CRYSTAL RIVER UNIT 3

ENVIRONMENTAL TECHNICAL SPECIFICATIONS

IMPINGEMENT REPORT MARCH 13, 1977

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Florida Power
CORPORATION

FLORIDA POWER CORPORATION
CRYSTAL RIVER POWER STATION IMPINGEMENT STUDY
MARCH 13, 1977 TO MARCH 13, 1978

FINAL REPORT

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SUMMARY

A study of the impingement of finfish and shellfish on the intake screens of the Crystal River Power Station (CRPS) Units 1, 2, and 3 was conducted between March 13, 1977 and March 13, 1978 to meet the requirements of the NRC Environmental Technical Specifications. Samples were collected during one 24 hr period each week for 51 weeks during the year. All finfish and invertebrates were identified to species, bulk-weighed, counted, and length ranges were determined. Once each month, weights and lengths of up to 30 individuals of each species of finfish and invertebrates were measured. Information on barge traffic, tidal stage, water temperature, wind, weather, and amount of seagrass was recorded with each sample.

A total of 376,965 finfish, representing at least 106 species, were collected during the study. The mean finfish catch for the year was 7,752 individuals per 24 hr. Scaled sardine, bay anchovy, pinfish, sea catfish, and silver perch were the most abundant finfish.

The average daily catch of finfish collected during the study was 81.5 kg per 24 hr. The scaled sardine and the polka-dot batfish were the predominant finfish, accounting for 27% and 26%, respectively of the total finfish biomass collected. No other species accounted for more than 6% of the total finfish catch.

A total of 99,108 invertebrates, representing at least 45 taxa, were collected during the study. The average daily invertebrate catch was 2,005 individuals and 22.6 kg per 24 hr. The most abundant invertebrates collected were pink shrimp, Portunus gibbesii, Metoporhaphis calcarata, and blue crab. Blue crab and pink shrimp made up the largest percentages of the total invertebrate biomass (66% and 24%, respectively).

Monthly impingement of finfish at CRPS (numbers and biomass) was greatest in December and January. The largest monthly catch of polka-dot batfish, one of the most important species throughout the study, occurred in December. Two unusually large catches of finfish (December 29-30, 1977 and January 12-13, 1978) also contributed to the high monthly impingement in December and January. Clupeid species, primarily scaled sardine and Atlantic thread herring, accounted for more than 50% of the catch on these two occasions. The scaled sardine was abundant in CRPS impingement samples only on these two dates.

The numbers of invertebrates caught were high from January through March and in July and August. Pink shrimp and blue crab accounted for approximately 68% of the number of invertebrates collected during the January-March peak and for about 30% during the July-August peak. Invertebrate biomass was highest in September samples, when approximately 92% of the biomass collected was made up of blue crab. Biomass of impinged invertebrates was also high in January, April, and November. Pink shrimp and blue crab constituted more than 89% of the biomass impinged per 24 hr during these months.

The total projected impingement for the year at CRPS was estimated to be 2,651,402 finfish and 271,402 invertebrates weighing a total of 35,662 kg. This estimate includes the large number of clupeids collected on two dates in December and January. The dominant species on these two dates, the scaled sardine and the Atlantic thread herring, are not of commercial importance in the Citrus-Pasco County area. The large numbers impinged at CRPS during the two sampling dates probably did not damage the natural populations of the CRPS area because of large clupeid populations available nearby for recruitment (the Gulf of Mexico) and because of their high fecundity and rapid growth (Texas Instruments 1977).

Blue crab and pink shrimp were the major commercially important species among the species making up a large percentage of the biomass collected at CRPS. The estimated total biomass of blue crabs and pink shrimp impinged for the year at CRPS represent approximately 0.5% and 1.0%, respectively, of the total commercial catch for the Citrus-Pasco county area.

The flow rate of cooling water at CRPS doubled with the addition of Unit 3 and a comparison of operational with preoperational data shows that the impingement rate also increased. Actual numbers and biomass impinged at CRPS were highest at Unit 3 and lowest at Unit 1.

Flow rates and impingement rates at the Anclote and Big Bend Power Stations were lower than those at CRPS. At the Cedar Bayou Generating

Station, Texas, which has a flow rate similar to that at CRPS, impingement of finfish was higher than at CRPS.

An analysis of variance and multiple range tests were performed on mean numbers of individuals and biomass of 45 important finfish and invertebrate species and groups impinged per 100 m^3 of intake water. Factors analyzed were month, time of sample collection, plant unit at which samples were taken, tide stage, presence or absence of barge traffic, and strength of wind during sampling. Mean numbers and biomass of most species and groups tested were significantly different in different months and at different units. Impingement of both numbers and biomass per 100 m^3 of intake water was greatest at Units 2 and 3 and lowest at Unit 1 for most species and groups.

Impingement of numbers of individuals and biomass of most species and groups was highest during dusk and night samples and lowest in day samples. The impingement of three fish species was greatest during flood or ebb tide, and lowest at mid tide. Impingement of invertebrates as a group and of six invertebrate species was significantly greater in samples taken during ebb tide than in samples taken during flood or mid tide. The impingement of the group "all organisms" and of seven fish and three invertebrate species was greater in samples taken when barges were moving. Presence or absence of strong wind during sample collection was a significant factor in the impingement of seven fish species and two invertebrate species.

INTRODUCTION

The impingement study conducted by NUS Corporation at Florida Power Corporation's (FPC) Crystal River Power Station (CRPS) was designed to fulfill the requirements of the NRC Environmental Technical Specifications. The objectives of the study were to estimate the biomass, number, and taxonomic composition of finfish and shellfish impinged on the intake screens of each unit and to identify seasonal and diurnal patterns of abundance and biomass of the impinged organisms.

This report includes a description of the methods used during the study as well as a presentation and discussion of the results, including statistical analyses. The effect of impingement losses on local fish and invertebrate populations, particularly those of commercial and recreational importance, is considered. The evaluation of the effect of impingement losses includes a comparison with some other operating power stations.

DESCRIPTION OF THE SITE

CRPS is situated approximately 112 km north of Tampa, Florida and about 12 km northwest of the town of Crystal River. The site is adjacent to the Gulf of Mexico and is bounded by areas of saltmarsh to the north, south, and west and by uplands to the east. The water in the immediate vicinity of CRPS is shallow (<3 m) except at the intake and discharge canals. The intake canal, located south of the site, extends offshore to the west approximately 8.3 km. This canal is approximately 6 m deep and serves as a channel for coal and oil barges that service the station. The canal terminates at Unit 3 (Figure II-1). To the west, there is large turning basin for the oil and coal barges. Coal barges also maneuver directly across the intake canal from Units 1 and 2. The cooling water from all three units is discharged into a canal north of the station.

The intakes of Units 1 and 2 are contained in a common structure. The screen wash from these units is discharged to a common sluiceway but the sluiceway is graded so that the screen wash from each unit is collected in a separate trash basket. Little mixing of material from the two units is believed to occur in the sluiceway. The Unit 3 intake is separate from that of Units 1 and 2. Material washed from the screens of Unit 3 is collected in a single trash basket. Characteristics of the intake of each unit are given in Table II-1 and a diagram of the intake structure of Unit 3 is shown in Figure II-2. The structures of the intakes at all three units are similar, although the intake water flows and velocities vary.

METHODS

Organisms were collected at Units 1, 2, and 3 for one 24-hr period each week between March 13, 1977 and March 13, 1978 (Table II-2), except during the week of April 18, 1977 when large numbers of ctenophores (comb-jellies) in the intake area prevented quantitative sampling. The number of 24-hr sampling periods for each unit in each month is presented in Table II-3.

The day of the week on which sampling was conducted was chosen from among six possible days (Monday through Saturday) by use of a random numbers table. During each 24-hr sampling period, samples were taken at each unit at 6-hr intervals for a total of four samples per unit. The traveling screens were rotated so that each sample contained the organisms impinged during the 6-hr interval immediately preceding the collection. The screens on Units 1 and 2 were cleaned at 0900 hr (the beginning of the first sampling interval) and then rotated every six hours so that collections could be made at 1500 hr, 2100 hr, 0300 hr, and 0900 hr. Unit 3 was first cleaned at 1000 hr and sampled at 1600 hr, 2200 hr, 0400 hr, and 1000 hr. The time intervals were chosen to represent day, dusk, night, and dawn.

This sampling schedule was followed as closely as possible without interfering with normal plant operations. If it became necessary to clean the screens before the end of a 6-hr sampling period, the material washed from the screens at this time was retained in the collection

baskets and counted with other organisms obtained during that sampling period. To assure that all organisms were washed from the screens, the screen wash system was operated for 30 min for the collection of a sample.

Samples were collected in baskets placed over the trash baskets at the end of the screenwash sluiceways. The collection baskets consisted of fiber-glassed wooden frames with 15 mm stainless steel wire mesh sides and bottoms. Window screening (approximately 2 mm mesh) lined the collection baskets. On several occasions, the window screening was removed and the sample was filtered through the larger (15 mm) mesh screen because of excessive clogging with debris or ctenophores.

All finfish and macroinvertebrates were separated from sea grass and other debris at the time of sampling. All finfish and the larger macroinvertebrates were sorted and identified to species, counted, and weighed. The largest and smallest individuals of each species were measured at a laboratory on site. Smaller macroinvertebrates were bagged and frozen for later processing in the NUS Dunedin laboratory. Length (standard length for finfish, greatest carapace width for crabs, total length for shrimp) was measured to the nearest millimeter. Weights for each species were measured to the nearest 0.1 g on an O'Haus Model 310 Dial-O-Gram balance or an O'Haus Model 2610 triple beam balance.

In several instances, very large numbers of organisms were collected in a single sample. On these occasions, a subsample was taken and

processed as described above and the remaining organisms were bulk-weighed. The total number of individuals of each species and their mean weights were then estimated from these data. On several other occasions when large numbers of a single species were collected, subsamples were taken in the same manner.

Once each month, up to 30 individuals of each species from one randomly selected sample at each unit were weighed and measured. When a large number of individuals of one species was collected, a maximum of 30 were randomly selected to be weighed and measured. The remaining individuals of that species were then counted and bulk-weighed.

Finfish and macroinvertebrates were identified to the lowest possible taxon. Taxonomic references used for finfish identification included Dahlberg (1975), Hoese and Moore (1977), Parker (1972), and Walls (1975). Nomenclature followed American Fisheries Society (1970). Identification of invertebrates followed Abbott (1968), Camp (1973), Farfante (1969), Wass (1955), and Williams (1965). Representative specimens are maintained in the NUS Dunedin laboratory.

Data on barge traffic, tide stage, water temperature, wind, weather, and the amount of sea grass in the sample were recorded each time a sample was collected. Tide level was determined from a continuous tide recorder at Units 1 and 2. Plant operation data (number of pumps or screens operating) were also recorded.

An analysis of variance (ANOVA) of the impingement data was performed to assess the effects of certain physical and biological factors. The ANOVA provides a statistical test for both mean differences among certain effects and a comparison of the variability for specified effects. Both the numbers and biomass of 45 species or groups of species were tested in the analysis. Species of sports or commercial importance, as well as those which were abundant in or constituted a large percentage of the biomass in impingement samples were selected for analysis.

The numbers and biomass of finfish and invertebrates impinged per 100 m^3 of water entering each unit were used in the ANOVA to standardize the data for differences in flow among units and sampling times. The standardized numbers and biomass of the organisms impinged were subjected to the common logarithmic transformation [$Y = \log_{10}(X+1)$] before statistical analyses. This transformation is used to stabilize the variance (Snedecor and Cochran 1968) and is one of the most commonly used transformations (Scheffe 1970).

The sources of variation in the ANOVA and their respective degrees of freedom were as follows:

Source of Variation	Degrees of Freedom
Month	11
Day: Month	89
Time	3
Unit	2
Tide	2
Barge	1
Wind	1
Remainder	418

The hypotheses tested for each source of variation in the analyses of variance were:

- Month - the mean differences among the twelve months are equal
- Day:Month - the variability among the days within a month is not equal to zero
- Time - the mean differences among the four sampling times (i.e., day, dusk, night, and dawn) are equal.
- Unit - the mean differences among the three units are equal
- Tide - the mean differences among the three tide stages (i.e., increasing, decreasing, mid) are equal
- Barge - the mean difference between presence and absence of barge traffic is equal
- Wind - the mean difference between strong and negligible wind is equal.

If time, unit, or tide was shown by the ANOVA to be a significant source of variability in the numbers or biomass of a species or group, a Duncan's Multiple Range Test (Duncan 1955) was performed to determine which means were significantly different from each other.

Species Occurrence

At least 106 species of finfish from 54 families (Table II-4) were collected at CRPS during the study year. Invertebrates representing at least 45 taxa belonging to at least 19 families from six orders (Table II-5) were also collected. Fourteen fish species were collected every month: shrimp eel, bay anchovy, gulf toadfish, polka-dot batfish, tidewater silverside, lined seahorse, dusky pipefish, chain pipefish, pigfish, pinfish, spot, scrawled cowfish, southern puffer, and striped burrfish (Table II-6). In comparison, 16 species of fish were taken during only one month. Twelve invertebrate species were found every month: squid, pink shrimp, blue crab, stone crab, mantis shrimp, Trachypenaeus constrictus, Alpheus heterochaelis, Palaemon floridanus, Portunus gibbesii, Panopeus herbstii, Libinia dubia, and Metoporhaphis calcarata (Table II-7). Nine invertebrates were collected during only one month. No rare or endangered species were collected during the study.

Abundance and Biomass

A total of 376,965 finfish were collected at CRPS during the sampling year. The mean daily finfish catch for the year was 7,752 individuals per 24 hr. Eleven species of finfish had total catches for the study exceeding 2,000 individuals (Table II-8). These species accounted for approximately 94% of the total number of finfish collected during

the study. The most abundant finfish were the scaled sardine (166,420 individuals, 44.1% of the total), bay anchovy (57,356, 15.2%), pinfish (30,077, 8.0%), sea catfish (29,077, 7.7%), and silver perch (26,831, 7.1%).

The mean biomass of finfish collected during the study was 81.5 kg per 24 hr. The scaled sardine and the polka-dot batfish made up the largest portion of total finfish biomass taken in the samples: 1,226.9 kg (27% of the total) and 1,176.7 kg (26%), respectively (Table II-9). Other fish species ranked among the top five in biomass collected during the study were sea catfish (239.8 kg, 5.3%), silver perch (178.3 kg, 4.0%), and pinfish (165.3 kg, 3.7%). Although the scaled sardine ranked first in both numbers of individuals and biomass collected during the study, it was abundant during only two of 51 sampling dates. The bay anchovy, which ranked second in abundance, was eighth in total biomass. In contrast, the polka-dot batfish was seventh in order of abundance but ranked second in total biomass.

If the scaled sardine and Atlantic thread herring which constituted a large portion of the biomass impinged on only two of 51 sampling dates are discounted, polka-dot batfish, blue crab, and pink shrimp make up a large portion of the impinged biomass (Table II-10) (Figure II-3). These three species combined account for 59% of the total biomass impinged yearly. Polka-dot batfish accounted for 32%, blue crab for 20%, and pink shrimp for 7% of the total catch. During nine months of the year these three species account for over 59% of the biomass and

during five months the portion made up by these species exceeded 80%. During January and February, these species made up only 28% and 12%, respectively, of the total biomass collected.

When the scaled sardine and Atlantic thread herring are eliminated from the calculations, sea catfish and silver perch make up most of the biomass collected during January, and the sea catfish also dominated the catch by numbers that month. During February the species making up the greatest biomass impinged were bay anchovy, pinfish, and Atlantic stingray.

A total of 99,108 invertebrates were collected at CRPS during the study. This represents a mean catch of 2,005 individuals per 24 hr for the study. Ten invertebrate species had total catches for the study exceeding 1,000 individuals (Table II-11). These species made up approximately 96% of the total invertebrate catch. The pink shrimp was the most abundant invertebrate in the impingement samples: 39,566 individuals or 39.9% of the total. Other abundant invertebrates were Portunus gibbesii (17,744, 17.9%); Metoporhaphis calcarata (12,510, 12.6%), and blue crab (10,070, 10.2%).

The mean invertebrate biomass collected during the study was 22.6 kg per 24 hr. The invertebrate which made up the largest portion of the catch by weight was the blue crab (715.6 kg, 65.7% of the total), followed by pink shrimp (260.2 kg, 23.9%), Portunus gibbesii (43.0 kg, 3.9%), and squid (26.7 kg, 2.5%) (Table II-12).

Monthly mean catches of numbers (individuals per 24 hr) and biomass (kg per 24 hr) of all organisms (finfish and invertebrates) are shown in Figure II-4. The mean number of individuals impinged was highest from December through March whereas mean biomass impinged was highest only in December and January.

The highest monthly finfish impingement (both numbers of individuals and biomass per 24 hr) occurred in December 1977 and January 1978 (Tables II-13 and Figure II-5). Large numbers of clupeids (primarily scaled sardine), which were collected only during two sampling dates, one each month, contributed greatly to this peak. Clupeids comprised about 65% of the biomass and 88% of the numbers of finfish collected during December and accounted for approximately 56% of the biomass and 57% of the numbers of fish collected in January. Mean impingement of finfish was lowest in September and October for numbers of individuals (386 and 568, respectively) and in May for biomass (8.8 kg).

The polka-dot batfish constituted the greatest finfish biomass during nine months, it was among the five species contributing the greatest biomass impinged in all months except February (Table II-14), and it was one of the five most abundant species during ten months. December was the peak month of impingement for polka-dot batfish biomass (42.5 kg per 24 hr) and numbers (501 individuals per 24 hr). Other species ranking among the top five by biomass during five or more months were pinfish, striped burrfish, silver perch, and scrawled cowfish. Pinfish, silver perch, and bay anchovy were among the five most abundant species in five or more months.

Largest numbers of invertebrates were impinged in January (5,178 individuals per 24 hr), February (2,961 individuals per 24 hr), and March (2,771 individuals per 24 hr) (Table II-15 and Figure II-6). A smaller peak in invertebrate numbers impinged occurred during July and August (2,943 and 2,740 individuals per 24 hr). Pink shrimp and blue crab accounted for approximately 68% of the numbers of invertebrates impinged during the January-March peak and for about 30% during the July and August peak. Invertebrate biomass was greatest in September samples (39.3 kg per 24 hr) (Table II-15 and Figure II-6). About 92% of the biomass was blue crab. Biomass of impinged invertebrates was also large in April, January, and November. At these times, pink shrimp and blue crab constituted approximately 98%, 90%, and 89% of the biomass, respectively. Invertebrate impingement was lowest in May for numbers of individuals (426) and in June for biomass (6.3 kg).

Blue crab and pink shrimp were the most abundant invertebrate species during the sampling year (Table II-16). Pink shrimp was one of the five dominant species by both biomass and numbers during each month, ranking first or second in biomass during seven months and first or second by numbers during nine months (Table II-14). The blue crab ranked among the five most abundant invertebrates all months except February and, in terms of biomass, ranked first or second every month.

Portunus gibbesii was among the top five invertebrate species (biomass and numbers) during eight months of the study (Table II-14). Other species occurring among the top-ranked invertebrates for five or

more months were stone crab and brief squid (biomass) and Trachypenaeus constrictus (numbers).

Comparisons of Impingement Rate by Unit

A comparison by operating unit of the number and biomass of all finfish and all invertebrates collected during sampling is presented in Tables II-13 and -15. The flow rate of intake water into Unit 3 approximately equals that of Units 1 and 2 combined (Table II-1). Unit 3 had the highest mean 24-hr impingement in terms of both numbers and biomass for finfish and invertebrates during the study period. Units 2 and 1 ranked second and third, respectively. The means of numbers and biomass of all organisms impinged per 100 m^3 of intake water were not significantly different ($P < 0.05$) between Units 2 and 3 but the mean numbers and biomass impinged per 100 m^3 at Unit 1 were significantly lower than those of Units 2 and 3 (see Statistical Analysis below). The proportion of the finfish impinged at CRPS occurring at Unit 3 appears to be lower during the warmer months. Although less pronounced, a similar trend is apparent for invertebrates.

The mean numbers of finfish impinged at Unit 3 was highest during December (23,479 individuals per 24 hr) and mean biomass of finfish impinged was greatest during January (196.6 kg per 24 hr). Monthly mean impingement of finfish numbers and biomass for Units 1 and 2 was also highest in January.

For all three units, the mean numbers of invertebrates impinged was highest during January. The mean biomass of invertebrates impinged by Unit 3 was highest during November and April. At Unit 1 the highest mean biomass of invertebrates was impinged in January and at Unit 2 invertebrate biomass was greatest during September.

Length and Weight

The mean and ranges of length and weight for species considered important (commercially, numerically, or by biomass) are presented for one sampling date each month in Tables II-17. A summary of these data for the sampling year can be found in Table II-18.

Statistical Analysis

The results of the analysis of variance (ANOVA) of CRPS 1977-1978 impingement data are summarized in Tables II-19 and -20. The complete ANOVA is given in Appendices II-1, -2, and -3.

Month

The differences among months of standardized mean numbers impinged at CRPS were significant ($P < 0.05$ or $P < 0.01$) for all species tested except sheepshead and striped mullet and for all groups tested except grunts. The differences among months of mean numbers of the two species of grunts found during the study, white grunt and pigfish, were significant

when analyzed separately. The differences in mean biomass impinged during the twelve months of the study were significant for all species and groups tested except sheepshead.

Time

The time of day the sample was collected was a significant source of variability for standardized numbers and biomass of finfish as a group, for numbers of individuals of 18 of the 29 fish species and groups tested, and for the biomass of 19 species and groups. Numbers of finfish impinged per 100 m^3 of intake water were significantly higher ($P < 0.05$) in samples collected during the dusk and night sampling periods than they were in samples taken during the dawn and day sampling periods (Table II-21). Mean biomass of finfish impinged in samples collected during dusk was significantly greater than in samples collected at night. Biomass of finfish collected during the dawn or day sampling periods was significantly less than that collected at night.

Most of the species and groups of finfish for which time was a significant source of variability showed trends in both numbers and biomass similar to those described for finfish as a group. Mean numbers of individuals of nine of the fish species for which time of sample collection was a significant source of variation were higher in dusk samples than in those taken in any other sampling period. For ten of the species, biomass was greater in dusk samples than in samples from other sampling times ($P < 0.05$). Night samples contained significantly more individuals of bay anchovy than samples from any other sampling

period. The mean number of individuals of seatrout impinged during night samples was higher than dawn and dusk means, although only the differences between the night and dusk samples were statistically significant ($P < 0.05$). The mean biomass of bay anchovy, silver perch, and spotted seatrout was significantly higher in night samples than in samples from other time periods.

Numbers and biomass of all fish species and groups except striped mullet and the group "mullets" were lowest in day samples. The mullets were the only finfish examined which showed highest mean biomass in day samples.

Mean numbers and biomass of all invertebrates were lowest in day samples, higher in dawn samples, and highest in night and dusk samples (Table II-21). All invertebrate species for which mean numbers or biomass were significantly different in samples taken during different sampling periods had greatest numbers or biomass in night or dusk samples and lowest numbers in day or dawn samples.

Unit

The ANOVA indicated that differences between mean numbers of individuals impinged per 100 m^3 of intake water at the three units at CRPS were significant ($P < 0.05$) for 22 of the 29 finfish taxa tested and for mean biomass of 20 of the finfish species or groups. The mean number of individuals of all finfish impinged at Units 2 and 3 were not significantly different, but they were both significantly greater than

the mean number impinged at Unit 1 (Table II-22). Mean biomass of finfish impinged at Unit 2 was greater that that impinged at Unit 3 which, in turn, was greater than that impinged at Unit 1 ($P < 0.05$). The lowest mean biomass was impinged at Unit 1 for 17 of the 20 fish species and groups for which unit was a significant source of variation; lowest mean numbers occurred at this unit for 20 of the 22 fish species and groups.

Mean number of invertebrates impinged was higher at Unit 2 than at Unit 3 and was higher at Unit 3 than at Unit 1 ($P < 0.05$). The mean biomass of invertebrates impinged was highest at Unit 3 and lowest at Unit 1. Differences between these means were also statistically significant. The lowest impingement (mean numbers and biomass per 100 m^3 of intake water) of most invertebrates for which differences between units were significant occurred at Unit 1.

