

**NBP-89-14**

Recent Growth and Biochemical Composition of Juvenile,  
Young-of-Year Winter Flounder from Different  
Areas of Narragansett Bay 51 pp

Buckley & Calderone (National Marine Fisheries Service)

Narragansett Bay Estuary Program

**RECENT GROWTH AND BIOCHEMICAL COMPOSITION OF JUVENILE,  
YOUNG-OF-YEAR WINTER FLOUNDER FROM DIFFERENT AREAS OF  
NARRAGANSETT BAY**

**OCTOBER 1988**

**FINAL REPORT TO THE NARRAGANSETT BAY PROJECT**

**BY**

**LAWRENCE J. BUCKLEY and ELAINE M. CALDARONE**

**NOAA, NMFS  
Northeast Fisheries Center  
Narragansett Laboratory  
Narragansett, RI 02882-1199**

**REPORT # NBP-89-14**

## **FOREWORD**

The United States Congress created the National Estuary Program in 1984, citing its concern for the "health and ecological integrity" of the nation's estuaries and estuarine resources. Narragansett Bay was selected for inclusion in the National Estuary Program in 1984 and designated an "estuary of national significance" in 1988. The Narragansett Bay Project (NBP) was established in 1985. Under the joint sponsorship of the U.S. Environmental Protection Agency and the Rhode Island Department of Environmental Management, the NBP's mandate is to direct a five-year program of research and planning focussed on managing Narragansett Bay and its resources for future generations. The NBP will develop a comprehensive management plan by December, 1990, which will recommend actions to improve and protect the Bay and its natural resources.

The NBP has established the following seven priority issues for Narragansett Bay:

- \* management of fisheries
- \* nutrients and potential for eutrophication
- \* impacts of toxic contaminants
- \* health and abundance of living resources
- \* health risk to consumers of contaminated seafood
- \* land-based impacts on water quality
- \* recreational uses

The NBP is taking an ecosystem approach to address these problems and has funded research that will help to improve our understanding of various aspects of these priority problems. The Project is also working to expand and coordinate existing programs among state agencies, governmental institutions, and academic researchers in order to apply research findings to the practical needs of managing the Bay and improving the environmental quality of its watershed.

This report represents the technical results of an investigation performed for the Narragansett Bay Project. The information in this document has been funded wholly or in part by the United States Environmental Protection Agency through Interagency Agreement #DW13931613 with the National Oceanic and Atmospheric Administration. It has been subject to the Agency's and the Narragansett Bay Project's peer and administrative review and has been accepted for publication by the Management Committee of the Narragansett Bay Project. The results and conclusions contained herein are those of the author(s), and do not necessarily represent the views or recommendations of the NBP. Final recommendations for management actions will be based upon the results of this and other investigations.

"Mention of a commercial company or product does not constitute an endorsement by NOAA (National Marine Fisheries Service). Use for publicity or advertising purposes of information from this publication concerning proprietary products or the tests of such products is not authorized."

## EXECUTIVE SUMMARY

From July through October 1986 over 550 juvenile winter flounder were collected at selected sites throughout Narragansett Bay. Study sites included five sites sampled monthly and four secondary sites sampled once in October. Study sites, extending from Jamestown in the lower bay to Gaspee Point in the Providence River, were chosen to include a wide range of water quality and expected contaminant loadings. The objectives of the study were first, to determine if there were any differences in growth and condition of young-of-year (YOY) winter flounder from different areas of Narragansett Bay and second, to determine if any observed differences were consistent with the involvement of pollutants. A wide range of indicators of fish growth and condition were studied including relative liver weight, parasite incidence, and tissue nucleic acid, protein, and lipid concentrations.

Differences in size, relative liver weight, parasite incidence, and biochemical composition were observed among YOY winter flounder collected at different locations in Narragansett Bay. With the exception of parasite incidence, these differences in condition did not correspond to any known environmental gradient in the Bay, natural or anthropogenic. Furthermore, observed differences in size and biochemical composition were not great and showed a tendency to diminish over the sampling period. Our results suggest that growth and condition of YOY winter flounder in Narragansett Bay are primarily responsive to local environmental conditions, that while somewhat persistent over time, do not correspond to any bay-wide gradient.

**TABLE OF CONTENTS**

	Page
LIST OF FIGURES . . . . .	v
LIST OF TABLES . . . . .	vi
INTRODUCTION . . . . .	1
METHODS . . . . .	2
RESULTS . . . . .	2
YOUNG-OF-YEAR (YOY) . . . . .	3
DISCUSSION . . . . .	4
REFERENCES . . . . .	6
FIGURES . . . . .	8
TABLES . . . . .	12
APPENDIX . . . . .	31

## LIST OF FIGURES

	Page
Figure 1. Beach seine sampling sites in Narragansett Bay. Primary sites: (1) Jamestown, (2) Patience-Prudence Islands, (3) Greenwich Bay, (4) Conimicut Point, (5) Gaspee Point. Secondary sites: (6) Bissel Cove, (7) Mill Cove, (8) Spectacle Cove, and (9) Spar Island. . . . .	8
Figure 2. Monthly length frequency distribution of winter flounder caught with a beach seine. Sites are combined. . . . .	9
Figure 3. Prevalence (%) of "pigment spots" and <i>Glugea</i> cysts in YOY winter flounder. . . . .	10
Figure 4. Monthly prevalence (%) of <i>Glugea</i> cysts in YOY winter flounder. . . . .	10
Figure 5. Mean length (mm) of YOY winter flounder by month and site. . . . .	11
Figure 6. Relative liver weight of YOY winter flounder by month and site. . . . .	11

## LIST OF TABLES

	Page
Table 1. Occurrence of "Pigment spots" and <i>Glugea</i> cysts in juvenile winter flounder. . . . .	12
Table 2. Size and biochemical composition of YOY winter flounder. . . . .	13
Table 3. Size and biochemical composition of YOY winter flounder by month. . . . .	14
Table 4. Size and biochemical composition of YOY winter flounder by location. . . . .	16
Table 5. Size and biochemical composition of YOU winter flounder by month and location. . . . .	18
Table 6. Two-way analysis of variance for the effects of month and location on size and biochemical composition of YOY winter flounder. . . . .	25
Table 7. Monthly mean size and composition of YOY winter flounder at selected sites in Narragansett Bay. Bracketed means are not statistically different at $P \leq 0.05$ (Tukey's studentized range test). . . . .	26
Table 8. Lipid concentration ( $\mu\text{g}/\text{mg}$ wet tissue) in muscle and liver of YOY winter flounder collected in September. Bracketed means are not statistically different at $P \leq 0.05$ (Tukey's studentized range test). . . . .	27
Table 9. Correlations among size and biochemical composition of YOY winter flounder. Values are: correlation coefficients probability > R under $H_0$ : $Rho = 0$ , number of observations. . . . .	28
Table 10. Correlations among size and lipid concentration of YOY winter flounder. . . . .	30

## INTRODUCTION

The winter flounder is one of the most important species in the commercial and recreational fisheries of Narragansett Bay and adjacent waters. Unlike other finfish species found seasonally in Narragansett Bay, winter flounder abundance is dependent upon successful reproduction and survival of early life stages in the Bay. Winter flounder spawn adhesive, demersal eggs between January and April. The planktonic larvae are found throughout the Bay from March to June. The larvae metamorphose into demersal juveniles 2 to 3 mo after hatching. While adult winter flounder move to deeper, cooler water offshore in summer, juveniles are found throughout the Bay year-round. The winter flounder is considered to be one of the most stationary fishes (Bigelow and Schroeder 1953). The population consists of many independent localized stocks that inhabit and spawn in the different bays and estuaries along the Northeast Coast of North America (Lobell 1939, Perlmutter 1947, Saila 1961). Winter flounder population levels have declined recently both in Narragansett Bay and on the northeast coast of the USA (Jeffries 1987, NMFS 1986). The roles of overfishing, pollution, and natural cycles in this decline have been the subject of considerable debate.

This study was undertaken first, to determine if there were differences in growth and condition of young-of-year (YOY) winter flounder from different areas of Narragansett Bay and second, to determine if any observed differences were consistent with the involvement of pollutants. Gradients in both organic and inorganic contaminant levels have been demonstrated in Narragansett Bay sediments (Santschi et al. 1984, Pruell and Quinn 1985). Contaminant levels were highest in the Providence River and decreased down bay. We hypothesized that if contaminants were having an adverse effect on winter flounder, differences in growth and condition would roughly correspond to this pollution gradient. The juvenile stage was chosen for study because of its importance to recruitment success and its sedentary, demersal nature. Juvenile winter flounder live in close association with the bottom, where they feed on a variety of organisms including crustaceans and polychaetes. In highly impacted portions of upper Narragansett Bay this behavior should result in exposure to a wide variety of contaminants both through direct contact with contaminants in water and sediments, and indirectly through the food chain. Sampling sites were selected to include a wide range of water quality and expected contaminant loadings.

A suite of indicators of fish growth and condition were studied including relative liver weight or hepato-somatic index (HSI), and RNA, DNA, protein, and lipid content of muscle and liver. At the time of dissection obvious lesions were noted. Relative liver weight is an index of nutritional condition or health of an organism. Abnormally low values indicate stress and poor condition. Abnormally high values indicate liver toxicosis. Tissue biochemical composition is sensitive to nutritional state (Love 1970) and contaminant exposure (Kearns and Atchinson 1979, Barron and Adelman 1984). The concentration of DNA is an index of cell number or biomass. RNA concentration is an index of metabolic activity or the rate of protein synthesis. RNA concentration and the RNA-DNA ratio have been used to estimate growth rate (Bulow 1987, Buckley 1984). Growth in fish is primarily accomplished by protein synthesis. Protein and lipid content of liver and muscle tissue are indices of nutritional condition. Both protein and lipid play major roles in energy storage and metabolism, in addition to their roles as structural components of tissue. A comparison of the biochemical composition of muscle and liver can provide information on the partitioning of energy between growth and detoxification of xenobiotics.

## METHODS

Winter flounder were collected by NEFC personnel using a 23-m x 1.5-m seine with 0.6-cm mesh in the cod-end. A minimum of ten fish per site were collected except for the September sample when 30 fish per site were collected to facilitate additional chemical analyses. Fish were held overnight at ambient temperature. Fish were blotted dry, weighed to the nearest milligram and measured to the nearest millimeter standard length. Scale samples were removed for ageing. Fish <65 mm were frozen whole, stored for up to 6 mo at -75°C and dissected without thawing. Fish >65 mm were dissected fresh. The liver and a sample of muscle tissue were removed from all fish. Muscle samples consisted of a fillet taken from above the lateral line on the dark side, anterior to the gill arch. Tissue samples were weighed and then either homogenized immediately in 9 volumes of ice cold distilled water to give a 10X homogenate, or frozen at -75°C. Tissues from fish that had previously been frozen were homogenized immediately. Muscle samples were homogenized with three 15-second pulses in an Omni-Mixer with a micro attachment at maximum speed. Liver samples were homogenized in a SDT Tissumizer with three 10-second pulses at maximum power. Frozen muscle homogenates were thawed and rehomogenized with one 5-second pulse of the SDT Tissumizer prior to pipeting out aliquots for the various assays. Dissections, homogenizations, and sample handling were done on ice. At the time of dissection any obvious abnormalities or lesions were noted.

Muscle and liver samples were analyzed for RNA, DNA and protein content using techniques described in Buckley (1979) and Buckley and Bulow (1987) with the following exception. RNA hydrolysis of muscle samples was done with 2.24 ml of 0.3N KOH and the hydrolysate acidified with 1.0 ml of 1.32N HClO<sub>4</sub>. The increased volume of base gave improved recovery of RNA from this tissue. The volumes of 10X homogenate used for the different assays were: for nucleic acids--100 µl of liver homogenate and 350 µl of muscle homogenate; for protein--2.0 µl of both liver and muscle homogenate; for lipid--7 µl of liver homogenate and 50 µl of muscle homogenate; and for carbohydrates--50 to 100 µl of liver homogenate.

Because of the limited tissue available, analyses for lipid and carbohydrate levels could not be run on the same fish analyzed for nucleic acids and protein. Muscle and liver from a subsample of fish collected in September were analyzed for total lipid content using the sulphophosphovanillin method ( Barnes and Blackstone 1973). Results on test samples run using this method and dry column elution followed by gravimetric analysis (Marmer and Maxwell 1981) were in good agreement. Liver samples from the September collections were analyzed for glycogen and free glucose content using enzymatic cleavage of glycogen (Carr and Neff 1984) and enzymatic (glucose oxidase) determination of glucose (Sigma Chemical Company). Low levels of carbohydrates in muscle samples made their analysis impractical.

Statistical analyses were run using SAS for personal computers (SAS Institute Inc.).

## RESULTS

More than 500 juvenile winter flounder were collected at 10 sites in Narragansett Bay during the 4 mos of sampling. Sampling sites included 5 primary sites sampled monthly between July and October (Figure 1) and 4 secondary sites sampled only once in October. A site just south of Sabin Point was abandoned after an initial sampling in July because of an abundance of urban litter which made seining operations difficult. A summary of all the data collected on each fish can be found in Appendix I as a Lotus 123 Spreadsheet.

Winter flounder ranged in size from 43 mm to 184 mm standard length. Length frequency distributions for each month showed a bimodal distribution for July, indicative

of two year classes (Figure 2). When the data were further broken-down by site, it was possible to estimate a maximum length for YOY winter flounder for each month: 100 mm for July, 107 mm for August, 109 mm for September and 115 mm for October. In 48 fish examined, 100% agreement was observed between age assignments based on length and scale analysis. The highest proportion of winter flounder >1-year old were collected at the Conimicut Point and Gaspee Point sites.

Two lesions were repeatedly observed in juvenile winter flounder collected in Narragansett Bay. "Pigment spots" or "black spot" were observed primarily on the fins. These were apparently the result of host response to larval trematode invasion. New England inshore fishes, including winter flounder, are subject to invasion by cercariae of *Cryptocotyle lingua* (Creplin) (Sindermann 1970). White cysts, observed on the viscera, were tentatively identified as cysts of the microsporidian *Glugea stephani* (Stuckard and Lux 1965). The incidence of these lesions is summarized in Table 1 and in Figures 3 and 4. The incidence of "black spots" was highest in the fish taken from the mid and lower Bay and showed no variation with month of collection. *Glugea* cysts were most often observed in fish from the upper bay and the percentage of infected fish increased over the sampling period, approaching 30% in YOY winter flounder collected at the Gaspee Point site in October (Figure 4).

#### YOUNG OF YEAR (YOY)

Data on the length, weight, and biochemical characters of YOY winter flounder collected in Narragansett Bay are presented in summary in Table 2, by month in Table 3, by location in Table 4 and by location within month in Table 5. Mean size of YOY winter flounder at all locations was 65.7, 71.7, 78.7, and 80.3 mm at the end of July, August, September, and October, respectively (Table 3). This corresponds to a growth rate in length of 6, 7, and 2 mm per month during August, September and October.

Two way analysis of variance indicated that both month of collection and location had a significant effect ( $P < 0.001$ ) on most of the variables measured (Table 6). Certain variables including muscle and liver RNA concentration were selected for further statistical analysis (Table 7). The monthly mean length for each location is given in Table 7 and Figure 5. Generally, Greenwich Bay fish were the largest and Conimicut Point fish were the smallest. Among the expanded suite of nine stations sampled in October, Greenwich Bay, Mill Cove, and Spectacle Cove produced the largest YOY winter flounder. Bissel Cove produced the smallest.

The relative liver weight (HSI) followed a similar pattern at the different locations showing a minimum value in September at all sites (Figure 6). YOY winter flounder taken at Greenwich Bay and Gaspee Point generally had the highest HSI, while fish taken at Conimicut Point had the lowest HSI. Among the suit of nine stations sampled in October, fish from the Gaspee Point and Mill Cove sites had the highest HSI and those from Conimicut Point and Spar Island the lowest (Table 7).

