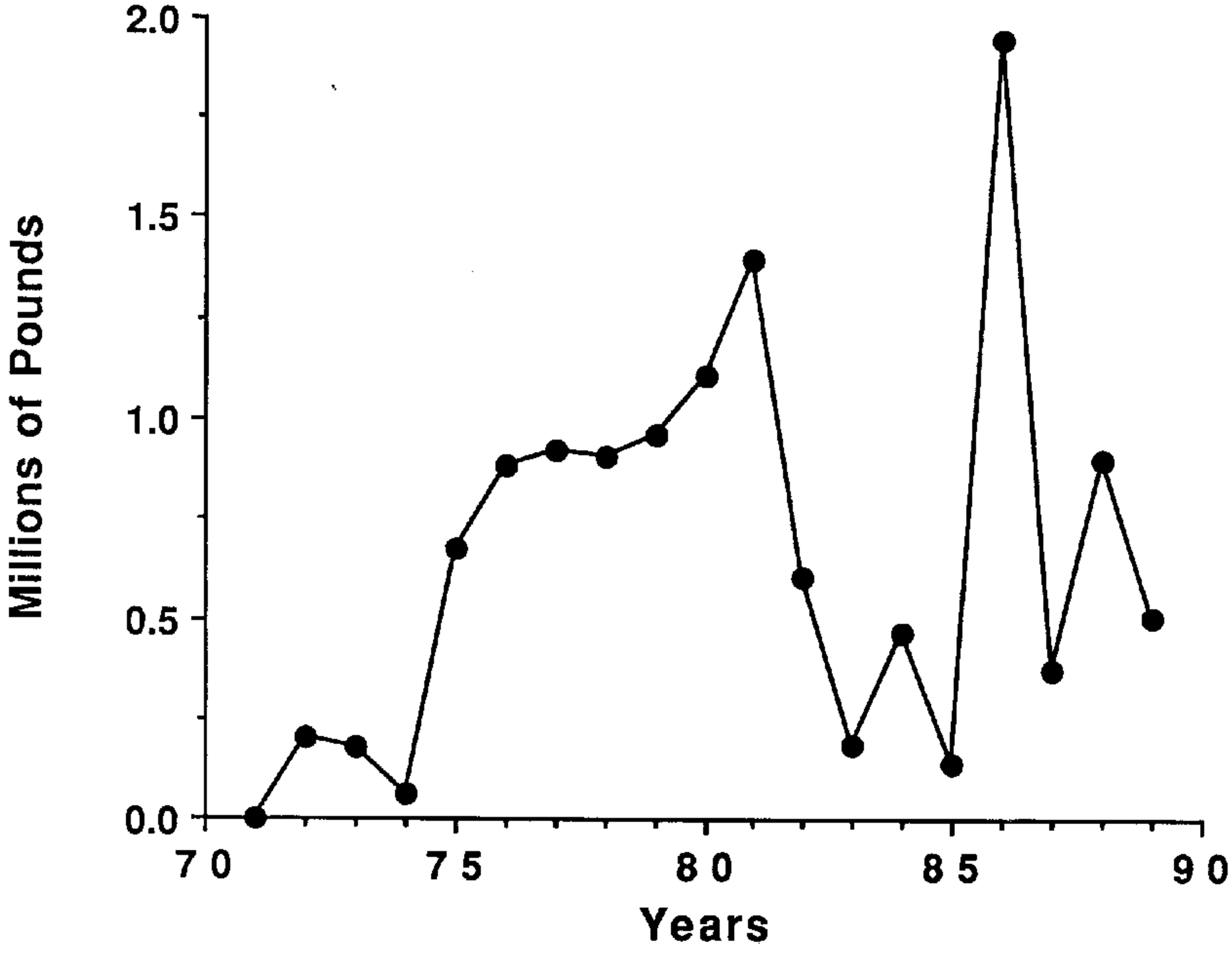
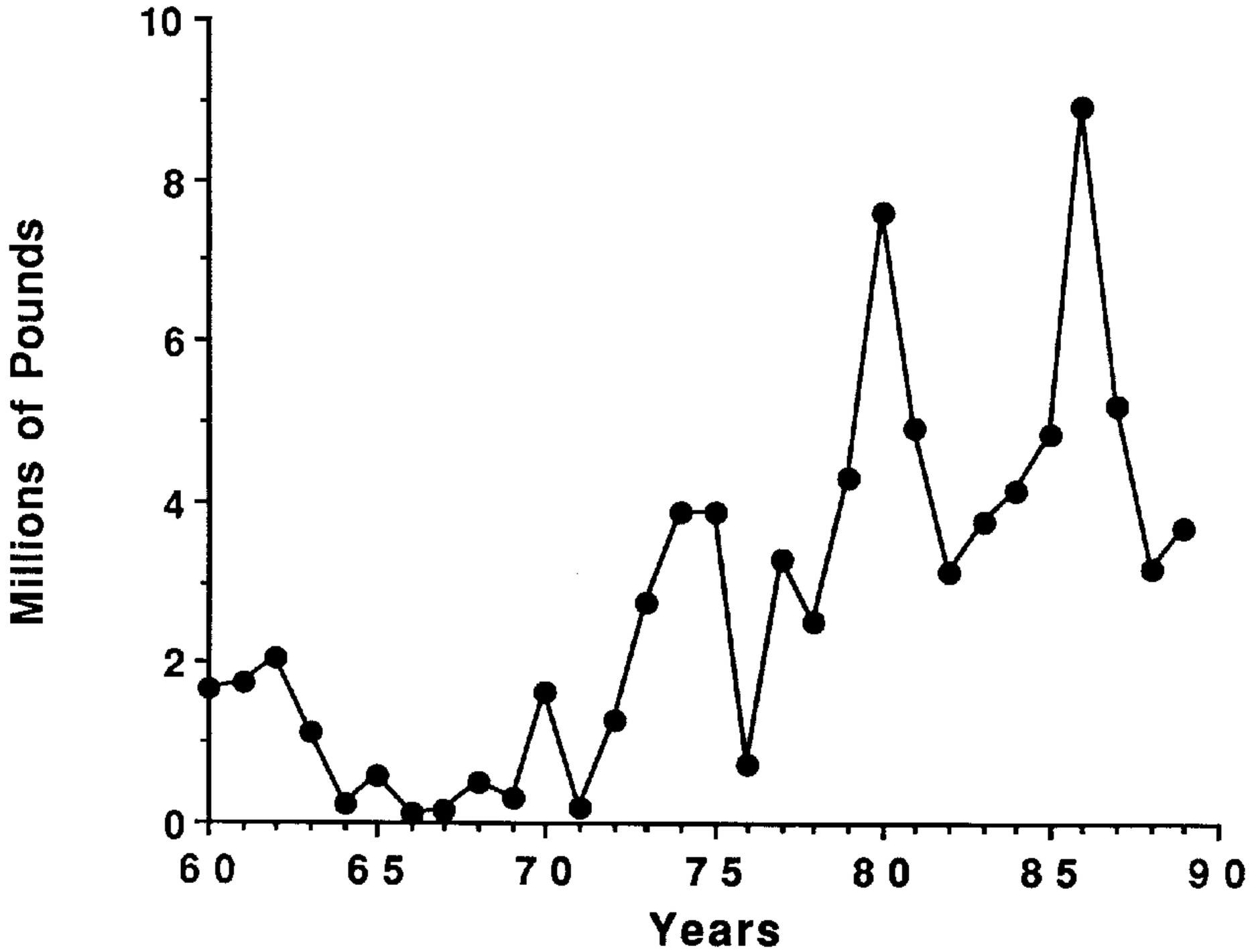