Tide

Differences between mean numbers of scaled sardine and silver jenny impinged during the three tide stages were significant. Differences between mean biomass of scaled sardine and crevalle jack impinged during the three tide stages was also significant (Table II-23). For these three fish species, greater numbers or biomass were impinged during ebb or flood tide than during mid tide. Tide stage was a significant source of variability for numbers and biomass of invertebrates as a group as well as for the following species: mantis shrimp (numbers only), pink shrimp, Trachypenaeus constrictus, blue crab,

Portunus gibbesii, and Metoporhaphis calcarata. The mean numbers and biomass of all these invertebrates species and groups were highest in samples taken during ebb tide.

Barge Traffic

For eleven species or groups the means of numbers of individuals impinged in samples taken when barges were moving in the intake canal were significantly greater than in samples taken when barges were absent or not moving (docked barges were considered absent). These eleven species or groups included seven species of finfish (polka-dot batfish, spotfin mojarra, silver jenny, white grunt, Atlantic spadefish, scrawled cowfish, and striped burrfish), three invertebrate species (brief squid, Trachypenaeus constrictus, and Portunus gibbesii), and the group "all organisms" (Tables II-24). For all the same species except silver jenny, mean biomass was significantly higher in samples taken when barge traffic was present in the intake canal than it was in samples taken when barges were absent. The biomass of the group finfish and of stone crab were also significantly higher in samples taken when barges were moving.

Wind

Differences in mean numbers or biomass of seven fish species and two invertebrate species were significant between samples taken when wind was strong versus when wind was negligible (Table II-25). Impingement of sheepshead (numbers and biomass), Palaemon floridanus (biomass), and Alpheus heterochaelis (numbers and biomass) was significantly greater

when the wind was strong. For polka-dot batfish (biomass), silver perch (numbers and biomass), striped mullet (biomass), ocellated flounder (numbers and biomass), southern puffer (numbers), and striped burrfish (biomass), impingement was significantly greater in samples taken when the wind was negligible than in samples taken when the wind was strong.

DISCUSSION

Influence of Two Large Collections

During two sampling periods (December 29-30, 1977 and January 12-13, 1978), large numbers of fish were impinged. The catches consisted primarily of scaled sardine and Atlantic thread herring. In January, large numbers of sea catfish were also impinged. On December 29-30, approximately 103,000 scaled sardines weighing approximately 647 kg and 7,000 Atlantic thread herring weighing 58 kg were impinged during the 24-hr sampling period. In December the largest catch occurred at Unit 3 between 1615 and 2230 hr, when approximately 68,000 clupeids weighing 376 kg were impinged. On January 12-13, the catch consisted of approximately 62,000 scaled sardines weighing 566 kg, 4,000 Atlantic thread herring weighing 72 kg, and 19,000 sea catfish weighing 166 kg. In January the largest catch occurred at Unit 3 between 1650 and 2245 hr when 66,000 clupeids weighing 236 kg and 6,000 sea catfish weighing 52 kg were impinged.

Large catches of schooling fish such as the scaled sardine and the Atlantic thread herring occur periodically at CRPS. However, these large catches occurred during only two of the 51 days studied. The inclusion of these large numbers of clupeids, which are not usually abundant in CRPS samples, in the calculation of the overall mean catch at CRPS may bias the estimate. A mean calculated without these clupeids may also be informative and more representative of most catches at CRPS.

The mean catch of all organisms in kg per 24 hr for the entire study was calculated both with and without the two large clupeid catches that occurred in December 1977 and January 1978. When calculated with clupeids included, the mean catch was 104.1 kg per 24 hr (Tables II-13 and II-15). If the clupeids are excluded from the calculations for the two dates on which they were unusually abundant, the mean impingement is reduced to 72.2 kg per 24 hr. Thus, two unusual events produce a 31% difference in the overall mean. Sea catfish were also abundant during the January 1978 sampling period when the clupeids were abundant. They were not excluded from the calculations because they were abundant during other sampling periods.

Atlantic thread herring apparently make local temperature-induced migrations (Springer and Woodburn 1960). Springer and Woodburn (1960) collected scaled sardine in waters as cold as 16.8°C, but two cold-killed specimens were found after a cold snap when the water temperature reached 13°C. At CRPS, the two large clupeid catches followed cold snaps during which the water temperature dropped rapidly. On December 21-22, 1977, the lowest water temperature was 14.4°C, and by December 29-30 the water temperature had dropped to a low of 10.7°C. The following week the minimum water temperature was 12.0°C. On January 12-13, when the second large catch was impinged, the water temperature had reached a minimum of 10.5°C.

The impact of the loss of the clupeids impinged in December and January at CRPS is small because the scaled sardine and the Atlantic thread herring are abundant in the Gulf of Mexico and Tampa Bay area and the numbers and biomass of clupeids impinged at CRPS during December and January probably only represent a small percentage of the local populations. Scaled sardines were taken by the tens of thousands in Tampa Bay by Springer and Woodburn (1960), who also report that commercial fisbermen consider the Atlantic thread herring to be the most common clupeid in the Gulf of Mexico. In addition, a large population of clupeids is available nearby in the Gulf of Mexico for recruitment. These species also have high fecundity and grow rapdily (Texas Instrument 1977). Scaled sardine and Atlantic thread herring are not of major commercial importance in the Citrus-Pasco County area (Florida DNR 1975, United States Department of Commerce 1978), although the Atlantic thread herring may be of importance in other areas where it is used as feed for aquaria and as fish meal.

Information on the life histories of these clupeids and most of the other fish caught in the CRPS study may be found in the life history addendum to the "Fish Studies for the Anclote Power Station Postoperational Ecological Monitoring Program" (Texas Instruments 1977).

Projected Impingement Losses

Yearly impingement at CRPS was estimated by summing the products of the monthly mean numbers or biomass impinged per 24 hrs and the number

of days per month. The total projected impingement for the year was estimated to be 2,651,402 finfish and 271,402 invertebrates weighing a total of 35,662 kg. The two large clupeid catches were included in these estimates. Monthly projected impingement rates for finfish and in vertebrates are shown in Tables II-26 (numbers) and II-27 (biomass). Peak impingement in terms of biomass and numbers occurred in December and January. During these two months, 58% of the total biomass and 64% of the total numbers of finfish were impinged. Impingement during these two months also accounted for 49% of the biomass and 56% of the numbers of all organisms impinged. Most of the biomass and numbers impinged in December and January were due to two large catches of clupeids. The months of lowest total biomass impingement were October and May. May, June, and October, were the months with the lowest numbers of organisms impinged.

Commercially Important Species

Commercially important species were defined in this study as those species with a value exceeding $1,000 in the commercial catch for the Citrus-Pasco area in 1975 (Florida DNR 1975). Ten species impinged at CRPS met this criterion: blue crab, striped (black) mullet, crevalle jack, stone crab, spotted seatrout, grunt, pink shrimp, sheepshead, black seabass, and gray snapper (Table II-28). The most important species economically for the Citrus-Pasco area were blue crab and striped mullet; over 1.5 million pounds of each of these species were caught in both 1975 and 1976 (Florida DNR 1975, United States Department of

Commerce 1978). It is estimated that the CRPS will impinge 5,354.4 kg per year of blue crab. This represents approximately 0.5% of the blue crabs taken commercially in the Citrus-Pasco county area in 1976. The peak months of blue crab impingement were September (36.8 kg per 24 hr), April (27.1 kg per 24 hr), and November (24.3 kg per 24 hr). The months of lowest impingement were February (1.8 kg per 24 hr) and January (2.4 kg 24 hr). Mullet, the sixth most valuable finfish caught in Florida in 1976, was not impinged at CRPS in sufficient numbers or biomass to affect the commercial fishery.

Comparison of the biomass of shrimp impinged at CRPS with that of the commercial catch is difficult. Because of the large area fished by shrimp trawlers, shrimp taken in the Citrus-Pasco area may be sold at docks in different counties. The commercial shrimp catch is also divided into bait shrimp and edible shrimp caught in various areas (e.g., upper west coast, central west coast, Tortugas). Impinged shrimp represent all size classes. To facilitate comparison with impingement data, bait shrimp data were combined with data on shrimp from the central west coast landed in the Citrus-Pasco area. Based on the total of 260.2 kg of pink shrimp taken in the CRPS impingement study, total annual impingement of pink shrimp would represent approximately 1,575.5 kg per year or 1.0% of the commercial catch for the area. The greatest biomass of pink shrimp was caught in January (25.7 kg per 24 hr), followed by March (13.3 kg per 24 hr). Shrimp impingement was lowest in June (0.2 kg per 24 hr) and October (0.4 kg per 24 hr).

Since the estimated annual impingement of pink shrimp and blue crab at CRPS represents 1% or less of the local commerical catches, the plant is probably not competing with the commercial shrimp or blue crab fishery. The remaining seven commercially important species were impinged in low numbers during the 1977-78 study period, ar interference with the commercial fishery is unlikely.

Comparison of CRPS Impingement Data with Other Studies

Data from the preoperational impingement study (1973-1974) at CRPS may be compared to data from the operational study (1977-1978) to determine if overall trends and impingement rates are consistent in different years. Samples were taken weekly only at Unit 2 during the preoperational study. Figure II-7 shows the mean biomass impinged per 24 hr each month at Unit 2 during the preoperational and operational studies. The overall trends for the two years appear similar. Operational means are higher than preoperational means during six of the ten months that can be compared. The overall mean biomass of all organisms impinged at Unit 2 during the preoperational study was 29.0 kg per 24 hr and during the operational study the mean was 22.7 kg per 24 hr. Both means were calculated excluding unusual and rare collections of extremely large numbers of schooling fish. The comparison of these means may be misleading, however, since Unit 2 was shut down during November and December of the operational study, and may have been shut down for periods during the preoperational study.

Values for these two months were among the highest values for mean monthly biomass impinged at Units 1 and 3 during the operational study. Biomass impinged at Unit 2 during the operational study was an average of 2.7 times greater than the biomass impinged at Unit 1 during the ten months in which both units were operating. The biomass that would have been impinged at Unit 2 during November and December of the operational study can be estimated by applying this factor to Unit 1 data. If these values are included in calculations of the mean biomass impinged at Unit 2 during the operational study, the mean becomes 28.6 kg per 24 hr, a figure which is very close to the preoperational value.

The monthly impingement expected at CRPS for Units 1, 2, and 3 can be estimated from preoperational data and compared to operational values. Figure II-8 illustrates this comparison. The projected impingement for Units 1, 2, and 3 was calculated in two steps. To estimate preoperational impingement for Units 1 and 2, a conversion factor was developed from a comparison of operational data for Units 1 and 2. The ratio of mean biomass impinged per 24 hr at Units 1 and 2 combined to the mean biomass impinged at Unit 2 alone was determined for the ten months when both units were operating. The mean of these ten values (1.36) was then used as the conversion factor and applied to monthly values for mean biomass impinged during the preoperational study to estimate the mean monthly preoperational impingement at Units 1 and 2. Since the addition of Unit 3 approximately doubled the flow rate of intake water at CRPS, the estimates of monthly impingement for Units 1 and 2 were doubled to give estimates of monthly impingement for all three units.

The trends for actual mean biomass impinged during the operational study are similar to those of the estimates based on preoperational data. Impingement observed during the operational study appears to be somewhat higher than the estimates based on preoperational data. Since Unit 2 was shut down during November and December, the mean values of biomass impinged per 24 hr during these two months were lower than they would have been under normal operating conditions. A mean of the ratios of biomass impinged at Unit 2 to those impinged at Unit 1 during the operational study can be applied to Unit 1 values for these two months and added to the total. The mean biomass impinged during November would increase from 69.7 to 115.1 kg per 24 hr and the value for December would increase from 97.8 to 157.1 kg per 24 hr for the operational study. The trend toward greater impingement during the operational study than would be estimated on the basis of preoperational data would become more pronounced. Since the comparison of preoperational and operational data for Unit 2 showed little difference between the two years, it appears that some factor other than doubling of the intake water flow caused a greater-than-expected increase in impingement.

The mean daily impingement catches of finfish and invertebrates of the present study (with the unusual clupeid catches included) are compared to CRPS preoperational impingement data at Unit 2 (Snedaker 1974) (including a large catch of Atlantic threadfin) and data from the Anclote Power Station (Texas Instruments 1977) and TECO Power Station 1976-1977 (Conservation Consultants 1977) in Tables II-29 and II-30. Data are presented as monthly mean catches per 24 hr for numbers and

biomass. The flow rates at the Anclote and Big Bend Power Stations are less than half of the combined flows for Units 1, 2, and 3 at CRPS (Tables II-29 and II-30). Because of the greater flow rate, larger impingement catches were expected at CRPS than at the other plants. Data were collected from only two of three units in the Big Bend Power Station study. Impingement values reported from the Big Bend study are probably low estimates.

The mean daily catches (numbers and biomass) of fish at CRPS Units 1, 2, and 3 are greater than those shown for the preoperational data in all months except May, when a large school of Atlantic threadfin was impinged during the preoperational study. Similarly, the operational impingement rates for December 1977 and January 1978 were inflated because of large catches of clupeids. These catches occurred on only one sampling date in each month. The Anclote and Big Bend Power Stations also had lower values for finfish impingement than at CRPS in 1977-1978. The impingement rates for invertebrates during the CRPS operational study were higher than those of the other plants during most months.

Some comparisons can be made between CRPS and the Cedar Bayou Generating Station in Houston, Texas (Stupka and Sharma 1977). The flow rate at Cedar Bayou (1,012,500 gpm) is similar to that of the three CRPS units (1,314,000 gpm). At Cedar Bayou, the mean impingment (number of fish per 24 hr) was 335,493 fish in 1973, 395,451 in 1974, and 181,236 in 1977. These values are all higher than the mean daily impingement at

CRPS for any month of the present study. The dominant fish species in samples collected at the Cedar Bayou Generating Station were Gulf menhaden, Atlantic croaker, and spot.

The species contributing the greatest biomass at CRPS (1973-74 and 1977-78) and at the Anclote Power Station are listed in Table II-31. At CRPS the scaled sardine was the dominant species in terms of biomass impinged in the operational study and the Atlantic threadfin was the dominant species in the preoperational study, but these species were dominant during only one or two sampling periods. Blue crab, pink shrimp, and scrawled cowfish ranked among the ten species contributing the greatest biomass in all three studies. Polka-dot batfish, silver perch, and pinfish are included in the most important species in terms of biomass in both CRPS studies. A comparison of the most abundant species at CRPS (1977-1978) and at the Anclote and Big Bend Power Stations show that pink shrimp, pinfish, silver perch, and Portunus gibbesii were abundant in all three studies (Table II-32). The bay anchovy was abundant at the Big Bend Power Station and at CRPS.

Statistical Analysis

The significant differences in mean numbers and biomass of almost all species and groups tested shown by the ANOVA (Tables II-19 and 20, Appendices II-1, -2, and -3) reflect the seasonal changes in abundance, growth, and year-class composition of local populations. Monthly changes in the numbers and biomass of important species have been discussed previously.

Time

For most of the species and groups for which time of sample collection was a significant source of variability, impingement of both numbers and biomass was greatest in dusk or night samples and lowest in day samples. It should be noted that the dusk sampling period at CRPS in 1977-1978 was from 1500-2100 hr at Units 1 and 2 and from 1600 to 2200 hr at Unit 3, increasing the after-dark component of this sampling period during much of the year. Many species of fish are most active during dusk and night, feeding on benthos and plankton or on small forage fish. Pink shrimp are considerably more active at night than during the day and they reportedly respond positively to moonlight by moving toward the surface at ebb tide (Florida Power Corporation 1977, Beardsly 1970). Both invertebrates and fish are more vulnerable to impingement when actively moving about in the water column. Avoidance of intake structures may be reduced at night because of reduced visibility.

Unit

The greater impingement per 100 m^3 of intake water of all organisms at Units 2 and 3 than at Unit 1 is probably the result of both the lower intake velocity of this unit compared to that of Unit 2 or 3 and of the physical orientation of the intake. The intake of Unit 1 is between that of Unit 2 and the canal leading to Unit 3's intake. The greatest impingement of invertebrate numbers per 100 m^3 of intake water was in samples taken at Unit 2, while greatest biomass impinged per 100 m^3 was in samples at Unit 3, suggesting that a larger number of smaller

individuals are impinged at Unit 2. The slightly higher overall intake velocity of Unit 2 might tend to impinge smaller and weaker-swimming organisms. The larger organisms that pass by Units 1 and 2 must either swim out the entire length of the intake canal against the intake current or enter the intake for Unit 3. Of course, Unit 3 takes in almost as much water as Units 1 and 2 combined and usually impinges more organisms than Units 1 and 2 combined.

Tide

Impingement of invertebrates (both numbers and biomass per 100 m^3 of intake water) for which tide stage was a significant source of variation was highest in samples taken during ebb tide. Many invertebrates, including the pink shrimp, are more active during ebb tide, responding positively to moonlight by moving toward the surface. They do not move during flood tide but return to the bottom and burrow to maintain position (Florida Power Corporation 1977, Beardsley 1970). These invertebrates are more vulnerable to impingement when swimming in the water column. The fish impinged in greater numbers or biomass at this tide stage may be feeding on the invertebrates that are off bottom or swimming in the water column.

Barge Traffic

The species which showed significantly higher numbers or biomass impinged in samples taken when barges were moving than in samples when barges were absent or docked may have been disturbed from their usual near-bottom position by the turbulence caused by the barge passage.

Reduced visibility resulting from increased turbidity caused by the turbulence may also result in increased impingement. Some species are probably associated with large amounts of sea grass which are carried into the plant intakes by turbulence caused by barge movement. These species may either inhabit the sea grass or feed on species inhabiting it.

Wind

The significant effect of strong or negligible wind on biomass or numbers of individuals of various species is difficult to interpret. The duration and direction of the wind could be of considerable importance in an assessment of this variable. Wind blowing inshore from the west could move concentrations of less mobile forms inshore. Wind blowing strongly across shallow water could cause turbulence which would then disturb bottom-dwelling forms and disrupt grass beds, bringing organisms up into the water column where they would become vulnerable to impingement. Increased turbidity caused by wind-generated turbulence might reduce visibility, thereby reducing avoidance of the intakes by mobile forms.

Conclusions

The projected impingement at CRPS between March 13, 1977 and March 13, 1978 (2,642,732 finfish and 721,053 invertebrates totaling 35,692 kg) is not likely to have any major impact on either the water body or the commercial fisheries. Large numbers of clupeids (primarily

scaled sardine and Atlantic thread herring) were impinged at CRPS but the catch is probably low in proportion to the populations. The catches of pink shrimp and blue crab, the most abundant invertebrates impinged, represent only 1.0% and 0.5% of the local commercial catch. The number and biomass of other species of finfish and invertebrates impinged at CRPS are considered minimal.

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Table II-1. Characteristics of the cooling water intakes of the CRPS .

	No. of Horizontal Traveling Screens	No. of Pumps	Cooling Water Flow (gpm)	General Capacity (MW)
Unit 1	4	4	310,000	390
Unit 2	4	4	328,000	510
Unit 3	8	4	680,000	855

Intake velocities[a]

	High Tide		Low Tide	
	Mean	Range	Mean	Range
Unit 1	0.64	0.47-0.81	0.70	0.44-0.91
Unit 2	0.87	0.66-1.02	0.94	0.62-1.20
Unit 3	0.81	0.55-1.09	0.97	0.62-1.17

[a] In ft/sec, as measured in front of traveling screens by FPC.

Table II-2. Impingement sampling schedule.

1977	March 18-19		October 3-4
	March 24-25		October 14-15
	March 30-31		October 18-19
	April 5-6		October 29-30
	April 13-14		November 3-4
	April 21-22[a]		November 11-12
	April 28-29		November 18-19
	May 5-6		November 22-23
	May 9-10		December 3-4
	May 16-17		December 6-7
	May 25-26		December 12-13
	June 4-5		December 21-22
	June 9-10		December 29-30
	June 13-14	1978	January 3-4
	June 25-26		January 12-13
	June 30-July 1		January 19-20
	July 6-7		January 27-28
	July 14-15		February 1-2
	July 23-24		February 6-7
	July 28-29[b]		February 16-17
	August 1-2		February 23-24
	August 9-10		March 3-4
	August 20-21		March 7-8
	August 26-27		
	August 30-31		
	September 9-10		
	September 17-18		
	September 21-22		
	September 28-29		

[a]Cancelled due to clogging of sampling baskets by large numbers of ctenophores.

[b]Sampling discontinued after 12 hr because of very large quantities of seagrass obstructing the intakes.

Table II-3. Number of 24-hr samples taken at each unit, March 13, 1977-March 13, 1978. (Numbers are not identical for the three units because of shut downs).

	Unit 1	Unit 2	Unit 3
March 1977, 1978	5	5	5
April[a]	3	3	3
May	4	4	3
June[b]	5	5	5
July	3.5	3.5	3.5
August	5	5	5
September	4	4	4
October[c]	4	4	4
November[c]	4	0	4
December	5	0	5
January 1978	4	4	4
February	4	4	4
Total	50.5	41.5	49.5

[a] Sampling during April 21-22 cancelled because of clogging of sampling baskets by large numbers of ctenophores.

[b] Sampling during July 28-29, 1977 was discontinued because of very large quantities of seagrass which obstructed the intakes.

[c] Unit 2 shut down.

Table II-4. Finfish taxa identified from CRPS impingement samples, March 13, 1977-March 13, 1978 (fish names follow American Fisheries Society 1970.)

Rajidae
Raja texana - Roundel skate

Dasyatidae
Dasyatis sabina - Atlantic stingray
Dasyatis sayi - Bluntnose stingray
Gymnura micrura - Smooth butterfly ray

Elopidae
Elops saurus - Ladyfish

Muraenidae
Gymnothorax nigromarginatus - Blackedge moray

Congridae
Congrina flava - Yellow conger eel

Ophichthidae
Bascanichthys scuticaris - Whip eel
Myrophis punctatus - Speckled worm eel
Mystriophis intertinctus - Spotted spoon-nose eel
Ophichthus gomesi - Shrimp eel

Clupeidae
Brevoortia sp. - menhaden sp.
Brevoortia patronus - Gulf menhaden
Dorosoma cepedianum - Gizzard shad
Harengula pensacolae - Scaled sardine
Ophisthonema oglinum - Atlantic thread herring
Sardinella anchovia - Spanish sardine

Engraulidae
Anchoa hepsetus - Striped anchovy
Anchoa mitchelli - Bay anchovy

Synodontidae
Synodus foetens - Inshore lizardfish

Ariidae
Arius felis - Sea catfish
Bagre marinus - Gafftopsail catfish

Batrachoididae
Opsanus beta - Gulf toadfish
Porichthys porosissimus - Atlantic midshipman

Gobiesocidae
Gobiesox strumosus - Skilletfish

Table II-4 (Cont'd).

Ogcocephalidae
Ogcocephalus radiatus - Polka-dot batfish

Gadidae
Urophycis floridanus - Southern hake

Ophidiidae
Ophidion holbrooki - Bank cusk-eel
Ophidion welshi - Crested cusk-eel

Exocoetidae
Hyporhamphus unifasciatus - Halfbeak
Strongylura marina - Atlantic needlefish
Strongylura notata - Redfin needlefish
Strongylura timucu - Timucu

Cyprinodontidae
Cyprinodon variegatus - Sheepshead minnow
Fundulus grandis - Gulf killifish
Lucania parva - Rainwater killifish

Poeciliidae
Poecilia latipinna - Sailfin molly

Atherinidae
Membras martinica - Rough silverside
Menidia beryllina - Tidewater silverside

Syngnathidae
Hippocampus erectus - Lined seahorse
Hippocampus zosterae - Dwarf seahorse
Micrognathus crinigerus - Fringed pipefish
Syngnathus floridae - Dusky pipefish
Syngnathus louisianae - Chain pipefish
Syngnathus scovelli - Gulf pipefish
Syngnathus springeri - Bull pipefish

Serranidae
Centropristis melana - Southern (black) sea bass
Diplectrum formosum - Sand perch

Grammistidae
Rypticus saponaceus - Greater soapfish

Pomatomidae
Pomatomus saltatrix - Bluefish

Apogonidae
Astropogon alutus - Bronze cardinalfish

Rachycentridae
Rachycentron canadum - Cobia

Table II-4 (Cont'd).