Among the five primary sites, muscle RNA concentrations were generally highest in Greenwich Bay fish and lowest in fish from Conimicut Point. Liver RNA concentrations were on average highest in fish from Patience- Prudence Islands and lowest in fish from Conimicut Point. Among YOY winter flounder sampled at nine sites in October, fish from Greenwich Bay and Mill Cove had the highest muscle and liver RNA concentrations. Fish from Conimicut Point and Mill Cove had the lowest muscle and liver RNA concentrations. There was no significant difference in muscle lipid levels between locations (Table 8). Fish from Conimicut Point had lower liver lipid levels than any other group.

Tables 9 and 10 show the correlations between the different variables measured. Among the biochemical characters positively related to fish size were muscle DNA

concentration, and liver RNA and lipid concentrations. Muscle protein levels showed a negative correlation with fish size. Fish size did not explain a large portion of the variability observed in any of the biochemical characters measured. The relative liver weight (HSI) was positively correlated with muscle RNA concentration, and the lipid concentration and RNA-DNA ratio of both muscle and liver.

## DISCUSSION

Differences in size, relative liver weight, parasite incidence, and biochemical composition of YOY winter flounder were observed among fish taken at different locations in Narragansett Bay. These differences tended to persist over the sampling period, although most decreased in magnitude between the first samples taken in July and the last samples taken in October. While certain characteristics of fish taken at the different sampling sites were consistent over the entire sampling period, with the exception of parasite incidence, these characters did not correspond to geographic proximity in the bay or to any known environmental gradient, natural or anthropogenic. For example, Conimicut Point consistently produced small fish. These fish on average had the lowest relative liver weights, liver lipid levels, and liver and muscle RNA concentrations, all suggesting slow growth and poor condition relative to the other sites. Gaspee Point, 2 miles up the estuary and closer to major sources of pollutants, produced YOY winter flounder surpassed in size only by Greenwich Bay fish. Furthermore, Gaspee Point fish had on average the highest HSI, the second highest muscle RNA and liver lipid levels, and average liver RNA levels, all indicative of good growth and condition of YOY winter flounder at this site. Greenwich Bay consistently produced the largest winter flounder. Fish from this location had on average high relative liver weight as well as high concentrations of RNA in muscle and liver, all indicative of rapid growth and good condition.

Both trematode invasion and *Glugea* infection can result in mortality of juvenile fish (Sindermann 1970). During controlled exposures, infestation by *Glugea* produced mortality on the order of 50% in juvenile winter flounder (Cali et al. 1986). The close parallel between the pollution gradient in Narragansett Bay (Pruell and Quinn 1985) and the incidence of *Glugea* cysts in winter flounder warrants further investigation. The increase in the prevalence of *Glugea* cysts in YOY winter flounder from July to October is in agreement with previous reports on temperature requirements (Mc Vicar 1975, Olson 1976) and seasonal prevalence (Takvorian and Cali 1984). Since identification was limited to cysts visible to the unaided eye, earlier stages of infection would have been missed.

In contrast to the *Glugea* infestation pattern, larval trematode incidence decreased along the pollution gradient and showed no trend with month of collection. The life cycle of the trematode involves two other intermediate hosts, consequently, its presence in winter flounder is dependent upon the availability of intermediate hosts and other environmental factors.

The roughly inverse distribution of the two lesions in winter flounder provides an interesting contrast: the Jamestown site had the lowest prevalence of *Glugea* cysts (0%) and the highest prevalence of "black spots" (100%) while the Gaspee Point Site had the lowest prevalence of "black spots" (0%) and the highest prevalence of *Glugea* cysts (30% in October). No correlation was observed between the presence of either parasite and size or condition of fish, however, in most instances the degree of infestation did not appear severe.

Preliminary findings from a study of growth and survival of winter flounder larvae in Narragansett Bay indicated that (1) hatching occurs first in the Providence River and progressively later down Bay, (2) larval abundance is usually highest in the Providence river and decreases down Bay, and (3) larvae were generally largest in the Providence River, decreasing down Bay in absolute size and size within stage (A. Durbin personal

communication). In contrast, our data show that during the summer and early fall YOY winter flounder are largest in Greenwich Bay and show no trend in size along the North-South axis of the bay. Further, while sampling for this study was not designed to produce quantitative estimates of YOY winter flounder abundance, the catch per unit of effort was almost an order of magnitude greater at the Jamestown site in the lower bay than at any of the other sites sampled. The distribution of "black spots" and *Glugea* cysts together with the persistence of other characters of winter flounder at the various study sites over time suggests that movement of YOY winter flounder between study sites was limited during the sampling period.

The mean size of YOY winter flounder in Narragansett Bay appears larger than that reported for Mystic River Estuary (Pearcy 1962) or the Niantic River (Northeast Utilities 1987). At least part of this difference may be due to the tendency of YOY flounder collected with a beach seine to be larger than those collected with a trawl as noted by Pearcy (1962) and observed in this work. Growth of juvenile winter flounder was highest in Narragansett Bay during warm summer months and decreased in October with falling water temperatures. The occurrence of minima in relative liver weight at all sites in September suggests a bay-wide response of YOY winter flounder to broad scale environmental stimuli. Several other indices of growth and condition also reached minimum values in September, including muscle and liver RNA concentration and liver RNA-DNA ratio. These minima were observed more than a month after maximum water temperature was reached and may be a physiological consequence of the transition from a period of rapid growth to one of accumulation of energy reserves.

Our results suggest that growth and condition of YOY winter flounder in Narragansett Bay are primarily responsive to local conditions such as food availability that, while somewhat persistent over time, do not correspond to any bay-wide gradient. Furthermore, the observed differences in size and composition of YOY winter flounder among sites are not great and tend to diminish with time over the first year of life. These observations suggest that future work should emphasize the early juvenile period or even earlier life history stages. The apparent higher abundance of juvenile winter flounder at the Jamestown site in the lower bay suggests that quantitative studies of YOY winter flounder abundance and mortality are warranted.

## REFERENCES

- Barnes, H., and J. Blackstone. 1973. Estimation of lipids in marine animals and tissues: Detailed investigation of the sulphophosphovanillin method for "total" lipids. *J. Exp. Mar. Biol. Ecol.* 12:103-118.
- Barron, M. G., and I. R. Adelman. 1984. Nucleic acid, protein content and growth of larval fish sublethally exposed to various toxicants. *Can. J. Fish. Aquat. Sci.* 41:141-150.
- Bigelow, H. B., and W. C. Schroeder. 1953. Fishes of the Gulf of Maine. *Fish. Bull., Fish Wildl. Serv., U.S.* 53:1-577.
- Buckley, L. J. 1979. Relationships between RNA-DNA ratio, prey density, and growth rate in Atlantic cod (*Gadus morhua*) larvae. *J. Fish. Res. Board Can.* 36:1497-1502.
- Buckley, L. J. 1984. RNA-DNA ratio: An index of larval fish growth in the sea. *Mar. Biol.* 80:291-298.
- Buckley, L. J., and F. J. Bulow. 1987. Techniques for the estimation of RNA, DNA, and protein in fish. pp. 345-354. In R. C. Summerfelt and G. E. Hall (Eds.) *Age and growth of fish*. Iowa State Univ. Press, Ames.
- Bulow, F. J. 1987. RNA-DNA ratios as indicators of growth in fish: A review. pp. 45-64. In R. C. Summerfelt and G. E. Hall (Eds.) *Age and growth of fish*. Iowa State Univ. Press, Ames.
- Cali, A., P. M. Takvorian, J. J. Ziskowski, and T. Sawyer. 1986. Experimental infection of American winter flounder (*Pseudopleuronectes americanus*) with *Glugea stephani* (Microsporidia). *J. Fish. Biol.* 28(2):99-206.
- Carr, S., and J. Neff. 1984. Quantitative semi-automated enzymatic assay for glycogen. *Comp. Biochem. Physiol.* 77B:447-449.
- Jeffries, H. P. 1987. Final report to Narragansett Bay Project.
- Kearns, P. K., and G. J. Atchison. 1979. Effects of trace metals on growth of yellow perch (*Perca flavescens*) as measured by RNA-DNA ratios. *Environ. Biol. Fish.* 4:383-387.
- Lobell, M. J. 1939. A biological survey of the salt waters of Long Island, 1938. Report on certain fishes, winter flounder (*Pseudopleuronectes americanus*). Suppl. 28th Ann. Rep., N. Y. Cons. Dep., Pt. I:63-96.
- Love, M. R. 1970. *The chemical zoology of fishes*. Academic Press, New York.
- Marmer, W. N., and R. J. Maxwell. 1981. Dry column method for the quantitative extraction and simultaneous class separation of lipids from muscle tissue. *Lipids* 16:365-371.
- McVicar, A. H. 1975. Infection of plaice *Pleuronectes platessa* L. with *Glugea (Nosema) stephani* (Hagenmuller, 1899) (Protozoa: Microsporidia) in a fish farm and under experimental conditions. *J. Fish. Biol.* 7:611-619.
- NMFS (National Marine Fisheries Service). 1986. Status of the fishery resources off the Northeastern United States for 1986. NOAA Tech. Mem. NMFS-F/NEC-43.

- Northeast Utilities. 1987. Monitoring the marine environment of Long Island Sound at Millstone Nuclear Power Station, Summary of studies prior to unit 3 operation. Northeast Utilities Service Company, Environmental Lab., Waterford, CT.
- Olson, R. E. 1976. Laboratory and field studies on *Glugea stephani* (Hagenmuller). A microsporidian parasite of pleuronectid flatfishes. J. Protozool. 23:158-164.
- Pearcy, W. G. 1962. Ecology of an estuarine population of winter flounder *Pseudopleuronectes americanus* (Walbaum). Bull. Bingham Oceanogr. Coll. 18:5-78.
- Perlmutter, A. 1947. The black back flounder and its fishery in New England and New York. Bull. Bingham Oceanogr. Coll. 11:1-92.
- Pruell, R. J., and J. G. Quinn. 1985. Geochemistry of organic contaminants in Narragansett Bay sediments. Est., Coast. Shelf Sci. 21:195-312.
- Saila, S. B. 1961. A study of winter flounder movements. Limnol. Oceanogr. 6:292-298.
- Santschi, P. H., S. Nixon, M. Pilson, and C. Hunt. 1984. Accumulation of sediments, trace metals (Pb, Cu) and total hydrocarbons in Narragansett Bay, Rhode Island: Est., Coast. Shelf Sci. 19:427-449.
- Sindermann, C. J. 1970. Principal diseases of marine fish and shellfish. Academic Press, New York.
- Stuckard, H. W., and F. E. Lix. 1965. A microsporidian infection of the digestive tract of the winter flounder, *Pseudopleuronectes americanus*. Biol. Bull. (Woods Hole) 129:371-387.
- Takvorian, P. M., and A. Cali. 1984. Seasonal prevalence of the microsporidian, *Glugea stephani* (Hagenmuller), in winter flounder, *Pseudopleuronectes americanus* (Walbaum), from the New York-New Jersey Lower Bay Complex. J. Fish. Biol. 24:655-663.

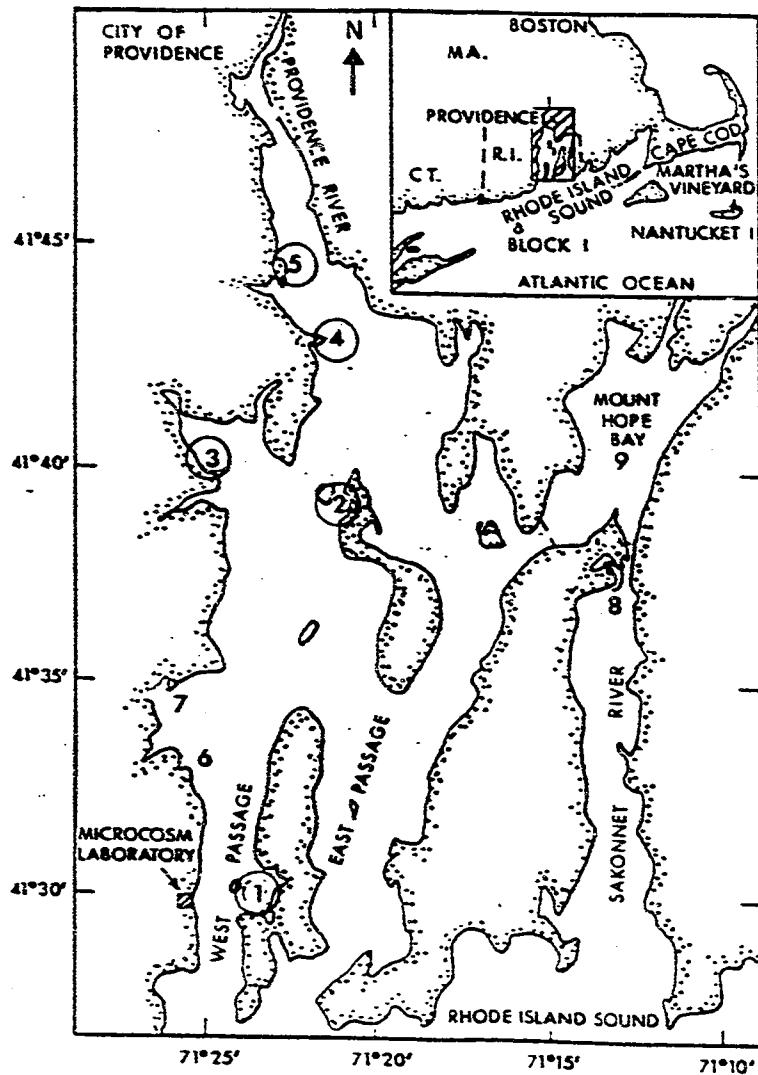


Figure 1. Study sites. Primary sites: (1) Sheffield's Cove, Jamestown ( $41^{\circ}29'25''N$ ;  $71^{\circ}23'00''W$ ), (2) Patience-Prudence ( $41^{\circ}39'10''N$ ;  $71^{\circ}20'55''W$ ), (3) Greenwich Bay ( $41^{\circ}40'30''N$ ;  $71^{\circ}26'35''W$ ), (4) Conimicut Point ( $41^{\circ}43'05''N$ ;  $71^{\circ}21'20''W$ ), and (5) Gaspee Point ( $41^{\circ}44'45''N$ ;  $71^{\circ}22'35''W$ ). Secondary sites: (6) Bissel Cove ( $41^{\circ}33'40''N$ ;  $71^{\circ}25'55''W$ ), (7) Mill Cove ( $41^{\circ}34'50''N$ ;  $71^{\circ}27'25''W$ ), (8) Spectacle Cove ( $41^{\circ}37'55''N$ ;  $71^{\circ}13'15''W$ ), and (9) Spar Island ( $41^{\circ}41'20''N$ ;  $71^{\circ}13'20''W$ ).