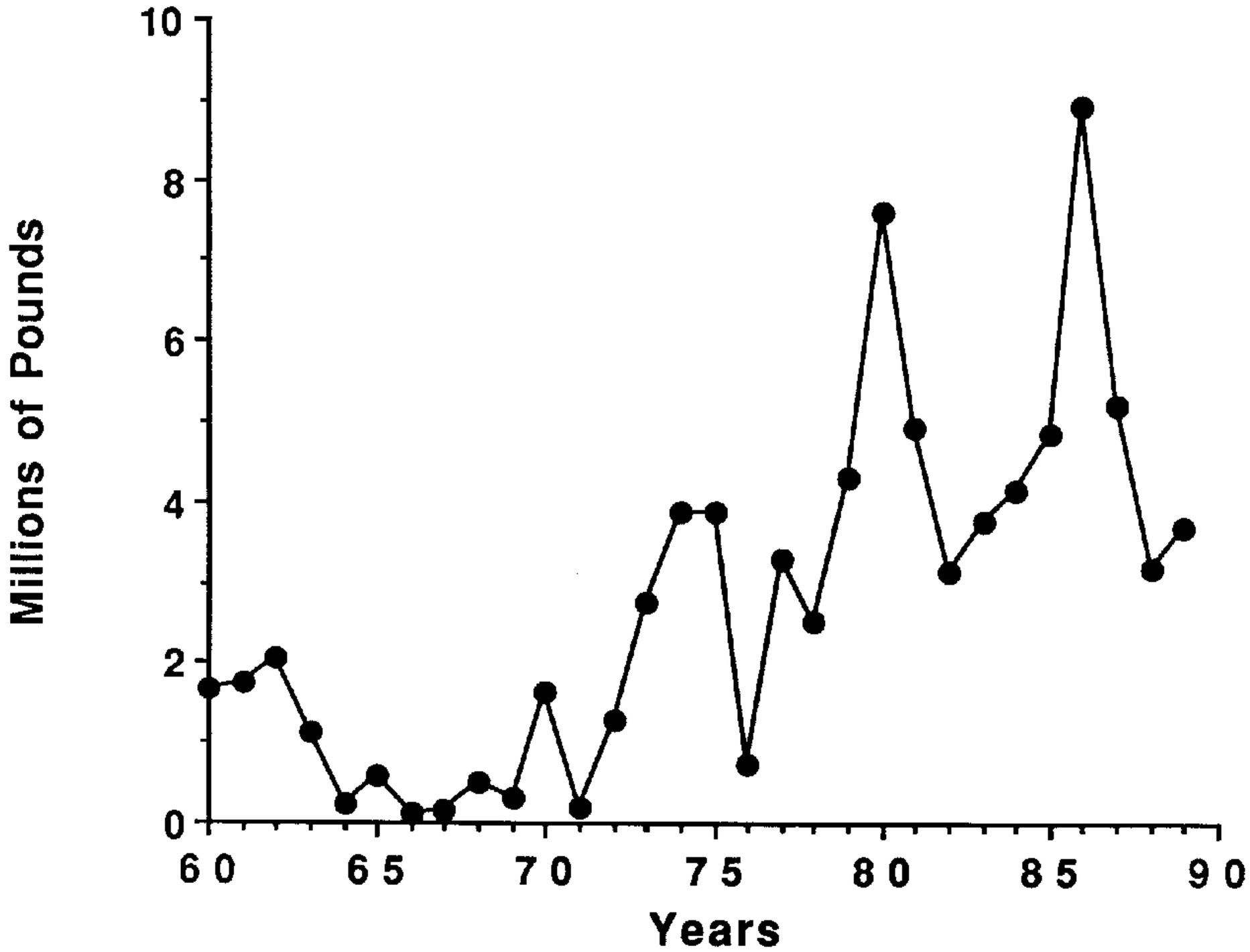


Figure 21. Seabob Shrimp Landings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