Echeneidae
Echeneis naucrates - Sharksucker

Carangidae
Caranx hippos - Crevalle jack
Chloroscombrus chrysurus - Atlantic bumper
Oligoplites saurus - Leatherjacket
Selene vomer - Lookdown
Trachinotus falcatus - Permit

Lutjanidae
Lutjanus griseus - Gray or mangrove snapper

Gerreidae
Eucinostomus argenteus - Spotfin mojarra
Eucinostomus gula - Silver jenny

Pomadasyidae
Haemulon plumieri - White grunt
Orthopristis chrysoptera - Pigfish

Sparidae
Archosargus probatocephalus - Sheepshead
Calamus bajonado - Jolthead porgy
Diplodus holbrooki - Spottail pinfish
Lagodon rhomboides - Pinfish

Sciaenidae
Bairdiella chrysura - Silver perch
Cynoscion arenarius - Sand seatrout
Cynoscion nebulosus - Spotted seatrout
Leiostomus xanthurus - Spot
Menticirrhus americanus - Southern kingfish
Pogonias cromis - Black drum

Ephippidae
Chaetodipterus faber - Atlantic spadefish

Scaridae
Nicholsina usta - Emerald parrotfish

Mugilidae
Mugil cephalus - Striped mullet
Mugil trichodon - Fantail mullet

Sphyraenidae
Sphyraena sp. - Barracuda or sennet
Sphyraena borealis - Northern sennet

Polynemidae
Polydactylus octonemus - Atlantic threadfin

Table II-4 (Cont'd).

Opisthognathidae
Opistognathus sp. - Jawfish
Opistognathus macrognathus - Spotfin jawfish

Uranoscopidae
Astrocopus y-graecum - Southern stargazer

Clinidae
Paraclinus fasciatus - Banded blenny

Blenniidae
Chasmodes bosquianus - Striped blenny
Hypleurochilus geminatus - Crested blenny
Hypsoblennius hentzi - Feather blenny

Gobiidae
Microgobius gulosus - Clown goby

Trichiuridae
Trichiurus lepturus - Atlantic cutlassfish

Scombridae
Scomberomerus maculatus - Spanish mackerel

Stromateidae
Peprilus alepiodotus - Harvestfish
Peprilus burti - Gulf butterfish

Scorpaenidae
Scorpaena brasiliensis - Barbfish

Triglidae
Prionotus scitulus - Leopard searobin
Prionotus tribulus - Bighead searobin

Bothidae
Ancylopsetta quadrocellata - Ocellated flounder
Etropus crossotus - Fringed flounder
Paralichthys albigutta - Gulf flounder
Paralichthys lethostigma - Southern flounder

Soleidae
Achirus lineatus - Lined sole
Trinectes maculatus - Hogchoker

Cynoglossidae
Symphurus plagiusa - Blackcheek tonguefish

Balistidae
Aluterus schoepfi - Orange filefish
Monacanthus ciliatus - Fringed filefish
Monacanthus hispidus - Planehead filefish

Table II-4 (Cont'd).

Ostraciidae
Lactophrys quadricornis - Scrawled cowfish

Tetraodontidae
Sphoeroides nephelus - Southern puffer
Sphoeroides spengleri - Bandtail puffer

Diodontidae
Chilomycterus schoepfi - Striped burrfish

Table II-5. Invertebrate taxa identified from CRPS impingement samples, March 13, 1977-March 13, 1978.

Ophiuroidea
Brittle star

Holothuroidea
Sea cucumber

Gastropoda
Aplysia wilcoxi - sea hare

Cephalopoda
Lolliguncula brevis - squid

Xiphosura
Limulus polyphemus - horseshoe crab

Stomatopoda
Squilla empusa - mantis shrimp

Decapoda

Penaeidae
Penaeus duorarum - pink shrimp
Penaeus setiferus - white shrimp
Sicyonia laevigata
Sicyonia typica
Trachypenaeus constrictus

Hippolytidae
Hippolysmata wurdemanni
Palaemon floridanus
Tozeuma carolinense

Alpheidae
Alpheus heterochaelis
Alpheus normanni

Paguridae
Hermit crab

Call nassidae
Upogebia affinis

Porcellanidae
Petrolisthes armatus

Leucosiidae
Persephona punctata

Table II-5 (Cont'd).

Portunidae
Arenaeus cribrarius
Callinectes ornatus
Callinectes sapidus - blue crab
Portunus depressifrons
Portunus gibbesii
Portunus spinimanus

Xanthidae
Eurypanopeus depressus
Hexapanopeus angustifrons
Menippe mercenaria - stone crab
Neopanope texana
Panopeus herbstii
Panopeus occidentalis
Pilumnus floridanus
Pilumnus sayi

Pinnotheridae
Pinnotheres maculatus

Grapsidae
Sesarma cinereum

Ocypodidae
Uca minax
Uca sp.

Majidae
Epialtus dilatatus
Libinia dubia
Macrocoeloma camptocerum
Metoporhaphis calcarata
Mithrax pleuracanthus
Pelia mutica
Pitho sp.
Podochela riisei

Table II-6. Monthly occurrence of finfish collected during impingement studies, March 13, 1977-March 13, 1978.

Species	J	F	M	A	M	J	J	A	S	O	N	D
Roundel skate	X										X	X
Atlantic stingray	X	X	X	X		X	X	X	X	X	X	X
Bluntnose stingray			X									
Smooth butterfly ray			X	X	X	X		X				
Ladyfish			X	X						X		
Blackedge moray	X	X	X		X	X		X		X	X	X
Yellow conger eel	X	X										
Whip eel	X	X	X							X	X	X
Speckled worm eel											X	X
Spotted spoon-nose eel			X									
Shrimp eel	X	X	X	X	X	X	X	X	X	X	X	X
Menhaden (unidentified)				X								
Gulf menhaden	X	X	X	X	X	X	X	X		X	X	X
Gizzard shad		X										
Scaled sardine	X		X			X		X	X	X	X	X
Atlantic thread herring	X	X	X				X	X	X	X	X	X
Clupeid larvae							X		X	X		
Clupeid (unidentified)				X								
Spanish sardine		X										
Anchovy (unidentified)										X		
Striped anchovy	X	X	X	X			X	X	X		X	X
Bay anchovy	X	X	X	X	X	X	X	X	X	X	X	X
Inshore lizardfish	X	X	X			X	X	X	X	X	X	X
Sea catfish	X	X		X		X		X	X	X	X	X
Gafftopsail catfish			X	X							X	X
Gulf toadfish	X	X	X	X	X	X	X	X	X	X	X	X
Atlantic midshipman	X	X	X	X	X			X	X	X	X	X
Skilletfish	X	X	X									
Polka-dot batfish	X	X	X	X	X	X	X	X	X	X	X	X
Southern hake	X	X	X	X	X							X
Bank cusk-eel	X	X	X								X	
Crested cusk-eel					X							
Halfbeak (unidentified)				X								
Halfbeak			X	X	X	X	X	X	X	X	X	X
Needlefish (unidentified)				X	X							
Atlantic needlefish	X	X	X	X	X	X	X	X	X	X	X	
Redfin needlefish	X	X	X			X	X	X	X	X	X	X
Timucu						X						
Sheepshead minnow			X									
Gulf killifish	X											
Rainwater killifish			X	X								
Sailfin molly												X
Rough silverside	X	X	X		X		X	X	X	X	X	X
Tidewater silverside	X	X	X	X	X	X	X	X	X	X	X	X
Lined seahorse	X	X	X	X	X	X	X	X	X	X	X	X
Dwarf seahorse			X	X	X							
Fringed pipefish			X	X	X	X	X	X	X			

Table II-6. (Cont'd).

Species	J	F	M	A	M	J	J	A	S	O	N	D
Dusky pipefish	X	X	X	X	X	X	X	X	X	X	X	X
Chain pipefish	X	X	X	X	X	X	X	X	X	X	X	X
Gulf pipefish	X	X	X	X		X	X	X	X			X
Bull pipefish			X	X	X							X
Southern (black) seabass		X	X	X	X	X	X	X	X	X	X	X
Sand perch	X	X						X			X	X
Greater soapfish								X				
Bluefish	X	X	X								X	X
Bronze cardinalfish											X	
Cobia								X	X	X	X	
Sharksucker								X	X			
Crevalle jack							X	X	X	X	X	X
Atlantic bumper			X	X	X	X	X	X	X	X	X	X
Leather jacket	X					X	X	X	X	X	X	X
Lookdown						X	X	X	X	X	X	X
Permit							X	X	X	X	X	
Gray snapper	X	X					X			X	X	X
Spotfin mojarra	X							X	X	X	X	X
Silver jenny	X											X
Mojarra (unidentified)									X			
White grunt	X	X	X						X	X	X	X
Pigfish	X	X	X	X	X	X	X	X	X	X	X	X
Sheepshead		X	X							X		X
Joltheaded porgy			X			X	X					X
Spottail pinfish		X	X		X	X	X	X		X		
Pinfish	X	X	X	X	X	X	X	X	X	X	X	X
Silver perch	X	X	X		X	X	X	X	X	X	X	X
Sand seatrout	X	X	X				X				X	X
Spotted seatrout	X	X	X	X		X	X	X	X	X	X	X
Spot	X	X	X	X	X	X	X	X	X	X	X	X
Southern kingfish	X	X	X				X	X			X	X
Black drum											X	
Atlantic spadefish	X		X	X			X	X		X	X	X
Emerald parrotfish												X
Mullet (unidentified)	X	X	X	X	X						X	X
Striped mullet	X	X			X	X	X				X	
Fantail mullet				X	X							
Barracuda (unidentified)			X									
Northern sennet			X	X	X	X	X	X			X	X
Atlantic threadfin		X									X	X
Jawfish (unidentified)											X	
Spotfin jawfish			X				X				X	
Southern stargazer	X	X	X									X
Banded blenny		X		X								
Striped blenny	X	X	X	X			X				X	
Crested blenny	X	X		X	X	X				X		
Feather blenny	X	X	X	X			X	X			X	X
Clown goby										X		

Table II-6. (Cont'd).

Species	J	F	M	A	M	J	J	A	S	O	N	D
Atlantic cutlassfish			X	X								
Spanish mackerel										X		
Harvestfish	X	X			X			X	X		X	X
Gulf butterfish	X	X	X							X	X	X
Barbfish	X	X									X	X
Searobin (unidentified)			X									
Leopard searobin	X	X	X				X	X	X	X	X	X
Bighead searobin	X	X	X				X	X			X	X
Flounder (unidentified)												X
Ocellated flounder	X	X	X	X	X	X	X	X		X	X	X
Fringed flounder	X	X	X						X	X	X	X
Gulf flounder	X	X	X					X				
Southern flounder										X		
Lined sole	X	X	X	X	X		X	X		X	X	X
Hogchoker	X	X	X	X				X	X	X	X	X
Blackcheek tonguefish	X	X	X	X		X	X	X	X	X	X	X
Orange filefish			X	X		X	X	X	X	X	X	X
Fringed filefish	X	X	X	X	X	X		X	X		X	X
Planehead filefish	X	X				X	X	X	X	X	X	X
Scrawled cowfish	X	X	X	X	X	X	X	X	X	X	X	X
Southern puffer	X	X	X	X	X	X	X	X	X	X	X	X
Bandtail puffer			X					X				X
Striped burrfish	X	X	X	X	X	X	X	X	X	X	X	X

Table II-7. Monthly occurrence of invertebrates collected during impingement studies, March 13, 1977-March 13, 1978

Species	J	F	M	A	M	J	J	A	S	O	N	D
Ophiuroidae (unidentified)			X		X		X	X		X	X	
Holothuroidae (unidentified)										X		
Sea hare						X	X					
Squid	X	X	X	X	X	X	X	X	X	X	X	X
Horseshoe crab							X					
Mantis shrimp	X	X	X	X	X	X	X	X	X	X	X	X
Penaeus sp.			X									
Pink shrimp	X	X	X	X	X	X	X	X	X	X	X	X
White shrimp	X									X	X	X
Sicyonia laevigata				X	X	X		X			X	X
Sicyonia typica										X	X	X
Trachypenaeus constrictus	X	X	X	X	X	X	X	X	X	X	X	X
Hippolysmata wurdemanni	X	X			X	X						
Palaemon floridanus	X	X	X	X	X	X	X	X	X	X	X	X
Tozeuma carolinense	X	X	X	X	X	X	X	X	X			X
Alpheus heterochaelis	X	X	X	X	X	X	X	X	X	X	X	X
Alpheus normanni		X	X									
Hermit crab								X	X	X		
Upogebia affinis	X	X	X							X	X	
Petrolisthes armatus	X	X	X	X	X	X	X	X				
Persophona punctata											X	
Arenaeus cribrarius							X					
Callinectes ornatus			X			X	X	X	X	X		X
Blue crab	X	X	X	X	X	X	X	X	X	X	X	X
Portunus depressifrons					X	X	X	X	X	X	X	X
Portunus gibbesii	X	X	X	X	X	X	X	X	X	X	X	X
Portunus spinimanus	X					X	X		X	X	X	X
Xanthidae (unidentified)			X	X				X	X			
Eurypanopeus depressus	X	X	X		X	X	X	X	X	X	X	X
Hexapanopeus angustifrons	X	X	X	X	X				X	X	X	X
Stone crab	X	X	X	X	X	X	X	X	X	X	X	X
Neopanope texana	X	X	X		X	X	X	X	X	X	X	X
Panopeus herbstii	X	X	X	X	X	X	X	X	X	X	X	X
Panopeus occidentalis	X	X	X			X	X	X	X	X	X	X
Pilumnus floridanus	X	X	X		X	X		X	X	X	X	
Pilumnus sayi	X	X	X	X	X	X		X	X	X	X	X
Pinnotheres maculatus								X				
Sesarma cinereum				X	X	X	X	X	X	X	X	X
Uca sp.										X	X	
Uca minax						X	X					
Epialtus dilatatus					X							
Libinia dubia	X	X	X	X	X	X	X	X	X	X	X	X
Macrocoeloma camptocerum					X							
Metoporhaphis calcarata	X	X	X	X	X	X	X	X	X	X	X	X
Mithrax pleuracanthus		X										
Pelia mutica							X					
Pitho sp.		X	X									
Podochela riisei	X	X	X									

Table II-8. Rank by numerical abundance of finfish collected at CRPS, March 13, 1977-March 13, 1978. (Only species having a cumulative total of 2,000 or more individuals collected during the study are listed.)

Rank	Species	No. of Individuals
1	Scaled sardine	166,420
2	Bay anchovy	57,356
3	Pinfish	30,077
4	Sea catfish	29,077
5	Silver perch	26,831
6	Atlantic thread herring	12,351
7	Polka-dot batfish	12,245
8	Spot	6,282
9	Scrawled cowfish	4,129
10	Silver jenny	2,963
11	Ocellated flounder	2,064
	Subtotal	349,795
	All other finfish	27,170
	Total	376,965

Table II-9. Rank by relative biomass of finfish collected at CRPS, March 13, 1977-March 13, 1978. (Only species comprising 10 kg or more throughout the study are listed.)

Rank	Species	Biomass (kg)
1	Scaled sardine	1,226.9
2	Polka-dot batfish	1,176.7
3	Sea catfish	239.8
4	Silver perch	178.3
5	Pinfish	165.3
6	Atlantic thread herring	137.9
7	Scrawled cowfish	128.7
8	Bay anchovy	117.4
9	Striped burrfish	87.8
10	Atlantic stingray	84.9
11	Silver jenny	39.6
12	Atlantic bumper	29.9
13	Spot	29.8
14	Barbfish	24.5
15	Shrimp eel	22.0
16	Crevalle jack	20.9
17	Atlantic spadefish	14.7
18	Orange filefish	12.0
19	Southern puffer	11.9
20	Pigfish	11.2
21	Spotfin mojarra	10.0
	Subtotal	3,770.2
	All other finfish	132.8
	Total	3,903.0

Table II-10. Percentage of mean monthly catches consituted by polka-dot batfish, blue crab, and pink shrimp.

Month	Polka-dot Batfish	Blue Crab	Pink Shrimp	Total (3 Species)
March 1977, 1978	38	8	12	58
April	34	42	7	83
May	16	55	2	73
June	84	10	<1	94
July	63	18	3	84
August	48	31	4	83
September	20	72	2	94
October	33	39	1	73
November	34	35	1	70
December[a]	43	18	2	63
January[a]	11	1	16	28
February	2	2	8	12
Total Year	32	20	7	59

[a]Unusual large catches of clupeids excluded.

Table II-11. Rank by numerical abundance of invertebrates collected at CRPS, March 13, 1977-March 13, 1978. (Only species having a cumulative total of 1,000 or more individuals collected during the study are listed.)

Rank	Species	Number of Individuals
1	Pink shrimp	39,566
2	Portunus gibbesii	17,744
3	Metoporhaphis calcarata	12,510
4	Blue crab	10,070
5	Trachypenaeus constrictus	4,855
6	Squid	3,586
7	Palaemon floridanus	2,578
8	Neopanope texana	1,951
9	Unidentified Xanthidae	1,162
10	Alpheus heterochaelis	1,068
	Subtotal	95,090
	All other invertebrates	4,018
	Total	99,108

Table II-12. Rank by relative biomass of invertebrates collected at CRPS, March 13, 1977-March 13, 1978. (Only species comprising 2 kg or more throughout the study are listed.)

Rank	Species	Biomass (kg)
1	Blue crab	715.6
2	Pink shrimp	260.2
3	*Portunus gibbesii*	43.0
4	Squid	26.7
5	Stone crab	12.6
6	*Metoporhapsis calcarata*	7.4
7	*Libinia dubia*	4.9
8	Mantis shrimp	2.9
9	*Trachypenaeus constrictus*	2.9
10	White shrimp	2.3
11	*Alpheus heterochaelis*	2.1
12	*Neopanope texana*	2.0
	Subtotal	1082.6
	All other species	6.9
	Total	1089.5

Table II-13. Comparison by unit of mean 24-hr catches (numbers and biomass) of finfish, March 13, 1977-March 13, 1978. (Data are presented as mean number of individuals per 24 hr. Mean biomass (kg) per 24 hr is in parentheses. The number of days sampled in each month is given in Table II-3.)

Month	Unit 1	Unit 2	Unit 3	Total
March[a]	201 (7.2)	616 (32.3)	2,149 (42.6)	2,966 (82.1)
April	53 (1.2)	992 (15.4)	1,689 (15.6)	2,734 (32.2)
May	154 (1.5)	45 (3.1)	538 (4.2)	737 (8.8)
June	95 (4.7)	337 (24.2)	251 (14.7)	683 (43.6)
July	159 (3.3)	467 (18.1)	445 (14.8)	1,071 (36.2)
August	134 (2.7)	449 (11.1)	308 (7.6)	891 (21.4)
September	41 (0.8)	169 (5.8)	176 (4.9)	386 (11.5)
October	76 (3.2)	182 (3.8)	310 (8.3)	568 (15.3)
November	554 (13.9)	Unit was shut down	1,989 (27.2)	2,543 (41.1)
December	1,807 (25.5)	Unit was shut down	23,479 (193.0)	25,286 (218.5)
January 1978	4,671 (45.5)	4,267 (49.5)	20,724 (196.6)	29,662 (291.6)
February	922 (6.8)	2,274 (18.9)	16,991 (70.3)	20,187 (96.0)
Yearly Mean/24 hr	744 (9.9)	949 (18.6)	6,059 (53.0)	7,752 (81.5)

[a]Three 24 hr samples were taken in March 1977 and two were taken in March 1978.

Table II-14. Five species of finfish and of invertebrates contributing the greatest biomass (kg/24-hr) and numbers (number/24 hr) collected each month at CRPS.

MARCH 1977 AND 1978

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	40.5	Bay anchovy	823
Scrawled cowfish	17.9	Pinfish	701
Pinfish	4.3	Polka-dot batfish	449
Striped burrfish	4.0	Silver perch	137
Orange file fish	1.9	Scrawled cowfish	127
INVERTEBRATES		INVERTEBRATES	
Pink shrimp	13.3	Pink shrimp	1,581
Blue crab	9.0	Metoporhaphis calcarata	439
Squid	1.0	Blue crab	267
Mantis shrimp	0.1	Palaemon floridanus	152
Metoporhaphis calcarata	0.2	Squid	110

APRIL 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	21.8	Pinfish	1,360
Scrawled cowfish	4.2	Spot	731
Spot	1.2	Polka-dot batfish	184
Striped burrfish	0.8	Dusky pipefish	122
Pinfish	0.7	Lined seahorse	72
INVERTEBRATES		INVERTEBRATES	
Blue crab	27.1	Blue crab	363
Pink shrimp	4.5	Pink shrimp	345
Squid	0.2	Palaemon floridanus	151
Stone crab	0.2	Trachypenaeus constrictus	42
Palaemon floridanus	0.1	Eurypanopeus depressus	40

Table II-14 (Cont'd.)

MAY 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	5.6	Spot	445
Spot	1.0	Polka-dot batfish	44
Striped burrfish	0.3	Pinfish	38
Southern hake	0.1	Bay anchovy	19
Atlantic bumper	0.1	Atlantic needlefish	12
INVERTEBRATES		INVERTEBRATES	
Blue crab	19.7	Blue crab	186
Pink shrimp	0.8	Pink shrimp	70
Stone crab	0.2	Squid	21
Squid	0.1	Eurypanopeus depressus	14
Libinia dubia	<0.1	Metoporhaphis calcarata	11

JUNE 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	42.0	Polka-dot batfish	348
Smooth butterfly ray	0.2	Pinfish	53
Pinfish	0.2	Atlantic needlefish	46
Striped burrfish	0.2	Tidewater silverside	35
Scrawled cowfish	0.1	Dusky pipefish	32
INVERTEBRATES		INVERTEBRATES	
Blue crab	4.9	Portunus gibbesii	245
Portunus gibbesii	0.5	Pink shrimp	100
Pink shrimp	0.2	Blue crab	68
Stone crab	0.2	Trachypenaeus constrictus	30
Sea hare	0.1	Palaemon floridanus	25

Table 11-14 (Cont'd.)

JULY 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	33.7	Polka-dot batfish	328
Pinfish	0.3	Silver perch	215
Striped burrfish	0.3	Tidewater silverside	90
Silver perch	0.3	Gulf menhaden	56
Tidewater silverside	0.2	Pinfish	52
INVERTEBRATES		INVERTEBRATES	
Blue crab	9.3	Portunus gibbesii	1410
Portunus gibbesii	3.8	Pink shrimp	852
Pink shrimp	1.8	Squid	386
Squid	1.3	Blue crab	98
Sea hare	0.2	Trachypenaeus constrictus	60

AUGUST 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	18.6	Orange filefish	225
Pinfish	0.5	Polka-dot batfish	184
Atlantic stingray	0.4	Pinfish	64
Atlantic bumper	0.3	Dusky pipefish	46
Orange filefish	0.2	Leather jacket	41
INVERTEBRATES		INVERTEBRATES	
Blue crab	12.0	Portunus gibbesii	1,304
Portunus gibbesii	2.5	Pink shrimp	788
Pink shrimp	1.6	Blue crab	132
Stone crab	0.3	Trachypenaeus constrictus	131
Horseshoe crab	0.2	Neopanope texana	92

Table II-14 (Cont'd.)

SEPTEMBER 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	10.0	Polka-dot batfish	94
Pinfish	0.3	Lined seahorse	77
Atlantic stingray	0.2	Dusky pipefish	35
Atlantic bumper	0.1	Planehead filefish	26
Gulf toadfish	0.1	Pinfish	18
INVERTEBRATES		INVERTEBRATES	
Blue crab	36.8	Pink shrimp	475
Pink shrimp	1.3	Blue crab	391
Stone crab	0.5	Trachypenaeus constrictus	134
Libinia dubia	0.3	Neopanope texana	125
Portunus gibbesii	0.3	Portunus gibbesii	107

OCTOBER 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	9.4	White grunt	111
Crevalle jack	2.0	Polka-dot batfish	105
Atlantic bumper	0.4	Bay anchovy	81
Southern flounder	0.4	Spotfin mojarra	46
Pinfish	0.4	Silver perch	44
INVERTEBRATES		INVERTEBRATES	
Blue crab	11.2	Portunus gibbesii	167
Stone crab	0.5	Blue crab	118
Portunus gibbesii	0.5	Pink shrimp	112
Pink shrimp	0.4	Neopanope texana	72
Libinia dubia	0.2	Stone crab	37

Table II-14 (Cont'd.)