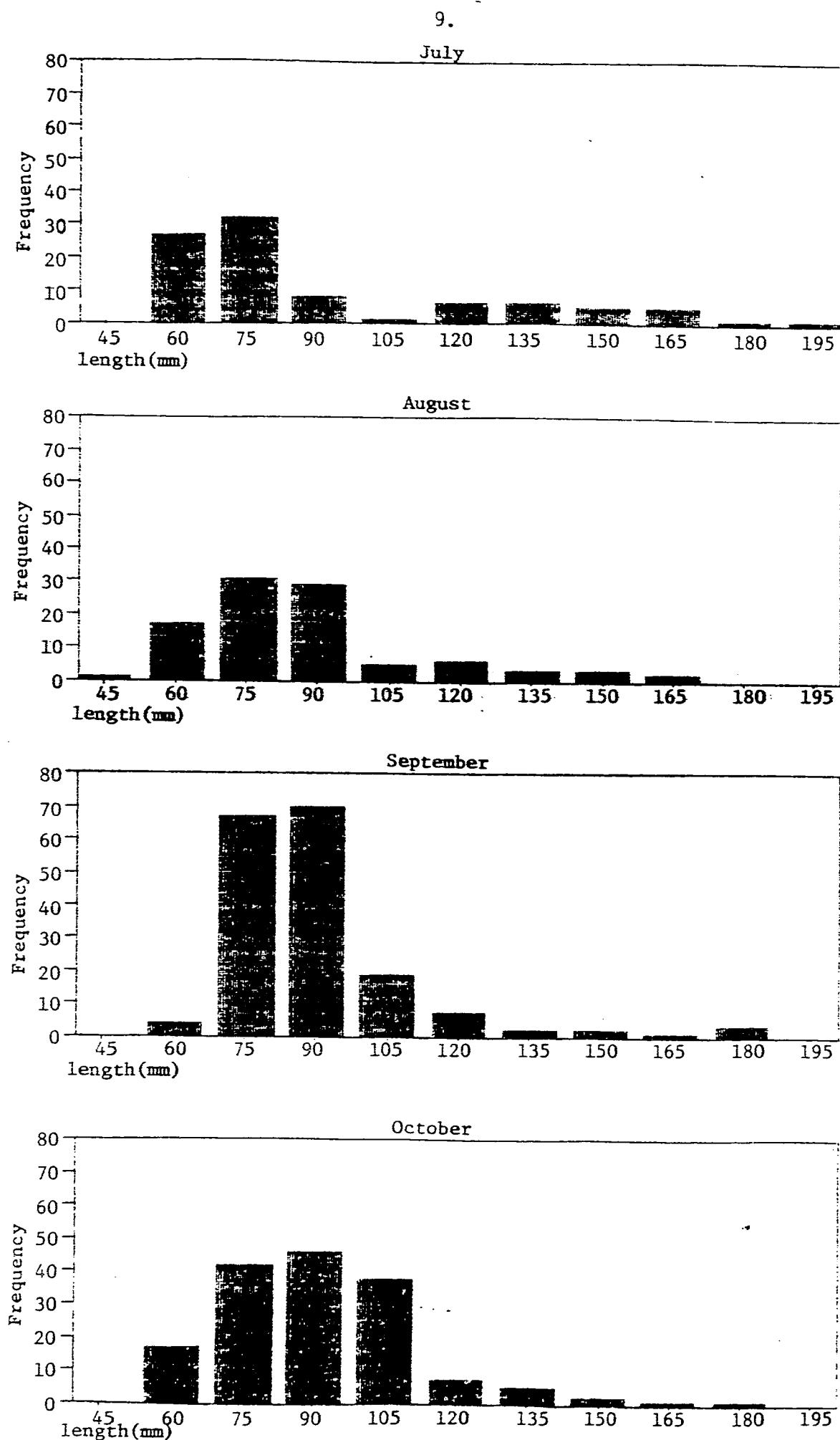


Figure 2. Length frequency distribution for winter flounder.

Figure 3. Prevalence (%) of Glugea and Black Spot

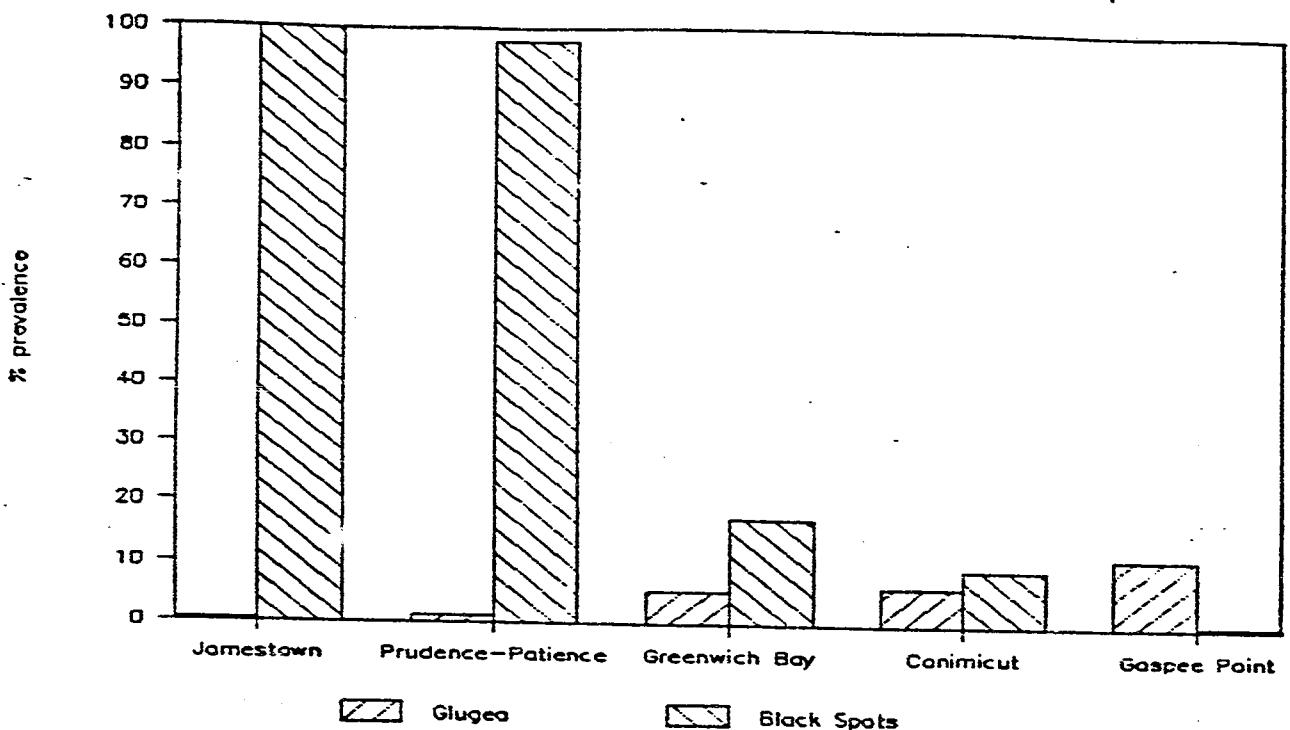


Figure 4. MONTHLY INCIDENCE (%) OF GLUGEAE

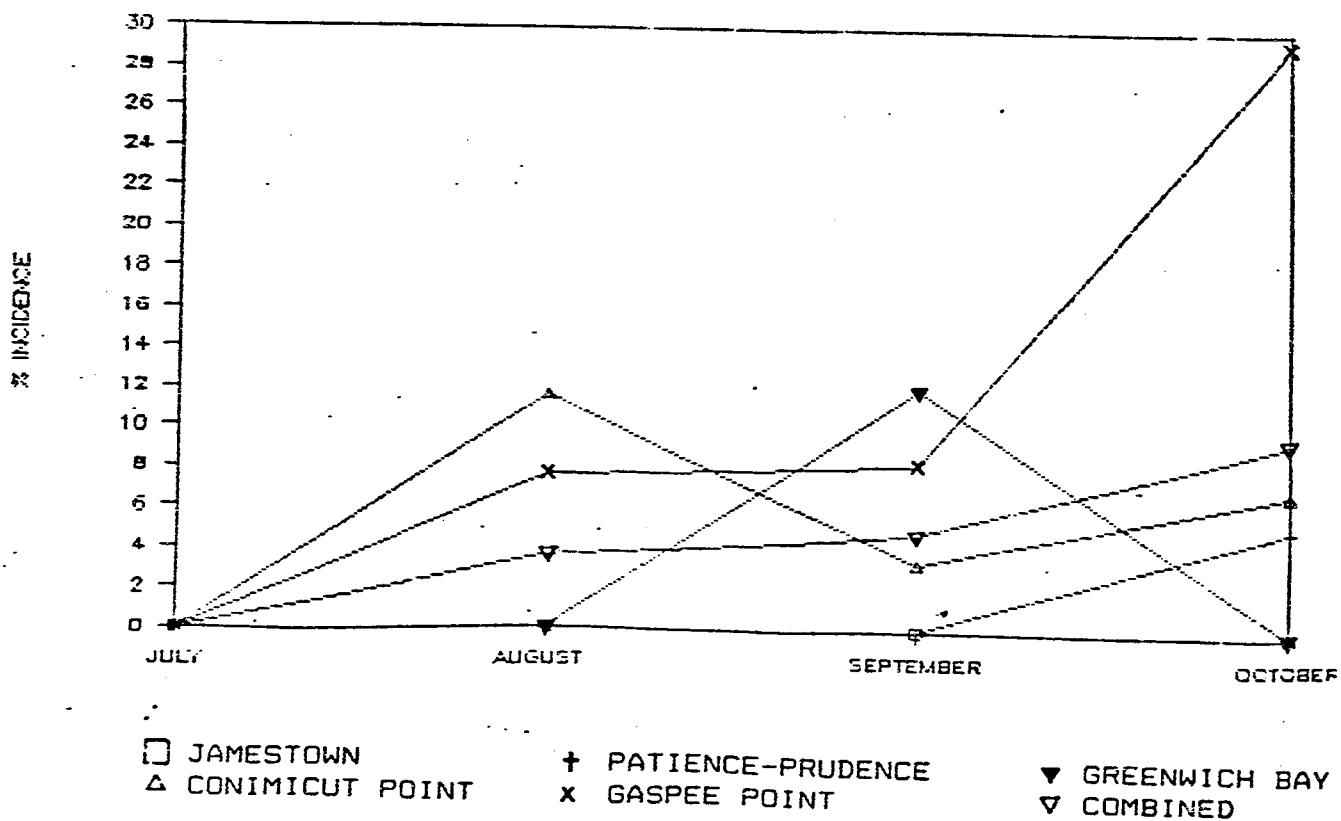


Figure 5. Mean Length by Month and Site

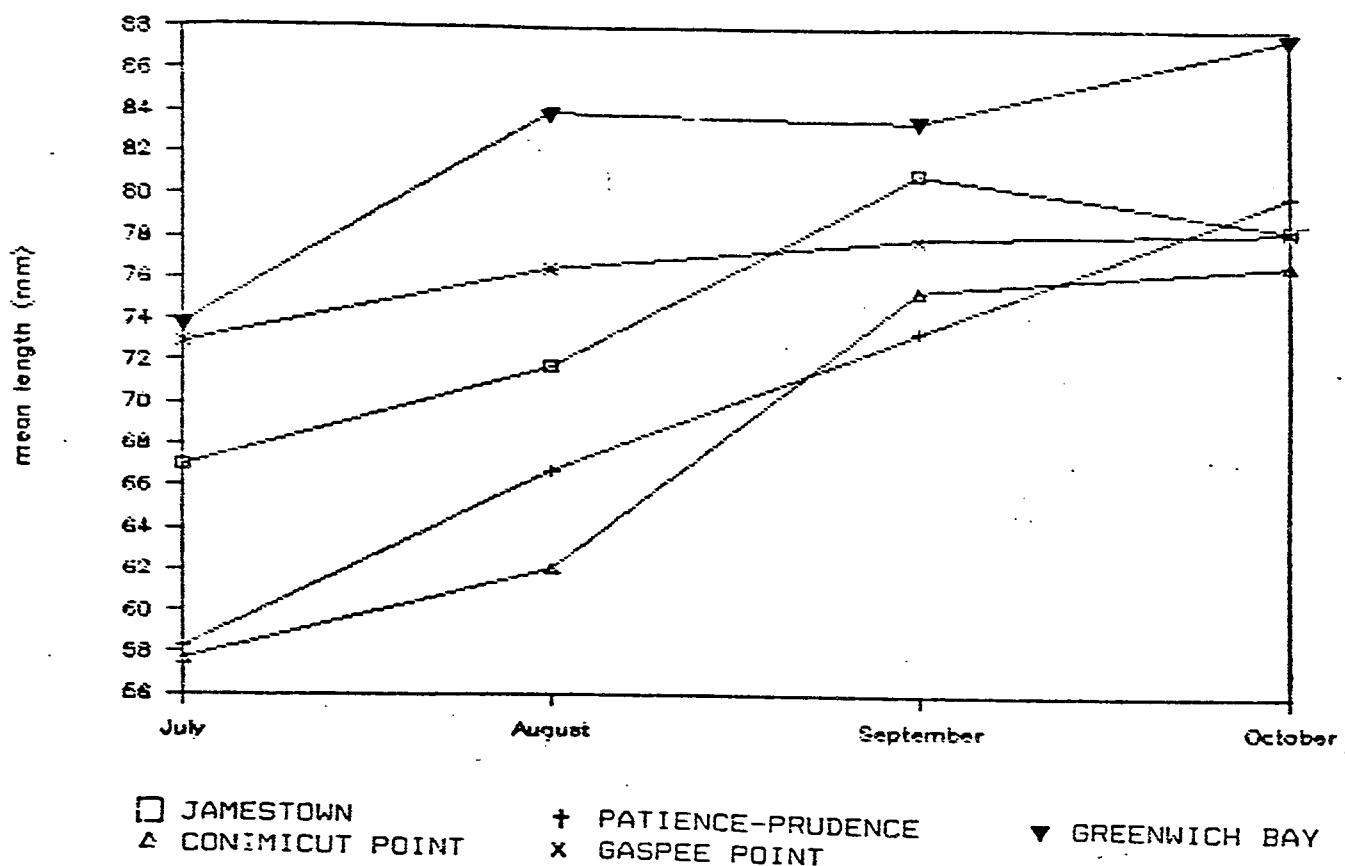


Figure 6. Relative Liver Weight

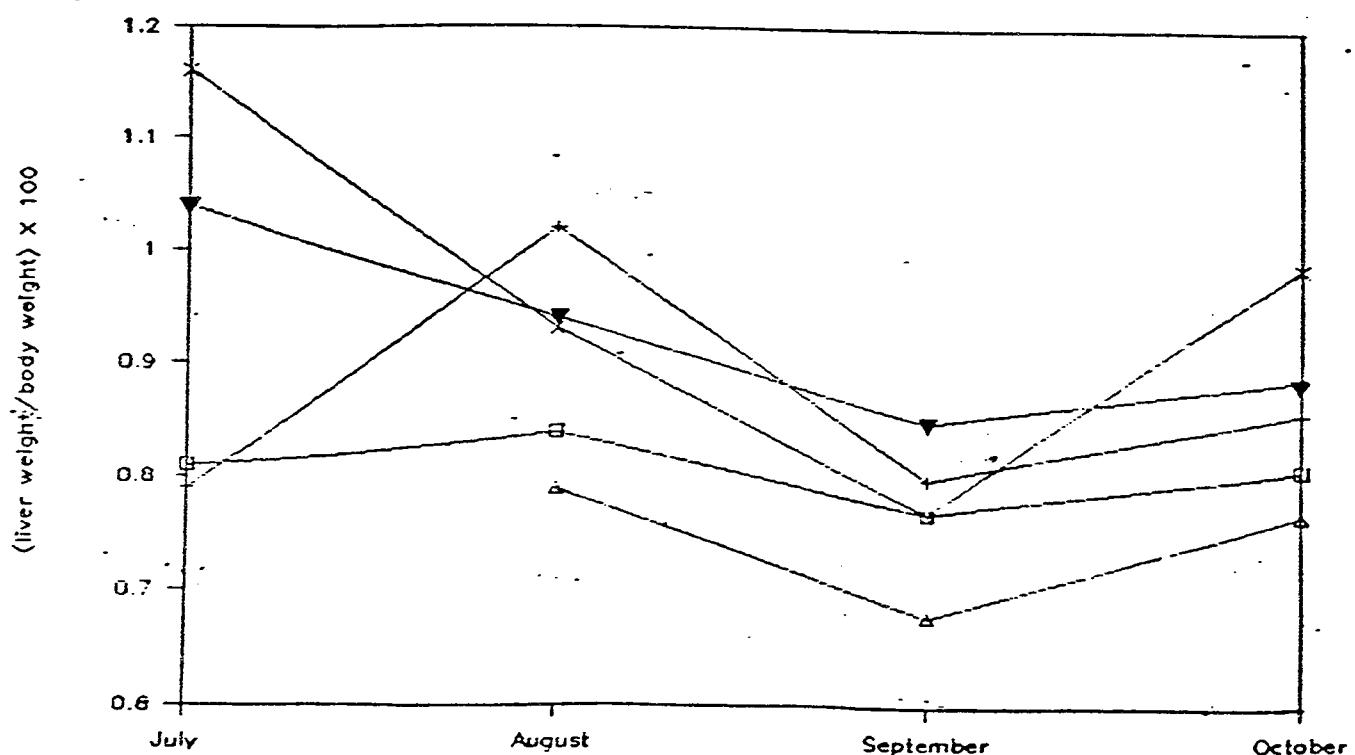


Table 1. Occurrence of "pigment spots" and *Glugea* cysts in juvenile winter flounder.