NOVEMBER 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Polka-dot batfish	24.1	Sea Catfish	700
Sea catfish	3.9	Silver perch	360
Striped burrfish	3.4	Polka-dot batfish	270
Silver perch	1.8	Bay anchovy	254
Scrawled cowfish	0.8	Lined sole	214
INVERTEBRATES		INVERTEBRATES	
Blue crab	24.3	Trachypenaeus constrictus	641
Portunus gibbesii	1.3	Portunus gibbesii	454
Pink shrimp	0.9	Blue crab	294
Squid	0.7	Pink shrimp	160
Stone crab	0.6	Squid	130

DECEMBER 1977

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Scaled sardine	130.5	Scaled sardine	20,794
Polka-dot batfish	42.5	Atlantic thread herring	1,478
Atlantic thread herring	11.8	Silver perch	954
Silver perch	6.0	Sea catfish	596
Striped burrfish	4.8	Polka-dot batfish	501
INVERTEBRATES		INVERTEBRATES	
Blue crab	17.2	Blue crab	306
Pink shrimp	2.1	Portunus gibbesii	291
Portunus gibbesii	0.9	Pink shrimp	223
Squid	0.7	Metoporhaphis calcarata	82
White shirmp	0.3	Eurypanopeas depressus	27

Table II-14 (Cont'd.)

JANUARY 1978

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Scaled sardine	143.3	Scaled sardine	15,593
Sea catfish	49.8	Sea catfish	5,775
Silver perch	22.9	Silver perch	3,477
Atlantic thread herring	19.4	Atlantic thread herring	1,229
Polka-dot batfish	17.8	Pinfish	1,036
INVERTEBRATES		INVERTEBRATES	
Pink shrimp	25.7	Pink shrimp	3,396
Blue crab	2.4	Metoporhaphis calcarata	1,273
Squid	1.8	Palaemon floridanus	163
Metoporhaphis calcarata	0.8	Blue crab	114
Portunus gibbesii	0.2	Portunus gibbesii	80

FEBRUARY 1978

Species	Mean Biomass/ 24 hr	Species	Mean Number/ 24 hr
FINFISH		FINFISH	
Bay anchovy	26.0	Bay anchovy	12,680
Pinfish	24.7	Pinfish	4,097
Atlantic stingray	16.7	Silver perch	1,189
Silver perch	9.7	Scrawled cowfish	569
Scrawled cowfish	2.8	Ocellated flounder	358
INVERTEBRATES		INVERTEBRATES	
Pink shrimp	9.3	Pink shrimp	1,304
Blue crab	2.0	Metoporhaphis calcarata	906
Metoporhaphis calcarata	0.5	Alpheus heterochaelis	189
Alpheus heterochaelis	0.4	Alpheus normanni	144
Mantis shrimp	0.2	Palaemon floridanus	117

Table II-15. Comparison by unit of mean 24-hr catches (numbers and biomass) of all invertebrates, March 13, 1977-March 13, 1978. (Data are presented as mean numbers of individuals per 24 hr. Mean biomass (kg) per 24 hr is in parentheses. The number of days sampled in each month is given in Table II-3.)

Month	Unit 1	Unit 2	Unit 3	Total
March[a]	323 (2.0)	930 (8.0)	1,518 (14.2)	2,771 (24.2)
April	9 (0.3)	206 (6.4)	800 (25.9)	1,015 (32.6)
May	56 (0.9)	44 (2.4)	326 (23.3)	426 (26.6)
June	151 (0.9)	149 (2.1)	267 (3.3)	567 (6.3)
July	377 (1.9)	1,240 (6.1)	1,327 (8.9)	2,944 (16.9)
August	484 (2.8)	1,222 (6.8)	1,044 (7.7)	2,740 (17.3)
September	180 (3.1)	468 (9.8)	908 (26.4)	1,556 (39.3)
October	149 (0.9)	98 (1.8)	404 (10.5)	651 (13.2)
November	484 (2.9)	Unit was shut down	1,368 (25.6)	1,852 (28.5)
December	297 (3.6)	Unit was shut down	750 (18.0)	1,047 (21.6)
January 1978	1,162 (6.8)	1,466 (9.1)	2,550 (15.1)	5,178 (31.0)
February	433 (1.3)	858 (3.8)	1,670 (8.1)	2,961 (13.2)
Yearly Mean/24 hr	346 (2.1)	679 (5.6)	980 (14.9)	2,005 (22.6)

[a]Three 24 hr samples were taken in March 1977 and two were taken in March 1978.

Table II-16. Comparison of ranking on the basis of numerical abundance and biomass of finfish and invertebrates collected at CRPS, March 13, 1977-March 13, 1978.

Organism	Ranking	
	Number of Individuals Abundance	Biomass
FINFISH		
Scaled sardine	1	1
Bay anchovy	2	8
Pinfish	3	5
Sea catfish	4	3
Silver perch	5	4
Atlantic thread herring	6	6
Polka-dot batfish	7	2
Spot	8	13
Scrawled cowfish	9	7
Silver jenny	10	11
INVERTEBRATES		
Pink shrimp	1	2
Portunus gibbesii	2	3
Metoporhaphis calcarata	3	6
Blue crab	4	1
Trachypenaeus constrictus	5	9
Squid	6	4

Table II-17. Length and biomass data for important species (commercially, numerically, or by biomass) impinged at CRPS. (Data from one sampling period per month. Means calculated from up to 30 randomly selected individuals.)

No. Analyzed	Species	MARCH 18-19, 1977 Length (mm) Mean	Minimum	Maximum	Biomass (g) Mean	Minimum	Maximum
	FINFISH						
2	Atlantic stingray	175	160	190	197.5	145.0	250.0
1	Scaled sardine	122	-	-	48.0	-	-
2	Atlantic thread herring	156	152	160	75.0	75.0	75.0
11	Bay anchovy	57	46	65	2.1	0.9	3.2
47	Polka-dot batfish	107	37	195	81.7	1.3	153.0
3	Pigfish	96	84	100	24.3	11.3	31.0
10	Pinfish	76	24	95	10.4	0.3	18.9
3	Spot	37	35	42	1.2	0.9	1.4
2	Mullet	26	25	27	0.3	0.3	0.3
6	Ocellated flounder	17	34	64	2.7	1.2	6.2
30	Scrawled cowfish	152	90	205	162.7	34.0	342.0
8	Striped burrfish	145	82	210	185.5	65.0	374.0
	INVERTEBRATES						
12	Squid	56	31	115	5.7	1.2	17.0
46	Pink shrimp	109	80	142	9.7	3.7	21.0
1	Blue crab	149	-	-	189.0	-	-
2	Stone crab	69	65	73	127.5	65.0	190.0

Table II-17. (Cont'd.)

APRIL 5-6, 1977

No. Analyzed	Species	Length (mm)			Biomass (g)		
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
	FINFISH						
11	Bay anchovy	58	44	67	2.2	1.1	3.1
46	Polka-dot batfish	148	39	201	131.1	1.6	209.8
60	Pinfish	29	22	41	0.6	0.2	1.7
61	Spot	43	33	57	1.4	0.5	3.9
30	Mullet	29	26	36	0.5	0.2	0.7
10	Scrawled cowfish	160	118	210	135.5	70.8	320.0
2	Striped burrfish	72	65	79	44.2	30.7	55.7
	INVERTEBRATES						
2	Squid	64	55	74	9.2	5.5	12.8
60	Pink shrimp	116	87	150	14.9	6.2	32.9
22	*Trachypenaeus constrictus*	26	35	49	0.5	0.4	0.9
30	*Palaemon floridanus*	37	27	42	0.6	0.1	0.9
2	*Alpheus heterochaelis*	42	34	39	2.1	1.0	3.2
1	*Portunus gibbesii*	19	-	-	0.4	-	-
51	Blue crab	113	35	176	99.5	3.3	234.9
1	Stone crab	32	-	-	12.6	-	-
17	Xanthidae (unident.)	12	6	17	0.6	0.1	2.6
1	*Libinia dubia*	7	-	-	0.3	-	-
15	*Metoporhaphis calcarata*	7	4	11	0.5	0.1	0.9

Table II-17. (Cont'd.)

No. Analyzed	Species	MAY 5-6, 1977 Length (mm) Mean	Minimum	Maximum	Biomass (g) Mean	Minimum	Maximum
	FINFISH						
25	Bay anchovy	57	49	62	2.2	1.6	2.8
13	Polka-dot batfish	166	136	188	142.6	81.6	239.3
1	Pigfish	37	-	-	1.4	-	-
5	Pinfish	40	37	43	1.5	1.1	2.0
60	Spot	48	38	70	2.2	1.1	3.9
2	Mullet	42	40	44	1.6	1.4	1.8
	INVERTEBRATES						
1	Mantis shrimp	damaged	-	-	11.6	-	-
16	Pink shrimp	123	102	146	14.8	8.3	23.8
3	*Palaemon floridanus*	39	34	41	0.6	0.4	0.7
3	*Alpheus heterochaelis*	51	48	57	4.3	3.5	4.6
1	*Portunus gibbesii*	39	-	-	5.9	-	-
35	Blue crab	121	76	168	111.0	31.8	270.2
2	Stone crab	35	21	49	12.8	3.8	21.8
4	*Neopanope texana*	13	11	16	0.9	0.3	1.9
3	*Libinia dubia*	27	14	38	8.9	1.1	16.2

Table II-17. (Cont'd.)

JUNE 4-5, 1977

No. Analyzed	Species	Length (mm) Mean	Length (mm) Minimum	Length (mm) Maximum	Biomass (g) Mean	Biomass (g) Minimum	Biomass (g) Maximum
	FINFISH						
4	Bay anchovy	56	50	58	2.0	1.2	2.4
25	Polka-dot batfish	157	113	182	113.0	44.6	159.6
1	Black seabass	93	-	-	20.1	-	-
32	Pinfish	54	37	90	5.1	1.5	20.3
9	Spot	56	47	78	3.7	1.9	10.5
1	Scrawled cowfish	182	-	-	190.8	-	-
	INVERTEBRATES						
3	Squid	42	34	52	2.4	1.3	4.0
10	Pink shrimp	118	103	139	14.4	11.1	20.1
7	*Palaemon floridanus*	38	33	42	0.7	0.5	0.9
21	*Portunus gibbesii*	27	17	50	1.6	0.3	12.7
45	Blue crab	96	35	160	71.5	3.5	227.9
2	Stone crab	40	37	44	17.7	11.0	24.3
3	*Libinia dubia*	18	13	24	2.2	0.7	4.0
6	*Metoporhaphis calcarata*	8	6	10	0.6	0.3	1.0

Table II-17. (Cont'd.)

JULY 6-7, 1977

No. Analyzed	Species	Length (mm) Mean	Minimum	Maximum	Biomass (g) Mean	Minimum	Maximum
	FINFISH						
47	Polka-dot batfish	154	128	183	116.7	62.8	188.2
3	Pigfish	46	45	48	2.3	2.2	2.6
8	Pinfish	50	42	64	3.3	1.6	6.3
34	Silver perch	36	25	55	1.1	0.4	3.1
1	Spotted seatrout	35	-	-	0.6	-	-
4	Spot	70	68	76	6.8	3.7	8.4
1	Striped burrfish	23	-	-	1.2	-	-
	INVERTEBRATES						
48	Squid	40	25	58	2.5	0.5	7.8
76	Pink shrimp	63	23	105	1.9	0.3	8.8
8	*Trachypenaeus constrictus*	36	27	40	0.4	0.2	0.6
1	*Palaemon floridanus*	39	-	-	0.6	-	-
69	*Portunus gibbesii*	31	13	45	2.4	0.2	6.2
9	Blue crab	130	38	192	118.1	4.5	166.5
1	Stone crab	70	-	-	105.6	-	-
17	*Neopanope texana*	12	6	21	0.9	0.1	3.5
1	*Libinia dubia*	19	-	-	2.4	-	-
2	*Metoporhaphis calcarata*	10	9	11	0.6	0.5	0.7

Table II-17. (Cont'd.)

AUGUST 1-2, 1978

No. Analyzed	Species	Length (mm) Mean	Length (mm) Minimum	Length (mm) Maximum	Biomass (g) Mean	Biomass (g) Minimum	Biomass (g) Maximum
	FINFISH						
2	Atlantic stingray	122	111	134	66.6	55.3	77.9
1	Bay anchovy	47	-	-	1.2	-	-
40	Polka-dot batfish	150	129	181	102.8	66.1	155.1
1	Pinfish	47	-	-	2.8	-	-
5	Silver perch	42	37	59	1.6	1.0	3.0
1	Spotted seatrout	50	-	-	2.0	-	-
2	Spot	68	54	81	6.4	2.8	10.0
1	Striped burrfish	20	-	-	0.8	-	-
	INVERTEBRATES						
11	Squid	54	34	109	9.7	1.8	41.9
90	Pink shrimp	58	36	86	2.1	0.5	6.3
8	*Trachypenaeus constrictus*	36	31	43	0.6	0.3	0.8
90	*Portunus gibbesii*	31	15	46	2.4	0.6	6.9
17	Blue crab	85	37	139	82.5	5.4	224.2
36	*Neopanope texana*	12	7	17	0.7	0.2	2.1
1	*Libinia dubia*	27	-	-	2.8	-	-
20	*Metoporhaphis calcarata*	9	6	10	0.4	0.2	0.6

Table II-17. (Cont'd.)

SEPTEMBER 9-10, 1977

No. Analyzed	Species	Length (mm)			Biomass (g)		
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
	FINFISH						
2	Bay anchovy	35	30	40	0.5	0.3	0.7
18	Polka-dot batfish	152	106	185	108.7	64.1	174.4
3	Pinfish	73	53	84	11.3	3.9	15.7
3	Silver perch	43	36	48	1.9	1.0	2.4
1	Spotted seatrout	55	-	-	2.3	-	-
2	Scrawled cowfish	16	14	17	0.6	0.5	0.8
3	Striped burrfish	21	16	35	1.8	0.4	6.0
	INVERTEBRATES						
1	Squid	80	-	-	16.2	-	-
31	Pink shrimp	63	39	113	1.7	0.3	9.5
6	*Trachypenaeus constrictus*	40	37	43	0.5	0.4	0.6
13	*Portunus gibbesii*	32	23	51	3.3	0.7	16.4
62	Blue crab	105	36	134	75.9	2.6	179.4
9	Stone crab	17	9	26	1.8	0.3	5.6
118	Xanthidae (unident.)	-	-	-	0.7		-
4	*Libinia dubia*	32	7	46	13.3	0.1	25.1
56	*Metoporhaphis calcarata*	7	6	10	0.3	0.1	0.7

Table II-17. (Cont'd.)

No. Analyzed	Species	OCTOBER 3-4, 1977 Length (mm) Mean	Minimum	Maximum	Biomass (g) Mean	Minimum	Maximum
	FINFISH						
1	Bay anchovy	44	-	-	0.8	-	-
17	Polka-dot batfish	145	100	183	95.6	22.1	142.8
2	Pinfish	94	91	98	22.4	20.0	24.9
	INVERTEBRATES						
8	Pink shrimp	82	50	102	5.2	0.7	10.2
8	Portunus gibbesii	24	9	45	2.3	0.1	8.1
43	Blue crab	125	38	178	126.2	4.9	316.3
26	Stone crab	27	11	60	9.6	0.3	64.4
54	Neopanope texana	13	7	20	1.1	0.2	3.4
6	Metoporhaphis calcarata	8	6	10	0.4	0.2	0.7

Table II-17. (Cont'd.)

DECEMBER 3-4, 1977

No. Analyzed	Species	Length (mm) Mean	Length (mm) Minimum	Length (mm) Maximum	Biomass (g) Mean	Biomass (g) Minimum	Biomass (g) Maximum
	FINFISH						
2	Bay anchovy	50	47	53	2.3	0.8	1.5
11	Sea catfish	84	70	93	8.1	3.6	11.6
26	Polka-dot batfish	143	100	167	94.1	38.8	165.1
2	Crevalle jack	149	146	153	76.1	70.3	81.9
1	White grunt	39	-	-	1.3	-	-
11	Pinfish	73	65	84	10.1	7.3	15.7
21	Silver perch	63	54	138	7.1	2.7	60.1
5	Spot	91	85	93	14.2	11.8	16.5
2	Scrawled cowfish	40	38	43	5.8	5.3	6.4
1	Striped burrfish	154	-	-	131.3	-	-
	INVERTEBRATES						
4	Squid	74	35	116	26.5	1.4	63.0
1	Mantis shrimp	92	-	-	10.6	-	-
34	Pink shrimp	90	40	119	7.8	0.7	19.7
5	White shrimp	138	114	168	23.5	22.4	29.5
8	Trachypenaeus constrictus	37	35	41	0.6	0.5	0.8
49	Portunus gibbesii	28	19	58	2.4	0.4	18.0
28	Blue crab	109	23	167	104.1	0.8	222.2
2	Stone crab	27	14	40	11.6	1.5	21.8
5	Neopanope texana	13	10	19	1.2	0.5	1.9
24	Metoporhaphis calcarata	8	5	11	0.4	0.2	0.9

Table II-17. (Cont'd.)

No. Analyzed	Species	JANUARY 3-4, 1978 Length (mm) Mean	Minimum	Maximum	Biomass (g) Mean	Minimum	Maximum
	FINFISH						
72	Scaled sardine	78	59	140	10.2	3.1	55.3
74	Atlantic thread herring	85	57	121	7.8	2.8	29.0
9	Bay anchovy	46	30	72	1.1	0.3	3.5
90	Sea catfish	83	73	92	7.5	5.2	11.1
47	Polka-dot batfish	133	74	188	92.7	17.9	229.8
2	Silver jenny	73	71	75	10.5	10.1	10.9
1	Pigfish	81	-	-	11.3	-	-
68	Pinfish	63	44	88	7.0	1.9	19.4
56	Silver perch	69	60	89	6.3	3.3	14.4
9	Spot	81	77	86	10.0	7.0	11.4
2	Mullet	23	23	23	0.2	0.2	0.2
4	Scrawled cowfish	49	25	105	15.6	2.2	63.8
4	Striped burrfish	119	86	153	110.7	62.0	170.2
	INVERTEBRATES						
2	Squid	116	9	135	59.4	34.7	84.1
7	Pink shrimp	98	85	98	9.4	7.3	11.4
11	Portunus gibbesii	34	24	54	3.9	1.0	15.4
17	Blue crab	51	28	114	17.5	2.1	88.0
1	Neopanope texana	13	-	-	0.9	-	-
90	Metoporhaphis calcarata	9	5	13	0.5	0.1	1.1

Table II-17. (Cont'd.)

FEBRUARY 1-2, 1978

No. Analyzed	Species	Length (mm)			Biomass (g)		
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
	FINFISH						
10	Bay anchovy	53	39	69	1.6	0.6	3.2
9	Polka-dot batfish	88	34	171	49.7	1.7	197.8
1	Black seabass	162	-	-	159.3	-	-
1	Gray snapper	79	-	-	12.0	-	-
64	Pinfish	64	47	89	6.1	2.0	15.8
41	Silver perch	69	47	97	6.4	2.4	17.8
9	Spot	75	66	92	8.5	7.0	14.2
14	Ocellated flounder	39	32	46	1.5	1.0	2.5
36	Scrawled cowfish	45	20	64	5.7	1.1	10.4
	INVERTEBRATES						
66	Pink shrimp	62	20	128	6.1	1.1	12.9
31	Palaemon floridanus	43	37	49	0.6	0.3	0.8
14	Alpheus heterochaelis	43	32	49	2.0	0.9	3.2
2	Blue crab	30	30	30	2.4	2.3	2.6
4	Neopanope texana	13	7	19	1.9	0.2	3.5
28	Metoporhaphis calcarata	10	6	12	0.5	0.2	1.0

Table II-18. Overall lengths and biomass of important species (commercially, numerically, or by biomass) impinged at CRPS, March 13, 1977-March 13, 1978. (Means calculated from Table II-16).

No. Analyzed	Species	Length (mm)			Biomass (g)		
		Mean	Maximum	Minimum	Mean	Maximum	Minimum
	FINFISH						
4	Atlantic stingray	148	111	190	132.0	55.3	145.0
73	Scaled sardine	100	59	140	29.1	3.1	55.3
76	Atlantic thread herring	120	57	160	41.4	2.8	75.0
79	Bay anchovy	50	39	72	1.6	0.3	3.5
101	Sea catfish	84	70	93	7.8	3.6	11.6
367	Polka-dot batfish	139	34	201	100.4	1.3	239.3
2	Black seabass	128	93	162	89.7	20.1	159.3
2	Crevalle jack	149	146	153	76.1	70.3	81.9
1	Gray snapper	79	-	-	12.0	-	-
2	Silver jenny	73	71	75	10.5	10.1	10.9
1	White grunt	39	-	-	1.3	-	-
8	Pigfish	65	37	100	9.8	1.4	31.0
264	Pinfish	60	22	98	7.8	0.2	24.9
162	Silver perch	56	25	138	4.4	0.4	60.0
3	Spotted seatrout	47	35	55	1.6	0.6	2.3
163	Spot	73	33	163	12.7	0.5	72.4
36	Mullet	30	25	44	0.6	0.2	1.8
20	Ocellated flounder	28	32	64	2.1	1.0	6.2
85	Scrawled cowfish	92	14	210	73.8	0.5	342.0
20	Striped burrfish	79	16	210	67.9	0.4	374.0
	INVERTEBRATES						
93	Squid	63	25	135	15.0	0.5	84.1
2	Mantis shrimp	92	-	-	11.1	10.6	11.6
448	Pink shrimp	80	23	150	8.2	0.3	64.0

Table II-18. (Cont'd.)

No. Analyzed	Species	Length (mm)			Biomass (g)		
		Mean	Maximum	Minimum	Mean	Maximum	Minimum
6	White shrimp	143	114	168	21.7	20.0	29.5
86	Trachypenaeus constrictus	36	27	51	0.5	0.2	1.7
72	Palaemon floridanus	39	27	49	0.6	0.1	0.9
19	Alpheus heterochaelis	45	32	57	2.8	0.9	4.6
307	Portunus gibbesii	29	12	58	2.7	0.1	18.0
330	Blue crab	102	23	192	89.6	0.8	316.3
50	Stone crab	37	91	73	33.4	0.2	140.0
126	Neopanope texana	13	7	21	0.9	0.1	3.5
135	Xanthidae (unidentified)	12	6	17	0.6	0.1	2.6
15	Libinia dubia	22	7	52	7.5	0.1	25.1
235	Metoporhaphis calcarata	8	4	1[illegible]	0.4	0.1[illegible]	1.1

Table II-19. Analysis of variance for mean numbers of finfish and invertebrates impinged at CRPS per 100 m^3/intake water.

	Month	Day: Month	Time	Unit	Tide	Barge	Wind	Remainder
DEGREES OF FREEDOM	11	89	3	2	2	1	1	418
FINFISH	**	**	**	**	NS	NS	NS	
Atlantic stingray	**	**	NS	**	NS	NS	NS	
Shrimp eel	**	**	**	**	NS	NS	NS	
Scaled sardine	**	**	**	**	*	NS	NS	
Atlantic thread herring	**	**	NS	**	NS	NS	NS	
Bay anchovy	**	**	**	**	NS	NS	NS	
Sea catfish	**	**	*	**	NS	NS	NS	
Polka-dot batfish	**	**	**	**	NS	**	NS	
Crevalle jack	**	**	NS	NS	NS	NS	NS	
Atlantic bumper	**	**	**	**	NS	NS	NS	
Gray snapper	**	NS	NS	NS	NS	NS	NS	
Spotfin mojarra	**	**	**	NS	NS	**	NS	
Silver jenny	**	**	**	*	**	*	NS	
Grunts	NS	**	**	**	NS	NS	NS	
White grunt	**	**	**	NS	NS	**	NS	
Pigfish	*	**	**	**	NS	NS	NS	
Sheepshead	NS	NS	NS	*	NS	NS	**	
Pinfish	**	**	**	**	NS	NS	NS	
Silver perch	**	**	**	**	NS	NS	**	
Spotted seatrout	**	**	**	**	NS	NS	NS	
Spot	**	**	**	**	NS	NS	NS	
Atlantic spadefish	**	**	NS	**	NS	**	NS	
Mullets	**	**	NS	*	NS	NS	NS	
Striped mullet	NS	**	**	NS	NS	NS	NS	
Barbfish	**	**	NS	NS	NS	NS	NS	
Ocellated flounder	**	**	**	**	NS	NS	**	
Orange filefish	*	**	NS	**	NS	NS	NS	

Table II-19. (Cont'd)

	Month	Day: Month	Time	Unit	Tide	Barge	Wind	Remainder
DEGREES OF FREEDOM	11	89	3	2	2	1	1	418
Scrawled cowfish	**	**	NS	**	NS	*	NS	
Southern puffer	**	**	**	NS	NS	NS	*	
Striped burrfish	**	**	NS	**	NS	*	NS	
INVERTEBRATES	**	**	**	**	**	NS	NS	
Brief squid	**	**	**	**	NS	*	NS	
Mantis shrimp	**	**	**	NS	*	NS	NS	
Pink shrimp	**	**	**	**	**	NS	NS	
White shrimp	**	**	NS	*	NS	NS	NS	
Trachypenaeus constrictus	**	**	**	NS	*	*	NS	
Palaemon floridanus	**	**	**	**	NS	NS	NS	
Alpheus heterochaelis	**	**	**	NS	NS	NS	*	
Blue crab	**	**	**	**	**	NS	NS	
Portunus gibbesii	**	**	**	**	**	**	NS	
Stone crab	**	**	**	**	NS	NS	NS	
Neopanope texana	**	**	NS	*	NS	NS	NS	
Libinia dubia	**	**	NS	**	NS	NS	NS	
Metoporhapsis calcarata	**	**	**	**	*	NS	NS	
TOTAL ORGANISMS	**	**	**	**	NS	NS	NS	

* P <0.01

** P ≤0.05

N.S. = Not statistically significant

Table II- 20 Analysis of variance for mean biomass of finfish and invertebrates impinged at CRPS per 100m^3/intake water.

	Month	Day: Month	Time	Unit	Tide	Barge	Wind	Remainder
DEGREES OF FREEDOM	11	89	3	2	2	1	1	418
FINFISH	**	**	**	**	NS	**	NS	
Atlantic stingray	**	**	NS	**	NS	NS	**	
Shrimp eel	**	**	**	**	NS	NS	NS	
Scaled sardine	**	**	**	**	*	NS	NS	
Atlantic thread herring	**	**	**	**	NS	NS	NS	
Bay anchovy	**	**	**	*	NS	NS	NS	
Sea catfish	**	**	NS	**	NS	NS	NS	
Polka-dot batfish	**	**	**	**	NS	**	*	
Crevalle jack	**	**	NS	**	*	NS	NS	
Atlantic bumper	**	**	NS	NS	NS	NS	NS	
Gray snapper	**	NS	NS	NS	NS	NS	NS	
Spotfin mojarra	**	**	**	NS	NS	**	NS	
Silver jenny	**	**	**	*	NS	NS	NS	
Grunts	**	**	**	**	NS	NS	NS	
White grunt	**	**	*	NS	NS	*	NS	
Pigfish	**	**	**	**	NS	NS	NS	
Sheepshead	NS	NS	NS	*	NS	NS	**	
Pinfish	**	**	**	**	NS	NS	NS	
Silver perch	**	**	**	**	NS	NS	**	
Spotted seatrout	**	**	*	**	NS	NS	NS	
Spot	**	**	**	**	NS	NS	NS	
Atlantic spadefish	**	**	NS	NS	NS	*	NS	
Mullet	*	**	**	NS	NS	NS	NS	
Striped mullet	*	**	**	NS	NS	NS	*	
Barbfish	**	NS	NS	NS	NS	NS	NS	
Ocellated flounder	**	**	**	**	NS	NS	*	
Orange filefish	*	**	NS	**	NS	NS	NS	

Table II-20. (Cont'd)

	Month	Day: Month	Time	Unit	Tide	Barge	Wind	Remainder
DEGREES OF FREEDOM	11	89	3	2	2	1	1	418
Scrawled cowfish	**	**	*	**	NS	**	NS	
Southern puffer	**	**	*	*	NS	NS	NS	
Striped burrfish	**	**	NS	**	NS	*	**	
INVERTEBRATES	**	**	**	**	**	NS	NS	
Brief squid	**	**	**	**	NS	*	NS	
Mantis shrimp	**	**	**	NS	NS	NS	NS	
Pink shrimp	**	**	**	**	**	NS	NS	
White shrimp	**	**	NS	*	NS	NS	NS	
Trachypenaeus constrictus	**	**	**	NS	*	*	NS	
Palaemon floridanus	**	**	**	**	NS	NS	*	
Alpheus heterochaelis	**	**	**	*	NS	NS	**	
Blue crab	**	**	**	**	**	NS	NS	
Portunus gibbesii	**	**	**	**	**	**	NS	
Stone crab	**	**	**	**	NS	*	NS	
Neopanope texana	**	**	NS	**	NS	NS	NS	
Libinia dubia	**	NS	NS	**	NS	NS	NS	
Metoporhaphis calcarata	**	**	**	**	*	NS	NS	
TOTAL ORGANISMS	**	**	**	**	NS	*	NS	

* = $P < 0.01$

** = $P \leq 0.05$

NS = Not statistically significant

Table II-21. Results of Duncan's Multiple Range Test of mean numbers and biomass of finfish and invertebrates impinged per 100^3 m of intake water at CRPS during the four sampling periods. (A line appears under the sampling period for which means are not significantly different, $P < 0.05$.)

	NUMBERS OF INDIVIDUALS				BIOMASS			
	High			Low	High			Low
FINFISH	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Shrimp eel	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Scaled sardine	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Atlantic thread herring	N. S.				Night	Dusk	Dawn	Day
Bay anchovy	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day
Sea catfish	Dusk	Day	Night	Dawn	N. S.			
Polka-dot batfish	Dusk	Night	Day	Dawn	Dusk	Day	Night	Dawn
Atlantic bumper	Dusk	Night	Dawn	Day	N. S.			
Spotfin mojarra	Dusk	Day	Night	Dawn	Dusk	Day	Night	Dawn
Silver jenny	Dusk	Dawn	Night	Day	Dusk	Dawn	Night	Day
Grunts	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
White grunts	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Pigfish	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day

Table II-21. (Cont'd).

	NUMBERS OF INDIVIDUALS				BIOMASS			
	High			Low	High			Low
Pinfish	Dusk	Night	Dawn	Day	Dusk	Night	Day	Dawn
Silver perch	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day
Spotted seatrout	Night	Dawn	Dusk	Day	Night	Dusk	Dawn	Day
Spot	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Mullets		N. S.			Day	Dusk	Dawn	Night
Striped mullet		N. S.[a]			Day	Dusk	Night	Dawn
Ocellated flounder	Night	Dusk	Dawn	Day	Dusk	Night	Dawn	Day
Scrawled cowfish		N. S.			Dusk	Dawn	Night	Day
Southern puffer	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
INVERTEBRATES	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day
Brief squid	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day
Mantis shrimp	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day
Pink shrimp	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day

[a]Statistical anomaly: ANOVA showed significance between time period; Duncan's Multiple Range Test showed no significant difference.

Table II-21. (Cont'd).

	NUMBERS OF INDIVIDUALS				BIOMASS			
	High			Low	High			Low
Trachypenaeus constrictus	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day
Palaemon floridanus	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Alpheus heterochaelis	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Blue crab	Dusk	Night	Dawn	Day	Dusk	Night	Dawn	Day
Portunus gibbesii	Night	Dusk	Dawn	Day	Night	Dusk	Dawn	Day
Stone crab	Dusk	Night	Day	Dawn	Dusk	Night	Dawn	Day
Metoporhaphis calcarata	Night	Dawn	Dusk	Day	Night	Dawn	Dusk	Day
TOTAL ORGANISMS	Night	Dusk	Dawn	Day	Dusk	Night	Dawn	Day

Table II-22. Results of Duncan's Multiple Range Test of mean numbers and biomass of finfish and invertebrates impinged at Units 1, 2, and 3, per 100^3 m of intake water at CRPS. (A line appears under units for which means are not significantly different, $P < 0.05$.)

	NUMBER OF INDIVIDUALS			BIOMASS		
	High		Low	High		Low
FINFISH	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Atlantic stingray	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Shrimp eel	Unit 3	Unit 2	Unit 1	Unit 3	Unit 2	Unit 1
Scaled sardine	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1	Unit 2
Atlantic thread herring	Unit 3	Unit 2	Unit 1	Unit 3	Unit 2	Unit 1
Bay anchovy	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Sea catfish	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1	Unit 2
Polka-dot batfish	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Crevalle jack		N. S.		Unit 3	Unit 1	Unit 2
Atlantic bumper		N. S.[a]			N. S.	
Silver jenny		N. S.[a]		Unit 3	Unit 2	Unit 1
Grunts	Unit 3	Unit 2	Unit 1	Unit 3	Unit 2	Unit 1

[a] Statistical anomaly: ANOVA showed significance between units; Duncan's Multiple Range Test showed no significant difference.

Table II-22. (Cont'd).

	NUMBER OF INDIVIDUALS			BIOMASS		
	High		Low	High		Low
Pigfish	Unit 2	Unit 3	Unit 1	Unit 3	Unit 2	Unit 1
Sheepshead	Unit 2	Unit 1	Unit 3	Unit 2	Unit 1	Unit 3
Pinfish	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Silver perch	Unit 3	Unit 2	Unit 1	Unit 3	Unit 2	Unit 1
Spotted seatrout	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Spot	Unit 2	Unit 3	Unit 1	Unit 3	Unit 2	Unit 1
Atlantic spadefish	Unit 2	Unit 3	Unit 1		N. S.	
Mullets	Unit 2	Unit 3	Unit 1		N. S.	
Ocellated flounder	Unit 2	Unit 3	Unit 1	Unit 3	Unit 2	Unit 1
Orange filefish	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Scrawled cowfish	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Southern puffer		N. S.		Unit 2	Unit 3	Unit 1
Striped burrfish	Unit 3	Unit 2	Unit 1	Unit 3	Unit 2	Unit 1
INVERTEBRATES	Unit 2	Unit 3	Unit 1	Unit 3	Unit 2	Unit 1
Brief squid	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1

Table II-22. (Cont'd).

	NUMBER OF INDIVIDUALS			BIOMASS		
	High		Low	High		Low
Pink shrimp	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
White shrimp	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1	Unit 2
Palaemon floridanus	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
Alpheus heterochaelis		N. S.		Unit 3	Unit 2	Unit 1
Blue crab	Unit 3	Unit 2	Unit 1	Unit 3	Unit 2	Unit 1
Portumus gibbesii	Unit 2	Unit 3	Unit 1	Unit 3	Unit 2	Unit 1
Stone crab	Unit 2	Unit 3	Unit 1	Unit 3	Unit 2	Unit 1
Neopanope texana		N. S.[a]		Unit 3	Unit 2	Unit 1
Libinia dubia	Unit 2	Unit 3	Unit 1	Unit 3	Unit 2	Unit 1
Metophorhaphis calcarata	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1
TOTAL ORGANISMS	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	Unit 1

[a]Statistical anomaly: ANOVA showed significance between units; Duncan's Multiple Range Test showed no significant difference between units.

Table II-23. Results of Duncan's Multiple Range Test of mean numbers and biomass of finfish and invertebrates impinged per 100 m^3 of intake water at CRPS listed according to whether tide was increasing, decreasing, or mid-stage. A line appears under tide stages for which means are not significantly different, $P < 0.05$.)

	NUMBERS OF INDIVIDUALS			BIOMASS		
	High		Low	High		Low
Scaled sardine	Increasing	Decreasing	Mid	Increasing	Decreasing	Mid
Crevalle jack		N.S.		Increasing	Decreasing	Mid
Silver jenny	Increasing	Decreasing	Mid		N.S.	
Invertebrates	Decreasing	Increasing	Mid	Decreasing	Mid	Increasing
Mantis shrimp	Decreasing	Increasing	Mid		N.S.	
Pink shrimp	Decreasing	Increasing	Mid	Decreasing	Increasing	Mid
Trachypenaeus constrictus	Mid	Decreasing	Increasing	Mid	Decreasing	Increasing
Blue crab	Decreasing	Mid	Increasing	Decreasing	Mid	Increasing
Portunus gibbesii	Decreasing	Mid	Increasing	Decreasing	Mid	Increasing
Metoporhaphis calcarata	Decreasing	Increasing	Mid	Decreasing	Increasing	Mid

Table II-24. Mean numbers and biomass of finfish and invertebrates impinged per 100 m^3 of intake water at CRPS listed according to whether barge traffic present or absent. [Only taxa for which this factor was significant ($P < 0.05$) in the ANOVA (Tables II-19 and -20) are listed. Log-transformed means are listed in parentheses under the arithmetic mean.]

	Number of Individuals		Biomass (g)	
	Present	Absent	Present	Absent
Finfish	N.S.		5,139.891 (3.2945)	3,451.884 (2.9859)
Polka-dot batfish	17.870 (1.0176)	13.178 (0.8311)	1,753.270 (2.8142)	1,210.850 (2.5489)
Spotfin mojarra	3.954 (0.2222)	0.687 (0.0753)	23.556 (0.3533)	5.035 (0.1339)
Silver jenny	8.104 (0.1062)	1.255 (0.0475)	N.S.	
White grunt	2.916 (0.1283)	0.150 (0.0372)	7.072 (0.2048)	0.496 (0.0708)
Atlantic spadefish	0.566 (0.0735)	0.082 (0.0238)	52.556 (0.1796)	3.036 (0.0758)
Scrawled cowfish	10.105 (0.4501)	3.077 (0.2594)	273.731 (0.9702)	78.103 (0.6720)
Striped burrfish	1.315 (0.2206)	0.552 (0.1155)	148.664 (0.8850)	63.318 (0.5109)
Brief squid	5.099 (0.4400)	3.987 (0.3582)	43.566 (0.8890)	25.097 (0.7020)
Trachysenaeus constrictus	10.484 (0.3072)	1.801 (0.1807)	6.436 (0.2505)	1.036 (0.1385)
Potunus gibbesii	26.478 (0.9041)	19.537 (0.7402)	60.806 (1.1427)	45.631 (0.9773)
Stone crab	N. S.		16.779 (0.5440)	13.187 (0.4901)
TOTAL ORGANISMS	525.231 (2.2794)	438.950 (2.0835)	6,478.716 (3.5074)	4,465.415 (3.2886)

Table II-25. Mean numbers and biomass of finfish and invertebrates impinged per 100 m^3 of intake water at CRPS listed according to whether wind strong or negligible. [Only taxa for which this factor was significant ($P < 0.05$) in the ANOVA (Table II-19 and -20) are listed. Log-transformed means are listed in parentheses under the arithmetic mean.]

	Number of Individuals		Biomass	
	Strong	Negligible	Strong	Negligible
Polka-dot batfish	N.S.		1,280.462 (2.5310)	1,408.231 (2.6521)
Sheepshead	0.037 (0.0043)	0.004 (0.0011)	6.521 (0.0432)	0.831 (0.0096)
Silver perch	7.400 (0.4164)	32.271 (0.6380)	36.956 (0.6656)	218.633 (0.9753)
Striped mullet	N.S.		0.090 (0.0183)	2.265 (0.0530)
Ocellated flounder	1.457 (0.1079)	2.312 (0.1801)	4.366 (0.2101)	4.7214 (0.2480)
Southern puffer	0.866 (0.1464)	1.514 (0.2209)	N.S.	
Striped burrfish	N.S.		27.008 (0.4950)	100.434 (0.6552)
Palaemon floridanus	N.S.		2.726 (0.2521)	1.224 (0.1599)
Alpheus heterochaelis	2.288 (0.1299)	1.005 (0.1157)	5.643 (0.1705)	1.937 (0.1610)

Table II-26. Projected number of finfish and invertebrates impinged at CRPS, March 13, 1977-March 13, 1978.

Month	Finfish	Invertebrates	Total
March	91,946	85,901	177,847
April	82,020	30,450	112,470
May	22,844	13,214	36,058
June	20,526	16,998	37,524
July	33,213	91,246	124,459
August	26,679	85,225	111,904
September	11,601	46,702	58,305
October	17,624	20,204	37,828
November	76,305	55,568	131,872
December	783,878	32,445	816,323
January	919,530	160,541	1,080,071
February	565,236	82,908	648,144
TOTAL	2,651,402	721,402	3,372,804

Table II-27. Projected biomass (kg) of finfish and invertebrates impinged at CRPS, March 13, 1977-March 13, 1978.

Month	Finfish	Invertebrates	Total
March	2,545.1	750.2	3,295.3
April	961.9	964.7	1,926.6
May	272.5	827.6	1,100.1
June	1,307.8	187.1	1,494.9
July	1,123.0	521.0	1,644.0
August	665.3	538.1	1,203.4
September	344.7	1,179.0	1,523.7
October	473.6	408.2	881.8
November	1,232.6	854.6	2,087.2
December	6,773.9	671.1	7,445.0
January	9,032.7	970.0	10,002.7
February	2,688.0	369.6	3,057.6
TOTAL	27,421.1	8,241.2	35,662.3

Table II-28. Commercial landings of important species from the Citrus Pasco County reporting area during 1975 and 1976 (Florida DNR 1975; United States Department of Commerce 1978).

	1975		1976	
Species	Value	Pounds	Value	Pounds
Blue crab	$206,154	1,518,884	no data	2,091,055
Striped mullet	$308,662	2,112,392	"	1,641,687
Shrimp	$450,993	366,782	"	321,956
Crevalle jack	$ 20,647	262,164	"	231,435
Stone crab	$ 84,444	94,548	"	200,310
Spotted seatrout	$ 37,780	90,443	"	92,128
Grunt	$ 18,473	88,038	"	66,104
Sheepshead	$ 3,064	20,799	"	---
Black seabass	$ 1,663	11,267	"	8,778
Gray snapper	$ 1,120	2,886	"	3,555

Table II-29. Mean 24-hr impingement rates of finfish at CRPS Units 1,2 and 3 (1977-1978), CRPS Unit 2 (1972-1973), Anclote Power Station (1976), and TECO-Big Bend Power Station (1976-1977). (Biomass data in kg.)

Month	Crystal River Units 1, 2, 3 1977-1978 (1,328,000 gpm)		Crystal River Unit 2 1972-1973[a] (328,000 gpm)		Anclote 1976[b] (723,000 gpm)		TECO-Big Bend 1976-1977[c] (723,000 gpm)	
	Number	Biomass	Number	Biomass	Number	Biomass	Number	Biomass
January	29,662	291.4	472	24.3	113	5.3		
February	20,187	96.0	1,728	50.6	111	5.8	52 (1976)	-
March	2,966	82.1	932	28.1	85	1.2	787 (1977)	-
April	2,734	32.2	333	11.9	80	1.9		
May	737	8.8	190,571	824.6	145	1.6	191	-
June	684	43.6	438	12.6	745	8.0		
July	1,071	36.2	2,384	12.6	118	2.5		
August	891	21.5	92	5.4	89	1.6	417	-
September	387	11.5	92	2.6	17	0.6		
October	568	15.3	298	5.8	72	2.6		
November	2,544	41.2	282	15.8	218	12.6	265	-
December	25,286	218.5	666	36.4	304	13.0		
MEAN	7,310	74.9	16,524	85.9	175	4.7	323	-

[a] Calculated from Snedaker (1974).

[b] Calculated from Texas Instruments (1977), Figures VII-4 and VII-5.

[c] From Conservation Consultants (1977), Table 7.2.

Table II-30. Mean 24-hr impingement rates of invertebrates at CRPS Units 1, 2 and 3 (1977-1978), CRPS Unit 2 (1972-1973), Anclote Power Station (1976), and TECO-Big Bend Power Station (1976-1977). (Biomass data in kg.)

Month	Crystal River Units 1,2,3 1977-1978 (1,318,000 gpm)		Crystal River Unit 2 1972-1973[a] (328,000 gpm)		Anclote 1976[b] (465,000 gpm)		TECO-Big Bend 1976-1977[c] (723,000 gpm)	
	Number	Biomass	Number	Biomass	Number	Biomass	Number	Biomass
January	5,179	31.3	298	2.0	143	0.2		
February	2,961	13.2	220	2.0	168	0.4	409 (1976)	-
March	2,771	24.2	131	1.0	490	2.3	408 (1977)	-
April	1,015	32.?	180	18.8	489	29.0		
May	345	26.7	89	7.0	350	14.2	152	-
June	567	6.2	316	3.2	1,525	7.4		
July	2,943	16.8	789	2.6	336	5.5		
August	2,749	17.4	59	0.4	636	3.8	422	-
September	1,557	39.3	84	0.6	145	8.9		
October	651	13.2	699	1.1	131	29.8		
November	1,852	28.5	84	0.5	139	29.8	185	-
December	1,047	21.6	508	2.4	150	6.6		
MEAN	1,970	22.6	288	3.5	392	11.5	292	-

[a] Calculated from Snedaker (1974).

[b] Calculated from Texas Instruments (1977), Figures VII-4 and VII-5.

[c] From Conservation Consultants (1977), Table 7.2.

Table II-31. Ranking (highest to lowest) of species by biomass impinged at CRPS (1977-1978, 1972-1973) and at Anclote Power Station (1976).

Crystal River 1977-78	Crystal River 1972-73	Anclote 1976
Scaled sardine	Atlantic threadfin	Horseshoe crab
Polka-dot batfish	Polka-dot batfish	Blue crab
Blue crab	Striped burrfish	Striped burrfish
Pink shrimp	Blue crab	Pink shrimp
Sea catfish	Scrawled cowfish	Atlantic stingray
Silver perch	Tunicates	Spotted eagle ray
Pinfish	Pinfish	Scrawled cowfish
Atlantic thread herring	Squid	Southern puffer
Scrawled cowfish	Silver perch	Spot
Bay anchovy	Pink shrimp	Spider crab

Table II-32. Ranking (highest to lowest) of species by numbers impinged at CRPS (1977-1978), at Anclote Power Station (1976) and at Big Bend Power Station (1976-1977).