	Age group	No. examined	Occurrence of cysts		Occurrence of "pigment spots"	
			No. infected	%	No. infected	%
PRIMARY SITES AND MONTHS COMBINED						
Total	0	398	18	4.5	200	50.3
	1	54	6	11.1	3	5.6
	0+1	452	24	5.3	203	44.9
PRIMARY SITES COMBINED BY MONTH						
July	0	68	0	0	41	60.3
	1	24	1	4.2	1	4.2
	0+1	92	1	1.1	42	45.6
August	0	84	3	3.6	42	50.0
	1	13	2	15.4	2	15.4
	0+1	97	5	5.2	44	45.4
September	0	163	8	4.8	76	46.6
	1	12	2	16.7	0	0.0
	0+1	175	10	5.7	76	43.4
October	0	83	7	8.4	41	49.4
	1	5	1	20.0	0	0.0
	0+1	88	8	9.1	41	46.6
MONTHS COMBINED BY PRIMARY SITES						
Jamestown	0	90	0	0	90	100.0
	1	0	0	0	90	100.0
	0+1	90	0	0	90	100.0
Patience-Prudence	0	92	1	1.1	91	98.9
	1	1	0	0	1	100.0
	0+1	93	1	1.1	92	98.9
Greenwich Bay	0	73	4	5.5	13	17.8
	1	2	0	0	1	50.0
	0+1	75	4	5.3	14	18.7
Conimicut Point	0	64	4	6.3	6	9.4
	1	36	5	13.9	1	2.8
	0+1	100	9	9.0	7	7.0
Gaspee Point	0	79	9	11.4	0	0
	1	15	1	6.7	0	0
	0+1	94	10	10.6	0	0
SECONDARY SITES COMBINED						
October	0	65	1	1.5	63	96.9
	1	7	0	0	7	100.0
	0+1	72	1	1.4	70	97.2

Table 2. Size and biochemical composition of YOY winter flounder.

No. Obs	Variable <sup>1</sup>	No.	Mean	Std Dev	CV
463	Length	462	75.89	13.56	17.87
	Weight	463	4.42	2.47	55.90
	LWT	439	0.04	0.02	57.64
	MRNA	365	1.01	0.29	28.57
	MDNA	363	0.37	0.11	28.66
	LRNA	356	9.47	1.69	17.86
	LDNA	357	2.46	0.44	17.70
	MPROT	372	161.68	40.29	24.92
	LPROT	361	170.99	45.59	26.66
	HSI	439	0.84	0.19	22.47
	MRD	363	2.86	0.89	31.03
	LRD	356	3.92	0.77	19.75

<sup>1</sup>Length = total length in mm

Weight = wet weight in mg

LWT = liver wet weight in mg

MRNA = muscle RNA concentration in  $\mu\text{g}\cdot\text{mg}^{-1}$  of wet tissueMDNA = muscle DNA concentration in  $\mu\text{g}\cdot\text{mg}^{-1}$ LRNA = liver RNA concentration in  $\mu\text{g}\cdot\text{mg}^{-1}$ LDNA = liver DNA concentration in  $\mu\text{g}\cdot\text{mg}^{-1}$ MPROT = muscle protein concentration in  $\mu\text{g}\cdot\text{mg}^{-1}$ LPROT = liver protein concentration in  $\mu\text{g}\cdot\text{mg}^{-1}$ 

HSI = relative liver weight

MRD = muscle RNA·DNA $^{-1}$ LRD = liver RNA·DNA $^{-1}$

Table 3. Size and biochemical composition of YOY winter flounder by month.

MONTH=7 -----

N Obs	Variable	N	Mean	Std Dev	CV
68	LENGTH	68	65.66	9.72	14.80
	WEIGHT	68	2.92	1.46	49.86
	LWT	45	0.03	0.02	55.46
	MRNA	44	1.15	0.24	21.05
	MDNA	44	0.36	0.08	22.81
	LRNA	41	9.02	1.34	14.88
	LDNA	41	2.31	0.48	20.60
	MPROT	45	154.70	47.39	30.63
	LPROT	41	156.87	49.36	31.47
	HSI	45	0.96	0.27	27.71
	MRD	44	3.24	0.59	18.12
	LRD	41	4.00	0.70	17.47

MONTH=8 -----

N Obs	Variable	N	Mean	Std Dev	CV
84	LENGTH	84	71.73	12.87	17.95
	WEIGHT	84	3.94	2.24	56.68
	LWT	83	0.04	0.02	60.62
	MRNA	80	0.89	0.16	17.74
	MDNA	80	0.38	0.08	22.12
	LRNA	81	9.03	1.49	16.54
	LDNA	81	2.34	0.44	18.63
	MPROT	84	174.35	39.29	22.54
	LPROT	80	156.35	35.16	22.49
	HSI	83	0.90	0.18	20.09
	MRD	80	2.46	0.62	24.99
	LRD	81	3.92	0.68	17.25

MONTH=9 -----

N Obs	Variable	N	Mean	Std Dev	CV
163	LENGTH	163	78.29	11.35	14.50
	WEIGHT	163	4.71	2.31	49.02
	LWT	163	0.04	0.02	51.10
	MRNA	97	0.87	0.20	23.55
	MDNA	96	0.34	0.12	34.74
	LRNA	91	8.60	1.31	15.22
	LDNA	92	2.37	0.40	17.01
	MPROT	98	151.27	38.69	25.58
	LPROT	92	156.00	35.25	22.59
	HSI	163	0.78	0.13	16.72
	MRD	96	2.83	0.99	34.85
	LRD	91	3.71	0.74	20.00

Table 3 continued.

MONTH=10 -----

N Obs	Variable	N	Mean	Std Dev	CV
148	LENGTH	147	80.33	14.66	18.25
	WEIGHT	148	5.05	2.80	55.44
	LWT	148	0.04	0.03	59.73
	MRNA	144	1.14	0.33	29.21
	MDNA	143	0.40	0.11	27.95
	LRNA	143	10.42	1.66	15.92
	LDNA	143	2.63	0.39	14.74
	MPROT	145	163.54	37.58	22.98
	LPROT	148	192.13	47.23	24.59
	HSI	148	0.84	0.19	23.05
	MRD	143	2.98	0.94	31.68
	LRD	143	4.03	0.84	20.94

Table 4. Size and biochemical composition of YOY winter flounder by location.

LOCATION=1 Jamestown

N Obs	Variable	N	Mean	Std Dev	CV
90	LENGTH	90	75.43	11.90	15.77
	WEIGHT	90	4.19	2.02	48.09
	LWT	81	0.04	0.02	49.50
	MRNA	69	0.91	0.20	22.09
	MDNA	68	0.36	0.10	28.69
	LRNA	62	9.39	1.58	16.80
	LDNA	62	2.62	0.43	16.52
	MPROT	69	153.63	37.34	24.30
	LPROT	60	178.95	50.93	28.46
	HSI	81	0.80	0.16	19.71
	MRD	68	2.65	0.63	23.96
	LRD	62	3.63	0.56	15.46

LOCATION=2 Patience-Prudence

N Obs	Variable	N	Mean	Std Dev	CV
92	LENGTH	92	69.64	13.14	18.87
	WEIGHT	92	3.39	2.03	59.74
	LWT	80	0.03	0.02	57.70
	MRNA	69	0.95	0.22	22.90
	MDNA	69	0.37	0.09	24.08
	LRNA	70	9.47	1.62	17.05
	LDNA	70	2.41	0.50	20.87
	MPROT	69	151.94	42.22	27.79
	LPROT	70	164.71	41.10	24.95
	HSI	80	0.86	0.17	19.84
	MRD	69	2.69	0.79	29.33
	LRD	70	4.01	0.66	16.37

LOCATION=3 Greenwich Bay

N Obs	Variable	N	Mean	Std Dev	CV
73	LENGTH	73	83.08	11.46	13.79
	WEIGHT	73	5.83	2.57	44.02
	LWT	73	0.05	0.02	44.27
	MRNA	55	1.11	0.30	26.79
	MDNA	54	0.40	0.12	30.04
	LRNA	55	9.44	1.67	17.69
	LDNA	56	2.23	0.35	15.74
	MPROT	57	143.65	40.24	28.01
	LPROT	57	148.07	41.27	27.87
	HSI	73	0.90	0.14	15.53
	MRD	54	2.99	1.01	33.84
	LRD	55	4.28	0.63	14.70

Table 4 continued.

LOCATION=4 -Conimicut Point

N Obs	Variable	N	Mean	Std Dev	CV
64	LENGTH	64	71.30	12.13	17.02
	WEIGHT	64	3.57	2.03	57.01
	LWT	61	0.03	0.02	56.74
	MRNA	45	0.80	0.14	16.92
	MDNA	45	0.33	0.06	18.42
	LRNA	46	8.32	1.55	18.65
	LDNA	46	2.58	0.35	13.64
	MPROT	48	182.10	36.27	19.92
	LPROT	47	166.96	53.88	32.27
	HSI	61	0.73	0.15	20.35
	MRD	45	2.52	0.58	22.99
	LRD	46	3.24	0.60	18.49

LOCATION=5 Gaspee Point

N Obs	Variable	N	Mean	Std Dev	CV
79	LENGTH	79	76.95	11.10	14.42
	WEIGHT	79	4.58	2.25	49.12
	LWT	79	0.04	0.02	46.11
	MRNA	63	1.04	0.27	25.93
	MDNA	63	0.33	0.10	28.58
	LRNA	62	9.20	1.07	11.60
	LDNA	62	2.32	0.39	16.80
	MPROT	64	162.80	35.86	22.02
	LPROT	62	168.24	19.59	11.64
	HSI	79	0.91	0.23	24.86
	MRD	63	3.32	1.11	33.49
	LRD	62	4.06	0.78	19.13

Table 5. Size and biochemical composition of YOY winter flounder by month and location

MONTH=7 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
1 Jamestown	18	LENGTH	18	67.00	7.03	10.49
		WEIGHT	18	2.89	0.98	33.78
		LWT	10	0.03	0.01	40.86
		MRNA	9	1.07	0.14	13.30
		MDNA	9	0.38	0.05	14.35
		LRNA	7	8.19	1.00	12.15
		LDNA	7	2.59	0.50	19.31
		MPROT	10	151.93	18.10	11.91
		LPROT	7	180.59	31.86	17.64
		HSI	10	0.81	0.23	28.82
		MRD	9	2.86	0.29	10.19
		LRD	7	3.23	0.59	18.20
2 Patience-Prudence	24	LENGTH	24	58.33	5.80	9.94
		WEIGHT	24	1.91	0.65	34.00
		LWT	12	0.02	0.01	48.00
		MRNA	12	1.21	0.21	17.51
		MDNA	12	0.38	0.06	16.00
		LRNA	12	9.97	1.20	12.07
		LDNA	12	2.63	0.42	15.86
		MPROT	12	186.84	47.34	25.34
		LPROT	12	186.06	50.49	27.14
		HSI	12	0.79	0.17	22.09
		MRD	12	3.17	0.41	12.90
		LRD	12	3.83	0.39	10.30
3 Greenwich Bay	10	LENGTH	10	73.80	12.31	16.68
		WEIGHT	10	4.32	2.07	47.91
		LWT	10	0.04	0.02	49.83
		MRNA	10	1.06	0.29	27.37
		MDNA	10	0.28	0.09	32.09
		LRNA	10	8.49	1.60	18.88
		LDNA	10	2.02	0.41	20.47
		MPROT	10	105.93	47.33	44.67
		LPROT	10	103.78	45.39	43.74
		HSI	10	1.04	0.15	14.54
		MRD	10	3.89	0.57	14.68
		LRD	10	4.24	0.43	10.23
4 Conimicut Point	3	LENGTH	3	57.67	8.08	14.02
		WEIGHT	3	1.84	0.68	37.19
		LWT	0	.	.	.
		MRNA	0	.	.	.
		MDNA	0	.	.	.
		LRNA	0	.	.	.
		LDNA	0	.	.	.
		MPROT	0	.	.	.
		LPROT	0	.	.	.
		HSI	0	.	.	.
		MRD	0	.	.	.
		LRD	0	.	.	.

Table 5 continued.

MONTH=7 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
5 Gaspee Point	13	LENGTH	13	72.92	5.48	7.52
		WEIGHT	13	4.01	1.07	26.72
		LWT	13	0.05	0.01	30.37
		MRNA	13	1.21	0.27	22.14
		MDNA	13	0.40	0.07	18.41
		LRNA	12	8.99	0.88	9.82
		LDNA	12	2.07	0.26	12.61
		MPROT	13	164.66	33.56	20.38
		LPROT	12	158.07	14.82	9.38
		HSI	13	1.16	0.27	23.47
		MRD	13	3.07	0.53	17.41
		LRD	12	4.42	0.79	17.92

MONTH=8 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
1 Jamestown	22	LENGTH	22	71.82	13.01	18.11
		WEIGHT	22	3.85	2.13	55.48
		LWT	21	0.03	0.02	66.64
		MRNA	21	0.96	0.15	15.50
		MDNA	21	0.39	0.08	19.55
		LRNA	20	10.06	1.97	19.56
		LDNA	20	2.68	0.54	20.25
		MPROT	22	174.99	35.01	20.01
		LPROT	19	174.95	55.83	31.91
		HSI	21	0.84	0.18	21.91
		MRD	21	2.57	0.68	26.43
		LRD	20	3.77	0.46	12.24
2 Patience-Prudence	17	LENGTH	17	66.82	12.06	18.05
		WEIGHT	17	3.10	1.68	54.28
		LWT	17	0.03	0.02	53.02
		MRNA	17	0.87	0.13	15.39
		MDNA	17	0.40	0.08	20.05
		LRNA	17	8.31	1.02	12.26
		LDNA	17	2.10	0.37	17.39
		MPROT	17	164.52	35.31	21.47
		LPROT	17	142.72	21.58	15.12
		HSI	17	1.02	0.19	18.48
		MRD	17	2.26	0.43	18.97
		LRD	17	4.03	0.61	15.18
3 Greenwich Bay	15	LENGTH	15	83.93	10.28	12.25
		WEIGHT	15	6.28	2.47	39.40
		LWT	15	0.06	0.02	38.40
		MRNA	15	0.94	0.21	22.86
		MDNA	15	0.43	0.08	18.68
		LRNA	15	8.73	0.67	7.68

Table 5 continued.

MONTH=8 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
3 Greenwich Bay	15	LDNA	15	2.18	0.21	9.86
		MPROT	15	188.93	17.15	9.08
		LPROT	15	161.93	10.76	6.65
		HSI	15	0.94	0.19	20.11
		MRD	15	2.26	0.65	28.58
		LRD	15	4.03	0.29	7.19
4 Conimicut Point	17	LENGTH	17	62.06	8.53	13.75
		WEIGHT	17	2.36	1.21	51.08
		LWT	17	0.02	0.01	55.07
		MRNA	14	0.80	0.12	15.46
		MDNA	14	0.32	0.06	20.09
		LRNA	17	8.32	1.24	14.94
		LDNA	17	2.50	0.32	12.73
		MPROT	17	189.61	52.93	27.92
		LPROT	17	140.78	29.77	21.15
		HSI	17	0.79	0.11	13.96
		MRD	14	2.60	0.59	22.54
		LRD	17	3.37	0.58	17.29
5 Gaspee Point	13	LENGTH	13	76.54	7.61	9.94
		WEIGHT	13	4.58	1.38	30.18
		LWT	13	0.04	0.01	33.88
		MRNA	13	0.85	0.10	12.11
		MDNA	13	0.33	0.08	22.54
		LRNA	12	9.73	1.03	10.62
		LDNA	12	2.12	0.22	10.16
		MPROT	13	149.33	37.13	24.87
		LPROT	12	161.31	18.31	11.35
		HSI	13	0.93	0.12	13.44
		MRD	13	2.66	0.66	24.67
		LRD	12	4.65	0.83	17.74

Table 5 continued.

MONTH=9 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
1 Jamestown	32	LENGTH	32	81.00	10.41	12.85
		WEIGHT	32	4.98	2.07	41.52
		LWT	32	0.04	0.02	44.54
		MRNA	21	0.71	0.13	18.53
		MDNA	20	0.29	0.11	36.40
		LRNA	17	8.47	0.79	9.36
		LDNA	17	2.57	0.31	11.89
		MPROT	21	127.35	37.92	29.77
		LPROT	16	146.22	31.47	21.52
		HSI	32	0.77	0.12	15.94
		MRD	20	2.62	0.65	24.64
		LRD	17	3.34	0.48	14.52
2 Patience-Prudence	32	LENGTH	32	73.44	10.44	14.21
		WEIGHT	32	3.80	1.83	48.28
		LWT	32	0.03	0.01	41.96
		MRNA	22	0.85	0.17	20.31
		MDNA	22	0.34	0.10	28.52
		LRNA	22	8.81	1.34	15.22
		LDNA	22	2.19	0.38	17.29
		MPROT	22	146.96	38.98	26.53
		LPROT	22	147.75	25.71	17.40
		HSI	32	0.80	0.13	15.98
		MRD	22	2.74	0.99	36.22
		LRD	22	4.08	0.55	13.52
3 Greenwich Bay	33	LENGTH	33	83.45	10.53	12.62
		WEIGHT	33	5.76	2.41	41.88
		LWT	33	0.05	0.02	41.35
		MRNA	16	1.04	0.25	23.97
		MDNA	16	0.44	0.14	32.87
		LRNA	16	8.77	1.01	11.49
		LDNA	17	2.13	0.29	13.60
		MPROT	17	131.54	25.86	19.66
		LPROT	17	135.88	45.82	33.72
		HSI	33	0.85	0.09	10.61
		MRD	16	2.62	0.97	37.07
		LRD	16	4.21	0.64	15.31
4 Conimicut Point	30	LENGTH	30	75.37	9.89	13.13
		WEIGHT	30	4.10	1.82	44.43
		LWT	30	0.03	0.01	51.67
		MRNA	17	0.83	0.14	16.94
		MDNA	17	0.33	0.06	19.50
		LRNA	15	7.76	1.96	25.29
		LDNA	15	2.71	0.42	15.41
		MPROT	17	182.75	15.21	8.32
		LPROT	16	169.07	35.74	21.14
		HSI	30	0.68	0.12	16.87
		MRD	17	2.60	0.54	20.73
		LRD	15	2.83	0.57	20.14

Table 5 continued.

MONTH=9 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
5 Gaspee Point	36	LENGTH	36	77.92	12.68	16.27
		WEIGHT	36	4.80	2.76	57.38
		LWT	36	0.04	0.02	56.68
		MRNA	21	0.94	0.18	19.35
		MDNA	21	0.31	0.12	38.73
		LRNA	21	8.94	1.06	11.84
		LDNA	21	2.35	0.35	14.82
		MPROT	21	170.21	36.55	21.47
		LPROT	21	178.43	20.46	11.47
		HSI	36	0.77	0.14	17.71
		MRD	21	3.48	1.30	37.21
		LRD	21	3.86	0.60	15.53

MONTH=10 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
1 Jamestown	18	LENGTH	18	78.39	11.19	14.27
		WEIGHT	18	4.52	1.92	42.42
		LWT	18	0.04	0.01	40.70
		MRNA	18	0.99	0.18	18.46
		MDNA	18	0.39	0.12	29.46
		LRNA	18	10.00	1.15	11.53
		LDNA	18	2.60	0.39	15.18
		MPROT	16	159.80	28.48	17.82
		LPROT	18	211.61	48.11	22.74
		HSI	18	0.81	0.13	16.25
		MRD	18	2.67	0.71	26.61
		LRD	18	3.90	0.55	14.00
2 Patience-Prudence	19	LENGTH	19	80.05	13.98	17.47
		WEIGHT	19	4.83	2.53	52.43
		LWT	19	0.04	0.02	57.43
		MRNA	18	0.98	0.19	19.70
		MDNA	18	0.38	0.10	26.01
		LRNA	19	10.97	1.33	12.11
		LDNA	19	2.82	0.47	16.47
		MPROT	18	122.90	26.19	21.31
		LPROT	19	190.53	43.78	22.98
		HSI	19	0.86	0.13	14.71
		MRD	18	2.71	0.80	29.43
		LRD	19	4.01	0.92	22.84
3 Greenwich Bay	15	LENGTH	15	87.60	11.59	13.23
		WEIGHT	15	6.56	3.05	46.53
		LWT	15	0.06	0.03	49.70
		MRNA	14	1.41	0.23	16.08
		MDNA	13	0.41	0.09	23.15
		LRNA	14	11.64	1.05	9.06

Table 5 continued.

MONTH=10 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
3 Greenwich Bay	15	LDNA	14	2.55	0.30	11.65
		MPROT	15	137.24	23.34	17.01
		LPROT	15	177.55	15.93	8.97
		HSI	15	0.89	0.10	11.00
		MRD	13	3.60	0.83	22.97
		LRD	14	4.65	0.84	18.16
4 Conimicut Point	14	LENGTH	14	76.71	13.08	17.05
		WEIGHT	14	4.25	2.65	62.24
		LWT	14	0.03	0.02	54.69
		MRNA	14	0.77	0.14	18.70
		MDNA	14	0.34	0.05	16.23
		LRNA	14	8.92	1.24	13.92
		LDNA	14	2.56	0.30	11.71
		MPROT	14	172.21	29.03	16.86
		LPROT	14	196.33	76.66	39.05
		HSI	14	0.77	0.22	27.78
		MRD	14	2.33	0.62	26.39
		LRD	14	3.50	0.43	12.22
5 Gaspee Point	17	LENGTH	17	78.29	12.87	16.44
		WEIGHT	17	4.54	2.32	51.04
		LWT	17	0.04	0.02	45.62
		MRNA	16	1.16	0.32	27.24
		MDNA	16	0.32	0.07	22.01
		LRNA	17	9.31	1.15	12.38
		LDNA	17	2.61	0.42	16.25
		MPROT	17	162.52	35.93	22.11
		LPROT	17	167.72	17.55	10.46
		HSI	17	0.99	0.20	19.98
		MRD	16	3.85	1.24	32.13
		LRD	17	3.63	0.58	15.98
6 Bissell Cove	13	LENGTH	12	72.58	12.42	17.11
		WEIGHT	13	3.49	1.95	55.72
		LWT	13	0.03	0.02	69.93
		MRNA	13	0.96	0.23	23.80
		MDNA	13	0.36	0.11	30.79
		LRNA	12	9.28	1.65	17.82
		LDNA	12	2.74	0.35	12.89
		MPROT	13	164.46	37.41	22.75
		LPROT	13	200.14	93.20	46.57
		HSI	13	0.83	0.27	32.96
		MRD	13	2.87	0.76	26.37
		LRD	12	3.44	0.78	22.78
7 Mill Cove	15	LENGTH	15	87.53	17.52	20.02
		WEIGHT	15	6.88	3.47	50.38
		LWT	15	0.06	0.03	53.53
		MRNA	15	1.63	0.36	22.37
		MDNA	15	0.48	0.14	28.15

Table 5 continued.

MONTH=10 -----

LOCATION	N Obs	Variable	N	Mean	Std Dev	CV
7 Mill Cove	15	L RNA	15	12.38	1.63	13.21
		L DNA	15	2.79	0.45	16.11
		M PROT	15	168.36	24.40	14.49
		L PROT	15	201.52	29.43	14.60
		HSI	15	0.93	0.26	27.52
		MRD	15	3.59	1.12	31.32
		LRD	15	4.53	1.02	22.51
8 Spectacle Cove	14	LENGTH	14	85.43	13.66	16.00
		WEIGHT	14	6.02	2.80	46.56
		LWT	14	0.05	0.03	52.71
		MRNA	14	1.15	0.26	22.30
		MDNA	14	0.40	0.08	18.61
		L RNA	14	9.97	1.17	11.71
		L DNA	14	2.42	0.39	16.21
		M PROT	14	173.93	33.87	19.47
		L PROT	14	190.48	27.37	14.37
		HSI	14	0.85	0.17	20.35
		MRD	14	2.86	0.48	16.97
		LRD	14	4.22	0.89	21.01
9 Spar Island	23	LENGTH	23	77.26	18.28	23.66
		WEIGHT	23	4.64	3.01	64.95
		LWT	23	0.04	0.03	71.78
		MRNA	22	1.18	0.21	17.38
		MDNA	22	0.48	0.11	22.65
		L RNA	20	10.92	1.30	11.93
		L DNA	20	2.59	0.27	10.43
		M PROT	23	200.61	33.94	16.92
		L PROT	23	193.52	30.50	15.76
		HSI	23	0.71	0.14	19.68
		MRD	22	2.58	0.61	23.53
		LRD	20	4.27	0.73	17.20

Table 6. Two-way analysis of variance for the effects of month and location on size and biochemical composition of YOY-winter flounder.

Dependent Variable	Source	DF	F value	Pr > F
Length	Month	3	30.38	0.0001
	Location	8	9.13	0.0001
	Month * Location	12	1.70	0.0642
	Total	461		
Weight	Month	3	16.70	0.0001
	Location	8	9.51	0.0001
	Month * Location	12	1.08	0.3725
	Total	462		
MRNA	Month	3	48.19	0.0001
	Location	8	20.03	0.0001
	Month * Location	11	5.48	0.0001
	Total	364		
MDNA	Month	3	8.74	0.0001
	Location	8	7.20	0.0001
	Month * Location	11	3.64	0.0001
	Total	362		
LRNA	Month	3	44.40	0.0001
	Location	8	10.22	0.0001
	Month * Location	11	5.80	0.0001
	Total	355		
LDNA	Month	3	17.22	0.0001
	Location	8	6.40	0.0001
	Month * Location	11	4.70	0.0001
	Total	355		
MPROT	Month	3	7.74	0.0001
	Location	8	9.96	0.0001
	Month * Location	11	6.37	0.0001
	Total	371		
LPROT	Month	3	23.68	0.0001
	Location	8	2.36	0.0175
	Month * Location	11	4.21	0.0001
	Total	360		
HSI	Month	3	20.01	0.0001
	Location	8	9.03	0.0001
	Month * Location	11	4.39	0.0001
	Total	438		
MRD	Month	3	11.40	0.0001
	Location	8	6.10	0.0001
	Month * Location	11	3.78	0.0001
	Total	362		
LRD	Month	3	4.67	0.0033
	Location	8	13.21	0.0001
	Month * Location	11	3.66	0.0001
	Total	355		

Table 7. Monthly mean size and composition of YOY winter flounder at selected sites in Narragansett Bay. Bracketed means are not statistically different at  $P < 0.05$  (Tukey's studentized range test). Locations are: 1 Jamestown, 2 Patience-Prudence Islands, 3 Greenwich Bay, 4 Comimicut Point, and 5 Gaspee Point.

Table 8. Lipid concentration ( $\mu\text{g}/\text{mg}$  wet tissue) in muscle and liver of YOY winter flounder collected in September. Bracketed means are not statistically different at  $P \leq 0.05$  (Tukey's studentized range test).

Location	N	Mean $\pm$ 1SD
Muscle Lipid ( $\mu\text{g}/\text{mg}$ wet tissue)		
3	16	8.65 $\pm$ 1.11
5	15	7.97 $\pm$ 1.25
2	10	7.72 $\pm$ 1.48
1	15	7.62 $\pm$ 2.04
4	13	7.37 $\pm$ 1.12
Liver Lipid ( $\mu\text{g}/\text{mg}$ wet tissue)		
1	15	49.7 $\pm$ 10.11
5	14	47.1 $\pm$ 5.44
3	15	46.8 $\pm$ 6.10
2	10	45.7 $\pm$ 12.66
4	13	36.2 $\pm$ 7.21

Table 9. Correlations among length, weight, and biochemical characters of VOY winter flounder.

Correlation Coefficients / Prob > IRI under Ho: Rho=0 / Number of Observations

	MONTH	LENGTH	WEIGHT	LWT	mRNA	MDNA	LRNA
MONTH	1.00000 0.00000 463	0.37077 0.0001 462	0.28602 0.0001 463	0.14264 0.0027 439	0.13836 0.0081 365	0.10671 0.0422 363	0.33158 0.0001 356
LENGTH	0.37077 0.0001 462	1.00000 0.0000 462	0.96307 0.0001 462	0.96307 0.0001 439	0.88899 0.0001 439	0.07129 0.1747 364	0.19764 0.0002 362
WEIGHT	0.28602 0.0001 463	0.96307 0.0001 462	1.00000 0.0000 463	0.93098 0.0001 439	0.11157 0.031 365	0.21504 0.0001 363	0.22828 0.0001 356
LWT	0.14264 0.0001 439	0.88899 0.0001 439	0.93098 0.0001 439	1.00000 0.0000 439	0.22876 0.0001 364	0.23952 0.0001 355	0.25047 0.0001 355
mRNA	0.13836 0.0081 365	0.07129 0.1747 364	0.96307 0.0001 365	0.22876 0.0001 364	1.00000 0.0000 363	0.43277 0.0001 363	0.49405 0.0001 347
MDNA	0.10671 0.0422 363	0.19764 0.0002 362	0.21504 0.0001 362	0.23952 0.0001 362	0.43277 0.0001 363	1.00000 0.0000 346	0.27016 0.0001 346
LRNA	0.33158 0.0001 356	0.28602 0.0001 355	0.22828 0.0001 355	0.25047 0.0001 355	0.49405 0.0001 347	0.27016 0.0000 346	1.00000 0.0000 356
LDNA	0.28984 0.0001 357	0.07104 0.1851 356	0.05366 0.0120 357	0.08230 0.1210 357	0.00142 0.4790 348	0.01826 0.7342 347	0.40467 0.0001 356
MPROT	0.01054 0.8334 372	-0.21685 0.0001 371	-0.12576 0.0152 372	-0.13920 0.0072 371	0.08861 0.0003 363	0.22045 0.0001 361	0.11391 0.0324 353
LPROT	0.31888 0.0001 361	0.00970 0.8545 360	0.03323 0.5291 360	-0.01042 0.8438 360	0.19787 0.0002 351	0.13460 0.0095 351	0.45912 0.0001 351
HSI	-0.18525 0.0001 439	0.00983 0.8375 438	0.02559 0.5429 439	0.33617 0.0001 439	0.09143 0.9596 355	0.00096 0.9596 355	0.00096 0.0001 355
MHD	0.04460 0.3968 362	-0.09422 0.0734 363	-0.07943 0.1288 363	-0.00368 0.4444 363	0.45514 0.0001 363	-0.56534 0.0001 363	0.17888 0.0008 346
LAD	0.03064 0.5607 355	0.10839 0.0050 355	0.14333 0.0001 355	0.88640 0.45158 347	0.23069 0.0001 346	0.54047 0.0001 356	0.54047 0.0001 356

Table 9 continued.

Correlation Coefficients / Prob &gt; IRI under Ho: Rho=0 / Number of Observations

	LDNA	M PROT	L PROT	H51	MRD	LRD
MONTH	0.28964 0.0001 357	-0.01054 0.8394 372	0.31886 0.0001 361	-0.18525 0.0001 439	0.04460 0.3968 363	0.03094 0.5607 356
LENGTH	0.07040 0.1851 356	-0.21685 0.0001 371	0.00970 0.8545 360	0.00983 0.8375 438	-0.09422 0.0734 362	0.10839 0.0412 355
WEIGHT	0.05366 0.3120 357	-0.12576 0.0152 372	0.03323 0.5291 361	0.02559 0.5929 439	-0.07988 0.1288 363	0.14833 0.0050 356
LWT	-0.08233 0.1210 356	-0.13720 0.0072 371	-0.01042 0.8438 360	0.33617 0.0001 439	-0.00368 0.9444 362	0.29660 0.0001 355
MIRNA	0.00142 0.9790 348	0.18861 0.0003 363	0.19767 0.0002 351	0.28505 0.0001 364	0.45514 0.0001 363	0.45150 0.0001 347
MDNA	0.01029 0.7342 347	0.222042 0.0001 361	0.13010 0.0095 350	0.09193 0.0807 362	-0.56534 0.0001 363	0.23069 0.0001 346
LRNA	0.40667 0.0001 356	0.11391 0.0324 353	0.45942 0.0001 354	0.0096 0.9856 355	0.17888 0.0008 346	0.54047 0.0001 356
LDNA	1.00000 0.0000 357	0.07876 0.0000 354	0.37978 0.0001 355	-0.44365 0.0001 356	-0.03958 0.4624 347	-0.52799 0.0001 356
M PROT	0.07876 0.1392 354	1.00000 0.0000 372	0.24839 0.0001 358	-0.11679 0.0245 371	-0.05552 0.2928 361	0.03009 0.5792 353
L PROT	0.37978 0.0001 355	0.24839 0.0001 358	1.00000 0.0000 361	-0.19123 0.0003 360	0.01887 0.7250 350	0.06951 0.1920 354
H51	-0.11679 0.0001 356	-0.19123 0.0003 371	1.00000 0.0000 360	1.00000 0.0000 439	0.16518 0.0016 362	0.41796 0.0001 355
MRD	-0.03958 0.4624 347	-0.05552 0.2928 361	0.01887 0.7250 350	0.16518 0.0016 362	1.00000 0.0000 363	0.19785 0.0002 346
LRD	-0.52799 0.0001 356	0.03009 0.5732 353	0.06951 0.1920 354	0.41796 0.0001 355	0.19785 0.0002 346	1.00000 0.0000 356

Table 10. Correlations among size and lipid concentration of YOY winter flounder.