Crystal River 1977-78	Anclote 1976	Big Bend 1976-1977
Scaled sardine	Pink shrimp	Bay anchovy
Bay anchovy	Spider crab	Pink shrimp
Pink shrimp	Blue crab	Silver perch
Pinfish	*Portunis* sp.	Blue crab
Sea catfish	Silver perch	Horseshoe crab
Silver perch	Silver jenny	Portunid crab
Portunis gibbesii	Southern puffer	Brief squid
Metoporhaphis calcarata	Spot	Mantis shrimp
Altantic thread herring	Mud crab	Pinfish
Polka-dot batfish	Pinfish	Sand seatrout

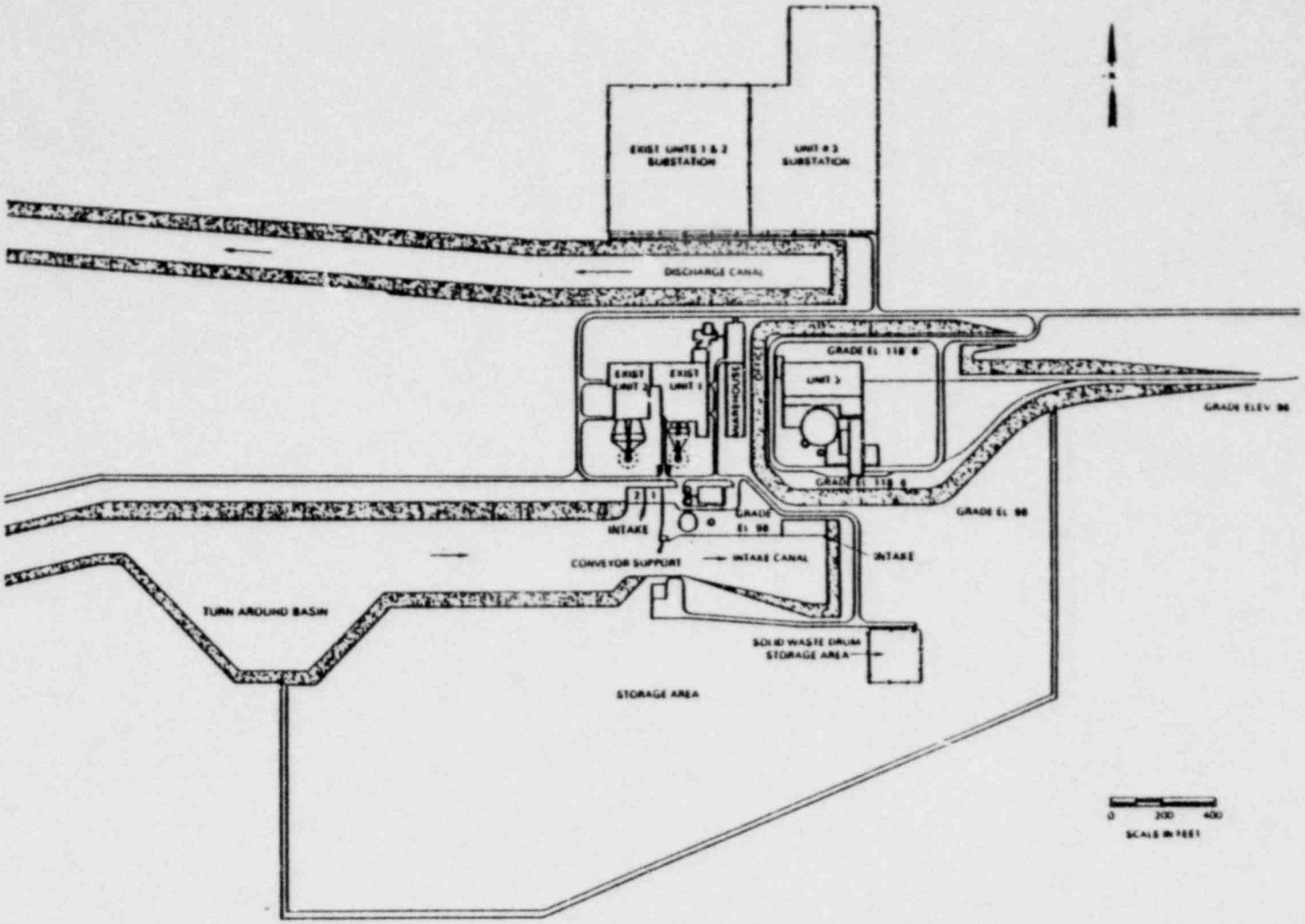

Fig. II-1. CRPS site plan.

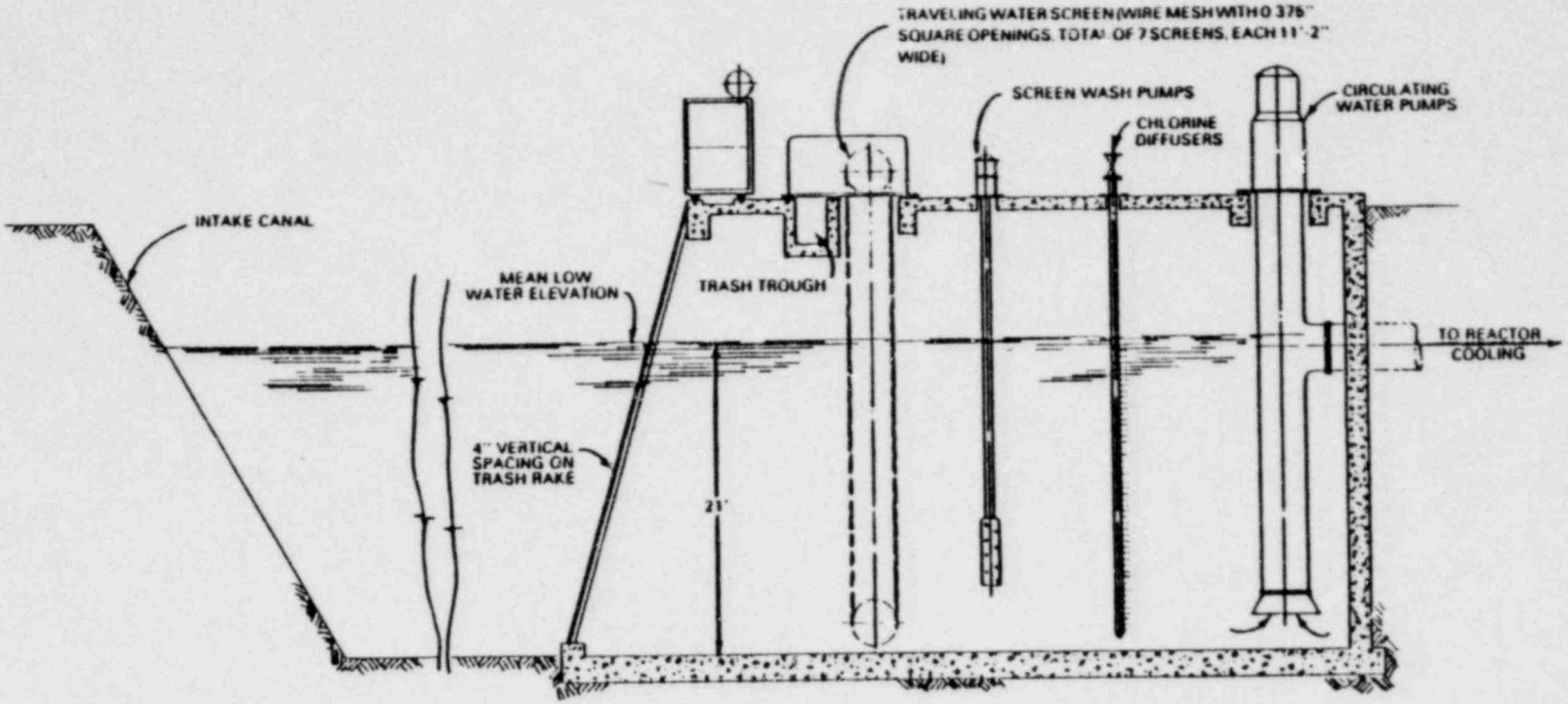

Fig. II-2. CRPS Unit 3 intake cross-section

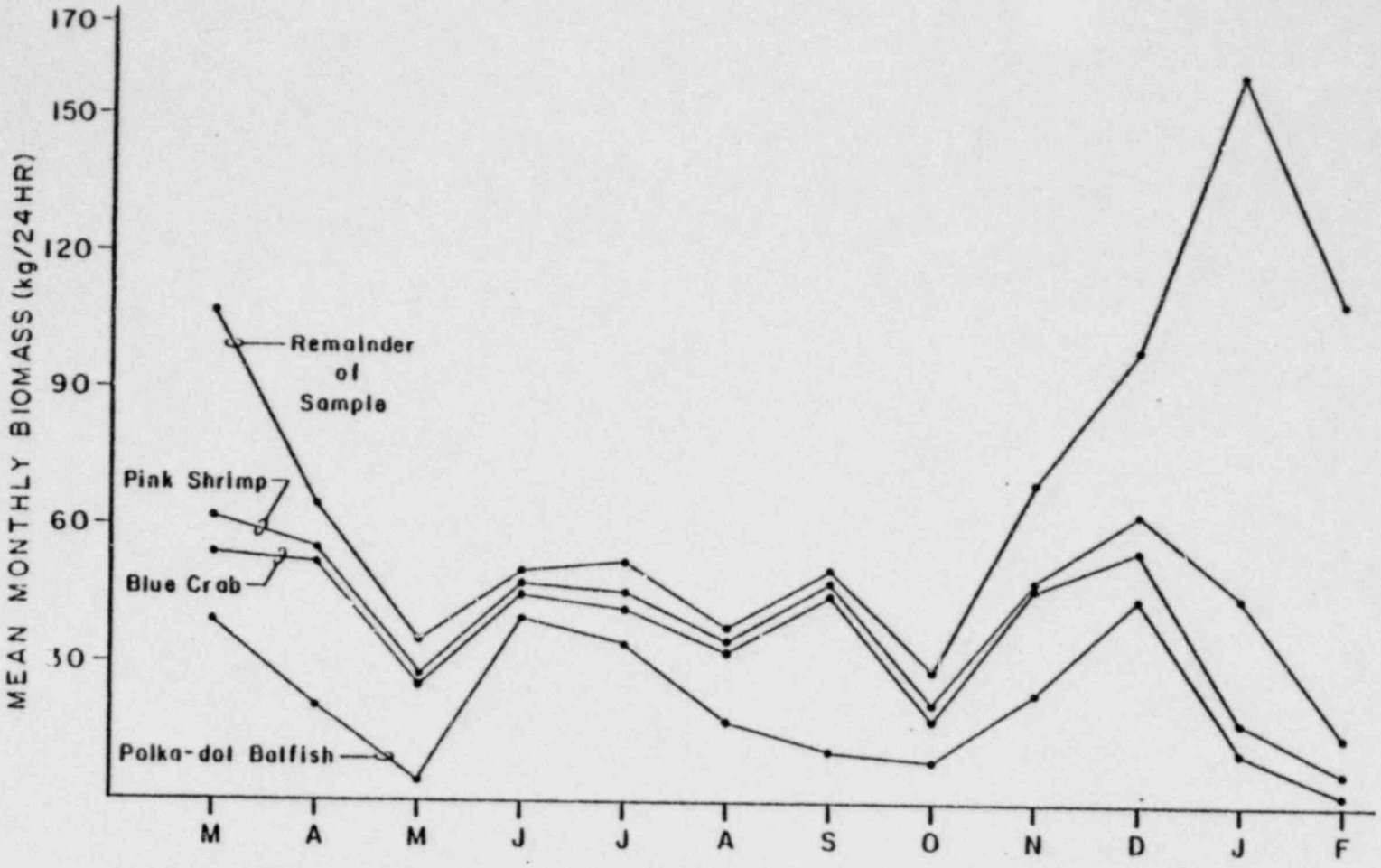

Fig. II-3. Mean monthly biomass impinged at CRPS (cumulative numbers). (Does not include large clupeid catches in December and January.

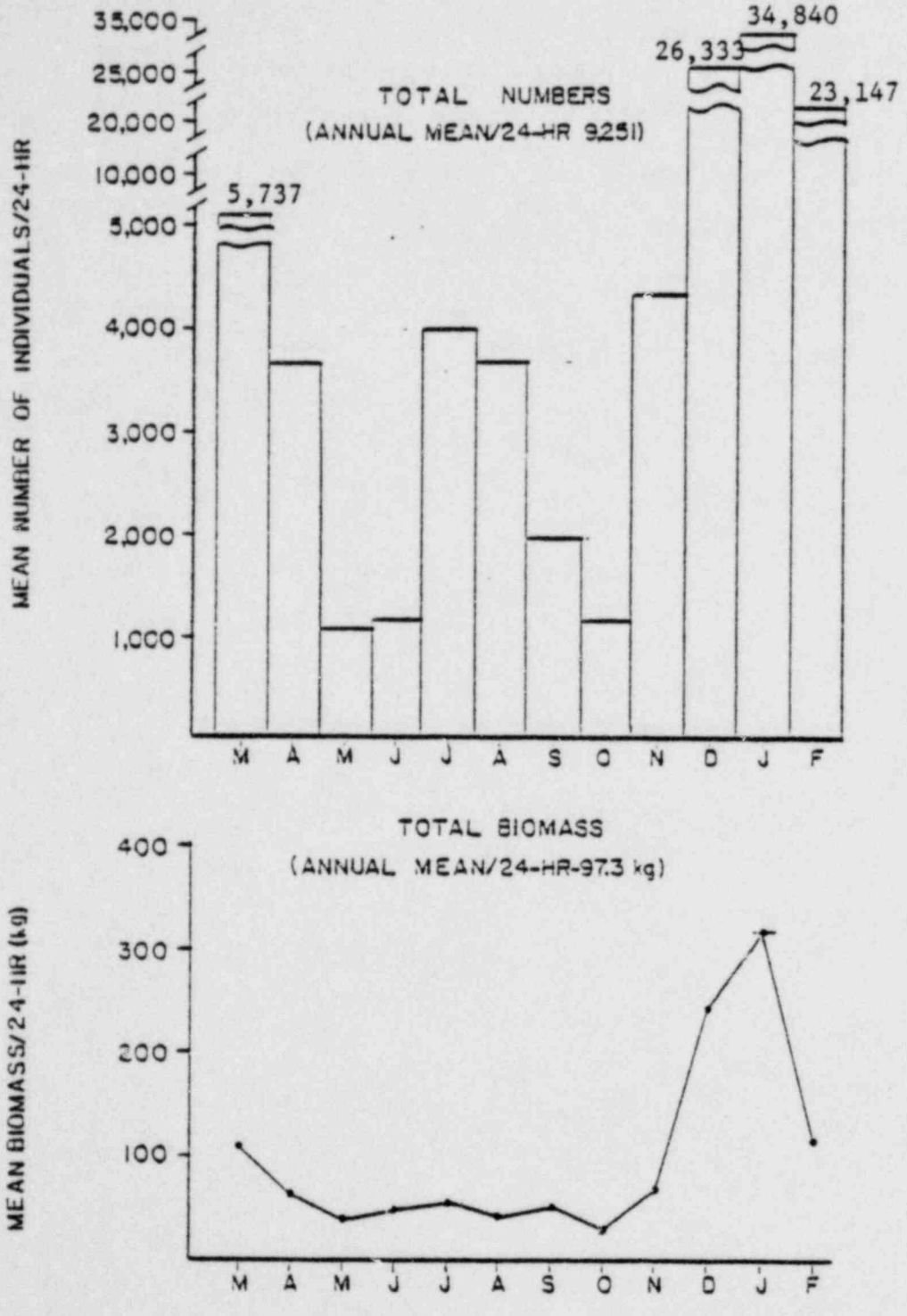

Fig. II-4. Total mean monthly catch of finfish and invertebrates combined.

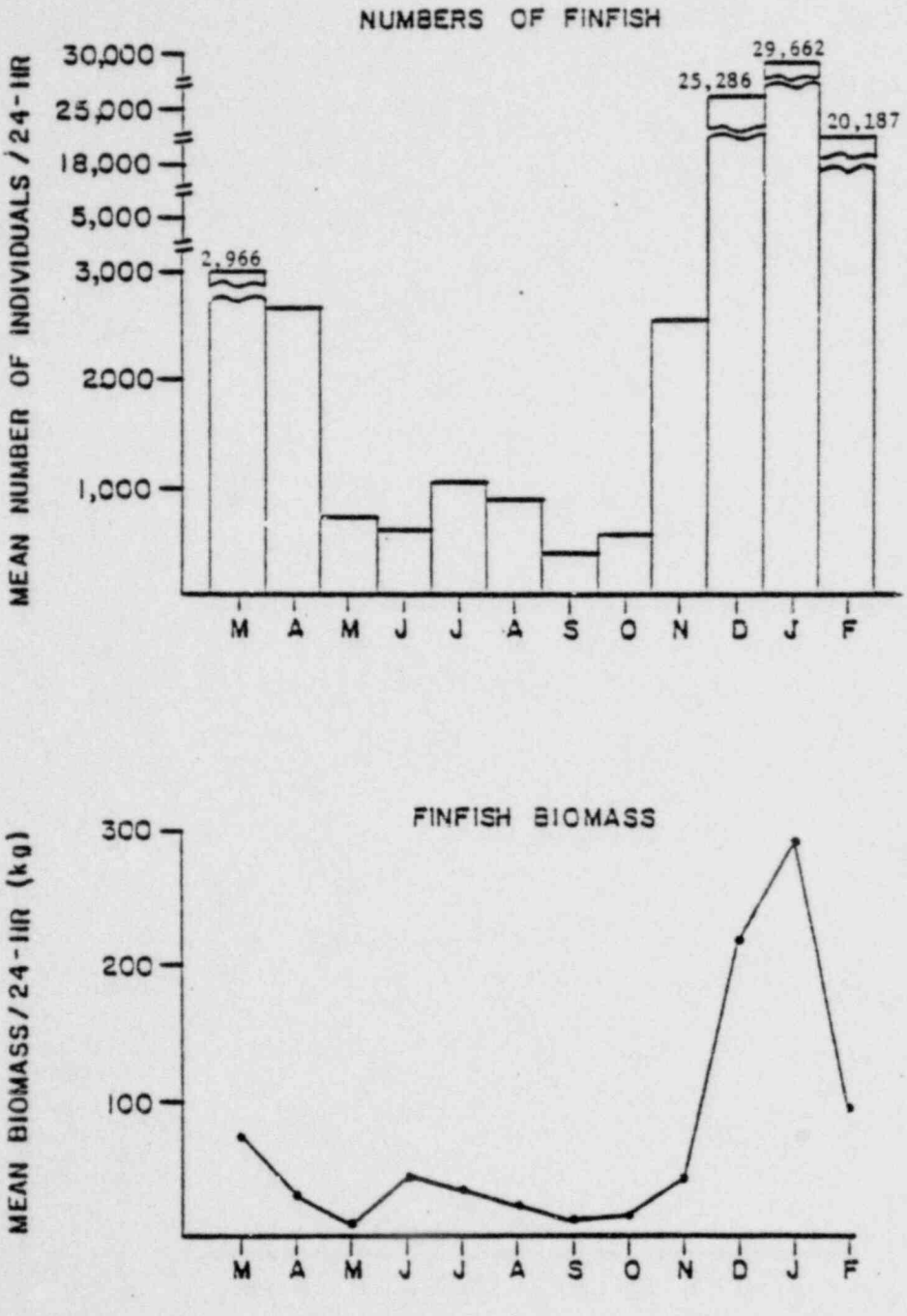

Fig. II-5. Mean monthly impingement rates of finfish during the study period.

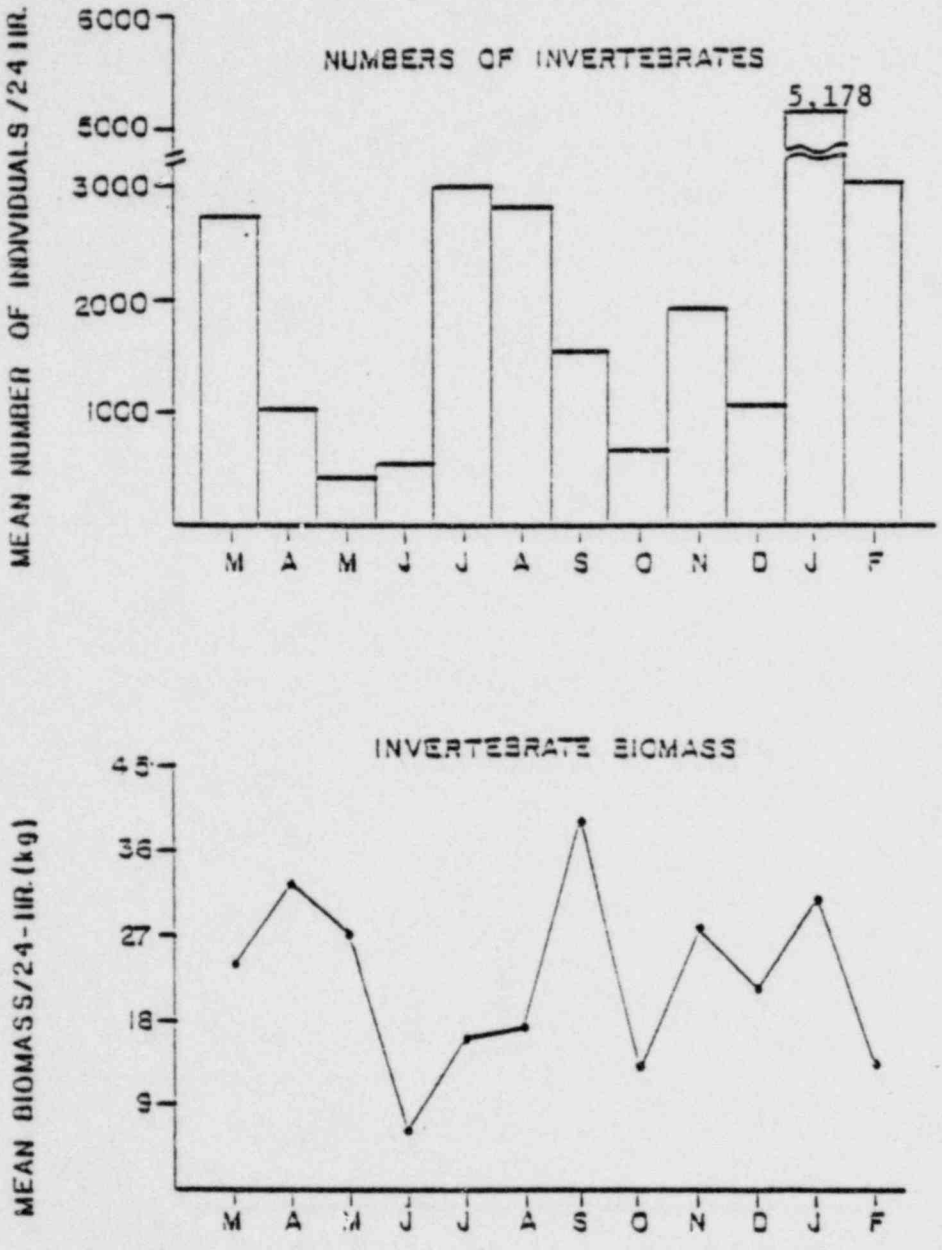

Fig. II-6. Mean monthly impingement rates of invertebrates during the study period.

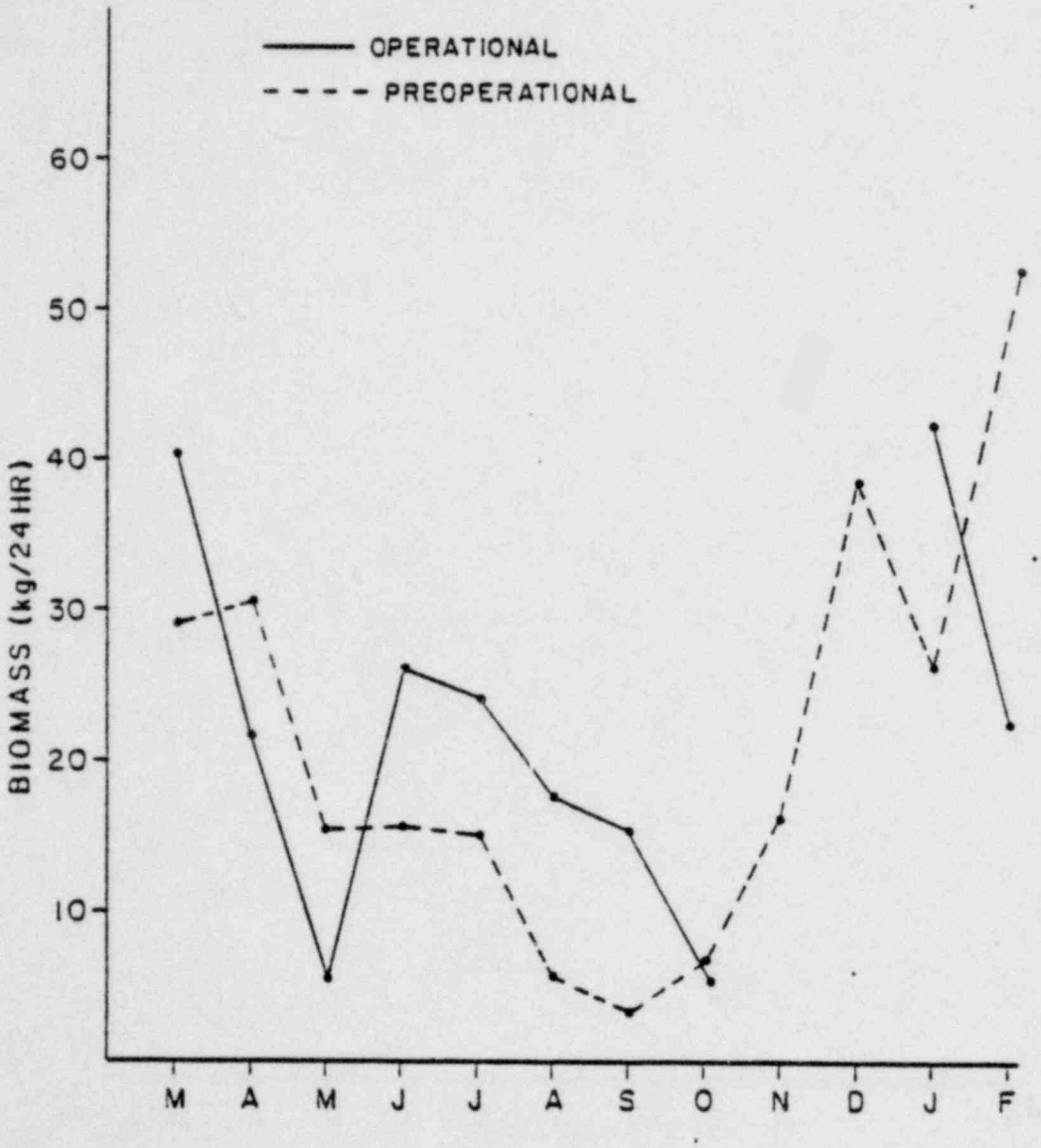

Fig. II-7. Comparison of operational and preoperational biomass impinged at CRPS Unit 2.