Correlation Coefficients / Prob >  R  under Ho: Rho=0 / Number of Observations						
	LENGTH	WEIGHT	LWT	HSI	MLIF	LLIF
LENGTH	1.00000	0.98119 0.0001	0.92015 0.0001	-0.14415 0.2373	0.13078 0.2841	0.32276 0.0077
	0.00000	0.0001 69	0.0001 69	69	69	67
	0.69					
WEIGHT	0.98119 0.0001	1.00000 0.0000	0.95091 0.0001	-0.09601 0.4326	0.14359 0.2392	0.31702 0.0065
	0.0001 69	0.0000 69	0.0001 69	69	69	67
	69					
LWT	0.92015 0.0001	0.95091 0.0001	1.00000 0.0000	0.18726 0.1234	0.25400 0.0346	0.39633 0.0069
	0.0001 69	0.0001 69	0.0000 69	69	69	67
	69					
HSI	-0.14415 0.2373	-0.09601 0.4326	0.18726 0.1234	1.00000 0.0000	0.40952 0.0005	0.70220 0.0122
	0.2373 69	0.4326 69	0.1234 69	69	69	67
	69					
MLIF	0.13078 0.2841	0.14359 0.2392	0.25400 0.0346	0.40952 0.0005	1.00000 0.0000	0.42257 0.0002
	0.2841 69	0.14359 0.2392	0.0346 69	69	69	67
	69					
LLIF	0.32276 0.0077	0.31702 0.0065	0.39633 0.0009	0.30228 0.0127	0.43557 0.0002	1.00000 0.0000
	0.0077 67	0.31702 0.0065	0.0009 67	67	67	67
	67					

**APPENDIX**

## APPENDIX I. WINTER FLOUNDER DATA

Data are for individual fish. STA is station location: JT = Jamestown,  
 PP = Patience-Prudence Islands, GB = Greenwich Bay, CP = Conimicut Point, GP =  
 Gaspee Point, BC = Bissell Cove, MC = Mill Cove, SP = Spectacle Cove, and SI =  
 Spar Island. MON is month. A "1" under "Black Spots" or White Cysts indicates  
 the presence of the disease.

NARRA FISH	#	STA	MON	gm tissue				gm tissue				gm tissue				gm tissue			
				TOTAL	LIVER	WT	WET	WT	MUSCLE	WT	MUSCLE	WT	LIPID	PROT.	DNA	RNA	LIPID	PROT.	MUSCLE
1	PP	7	134	23.52	0.234	0.95	0.37	9.762	2.749	186.53	161.29	0.57	0.41	0.07	0.03	0.57	0.41	116.82	127.40
2	PP	7	69	3.16	0.028	1.02	0.29	9.131	2.622	116.82	116.82	0.32	0.22	0.04	0.02	0.32	0.22	116.82	116.82
3	PP	7	60	2.16															
4	PP	7	60	2.00															
5	PP	7	51	1.18															
6	PP	7	55	1.47															
7	PP	7	48	1.02															
8	PP	7	62	2.37															
9	PP	7	60	1.80															
10	PP	7	55	1.47															
11	PP	7	63	2.71															
12	PP	7	57	1.62															
13	PP	7	73	3.65	0.033	1.25	0.50	10.735	2.815	166.34	290.80	0.38	0.25	0.05	0.02	0.38	0.25	133.00	208.56
14	PP	7	60	2.20	0.023	1.14	0.38	8.096	2.507	133.00	208.56	0.35	0.22	0.04	0.02	0.35	0.22	228.57	261.16
15	PP	7	65	2.60	0.014	1.03	0.35	18.298	3.079	228.57	261.16	0.41	0.28	0.05	0.02	0.41	0.28	166.34	184.12
16	PP	7	59	1.80	0.013	1.42	0.41	9.257	2.434	184.12	184.12	0.36	0.24	0.05	0.02	0.36	0.24	289.31	145.59
17	PP	7	58	1.77	0.015	0.95	0.34	10.980	2.140	145.59	145.59	0.34	0.23	0.05	0.02	0.34	0.23	157.45	190.04
18	PP	7	61	2.13	0.017	1.06	0.34	10.800	2.080	190.04	190.04	1.19	0.41	0.10	0.05	1.19	0.41	181.15	153.74
19	PP	7	57	1.77	0.015	1.01	0.31	10.777	2.639	194.49	202.64	0.32	0.21	0.05	0.02	0.32	0.21	194.49	202.64
20	PP	7	60	1.92	0.012	1.01	0.31	10.777	2.639	194.49	202.64	0.35	0.22	0.05	0.02	0.35	0.22	194.49	202.64
21	PP	7	54	1.35	0.011	1.46	0.38	8.908	2.104	200.41	211.52	0.38	0.25	0.05	0.02	0.38	0.25	200.41	211.52
22	PP	7	58	1.91															
23	PP	7	49	1.07	0.005	1.46	0.40	11.350	3.540	235.97	190.04	0.40	0.27	0.05	0.02	0.40	0.27	172.26	147.07
24	PP	7	50	1.11	0.011	1.56	0.48	9.900	2.400	172.26	147.07	0.46	0.23	0.05	0.02	0.46	0.23	172.26	147.07
25	PP	7	50	1.11	0.011	1.56	0.48	9.900	2.400	172.26	147.07	0.46	0.23	0.05	0.02	0.46	0.23	172.26	147.07
26	GB	7	60	5.05	0.064	1.05	0.26	5.401	1.275	79.95	82.89	0.29	0.17	0.04	0.02	0.29	0.17	85.81	79.68
27	GB	7	68	6.86	0.065	1.08	0.29	8.476	1.935	85.81	79.68	0.25	0.15	0.04	0.02	0.25	0.15	77.67	79.30
28	GB	7	92	7.91	0.083	0.90	0.25	7.459	1.627	67.58	73.11	0.92	0.28	0.09	0.02	0.92	0.28	73.11	61.58
29	GB	7	61	5.55	0.064	0.92	0.28	8.509	2.009	73.11	61.58	0.92	0.28	0.09	0.02	0.92	0.28	73.11	61.58
30	GB	7	73	3.80	0.036	0.88	0.23	7.274	1.876	86.79	63.02	0.88	0.23	0.07	0.02	0.88	0.23	86.79	63.02
31	GB	7	73	3.99	0.034	0.98	0.20	9.170	2.170	81.25	82.23	0.98	0.20	0.07	0.02	0.98	0.20	81.25	82.23
32	GB	7	75	4.10	0.034	0.98	0.20	9.170	2.170	81.25	82.23	0.98	0.20	0.07	0.02	0.98	0.20	81.25	82.23
33	GB	7	58	1.96	0.024	1.61	0.44	10.870	2.074	147.82	170.78	1.61	0.44	0.10	0.02	1.61	0.44	147.82	170.78
34	GB	7	64	2.54	0.029	1.21	0.39	8.358	2.001	212.27	130.04	1.21	0.39	0.10	0.02	1.21	0.39	212.27	130.04
35	GB	7	54	1.48	0.015	1.41	0.32	10.693	2.866	147.07	173.23	1.48	0.32	0.10	0.02	1.48	0.32	173.23	147.07
46	CP	7	146	34.24	0.305	0.83	0.57	11.609	2.522	155.91	249.80	34.24	0.305	0.57	0.02	34.24	0.305	155.91	249.80
47	CP	7	184	66.93	0.589	0.78	0.41	9.710	2.961	108.03	258.07	66.93	0.589	0.78	0.02	66.93	0.589	108.03	258.07
48	CP	7	158	42.23	0.278	0.53	0.42	8.988	3.174	155.91	209.42	42.23	0.278	0.53	0.02	42.23	0.278	155.91	209.42
49	CP	7	132	20.01	0.173	0.68	0.39	9.005	2.192	202.19	184.36	20.01	0.173	0.68	0.02	20.01	0.173	202.19	184.36
50	CP	7	133	24.35	0.170	0.70	0.38	9.030	2.192	173.67	165.88	24.35	0.170	0.70	0.02	24.35	0.170	173.67	165.88
51	CP	7	119	16.47	0.098	0.50	0.32	8.123	3.299	161.83	162.60	16.47	0.098	0.50	0.02	16.47	0.098	161.83	162.60

## APPENDIX I. cont.

52	CP	7	117	18.12	0.150	0.63	0.38	9.559	2.280	179.05	178.40
53	CP	7	117	15.35	0.137	0.74	0.37	8.551	1.884	205.41	191.21
54	CP	7	137	25.69	0.242	0.52	0.32	8.652	3.071	135.47	205.04
55	CP	7	112	14.19	0.127	0.74	0.33	8.946	2.331	144.62	161.41
56	CP	7	109	13.00	0.104	0.68	0.41	8.795	2.155	164.52	182.93
57	CP	7	121	15.95	0.147	0.64	0.37	8.610	2.397	161.29	157.46
58	CP	7	112	14.00	0.117	0.67	0.29	7.442	1.979	170.44	160.78
59	CP	7	59	1.99							
60	CP	7	49	1.09							
61	CP	7	65	2.43							
62	JT	7	60	2.09							
63	JT	7	60	2.19							
64	JT	7	57	1.67							
65	JT	7	65	2.53							
66	JT	7	63	2.30							
67	JT	7	60	1.90							
68	JT	7	58	1.72							
69	JT	7	61	2.25							
70	JT	7	68	2.90	0.008	1.13	0.39	7.249	3.086	159.62	225.56
71	JT	7	79	5.10	0.043	0.96	0.36	7.358	1.964	152.17	
72	JT	7	79	4.70	0.045	0.86	0.28	7.358	1.964	159.02	147.77
73	JT	7	73	3.50	0.035	1.07	0.34	7.358	1.964	152.17	
74	JT	7	75	3.80	0.036	0.89	0.38	9.374	3.430	137.86	220.30
75	JT	7	73	3.70	0.033	1.13	0.37	9.534	2.395	174.82	188.19
76	JT	7	72	3.40	0.033	1.23	0.48	8.744	2.495	160.21	154.14
77	JT	7	66	2.60	0.023	1.09	0.38	7.669	2.258	176.61	156.63
78	JT	7	69	2.90	0.015	1.27	0.40	7.426	2.551	117.89	171.58
79	JT	7	68	2.80	0.022	0.61	0.35	7.896	2.045	143.54	178.29
80	GP	7	154	41.17	0.632	0.76	0.33	8.282	2.866	163.99	193.85
81	GP	7	168	55.26	0.742	0.67	0.33	8.282	2.866	148.38	203.10
82	GP	7	162	40.46	0.347	0.76	0.33	8.282	2.866	163.99	193.85
83	GP	7	163	52.44	0.458	0.69	0.38	9.425	3.255	148.38	237.15
84	GP	7	161	45.81	0.579	0.64	0.33	7.669	2.001	155.38	184.61
85	GP	7	140	29.62	0.331	0.72	0.37	8.669	2.544	202.72	211.37
86	GP	7	129	23.98	0.475	0.59	0.26	6.661	1.730	170.44	176.34
87	GP	7	141	29.44	0.250	0.70	0.34	9.022	1.972	187.12	145.01
88	GP	7	136	29.52	0.360	0.62	0.32	7.459	2.074	147.84	212.83
89	GP	7	122	19.25	0.230	0.68	0.30	9.047	1.913	158.07	182.27
90	GP	7	68	3.13	0.044	1.15	0.34	9.215	2.001	166.77	151.27
91	GP	7	65	6.59	0.081	1.08	0.36	9.946	1.781	150.97	161.11
92	GP	7	66	3.07	0.056	1.90	0.48	1.0164	1.642	244.53	156.64
93	GP	7	74	3.84	0.042	1.53	0.55	7.854	1.693	130.66	131.90
94	GP	7	73	3.98	0.041	1.08	0.37				
95	GP	7	76	4.59	0.047	1.06	0.39	8.005	1.972	121.46	144.12
96	GP	7	82	5.82	0.062	1.15	0.46	9.534	2.089	148.66	178.69
97	GP	7	70	3.73	0.040	1.06	0.45	9.467	2.126	178.10	174.52
98	GP	7	74	3.75	0.042	0.95	0.28	7.846	2.228	150.97	163.95
99	GP	7	69	3.21	0.049	1.30	0.33	9.542	2.331	131.60	165.49
100	GP	7	70	3.33	0.032	1.09	0.43	7.728	2.118	135.77	151.27
101	GP	7	72	3.66	0.033	1.44	0.40	9.475	2.375	176.01	141.14
102	GP	7	69	3.36	0.029	0.97	0.35	9.055	2.434	158.43	177.20
103	GP	8	77	3.96	0.036	0.86	0.26				
104	GP	8	86	4.54	0.052	0.91	0.34	8.786	1.825	117.68	149.78
105	GP	8	82	5.79	0.052	0.79	0.23	8.610	2.287	110.14	144.12
106	GP	8	69	3.20	0.037	0.98	0.24	11.533	1.752	155.15	130.70

## APPENDIX I. cont.

107	GP	8	77	4.30	0.030	0.77	0.29	8.635	2.316	137.56	173.63
108	GP	8	66	3.48	0.032	0.90	0.28	10.458	2.21	129.81	167.37
109	GP	8	65	2.74	0.028	0.92	0.39	8.854	1.046	136.96	141.14
110	GP	8	72	3.59	0.032	0.81	0.40	9.845	2.258	137.96	173.63
111	GP	8	73	3.98	0.033	0.81	0.48	11.248	2.089	189.52	167.67
112	GP	8	77	4.40	0.045	0.87	0.38	10.214	1.906	186.75	197.17
113	GP	8	76	4.19	0.035	0.62	0.28	8.644	2.287	124.02	173.33
114	GP	8	87	7.04	0.073	0.78	0.37	10.004	2.236	144.70	151.87
115	GP	8	88	6.34	0.066	1.03	0.40	9.937	2.353	244.27	165.28
116	GP	8	153	39.29	0.402	0.53	0.37	8.056	2.060	192.83	219.64
117	GP	8	140	29.28	0.320	0.61	0.35	7.904	2.384	152.80	212.34
118	JT	8	56	1.55	0.014	0.94	0.38	9.030	2.763	169.30	121.89
119	JT	8	59	1.95	0.012	0.93	0.38	11.908	2.609	207.82	238.72
120	JT	8	60	2.21	0.011	0.87	0.46	12.390	3.584	234.49	277.13
121	JT	8	54	1.41	0.007	0.82	0.37	16.010	4.574	146.33	325.15
122	JT	8	58	1.73	0.012	0.90	0.35	10.542	2.819	194.49	218.50
123	JT	8	64	2.35	0.027	0.89	0.37	7.854	2.316	172.26	195.25
124	JT	8	47	0.94	0.009	1.22	0.42	7.809	2.031	192.27	163.40
125	JT	8	67	2.84	0.023	1.12	0.42	7.938	2.397	187.74	156.99
126	JT	8	69	2.97	0.032	0.98	0.30				
127	JT	8	86	6.60	0.064	1.10	0.45	12.583	2.551	162.59	130.09
128	JT	8	76	3.98	0.034	1.00	0.46	9.803	2.683	130.31	191.16
129	JT	8	83	5.29	0.037	1.05	0.40	10.416	2.624	134.81	139.77
130	JT	8	73	3.40	0.029	0.89	0.45	8.257	2.272	162.34	147.84
131	JT	8	92	8.74	0.084	1.11	0.59	11.029	2.309	266.47	198.23
132	JT	8	91	7.12	0.073	0.86	0.36	10.021	2.617	215.24	161.29
133	JT	8	79	4.41	0.041	1.33	0.26	8.543	2.500	116.10	127.94
134	JT	8	83	5.33	0.062	0.82	0.37	9.416	2.470	168.95	134.39
135	JT	8	74	3.50	0.029	0.71	0.29	9.593	2.771	156.34	138.16
136	JT	8	82	5.21	0.043			9.517	2.741	140.24	182.67
137	JT	8	72	3.41	0.028	0.93	0.29	9.626	2.734	155.44	
138	JT	8	90	7.08	0.056	0.93	0.44	9.223	2.324	182.43	135.47
139	JT	8	65	2.61	0.019	0.80	0.33				
140	GB	8	92	8.13	0.089	0.95	0.46				
141	GB	8	106	11.30	0.078	0.66	0.37	8.316	1.898	197.81	167.98
142	GB	8	69	2.62	0.035	0.82	0.30	7.241	1.884	146.45	151.92
143	GB	8	92	8.81	0.088	0.77	0.54	9.106	2.192	221.77	163.27
144	GB	8	160	39.40	0.365	0.61	0.39	10.643	2.580	211.50	150.53
145	GB	8	98	9.66	0.095	0.90	0.42	9.358	2.448	206.61	173.24
146	GB	8	69	2.94	0.022	1.58	0.38	9.610	2.360	173.84	172.69
147	GB	8	78	4.96	0.043	0.97	0.53	8.565	2.045	184.11	153.31
148	GB	8	77	5.01	0.045	0.97	0.43	7.795	1.920	168.95	150.34
149	GB	8	77	4.08	0.043	0.93	0.48	8.854	2.140	193.41	155.24
150	GB	8	90	7.88	0.072	0.80	0.33	9.202	2.375	187.05	180.44
151	GB	8	79	5.04	0.047	0.74	0.43	8.215	1.957	185.58	171.30
152	GB	8	85	5.76	0.040	0.94	0.36	8.333	2.587	190.47	164.10
153	GB	8	83	6.89	0.058	0.96	0.36	8.862	2.280	194.19	152.75
154	GB	8	90	7.88	0.072	0.92	0.46	9.618	2.294	197.32	169.64
155	GB	8	79	5.04	0.047	0.74	0.43	8.215	1.957	185.58	160.78
156	PP	8	87	7.03	0.073	0.79	0.45	7.610	1.957	149.84	146.71
157	PP	8	75	4.06	0.030	0.79	0.38	7.703	2.617	222.35	139.22
158	PP	8	78	4.28	0.037	0.92	0.38	9.223	2.192	129.43	134.44
159	PP	8	85	5.71	0.047	0.61	0.33	9.215	2.954	140.68	157.49
160	PP	8	73	4.14	0.051	0.77	0.36	8.509	1.854	124.44	143.12
161	PP	8	71	3.56	0.040	0.81	0.32	8.408	2.067	136.51	129.05

## APPENDIX I. cont.

162	PP	8	77	3.95	0.038	0.80	0.35	7.560	1.018	128.18	143.12
163	PP	8	70	3.43	0.032	1.01	0.40	7.745	2.258	147.76	126.05
164	PP	8	67	2.93	0.026	0.80	0.37	6.745	2.148	138.18	120.96
165	PP	8	62	2.31	0.024	1.03	0.51	9.148	1.891	226.73	149.65
166	PP	8	65	2.59	0.020	0.74	0.39	8.484	2.280	165.26	137.73
167	PP	8	63	2.24	0.024	0.88	0.48	8.064	2.030	217.23	152.15
168	PP	8	60	1.90	0.025	0.84	0.32	8.845	1.964	202.73	135.11
169	PP	8	56	1.57	0.016	1.02	0.56	9.156	2.045	167.24	157.97
170	PP	8	49	0.95	0.013	1.07	0.46	5.872	1.231	201.73	98.12
171	PP	8	43	0.67	0.006	0.83	0.24	9.154	2.378	200.23	203.27
172	PP	8	55	1.44	0.018	1.08	0.43	9.811	2.016	178.24	152.15
173	LIP	8	134	22.55	0.163	0.68	0.39	10.311	3.284	178.17	238.21
174	CP	8	136	30.73	0.271	0.48	0.31	7.363	2.298	191.50	214.96
175	CP	8	130	19.70	0.178	0.56	0.34	9.072	2.020	171.92	201.82
176	CP	8	123	16.43	0.125	0.47	0.37	7.871	2.342	184.42	214.96
177	CP	8	116	13.48	0.104	0.60	0.29	7.703	2.463	168.00	146.11
178	CP	8	121	16.83	0.113	0.56	0.26	7.921	2.316	159.91	155.39
179	CP	8	56	1.59	0.014	0.88	0.28	9.408	2.756	213.73	170.85
180	CP	8	64	2.37	0.017	0.84	0.34	7.409	2.631	147.24	162.12
181	CP	8	56	1.54	0.013	0.75	0.29	6.997	2.529	213.23	152.98
182	CP	8	53	1.36	0.012	0.86	0.28	7.333	2.250	202.23	145.50
183	CP	8	51	1.16	0.008	0.91	0.25	7.775	2.873	275.72	134.69
184	CP	8	48	1.06	0.007	0.86	0.41	10.282	3.182	272.72	193.29
185	CP	8	56	1.65	0.010	0.95	0.40	7.880	2.368	224.73	137.19
186	CP	8	61	1.95	0.012	0.67	0.29	7.434	2.807	178.74	146.75
187	CP	8	58	1.78	0.016	0.89	0.22	11.710	2.309	241.73	146.33
188	CP	8	65	2.52	0.021	0.98	0.42	6.593	2.434	106.52	162.12
189	CP	8	64	2.30	0.022	0.98	0.42	6.997	2.529	213.23	152.98
190	CP	8	72	3.36	0.028	0.49	0.26	7.123	2.155	123.60	121.56
191	CP	8	65	2.55	0.017	0.76	0.31	8.585	2.668	134.85	50.02
192	CP	8	68	2.94	0.023	0.76	0.31	9.248	2.727	156.45	143.12
193	CP	8	70	3.37	0.031	0.98	0.089	1.979	1.979	18.25	136.53
194	CP	8	66	2.49	0.021	0.59	0.38	7.577	2.441	195.66	123.06
195	CP	8	115	14.30	0.123	0.59	0.38	8.022	2.522	181.92	140.12
196	CP	8	82	6.16	0.050	0.76	0.39	8.266	2.206	173.65	145.21
197	CP	8	112	14.02	0.091	0.50	0.19	7.476	2.587	135.65	147.01
198	CP	8	117	14.28	0.123	0.46	0.16	7.451	2.705	123.75	147.31
199	CP	6	114	14.56	0.089	0.52	0.16	7.753	2.712	131.44	1
200	JT	9	82	4.78	0.043	0.59	0.38	8.022	2.522	181.92	140.12
201	JT	9	96	8.15	0.059	0.46	0.81	0.29	99.28	0.31	47.77
202	JT	9	95	7.94	0.064	0.40	0.81	0.29	99.28	9.47	48.77
203	JT	9	81	4.64	0.036	0.42	0.81	0.29	99.28	0.21	59.27
204	JT	9	106	11.73	0.104	0.42	0.81	0.29	99.28	0.76	71.65
205	JT	9	62*	4.96	0.036	0.42	0.81	0.29	99.28	5.80	44.35
206	JT	9	88	6.91	0.052	0.42	0.81	0.29	99.28	6.01	41.43
207	JT	9	92	7.51	0.050	0.42	0.81	0.29	99.28	6.50	50.32
208	JT	9	72	3.18	0.020	0.84	0.74	0.31	135.26	8.50	35.02
209	JT	9	95	7.60	0.055	0.73	0.35	0.35	119.52	6.35	43.04
210	JT	9	85	5.55	0.046	0.42	0.81	0.29	99.28	6.88	42.16
211	JT	9	85	5.52	0.040	0.42	0.81	0.29	99.28	6.92	50.91
212	JT	9	86	5.46	0.042	0.42	0.81	0.29	99.28	6.01	41.43
213	JT	9	69	2.75	0.023	0.84	0.74	0.31	135.26	7.74	41.87
214	JT	9	81	4.56	0.034	0.74	0.74	0.31	120.87	6.17	56.01
215	JT	9	74	3.44	0.029	0.67	0.21	0.812	3.013	78.54	160.18
216	JT	9	83	4.65	0.032	0.44	0.12	7.720	2.338	132.79	136.83

Appendix I. cont.

217	JT	9	89	5.99	0.041	0.65	0.18	9.248	2.346	119.47	148.21
218	JT	9	88	6.22	0.044	0.65	0.20	9.500	2.844	148.02	150.00
219	JT	9	85	5.29	0.040	0.43	0.14	8.778	2.558	65.29	139.82
220	JT	9	78	4.01	0.034	0.75	0.21	9.097	2.587	183.71	1
221	JT	9	80	4.44	0.029	0.64	0.20	7.778	2.250	138.50	135.63
222	JT	9	80	4.44	0.031	0.68	0.42	8.980	2.177	134.81	107.81
223	JT	9	76	4.45	0.023	0.75	0.40	8.593	3.123	84.36	134.75
224	JT	9	67	2.86	0.025	0.71	0.24	8.039	2.263	92.99	152.26
225	JT	9	76	4.16	0.033	0.84	0.36	6.409	2.653	104.68	132.06
226	JT	9	84	5.01	0.027	0.69	0.36	8.224	2.587	129.41	121.73
227	JT	9	67	2.75	0.023	0.59	0.27	8.064	2.507	107.38	246.56
228	JT	9	76	4.06	0.028	0.85	0.46	8.383	2.507	144.25	121.73
229	JT	9	65	2.38	0.022	0.68	0.28	9.702	2.259	117.27	123.97
230	JT	9	61	2.02	0.023	0.83	0.35	7.988	2.478	205.23	155.06
231	JT	9	62	2.06	0.020	1.00	0.50	8.694	3.152	212.73	172.93
232	GB	9	107	12.07	0.098					10.17	54.42
233	GB	9	98	8.67	0.071					7.75	42.70
234	GB	9	86	6.14	0.046					8.44	57.12
235	GB	9	82	5.12	0.042					8.49	46.88
236	GB	9	77	4.06	0.035					7.24	38.79
237	GB	9	102	10.23	0.089					9.22	54.56
238	GB	9	99	9.30	0.076					8.01	55.50
239	GD	9	81	5.01	0.039					10.34	48.76
240	GD	9	105	10.93	0.078					8.03	46.20
241	GD	9	87	6.64	0.049					8.04	38.79
242	GD	9	67	2.72	0.024					9.89	1
243	GD	9	88	7.62	0.048					6.90	44.45
244	GD	9	75	3.91	0.035					9.15	41.35
245	GD	9	73	3.65	0.028					9.87	46.74
246	GD	9	79	4.82	0.043					7.23	45.12
247	GD	9	85	6.01	0.047					9.43	41.08
248	GD	9	70	2.96	0.027	0.99	0.48	8.980	2.338	163.80	215.13
249	GD	9	68	6.73	0.056	0.84	0.21	8.005	2.272	154.90	106.46
250	GD	9	84	5.82	0.051	1.13	0.24	8.635	2.126	180.46	144.63
251	GD	9	73	4.06	0.042	0.51	0.11	8.383	1.664	126.75	101.97
252	GD	9	75	5.52	0.074	1.36	0.51	8.820	2.529	135.95	133.40
253	GD	9	84	5.42	0.040	1.07	0.59	7.493	1.686	161.27	103.32
254	GD	9	78	4.24	0.038	1.05	0.41	6.863	1.891	116.64	108.71
255	GD	9	69	2.92	0.030	1.45	0.49	7.602	2.544	124.17	103.77
256	GD	9	73	3.70	0.031	0.79	0.37	8.729	2.360	102.11	131.61
257	GD	9	87	5.80	0.048	0.87	0.41	10.198	2.228	114.37	123.52
258	GD	9	68	2.47	0.018	9.013	2.258	91.35	117.69	1	1
259	GD	9	77	3.99	0.038	1.35	0.61	9.383	1.833	113.41	120.38
260	GD	9	82	4.97	0.040	1.23	0.59	8.677	1.818	159.14	115.44
261	GD	9	86	5.68	0.048	0.75	0.51	NA	2.448	107.83	130.26
262	GD	9	79	4.55	0.038	1.03	0.44	8.753	2.001	100.63	129.34
263	GD	9	90	6.69	0.062	1.18	0.53	10.861	2.346	130.31	281.13
264	GD	9	80	4.56	0.048	0.98	0.50	9.727	1.906	152.80	143.28
265	PP	9	68	2.50	0.021					7.75	41.73
266	PP	9	88	6.22	0.052					6.40	47.29
267	PP	9	72	3.34	0.025					6.02	36.81
268	PP	9	91	6.56	0.045					8.15	45.38
269	PP	9	77	4.91	0.044					7.40	46.33
270	PP	9	65	2.37	0.023					8.55	38.08
271	PP	9	77	4.43	0.043					11.22	80.15

## APPENDIX I. cont.

272	PP	9	10.32	0.055	0.48	1.994	44.11
273	PP	9	6.6	0.022	0.48	1.488	6.44
274	PP	9	4.66	0.031	0.48	1.608	37.92
275	PP	9	6.5	0.050	0.73	1.420	39.66
276	PP	9	7.8	0.03	0.034	0.44	1.42.01
277	PP	9	6.5	5.97	0.048	0.74	147.32
278	PP	9	7.5	3.09	0.035	0.79	128.46
279	PP	9	0.0	4.49	0.031	0.65	136.55
280	PP	9	7.6	3.59	0.025	0.74	161.24
281	PP	9	8.0	4.66	0.028	0.56	182.80
282	PP	9	7.5	3.68	0.031	0.65	120.41
283	PP	9	7.5	3.66	0.030	0.68	129.41
284	PP	9	7.7	4.32	0.045	0.91	120.42
285	PP	9	7.6	3.87	0.031	0.85	110.05
286	PP	9	7.5	3.70	0.030	0.85	0.30
287	PP	9	7.3	3.30	0.022	0.77	0.30
288	PP	9	6.6	2.54	0.020	0.86	0.24
289	PP	9	6.7	2.90	0.026	0.79	0.24
290	PP	9	5.2	1.19	0.009	1.18	0.24
291	PP	9	6.2	2.05	0.014	1.05	0.21
292	PP	9	6.0	1.75	0.012	0.94	0.19
293	PP	9	6.1	1.91	0.016	1.04	0.17
294	PP	9	6.2	2.07	0.018	1.06	0.17
295	PP	9	5.9	1.68	0.011	1.00	0.20
276	PP	9	6.5	2.39	0.027	1.14	0.33
277	GP	9	10.0	13.48	0.092	0.89	0.21
278	GP	9	17.9	52.50	0.420	0.85	0.21
279	GP	9	16.0	42.87	0.398	0.60	0.17
280	GP	9	10.5	11.15	0.092	0.82	0.30
281	GP	9	10.0	9.22	0.069	0.73	0.30
302	GP	9	8.2	4.96	0.052	0.67	0.25
303	GP	9	8.6	6.10	0.043	0.72	0.21
304	GP	9	7.7	4.29	0.033	1.04	0.49
305	GP	9	7.6	4.07	0.029	1.06	0.61
306	GP	9	7.2	3.37	0.026	1.05	0.61
307	GP	9	7.8	4.45	0.034	1.15	0.60
308	GP	9	6.9	2.82	0.027	1.18	0.60
309	GP	9	9.6	7.80	0.066	1.13	0.60
310	GP	9	10.9	11.30	0.072	1.05	0.22
311	GP	9	8.4	6.20	0.050	0.92	0.21
312	GP	9	7.1	2.98	0.020	0.69	0.19
313	GP	9	9.0	7.12	0.056	0.80	0.48
314	GP	9	6.3	2.21	0.011	1.03	0.24
315	GP	9	6.1	2.03	0.011	0.81	0.23
316	GP	9	6.1	1.83	0.013	0.98	0.27
317	GP	9	6.5	2.24	0.016	0.77	0.23
318	GP	9	6.6	2.80	0.026	0.94	0.26
319	GP	9	9.0	7.38	0.056	7.686	2.023
320	GP	9	7.2	3.28	0.025	7.686	2.023
321	GP	9	9.4	8.11	0.052	7.686	2.023
322	GP	9	7.0	2.95	0.027	7.686	2.023
323	GP	9	6.5	2.68	0.022	1.32	0.36
324	GP	9	9.5	8.58	0.062	1.994	49.65
325	GP	9	8.5	5.75	0.052	8.40	46.21
326	GP	9	6.8	2.52	0.021	8.26	38.14

APPENDIX I. cont.