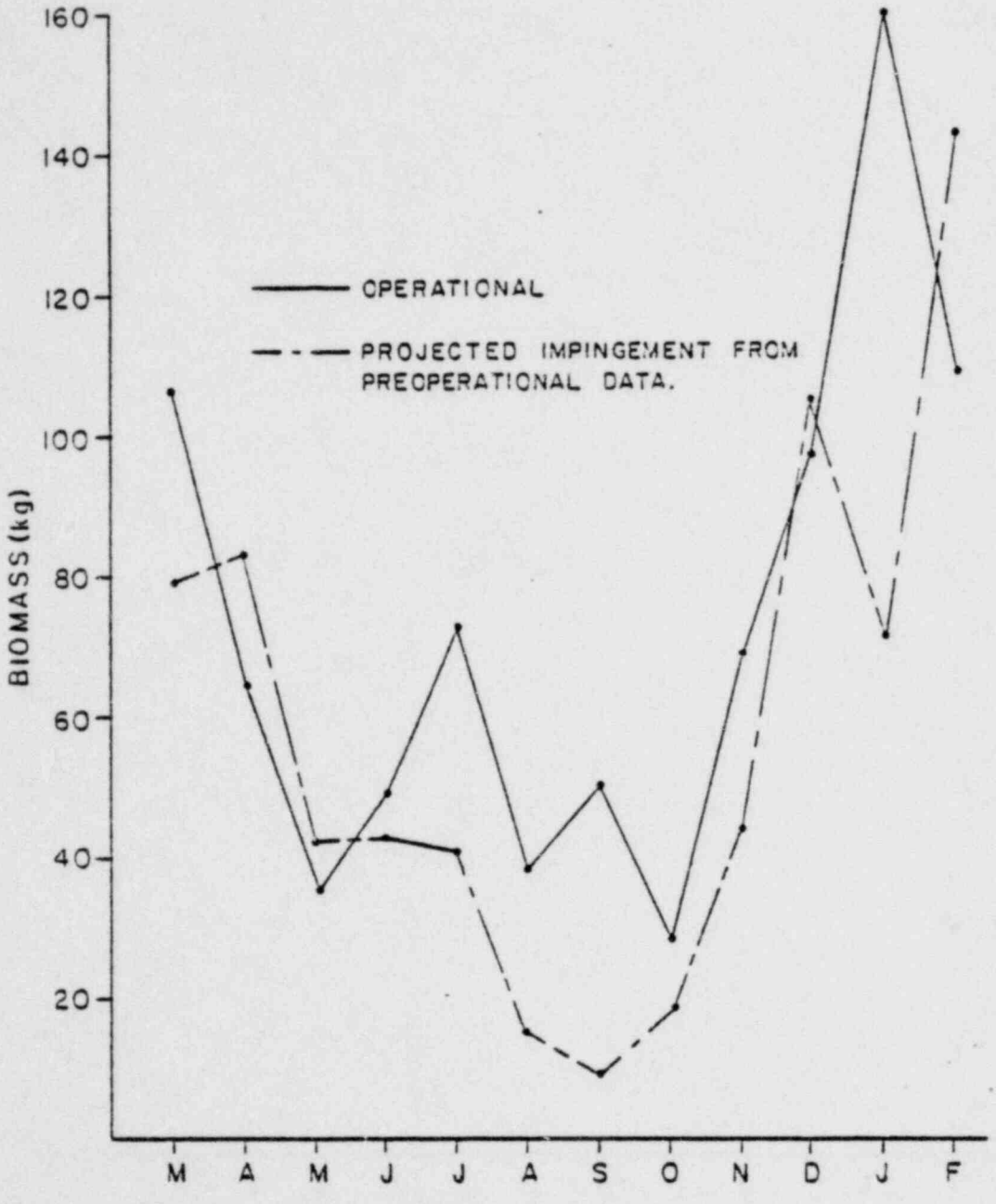

Fig. II-8. Comparison of operational biomass data with that projected from preoperational data.

Appendix II-1. Meanings of computer codes used in Appendicies II-2 and II-3.

Computer Code	Scientific Name	Common Name
FISH	Gnathostomata	Finfish
DASY_S	Dasyatis sabina	Atlantic stingray
OPHI_G	Ophichthus gomesi	Shrimp eel
HARE_P	Harengula pensacolae	Scaled sardine
OPIS_O	Opisthonema oglinum	Atlantic thread herring
ANCH_M	Anchoa mitchelli	Bay anchovy
ARIU_F	Arius felis	Sea catfish
OGCO_R	Ogcocephalus radiatus	Polka-dot batfish
CARA_H	Caranx hippos	Crevalle jack
CHLO_C	Chloroscombrus chrysurus	Atlantic bumper
LUTJ_G	Lutjanus griseus	Gray snapper
EUCI_A	Eucinostomus argenteus	Spotfin mojarra
EUCI_G	Eucinostomus gula	Silver jenny
GRUNTS	Pomadasyidae	Grunts
HAEM_P	Haemulon plumieri	White grunt
ORTH_C	Orthopristis chrysoptera	Pigfish
ARCH_P	Archosagus probatocephalus	Sheepshead
LAGO_R	Lagodon rhomboides	Pinfish
BAIR_C	Bairdiella chrysura	Silver perch
CYNO_N	Cynoscion nebulosus	Spotted seatrout
LEIO_X	Leiostomus xanthurus	Spot
CHAE_F	Chaetodipterus faber	Atlantic spadefish
MULLE	Mugilidae	Mullets
MUGI_C	Mugil cephalus	Striped mullet
SCOR_B	Scorpaena brasiliensis	Barbfish
ANCY_Q	Ancylopsetta quadrocellata	Ocellated flounder
ALUT_S	Aluterus schoepfi	Orange filefish
LACT_Q	Lactophrys quadricornis	Scrawled cowfish
SPHO_N	Sphoeroides nephelus	Southern puffer
CHIL_S	Chilomycterus schoepfi	Striped burrfish
INVERT	Invertebrata	Invertebrate
LOLL_B	Lolliguncula brevis	Brief squid
SQUI_E	Squilla empusa	Mantis shrimp
PENA_D	Penaeus durorarum	Pink shrimp
PENA_S	Penaeus setiferus	White shrimp
TRAC_C	Trachypenaeus constrictus	
PALA_F	Palaemon floridanus	
ALPH_H	Alpheus heterochaelis	
CALL_S	Callinectes sapidus	Blue crab
PORT_G	Portunus gibbesii	
MENI_M	Menippe mercenaria	Stone crab
NEOP_T	Neopanope texana	
LIBI_D	Libinia dubia	
METO_C	Metoporhaphis calcarata	
TOTAL		All organisms

Appendix II-2. Analysis of variance for mean numbers of important finfish and invertebrates impinged at CRPS per 100 m^3 of intake water.

COMBINED LEAST-SQUARES ANALYSIS OF VARIANCE

CARA_H

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	2.635421	0.239584	2.666	0.0053	DAY:MO
DAY:MO	89	7.999393	0.089881	14.440	0.0000	REMAINDR
TIME	3	0.026340	0.008780	1.411	0.2391	REMAINDR
UNIT	2	0.031867	0.015934	2.560	0.0785	REMAINDR
TIDE	2	0.001316	0.000658	0.106	0.8997	REMAINDR
BARGE	1	0.000285	0.000285	0.046	0.8305	REMAINDR
WIND	1	0.000108	0.000108	0.017	0.8950	REMAINDR
REMAINDER	418	2.601883	0.006225			

LUIJ_G

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	0.135820	0.012347	3.125	0.0013	DAY:MO
DAY:MO	89	0.351696	0.003952	0.951	0.6055	REMAINDR
TIME	3	0.012901	0.004300	1.035	0.3770	REMAINDR
UNIT	2	0.012507	0.006253	1.505	0.2233	REMAINDR
TIDE	2	0.016442	0.008221	1.978	0.1396	REMAINDR
BARGE	1	0.000000	0.000000	0.000	0.9933	REMAINDR
WIND	1	0.000296	0.000296	0.071	0.7898	REMAINDR
REMAINDER	418	1.737186	0.004156			

HAEM_P

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	4.568596	0.415327	3.826	0.0002	DAY:MO
DAY:MO	89	9.660154	0.108541	3.790	0.0000	REMAINDR
TIME	3	0.474144	0.158048	5.519	0.0010	REMAINDR
UNIT	2	0.041426	0.020713	0.723	0.4858	REMAINDR
TIDE	2	0.066453	0.033226	1.160	0.3144	REMAINDR
BARGE	1	0.199279	0.199279	6.958	0.0087	REMAINDR
WIND	1	0.009117	0.009117	0.318	0.5729	REMAINDR
REMAINDER	416	11.971371	0.028640			

ORTH_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	2.749487	0.249953	1.991	0.0385	DAY:MO
DAY:MO	89	11.175105	0.125563	3.117	0.0000	REMAINDR
TIME	3	1.572503	0.524168	13.015	0.0000	REMAINDR
UNIT	2	0.915654	0.457827	11.366	0.0000	REMAINDR
TIDE	2	0.038722	0.019361	0.481	0.6187	REMAINDR
BARGE	1	0.022667	0.022667	0.563	0.4536	REMAINDR
WIND	1	0.020680	0.020680	0.513	0.4743	REMAINDR
REMAINDER	418	16.836521	0.040279			

ARCH_P

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	0.005476	0.000496	1.147	0.3358	DAY:MO
DAY:MO	89	0.038633	0.000434	1.196	0.1274	REMAINDR
TIME	3	0.000510	0.000170	0.468	0.7047	REMAINDR
UNIT	2	0.002376	0.001188	3.273	0.0388	REMAINDR
TIDE	2	0.000570	0.000285	0.786	0.4565	REMAINDR
BARGE	1	0.000293	0.000293	0.807	0.3696	REMAINDR

WIND	1	0.010338	0.010338	28.481	0.0000	REMAINDR
REMAINDER	418	0.151728	0.000363			

CYAN_N

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.020222	0.092747	4.011	0.0001	DAY:MO
DAY:MO	89	2.058049	0.023124	1.931	0.0000	REMAINDR
TIME	3	0.149818	0.049939	4.170	0.0063	REMAINDR
UNIT	2	0.180535	0.090268	7.538	0.0006	REMAINDR
TIDE	2	0.033714	0.016857	1.408	0.2458	REMAINDR
BARGE	1	0.000775	0.000775	0.065	0.7993	REMAINDR
WIND	1	0.019748	0.019748	1.649	0.1998	REMAINDR
REMAINDER	418	5.005441	0.011975			

MAGI_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	0.179127	0.016284	1.554	0.1266	DAY:MO
DAY:MO	89	0.932342	0.010476	3.415	0.0000	REMAINDR
TIME	3	0.088265	0.029422	9.591	0.0000	REMAINDR
UNIT	2	0.006362	0.003181	1.037	0.3555	REMAINDR
TIDE	2	0.006729	0.003364	1.097	0.3349	REMAINDR
BARGE	1	0.000026	0.000026	0.008	0.9268	REMAINDR
WIND	1	0.002426	0.002426	0.791	0.3744	REMAINDR
REMAINDER	418	1.282305	0.003068			

LOLL_P

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	22.555287	2.050481	5.499	0.0000	DAY:MO
DAY:MO	89	33.133451	0.372893	4.519	0.0000	REMAINDR
TIME	3	7.718705	2.572902	31.184	0.0000	REMAINDR
UNIT	2	4.178114	2.089057	25.319	0.0000	REMAINDR
TIDE	2	0.126132	0.063066	0.764	0.4662	REMAINDR
BARGE	1	0.423312	0.423312	5.131	0.0240	REMAINDR
WIND	1	0.149866	0.149866	1.816	0.1785	REMAINDR
REMAINDER	418	34.488311	0.082508			

PENA_D

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	63.795939	5.799631	7.094	0.0000	DAY:MO
DAY:MO	89	72.757037	0.817495	5.844	0.0000	REMAINDR
TIME	3	32.924548	10.974849	78.456	0.0000	REMAINDR
UNIT	2	4.596295	2.298147	16.429	0.0000	REMAINDR
TIDE	2	2.853786	1.426893	10.200	0.0000	REMAINDR
BARGE	1	0.002021	0.002021	0.014	0.9044	REMAINDR
WIND	1	0.002732	0.002732	0.020	0.8869	REMAINDR
REMAINDER	418	58.472157	0.139886			

PANA_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.446903	0.131537	10.013	0.0000	DAY:MO
DAY:MO	89	1.169168	0.013137	2.193	0.0000	REMAINDR
TIME	3	0.031337	0.010446	1.744	0.1573	REMAINDR
UNIT	2	0.042278	0.021139	3.529	0.0302	REMAINDR
TIDE	2	0.034361	0.017180	2.868	0.0579	REMAINDR
BARGE	1	0.003452	0.003452	0.576	0.4482	REMAINDR
WIND	1	0.000020	0.000020	0.003	0.9545	REMAINDR

REMAINDER	418	2.503580	0.005989

CALL_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	22.804262	2.073115	5.556	0.0000	DAY:MO
DAY:MO	89	33.210221	0.373149	4.247	0.0000	REMAINDR
TIME	3	8.996802	2.998934	34 [illegible]	0.0000	REMAINDR
UNIT	2	10.708270	5.354135	60. [illegible]	0.0000	REMAINDR
TIDE	2	1.863548	0.931774	10.605	0.0000	REMAINDR
BARGE	1	0.058479	0.058479	0.666	0.4151	REMAINDR
WIND	1	0.062089	0.062089	0.707	0.4010	REMAINDR
REMAINDER	418	36.725615	0.087860			

MENT_M

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	11.492436	1.044767	25.855	0.0000	DAY:MO
DAY:MO	89	3.596339	0.040408	1.555	0.0000	REMAINDR
TIME	3	0.935002	0.311667	11.996	0.0000	REMAINDR
UNIT	2	0.417489	0.208745	8.035	0.0004	REMAINDR
TIDE	2	0.007581	0.003791	0.146	0.8643	REMAINDR
BARGE	1	0.021244	0.021244	0.818	0.3664	REMAINDR
WIND	1	0.022162	0.022162	0.853	0.3562	REMAINDR
REMAINDER	418	10.860053	0.025981			

GRUNTS

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	3.602363	0.327488	1.568	0.1221	DAY:MO
DAY:MO	89	18.584851	0.208819	3.353	0.0000	REMAINDR
TIME	3	2.899507	0.966502	15.517	0.0000	REMAINDR
UNIT	2	1.009085	0.504542	8.101	0.0003	REMAINDR
TIDE	2	0.032416	0.016208	0.260	0.7710	REMAINDR
BARGE	1	0.060031	0.060031	0.964	0.3268	REMAINDR
WIND	1	0.000770	0.000770	0.012	0.9115	REMAINDR
REMAINDER	418	26.035095	0.062285			

MULLET

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.284344	0.116759	2.522	0.0082	DAY:MO
DAY:MO	89	4.119652	0.046288	2.096	0.0000	REMAINDR
TIME	3	0.076919	0.025640	1.161	0.3243	REMAINDR
UNIT	2	0.161530	0.080765	3.657	0.0266	REMAINDR
TIDE	2	0.043349	0.021675	0.981	0.3756	REMAINDR
BARGE	1	0.019360	0.019360	0.877	0.3497	REMAINDR
WIND	1	0.007702	0.007702	0.349	0.5551	REMAINDR
REMAINDER	418	9.230813	0.022083			

FISH

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	99.861789	9.078344	12.247	0.0000	DAY:MO
DAY:MO	89	65.571218	0.741295	7.107	0.0000	REMAINDR
TIME	3	7.741741	2.580580	24.741	0.0000	REMAINDR
UNIT	2	11.280695	5.640347	54.077	0.0000	REMAINDR
TIDE	2	0.023054	0.011527	0.111	0.8954	REMAINDR
BARGE	1	0.000080	0.000080	0.001	0.9780	REMAINDR
WIND	1	0.044034	0.044034	0.422	0.5162	REMAINDR
REMAINDER	418	43.598622	0.104303			

INVERT

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	42.170235	3.833658	8.997	0.0000	DAY:MO
DAY:MO	89	37.922399	0.426094	5.222	0.0000	REMAINDR
TIME	3	14.865991	4.955330	60.727	0.0000	REMAINDR
UNIT	2	5.658058	2.829029	34.670	0.0000	REMAINDR
TIDE	2	1.866667	0.943333	11.561	0.0000	REMAINDR
BARGE	1	0.271189	0.271189	3.323	0.0690	REMAINDR
WIND	1	0.024320	0.024320	0.298	0.585[illegible]	REMAINDR
REMAINDER	416	34.108663	0.081600			

TOTAL

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	64.151681	5.831971	10.290	0.0000	DAY:MO
DAY:MO	89	50.440920	0.566752	7.521	0.0000	REMAINDR
TIME	3	11.457622	3.819207	50.680	0.0000	REMAINDR
UNIT	2	8.[illegible]72145	4.336072	57.539	0.0000	REMAINDR
TIDE	2	0.393230	0.196615	2.609	0.074[illegible]	REMAINDR
BARGE	1	0.049674	0.049674	0.659	0.4173	REMAINDR
WIND	1	0.009709	0.009709	0.129	0.7198	REMAINDR
REMAINDER	418	31.500130	0.075359			

COMBINED LEAST-SQUARES ANALYSIS OF VARIANCE

DASY_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.919045	0.174459	4.090	0.0001	DAY:MO
DAY:MO	89	3.798445	0.042657	3.930	0.0000	REMAINDR
TIME	3	0.070593	0.023531	2.168	0.0912	REMAINDR
UNIT	2	0.368991	0.184495	16.996	0.0000	REMAINDR
TIDE	2	0.009904	0.004952	0.456	0.6340	REMAINDR
BARGE	1	0.001517	0.001517	0.140	0.7087	REMAINDR
WIND	1	0.040289	0.040289	3.712	0.0547	REMAINDR
REMAINDER	416	4.537375	0.010855			

DPHI_G

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	3.005516	0.273229	4.013	0.0001	DAY:MO
DAY:MO	89	6.059160	0.068080	3.798	0.0000	REMAINDR
TIME	3	0.555857	0.185286	10.335	0.0000	REMAINDR
UNIT	2	0.525349	0.262675	14.652	0.0000	REMAINDR
TIDE	2	0.057858	0.028929	1.614	0.2004	REMAINDR
BARGE	1	0.004457	0.004457	0.249	0.6183	REMAINDR
WIND	1	0.039280	0.039280	2.191	0.1396	REMAINDR
REMAINDER	418	7.493562	0.017927			

HARE_P

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	87.409656	7.946332	5.363	0.0000	DAY:MO
DAY:MO	89	131.865139	1.481664	49.183	0.0000	REMAINDR
TIME	3	0.636827	0.212276	7.046	0.0001	REMAINDR
UNIT	2	0.410602	0.205301	6.815	0.0012	REMAINDR
TIDE	2	0.237499	0.118749	3.942	0.0201	REMAINDR
BARGE	1	0.090129	0.090129	2.992	0.0845	REMAINDR
WIND	1	0.001304	0.001304	0.043	0.8353	REMAINDR
REMAINDER	418	12.592392	0.030125			

DPIS_B

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	34.423761	3.129433	5.831	0.0000	DAY:MO
DAY:MO	89	47.769217	0.536733	15.464	0.0000	REMAINDR
TIME	3	0.179680	0.059893	1.726	0.1611	REMAINDR
UNIT	2	0.966148	0.483074	13.918	0.0000	REMAINDR
TIDE	2	0.002682	0.001341	0.039	0.9621	REMAINDR
BARGE	1	0.051746	0.051746	1.491	0.2228	REMAINDR
WIND	1	0.000000	0.000000	0.000	0.9997	REMAINDR
REMAINDER	416	14.508312	0.034709			

AMEH_M

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	71.046961	6.458815	9.808	0.0000	DAY:MO
DAY:MO	89	58.608454	0.658522	4.917	0.0000	REMAINDR
TIME	3	8.779745	2.926582	21.851	0.0000	REMAINDR
UNIT	2	1.568540	0.784270	5.856	0.0031	REMAINDR
TIDE	2	0.435647	0.217824	1.626	0.1979	REMAINDR
BARGE	1	0.287800	0.287800	2.149	0.1435	REMAINDR

WIND	1	0.017689	0.017689	0.132	0.7165	REMAINDR
REMAINDER	416	55.985185	0.133936			

ARID_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	106.230337	9.657303	10.247	0.0000	DAY:MO
DAY:MO	89	83.881121	0.942485	29.550	0.0000	REMAINDR
TIME	3	0.259277	0.086426	2.710	0.0448	REMAINDR
UNIT	2	0.897102	0.448551	14.064	0.0000	REMAINDR
TIDE	2	0.007969	0.003985	0.125	0.8826	REMAINDR
BARGE	1	0.031986	0.031986	1.003	0.3172	REMAINDR
WIND	1	0.031698	0.031698	0.994	0.3194	REMAINDR
REMAINDER	416	13.331760	0.031894			

UCCD_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	41.176044	3.743277	9.719	0.0000	DAY:MO
DAY:MO	89	34.278059	0.385147	4.240	0.0000	REMAINDR
TIME	3	4.733839	1.577946	17.373	0.0000	REMAINDR
UNIT	2	14.293161	7.146581	78.683	0.0000	REMAINDR
TIDE	2	0.019400	0.009700	0.107	0.8987	REMAINDR
BARGE	1	0.992667	0.992667	10.929	0.0010	REMAINDR
WIND	1	0.306767	0.306767	3.377	0.0668	REMAINDR
REMAINDER	416	37.965790	0.090827			

CHLD_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	7.432964	0.675724	4.366	0.0000	DAY:MO
DAY:MO	89	13.774916	0.154774	5.864	0.0000	REMAINDR
TIME	3	0.459988	0.153329	5.809	0.0007	REMAINDR
UNIT	2	0.498140	0.249070	9.437	0.0001	REMAINDR
TIDE	2	0.047984	0.023992	0.909	0.4037	REMAINDR
BARGE	1	0.089688	0.089688	3.398	0.0660	REMAINDR
WIND	1	0.006642	0.006642	0.252	0.6162	REMAINDR
REMAINDER	416	11.032817	0.026394			

EUCI_A

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	12.950681	1.177335	4.004	0.0001	DAY:MO
DAY:MO	89	26.166525	0.294006	8.975	0.0000	REMAINDR
TIME	3	0.568376	0.189459	5.783	0.0007	REMAINDR
UNIT	2	0.058182	0.029091	0.888	0.4122	REMAINDR
TIDE	2	0.166159	0.083079	2.536	0.0803	REMAINDR
BARGE	1	0.519281	0.519281	15.852	0.0001	REMAINDR
WIND	1	0.007942	0.007942	0.242	0.6227	REMAINDR
REMAINDER	416	13.693078	0.032759			