APPENDIX I. cont.

302	GB	10	74	3.66	0.034	1.31	0.30	12.331	2.162	103.90	203.87
303	GB	10	75	6.09	0.041	2.01	0.49	13.440	2.177	110.25	193.08
304	GB	10	91	6.62	0.049	1.08	0.32	9.727	3.123	172.56	193.48
305	GB	10	76	3.83	0.034	1.63	0.35	12.020	2.551	115.56	193.68
306	GB	10	84	5.26	0.048	1.38	0.47	11.256	2.800	130.09	172.58
307	GB	10	96	7.84	0.064	1.39	0.26	10.920	2.580	132.78	174.43
308	GB	10	75	3.63	0.036	1.26	0.41	10.550	2.763	147.31	164.72
309	GB	10	89	6.04	0.048	1.47	0.47	11.903	2.434	166.68	158.71
310	GB	10	91	7.31	0.055	1.32	0.58	10.584	2.893	165.60	181.96
311	JT	10	68	5.94	0.057	0.88	0.44	10.055	2.338	162.23	184.04
312	JT	10	84	5.15	0.047	0.86	0.38	8.996	2.309	102.34	169.09
313	JT	10	85	5.45	0.040	0.92	0.49	10.609	2.593	176.83	180.71
314	JT	10	87	5.89	0.046	1.10	0.59	11.290	2.522	165.15	200.51
315	JT	10	85	5.69	0.043	0.86	0.40	9.114	3.159	164.67	193.49
316	JT	10	81	4.42	0.034	0.92	0.46	11.164	3.386	177.80	215.55
317	JT	10	92	7.90	0.063	0.99	0.58	12.121	3.064	197.26	222.06
318	JT	10	67	2.46	0.026	0.97	0.31	9.215	2.162	177.45	
319	JT	10	98	7.98	0.057	1.04	0.38	11.483	3.181	147.59	198.46
320	JT	10	78	4.50	0.043	0.94	0.22	10.760	2.617	178.00	206.55
321	JT	10	88	6.25	0.037	0.81	0.26	8.089	2.954	175.62	166.10
322	JT	10	76	3.80	0.023	1.19	0.43	9.080	2.973	87.11	160.85
323	JT	10	68	2.66	0.027	1.17	0.43	8.719	2.441	193.60	
324	JT	10	70	3.03	0.027	1.15	0.45	10.408	2.587	148.49	218.63
325	JT	10	78	4.06	0.031	1.16	0.45	9.408	2.390	160.87	173.97
326	JT	10	65	2.48	0.019	0.76	0.20	8.593	2.014	157.45	318.95
327	JT	10	65	2.21	0.019	1.42	0.44	10.937	2.338	169.30	292.28
328	JT	10	56	1.46	0.010	0.68	0.21	9.956	2.147	184.12	316.73
329	PP	10	101	9.55	0.087	0.89	0.31	9.820	3.013	135.26	178.13
330	PP	10	95	7.17	0.054	0.87	0.38	10.349	3.181	87.14	172.12
331	PP	10	81	3.29	0.026	0.98	0.963	3.628	137.91		
332	PP	10	93	7.57	0.080	1.04	0.50	11.600	2.661	131.21	174.89
333	PP	10	83	5.07	0.045	1.09	0.45	12.986	2.705	101.98	177.67
334	PP	10	96	7.63	0.073	1.24	0.48	13.205	3.005	122.22	192.92
335	PP	10	91	6.67	0.055	0.88	0.49	11.794	2.961	136.16	173.04
336	PP	10	90	4.54	0.064	1.05	0.32	12.340	2.800	141.56	187.84
337	PP	10	99	9.20	0.075	0.84	0.54	10.819	3.049	139.76	180.90
338	PP	10	79	3.89	0.022	0.78	0.47	9.013	3.394	133.91	176.28
339	PP	10	74	3.33	0.032	0.66	0.31	10.912	3.064	80.39	203.56
340	PP	10	74	3.52	0.027	0.96	0.36	9.190	2.754	122.22	171.19
341	PP	10	76	3.69	0.032	1.00	0.28	10.836	3.181	92.99	176.28
342	PP	10	74	3.71	0.033	0.57	0.19	11.239	2.866	79.04	201.71
343	PP	10	71	2.94	0.025	1.03	0.42	12.482	2.294	136.16	173.04
344	PP	10	69	2.64	0.022	1.07	0.47	12.298	2.727	115.47	158.25
345	PP	10	66	2.43	0.016	1.34	0.35	10.408	2.566	181.15	276.72
346	PP	10	57	1.62	0.014	1.08	0.27	9.416	1.781	144.85	333.02
347	PP	10	52	1.28	0.014	1.18	0.28	10.668	1.840	130.78	174.49
348	GP	10	103	10.47	0.088	1.16	0.37	9.568	3.482	189.42	193.85
349	GP	10	67	2.68	0.030	1.00	0.38	8.509	2.045	167.10	146.69
350	GP	10	75	3.26	0.035	1.00	0.39	8.232	2.587	125.65	141.14
351	GP	10	70	3.02	0.025	1.14	0.39	8.249	2.807	161.53	192.70
352	GP	10	64	5.07	0.046	1.26	0.24	9.341	3.218	149.45	188.30
353	GP	10	84	4.87	0.051	1.08	0.27	9.307	2.184	156.58	158.71
354	GP	10	95	7.10	0.056	1.05	0.30	9.811	2.448	200.36	168.88
355	GP	10	67	5.71	0.054	1.17	0.24	9.122	2.390	154.20	177.21
356	GP	10	66	5.58	0.064	1.23	0.28	9.635	2.653	164.18	173.13

## APPENDIX I. cont.

437	GP	10	85	5.38	0.056	2.10	0.34	11.559	2.580	231.29	190.13
438	GP	10	95	7.70	0.070	1.05	0.22	10.929	3.035	146.11	177.80
439	GP	10	71	3.20	0.025	0.85	0.27	8.602	3.159	113.76	173.81
440	GP	10	72	3.26	0.042	1.59	0.30	10.248	2.1661	173.24	178.99
441	GP	10	68	2.76	0.035	1.30	0.28	8.148	2.346	96.15	144.38
442	GP	10	71	3.18	0.036	0.78	0.40	8.182	2.404	123.27	185.99
443	GP	10	55	1.40	0.016	0.86	0.31	7.652	1.884	175.23	153.74
444	CP	10	63	2.43	0.013	1.01	0.47	11.164	2.507	215.23	147.07
443b	CP	10	77	4.06	0.041	0.63	0.22	9.030	2.595	131.73	163.64
444b	CP	10	76	3.53	0.028	0.92	0.30	8.213	2.580	114.57	185.58
445	CP	10	158	40.08	0.287	0.43	0.27	9.358	2.756	140.66	208.93
446	CP	10	166	44.62	0.301	0.73	0.31	9.862	2.580	142.91	123.63
447	CP	10	135	23.72	0.174	0.69	0.33	10.332	3.181	125.47	181.81
448	CP	10	106	11.80	0.073	0.69	0.36	9.500	2.309	147.38	181.21
449	CP	10	80	4.60	0.045	0.94	0.41	8.224	2.522	211.03	176.83
450	CP	10	89	5.75	0.046	0.58	0.35	8.660	2.595	157.40	167.59
451	CP	10	92	6.99	0.049	0.59	0.33	7.720	2.939	214.54	165.64
452	CP	10	120	15.72	0.149	1.06	0.47	9.828	1.847	250.63	144.72
453	CP	10	75	3.69	0.038	0.83	0.31	8.677	2.331	188.48	200.66
454	CP	10	76	3.49	0.028	0.45	0.33	7.652	2.126	164.92	159.32
455	CP	10	70	2.72	0.019	0.62	0.38	7.140	2.456	192.99	170.99
456	CP	10	82	4.46	0.031	0.73	0.38	9.282	2.727	203.52	142.78
457	CP	10	72	3.32	0.037	0.85	0.42	9.114	2.177	163.92	195.31
458	CP	10	60	1.88	0.015	0.81	0.31	8.921	2.375	173.00	453.78
459	CP	10	59	1.54	0.006	0.99	0.27	11.794	3.138	168.56	164.11
460	CP	10	60	1.70	0.007	0.93	0.36	10.904	2.962	178.73	221.16
461	DC	10	73	7.70	0.085	0.70	0.45	10.080	3.101	192.88	197.09
462	DC	10	65	2.54	0.036	1.14	0.28	9.198	3.027	146.69	173.13
463	DC	10	72	3.62	0.031	1.06	0.49	8.580	2.580	173.35	168.61
464	DC	10	74	3.56	0.024	0.80	0.49	9.702	3.152	198.23	187.14
465	DC	10	118	19.29	0.120	0.91	0.31	9.131	3.145	152.24	178.10
466	DC	10	92	7.17	0.064	0.99	0.27	11.693	2.140	164.26	169.96
467	DC	10	92	7.16	0.080	1.09	0.35	9.038	2.675	169.35	174.94
468	DC	10	78	3.88	0.033	1.19	0.43	10.517	2.793	134.22	202.06
469	DC	10	69	2.47	0.018	0.90	0.33	5.930	2.939	167.01	167.70
470	DC	10	78	4.03	0.037	0.86	0.30	6.863	2.067	162.29	140.58
471	DC	10	131	23.05	0.156	0.95	0.33	9.626	3.086	173.97	193.02
472	DC	10	147	33.12	0.349	0.64	0.28	9.274	2.346	179.05	170.67
473	DC	10	73	3.68	0.038	0.84	0.29	10.718	3.020	143.13	185.33
474	DC	10	54	1.34	0.004	1.48	0.50	8.903	2.586	147.07	155.96
475	DC	10	51	1.15	0.009	0.73	0.20	8.930	2.586	127.81	173.74
476	DC	10	51	1.08	0.006	0.68	0.22	10.526	3.777	208.39	277.64
477	WH	10	51	1.17	0.005	1.10	0.31	14.652	3.159	130.95	221.95
478	WH	10	100	10.21	0.092	1.68	0.39	13.381	2.712	177.67	195.73
479	WH	10	117	14.56	0.113	1.90	0.41	13.037	3.057	227.60	194.83
480	WH	10	103	10.12	0.075	1.48	0.49	8.047	2.404	174.36	219.23
481	WH	10	109	12.00	0.110	1.94	0.40	12.936	2.881	195.24	208.39
482	WH	10	100	9.45	0.067	1.72	0.41	14.053	3.159	130.95	221.95
483	WH	10	88	6.42	0.077	2.42	0.65	13.759	1.796	169.91	190.31
484	WH	10	97	8.36	0.101	2.05	0.40	11.743	2.544	174.19	216.07
485	WH	10	82	4.88	0.047	1.87	0.42	12.163	3.181	106.56	193.92
486	WH	10	103	9.70	0.066	1.20	0.57	12.054	2.983	197.04	205.67
487	WH	10	101	10.07	0.125	1.62	0.63	13.280	2.390	165.62	203.41
488	WH	10	91	6.94	0.052	1.22	0.31	13.709	2.925	126.60	193.92
489	WH	10	75	3.48	0.032	1.30	0.54	12.054	3.042	118.99	200.25

## APPENDIX I. cont.

470	WH	10	72	3.16	0.028	1.50	0.69	10.440	2.778	160.87	137.87
491	WH	10	85	5.46	0.058	1.44	0.70	11.634	2.815	151.83	178.10
492	WH	10	56	1.58	0.022	1.07	0.35	11.542	2.507	146.33	180.41
493	SC	10	120	21.75	0.150	0.67	0.36	10.046	2.507	200.01	173.91
494	SC	10	99	9.04	0.103	1.66	0.45	12.121	2.016	133.84	198.23
495	SC	10	89	5.95	0.055	0.99	0.36	10.265	2.580	133.84	164.67
496	SC	10	127	19.67	0.110	0.50	0.29	10.441	2.426	196.30	191.42
497	SC	10	80	4.40	0.035	1.19	0.32	8.459	1.833	154.90	137.43
498	SC	10	72	3.62	0.022	1.01	0.33	9.161	2.368	147.38	163.21
499	SC	10	101	9.56	0.068	1.11	0.41	10.525	2.478	203.01	197.26
500	SC	10	105	10.66	0.087	1.11	0.43	10.727	2.705	171.44	223.53
501	SC	10	85	5.37	0.040	1.37	0.49	10.643	2.829	171.44	210.39
502	SC	10	102	9.78	0.090	1.47	0.55	11.558	2.008	186.47	194.34
503	SC	10	92	6.74	0.054	0.85	0.43	9.156	2.829	187.22	208.45
504	SC	10	86	5.61	0.056	1.43	0.49	10.408	2.089	166.15	188.02
505	SC	10	69	2.77	0.025	0.75	0.27	8.660	2.675	157.13	219.64
506	SC	10	84	5.61	0.032	0.98	0.41	9.173	3.042	205.92	228.98
507	SC	10	71	3.02	0.035	0.76	0.38	8.282	1.888	154.69	159.80
508	SC	10	61	2.09	0.017	1.19	0.35	10.399	2.595	261.73	172.93
509	SI	10	102	10.59	0.088	1.25	0.58	0.55	1.56.90	213.31	
510	SI	10	93	7.49	0.053	0.97	0.55	10.097	2.651	198.00	205.04
511	SI	10	71	2.96	0.017	0.97	0.41	8.282	1.888	154.69	159.80
512	SI	10	76	3.58	0.027	0.89	0.37	9.568	2.170	182.46	200.66
513	SI	10	96	7.98	0.063	1.21	0.52	12.516	2.538	213.54	220.12
514	SI	10	74	3.50	0.030	1.30	0.43	11.844	2.756	216.08	215.26
515	SI	10	98	8.97	0.078	1.06	0.55	10.676	2.228	199.00	223.53
516	SI	10	93	6.92	0.052	1.05	0.43	10.055	2.617	217.30	230.34
517	SI	10	81	4.88	0.043	1.52	0.71	12.205	2.624	185.39	228.88
518	SI	10	70	2.98	0.017					167.05	218.18
519	SI	10	85	5.41	0.041	1.54	0.61	11.777	3.064	167.53	231.31
520	SI	10	94	7.63	0.058	1.13	0.39	12.608	1.944	171.02	164.20
521	SI	10	96	7.38	0.051	1.15	0.52	11.290	2.243	203.69	198.46
522	SI	10	112	9.33	0.071	1.27	0.51	12.508	2.727	197.03	213.21
523	SI	10	79	4.09	0.034	1.30	0.55	9.685	2.522	155.16	176.57
524	SI	10	64	2.27	0.013	1.39	0.42	11.810	2.639	863.23	172.10
525	SI	10	63	2.05	0.010	1.33	0.37	11.016	2.891	278.22	171.68
526	SI	10	54	1.32	0.008	1.37	0.36	11.206	2.902	210.73	198.70
527	SI	10	47	0.95	0.003	1.35	0.48	9.525	2.735	212.23	120.98
528	SI	10	56	1.46	0.009	0.78	0.44	7.494	2.640	154.24	147.16
529	SI	10	58	1.67	0.013	1.26	0.63	10.105	2.456	199.29	155.06
530	SI	10	59	1.68	0.014	1.1	0.29	10.676	2.653	224.06	162.12
531	SI	10	56	1.62	0.013	0.87	0.33	11.827	2.463	261.46	211.58
532	SI	10	140	27.55	0.167	0.80	0.52	10.769	2.045	269.84	193.85