EUCI_G

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	13.387024	1.21700	3.349	0.0007	DAY:MO
DAY:MO	89	32.339874	0.363369	29.143	0.0000	REMAINDR
TIME	3	0.184969	0.061656	4.945	0.0022	REMAINDR
UNIT	2	0.080089	0.040044	3.212	0.0413	REMAINDR
TIDE	2	0.122070	0.061035	4.895	0.0079	REMAINDR
BARGE	1	0.071769	0.071769	5.756	0.0169	REMAINDR
WIND	1	0.000930	0.000930	0.075	0.7849	REMAINDR

REMAINDER	416	5.211615	0.012468

LAGD_R

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	127.644585	11.604051	18.866	0.0000	DAY:MO
DAY:MO	89	54.743046	0.615090	4.231	0.0000	REMAINDR
TIME	3	7.891750	2.630583	18.094	0.0000	REMAINDR
UNIT	2	4.123629	2.061814	14.182	0.0000	REMAINDR
TIDE	2	0.048132	0.024066	0.166	0.8475	REMAIND.
BARGE	1	0.001319	0.001319	0.009	0.9242	REMAINDR
WIND	1	0.034250	0.034250	0.236	0.6277	REMAINDR
REMAINDER	416	60.770506	0.145384			

BAIR_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	142.566966	12.960633	19.349	0.0000	DAY:MO
DAY:MO	89	59.616630	0.669850	4.890	0.0000	REMAINDR
TIME	3	6.784574	2.261525	16.508	0.0000	REMAINDR
UNIT	2	10.694578	5.347289	39.033	0.0000	REMAINDR
TIDE	2	0.069331	0.034665	0.253	0.7765	REMAINDR
BARGE	1	0.153037	0.153037	1.117	0.2912	REMAINDR
WIND	1	0.980818	0.980818	7.160	0.0078	REMAINDR
REMAINDER	416	57.262891	0.136993			

LEIO_X

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	63.285098	5.753191	15.385	0.0000	DAY:MO
DAY:MO	89	33.455489	0.375904	3.534	0.0000	REMAINDR
TIME	3	4.774792	1.591597	14.962	0.0000	REMAINDR
UNIT	2	2.219711	1.109856	10.433	0.0000	REMAINDR
TIDE	2	0.036821	0.018410	0.173	0.8411	REMAINDR
BARGE	1	0.000643	0.000643	0.006	0.9381	REMAINDR
WIND	1	0.273294	0.273294	2.569	0.1097	REMAINDR
REMAINDER	416	44.464820	0.106375			

CHAF_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.050250	0.095477	2.901	0.0026	DAY:MO
DAY:MO	89	2.929047	0.032911	2.265	0.0000	REMAINDR
TIME	3	0.041143	0.013714	0.944	0.4194	REMAINDR
UNIT	2	0.163954	0.081977	5.641	0.0038	REMAINDR
TIDE	2	0.001881	0.000940	0.065	0.9373	REMAINDR
BARGE	1	0.111054	0.111054	7.642	0.0060	REMAINDR
WIND	1	0.000774	0.000774	0.053	0.8176	REMAINDR
REMAINDER	418	6.074803	0.014533			

SCUR_B

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.338702	0.121700	6.795	0.0000	DAY:MO
DAY:MO	89	1.594079	0.017911	2.479	0.0000	REMAINDR
TIME	3	0.020048	0.006683	0.925	0.4266	REMAINDR
UNIT	2	0.032428	0.016214	2.244	0.1072	REMAINDR
TIDE	2	0.011127	0.005563	0.770	0.4637	REMAINDR
BARGE	1	0.002808	0.002808	0.389	0.5334	REMAINDR
WIND	1	0.002774	0.002774	0.384	0.5359	REMAINDR
REMAINDER	418	3.020084	0.007225			

AMLY_Q

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	43.974312	3.997665	18.518	0.0000	DAY:MO
DAY:MO	89	19.213477	0.215882	8.926	0.0000	REMAINDR
TIME	3	1.533374	0.511125	21.134	0.0000	REMAINDR
UNIT	2	0.224217	0.112109	4.635	0.0102	REMAINDR
TIDE	2	0.054028	0.027014	1.117	0.3282	REMAINDR
BARGE	1	0.003210	0.003210	0.133	0.7158	REMAINDR
WIND	1	0.319584	0.319584	13.214	0.0003	REMAINDR
REMAINDER	416	10.109322	0.024185			

ALUT_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	6.129067	0.557188	1.947	0.0436	DAY:MO
DAY:MO	89	25.471739	0.286199	13.365	0.0000	REMAINDR
TIME	3	0.051915	0.017305	0.808	0.4899	REMAINDR
UNIT	2	0.654752	0.327376	15.287	0.0000	REMAINDR
TIDE	2	0.020372	0.010186	0.476	0.6218	REMAINDR
BARGE	1	0.025195	0.025195	1.177	0.2787	REMAINDR
WIND	1	0.000763	0.000763	0.036	0.8503	REMAINDR
REMAINDER	416	8.951382	0.021415			

LACT_Q

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	84.943388	7.722126	25.675	0.0000	DAY:MO
DAY:MO	89	26.767565	0.300759	9.085	0.0000	REMAINDR
TIME	3	0.257497	0.085832	2.593	0.0523	REMAINDR
UNIT	2	0.575040	0.287520	8.685	0.0002	REMAINDR
TIDE	2	0.033582	0.016791	0.507	0.6025	REMAINDR
BARGE	1	0.177466	0.177466	5.361	0.0211	REMAINDR
WIND	1	0.088722	0.088722	2.680	0.1024	REMAINDR
REMAINDER	416	13.838150	0.033106			

SPHD_N

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	24.790670	2.253697	15.577	0.0000	DAY:MO
DAY:MO	89	12.876258	0.144677	5.023	0.0000	REMAINDR
TIME	3	0.537740	0.179247	6.223	0.0004	REMAINDR
UNIT	2	0.105995	0.052998	1.840	0.1601	REMAINDR
TIDE	2	0.010802	0.005401	0.187	0.8291	REMAINDR
BARGE	1	0.000396	0.000396	0.014	0.9067	REMAINDR
WIND	1	0.112514	0.112514	3.906	0.0488	REMAINDR
REMAINDER	416	12.040632	0.028805			

CHIL_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	7.919720	0.629065	5.162	0.0000	DAY:MO
DAY:MO	89	10.845372	0.121858	4.258	0.0000	REMAINDR
TIME	3	0.140616	0.046872	1.638	0.1800	REMAINDR
UNIT	2	0.820250	0.410125	14.332	0.0000	REMAINDR
TIDE	2	0.114806	0.057403	2.006	0.1358	REMAINDR
BARGE	1	0.136156	0.136156	4.758	0.0297	REMAINDR
WIND	1	0.049484	0.049484	1.729	0.1892	REMAINDR
REMAINDER	418	11.961659	0.028616			

TRAC_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	12.235399	1.112309	2.572	0.0070	DAY:MO
DAY:MO	89	38.491589	0.432490	5.019	0.0000	REMAINDR
TIME	3	4.511088	1.503696	17.449	0.0000	REMAINDR
UNIT	2	0.478880	0.239440	2.778	0.0632	REMAINDR
TIDE	2	0.715192	0.357596	4.150	0.0164	REMAINDR
BARGE	1	0.393357	0.393357	4.564	0.0333	REMAINDR
WIND	1	0.003520	0.003520	0.041	0.8399	REMAINDR
REMAINDER	418	36.022248	0.086178			

ALPH_H

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	15.469308	1.406301	9.441	0.0000	DAY:MO
DAY:MO	89	13.257324	0.148959	5.168	0.0000	REMAINDR
TIME	3	1.109478	0.369826	12.831	0.0000	REMAINDR
UNIT	2	0.115592	0.057796	2.005	0.1359	REMAINDR
TIDE	2	0.107708	0.053854	1.868	0.1556	REMAINDR
BARGE	1	0.025220	0.025220	0.875	0.3501	REMAINDR
WIND	1	0.172761	0.172761	5.994	0.0148	REMAINDR
REMAINDER	418	12.048267	0.028824			

PALA_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	23.206481	2.109680	6.720	0.0000	DAY:MO
DAY:MO	89	27.939351	0.313925	5.578	0.0000	REMAINDR
TIME	3	1.700994	0.566998	10.074	0.0000	REMAINDR
UNIT	2	1.182408	0.591204	10.504	0.0000	REMAINDR
TIDE	2	0.065151	0.032576	0.579	0.5610	REMAINDR
BARGE	1	0.011315	0.011315	0.201	0.6541	REMAINDR
WIND	1	0.151753	0.151753	2.696	0.1014	REMAINDR
REMAINDER	416	23.526428	0.056283			

PORT_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	132.239288	12.021753	24.649	0.0000	DAY:MO
DAY:MO	89	43.407556	0.487725	5.897	0.0000	REMAINDR
TIME	3	6.694684	2.231561	26.981	0.0000	REMAINDR
UNIT	2	3.264885	1.632443	19.736	0.0000	REMAINDR
TIDE	2	3.045087	1.522543	18.409	0.0000	REMAINDR
BARGE	1	1.063324	1.063324	12.856	0.0004	REMAINDR
WIND	1	0.080469	0.080469	0.973	0.3245	REMAINDR
REMAINDER	416	34.571571	0.082707			

NEUP_T

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	29.823929	2.711266	8.809	0.0000	DAY:MO
DAY:MO	89	27.392167	0.307777	5.192	0.0000	REMAINDR
TIME	3	0.322127	0.107376	1.811	0.1444	REMAINDR
UNIT	2	0.478249	0.239124	4.034	0.0184	REMAINDR
TIDE	2	0.110971	0.055486	0.936	0.3930	REMAINDR
BARGE	1	0.004024	0.004024	0.068	0.7946	REMAINDR
WIND	1	0.131912	0.131912	2.225	0.1365	REMAINDR
REMAINDER	418	24.779636	0.059281			

LIBI_D

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	4.758174	0.432561	5.569	0.0000	DAY:MO
DAY:MO	89	6.913058	0.077675	2.233	0.0000	REMAINDR
TIME	3	0.256186	0.085395	2.455	0.0626	REMAINDR
UNIT	2	1.526107	0.763053	21.941	0.0000	REMAINDR
TIDE	2	0.028454	0.014227	0.409	0.6645	REMAINDR
BARGE	1	0.004653	0.004653	0.134	0.7147	REMAINDR
WIND	1	0.119971	0.119971	3.450	0.0640	REMAINDR
REMAINDER	418	14.537158	0.034778			

MEID_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	119.598062	10.872551	33.911	0.0000	DAY:MO
DAY:MO	89	28.535028	0.320618	4.292	0.0000	REMAINDR
TIME	3	2.214652	0.738217	9.883	0.0000	REMAINDR
UNIT	2	2.516467	1.258233	16.845	0.0000	REMAINDR
TIDE	2	0.679995	0.339997	4.552	0.0111	REMAINDR
BARGE	1	0.041632	0.041632	0.557	0.4558	REMAINDR
WIND	1	0.012488	0.012488	0.167	0.6828	REMAINDR
REMAINDER	418	31.222119	0.074694			

SOUI_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.156934	0.105176	4.033	0.0001	DAY:MO
DAY:MO	89	2.321047	0.026079	2.715	0.0000	REMAINDR
TIME	3	0.366034	0.122011	12.703	0.0000	REMAINDR
UNIT	2	0.013153	0.006576	0.685	0.5048	REMAINDR
TIDE	2	0.062907	0.031453	3.275	0.0388	REMAINDR
BARGE	1	0.000001	0.000001	0.000	0.9941	REMAINDR
WIND	1	0.003390	0.003390	0.353	0.5528	REMAINDR
REMAINDER	418	4.014786	0.009605			

Appendix II-3. Analysis of variance for mean biomass of important finfish and invertebrates impinged at CRPS per 100 m^3 of intake water.

CARA_H

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	36.620336	3.329121	4.020	0.0001	DAY:MO
DAY:MO	89	73.703391	0.828128	20.994	0.0000	REMAINDR
TIME	3	0.074972	0.024991	0.634	0.5937	REMAINDR
UNIT	2	0.377828	0.188914	4.789	0.0088	REMAINDR
TIDE	2	0.289123	0.144562	3.665	0.0264	REMAINDR
BARGE	1	0.106660	0.106660	2.704	0.1009	REMAINDR
WIND	1	0.000013	0.000013	0.000	0.9858	REMAINDR
REMAINDER	418	16.480085	0.039445			

LUTJ_G

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	1.564251	0.142205	3.112	0.0014	DAY:MO
DAY:MO	89	4.066576	0.045692	1.118	0.2368	REMAINDR
TIME	3	0.113841	0.037947	0.928	0.4270	REMAINDR
UNIT	2	0.062502	0.031251	0.764	0.4663	REMAINDR
TIDE	2	0.123718	0.061859	1.513	0.2214	REMAINDR
BARGE	1	0.013444	0.013444	0.329	0.5666	REMAINDR
WIND	1	0.002376	0.002376	0.058	0.8096	REMAINDR
REMAINDER	418	17.088935	0.040883			

HAEM_P

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	11.108049	1.009823	5.745	0.0000	DAY:MO
DAY:MO	89	15.642837	0.175762	2.462	0.0000	REMAINDR
TIME	3	0.712941	0.237647	3.330	0.0196	REMAINDR
UNIT	2	0.093260	0.046630	0.653	0.5208	REMAINDR
TIDE	2	0.131455	0.065727	0.921	0.3990	REMAINDR
BARGE	1	0.422076	0.422076	5.913	0.0155	REMAINDR
WIND	1	0.082272	0.082272	1.153	0.2836	REMAINDR
REMAINDER	418	29.834984	0.071376			

ORTH_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	25.465132	2.315012	3.454	0.0005	DAY:MO
DAY:MO	89	59.651094	0.670237	7.721	0.0000	REMAINDR
TIME	3	6.932599	2.310866	9.383	0.0000	REMAINDR
UNIT	2	5.748540	2.874270	11.670	0.0000	REMAINDR
TIDE	2	0.134500	0.067250	0.273	0.7612	REMAINDR
BARGE	1	0.107887	0.107887	0.438	0.5084	REMAINDR
WIND	1	0.171126	0.171126	0.695	0.4050	REMAINDR
REMAINDER	418	102.950801	0.246294			

ARCH_P

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	0.452704	0.041155	1.081	0.3856	DAY:MO
DAY:MO	89	3.388145	0.038069	1.272	0.0633	REMAINDR
TIME	3	0.036871	0.012290	0.411	0.7455	REMAINDR
UNIT	2	0.194610	0.097305	3.251	0.0397	REMAINDR
TIDE	2	0.054737	0.027368	0.914	0.4016	REMAINDR
BARGE	1	0.019251	0.019251	0.643	0.4231	REMAINDR
WIND	1	1.037824	1.037824	34.669	0.0000	REMAINDR
REMAINDER	418	12.512782	0.029935			

CYNO_N

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	13.661266	1.241933	4.914	0.0000	DAY:MO
DAY:MO	89	22.495510	0.252759	1.843	0.0000	REMAINDR
TIME	3	1.219135	0.406378	2.964	0.0320	REMAINDR
UNIT	2	1.378262	0.689131	5.026	0.0069	REMAINDR
TIDE	2	0.366256	0.183128	1.335	0.2641	REMAINDR
BARGE	1	0.030404	0.030404	0.222	0.6380	REMAINDR
WIND	1	0.169435	0.169435	1.236	0.2670	REMAINDR
REMAINDER	418	57.318525	0.137126			

MUGI_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	4.417004	0.401546	2.279	0.0167	DAY:MO
DAY:MO	89	15.681414	0.176196	3.935	0.0000	REMAINDR
TIME	3	1.164190	0.388063	8.668	0.0000	REMAINDR
UNIT	2	0.101973	0.050986	1.139	0.3212	REMAINDR
TIDE	2	0.009361	0.004680	0.105	0.9008	REMAINDR
BARGE	1	0.015732	0.015732	0.351	0.5537	REMAINDR
WIND	1	0.239323	0.239323	5.346	0.0213	REMAINDR
REMAINDER	418	18.714223	0.044771			

LOLE_B

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	55.003465	5.000315	4.465	0.0000	DAY:MO
DAY:MO	89	99.661345	1.119790	3.720	0.0000	REMAINDR
TIME	3	19.771484	6.590495	21.897	0.0000	REMAINDR
UNIT	2	9.322156	4.661078	15.486	0.0000	REMAINDR
TIDE	2	0.261918	0.130959	0.435	0.6475	REMAINDR
BARGE	1	1.953600	1.953600	6.491	0.0112	REMAINDR
WIND	1	0.310178	0.310178	1.031	0.3106	REMAINDR
REMAINDER	418	125.810979	0.300983			

PENA_D

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	111.991987	10.181090	8.377	0.0000	DAY:MO
DAY:MO	89	108.170598	1.215400	4.923	0.0000	REMAINDR
TIME	3	56.481930	18.827310	76.263	0.0000	REMAINDR
UNIT	2	8.069289	4.034645	16.343	0.0000	REMAINDR
TIDE	2	4.025759	2.012880	8.153	0.0003	REMAINDR
BARGE	1	0.000006	0.000006	0.000	0.9962	REMAINDR
WIND	1	0.068494	0.068494	0.277	0.5987	REMAINDR
REMAINDER	418	103.193442	0.246874			

PANA_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	18.660028	1.696366	12.357	0.0000	DAY:MO
DAY:MO	89	12.217625	0.137277	2.135	0.0000	REMAINDR
TIME	3	0.266636	0.088879	1.383	0.2476	REMAINDR
UNIT	2	0.573929	0.286964	4.464	0.0121	REMAINDR
TIDE	2	0.342396	0.171198	2.663	0.0709	REMAINDR
BARGE	1	0.017746	0.017746	0.276	0.5996	REMAINDR
WIND	1	0.000029	0.000029	0.000	0.9831	REMAINDR
REMAINDER	418	26.871981	0.064287			

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	135.171950	12.288359	9.671	0.0000	DAY:MO
DAY:MO	89	113.090309	1.270678	2.719	0.0000	REMAINDR
TIME	3	15.525295	5.175098	11.074	0.0000	REMAINDR
UNIT	2	55.734974	27.867487	59.630	0.0000	REMAINDR
TIDE	2	5.327522	2.663761	5.700	0.0036	REMAINDR
BARGE	1	0.007314	0.007314	0.016	0.9005	REMAINDR
WIND	1	0.013908	0.013908	0.030	0.8631	REMAINDR
REMAINDER	418	195.348356	0.467341			

MENI_M

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	54.752023	4.977457	10.612	0.0000	DAY:MO
DAY:MO	89	41.744661	0.469041	1.402	0.0000	REMAINDR
TIME	3	15.025658	5.008553	14.968	0.0000	REMAINDR
UNIT	2	5.026840	2.513420	7.511	0.0006	REMAINDR
TIDE	2	0.161091	0.080545	0.241	0.7862	REMAINDR
BARGE	1	1.335458	1.335458	3.991	0.0464	REMAINDR
WIND	1	0.277996	0.277996	0.831	0.3626	REMAINDR
REMAINDER	418	139.872253	0.334623			

GRUNTS

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	30.599442	2.781767	3.907	0.0001	DAY:MO
DAY:MO	89	63.362581	0.711939	2.724	0.0000	REMAINDR
TIME	3	8.866660	2.955553	11.308	0.0000	REMAINDR
UNIT	2	4.582220	2.291110	8.766	0.0002	REMAINDR
TIDE	2	0.229894	0.114947	0.440	0.6445	REMAINDR
BARGE	1	0.023018	0.023018	0.088	0.7668	REMAINDR
WIND	1	0.048982	0.048982	0.187	0.6653	REMAINDR
REMAINDER	418	109.253308	0.261372			

MULLET

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	4.827071	0.438825	1.901	0.0495	DAY:MO
DAY:MO	89	20.539877	0.230785	3.291	0.0000	REMAINDR
TIME	3	0.933858	0.311286	4.439	0.0044	REMAINDR
UNIT	2	0.019427	0.009713	0.139	0.8707	REMAINDR
TIDE	2	0.006830	0.003415	0.049	0.9525	REMAINDR
BARGE	1	0.004572	0.004572	0.065	0.7986	REMAINDR
WIND	1	0.236110	0.236110	3.367	0.0672	REMAINDR
REMAINDER	418	29.313563	0.070128			

FISH

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	68.586019	6.235093	10.005	0.0000	DAY:MO
DAY:MO	89	55.462921	0.623179	3.722	0.0000	REMAINDR
TIME	3	6.581703	2.193901	13.102	0.0000	REMAINDR
UNIT	2	23.788013	11.894007	71.032	0.0000	REMAINDR
TIDE	2	0.145963	0.072981	0.436	0.6470	REMAINDR
BARGE	1	0.834542	0.834542	4.984	0.0261	REMAINDR
WIND	1	0.203744	0.203744	1.217	0.2707	REMAINDR
REMAINDER	418	69.992217	0.167445			

INVERT

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	24.453663	2.223060	4.542	0.0000	DAY:MO
DAY:MO	89	43.560985	0.489449	2.733	0.0000	REMAINDR
TIME	3	18.748719	6.249573	34.900	0.0000	REMAINDR
UNIT	2	24.548988	12.274494	68.546	0.0000	REMAINDR
TIDE	2	3.029923	1.514961	8.460	0.0002	REMAINDR
BARGE	1	0.138410	0.138410	0.773	0.3798	REMAINDR
WIND	1	0.062656	0.062656	0.350	0.5545	REMAINDR
REMAINDER	418	74.851000	0.179069			

TOTAL

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	29.636769	2.694252	6.835	0.0000	DAY:MO
DAY:MO	89	35.081552	0.394175	4.048	0.0000	REMAINDR
TIME	3	8.221338	2.740439	28.145	0.0000	REMAINDR
UNIT	2	20.263955	10.131978	104.057	0.0000	REMAINDR
TIDE	2	0.244881	0.122440	1.257	0.2854	REMAINDR
BARGE	1	0.395726	0.395726	4.064	0.0445	REMAINDR
WIND	1	0.070824	0.070824	0.727	0.3942	REMAINDR
REMAINDER	418	40.700423	0.097369			

COMBINED LEAST-SQUARES ANALYSIS OF VARIANCE

DASY_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	82.168384	7.469853	6.754	0.0000	DAY:MO
DAY:MO	89	98.439869	1.106066	2.402	0.0000	REMAINDR
TIME	3	1.684278	0.561426	1.219	0.3022	REMAINDR
UNIT	2	11.502597	5.751299	12.492	0.0000	REMAINDR
TIDE	2	0.534877	0.267439	0.581	0.5598	REMAINDR
BARGE	1	0.017296	0.017296	0.038	0.8464	REMAINDR
WIND	1	4.058037	4.058037	8.814	0.0032	REMAINDR
REMAINDER	418	192.445758	0.460397			

BPHI_G

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	38.141799	3.467436	5.095	0.0000	DAY:MO
DAY:MO	89	60.575340	0.680622	2.407	0.0000	REMAINDR
TIME	3	6.651516	2.217172	7.840	0.0001	REMAINDR
UNIT	2	13.615501	6.807751	24.072	0.0000	REMAINDR
TIDE	2	0.361084	0.180542	0.638	0.5286	REMAINDR
BARGE	1	0.021121	0.021121	0.075	0.7848	REMAINDR
WIND	1	0.133244	0.133244	0.471	0.4928	REMAINDR
REMAINDER	418	118.211390	0.282802			

BARE_P

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	192.657414	17.514310	7.490	0.0000	DAY:MO
DAY:MO	89	208.116002	2.338382	25.297	0.0000	REMAINDR
TIME	3	2.526991	0.842330	9.113	0.0000	REMAINDR
UNIT	2	1.695066	0.847533	9.169	0.0001	REMAINDR
TIDE	2	0.682910	0.341455	3.694	0.0257	REMAINDR
BARGE	1	0.269462	0.269462	2.915	0.0885	REMAINDR
WIND	1	0.004145	0.004145	0.045	0.8324	REMAINDR
REMAINDER	418	38.638222	0.092436			

BPIS_D

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	103.610293	9.419118	6.519	0.0000	DAY:MO
DAY:MO	89	128.587814	1.444807	12.955	0.0000	REMAINDR
TIME	3	1.501286	0.500429	4.487	0.0041	REMAINDR
UNIT	2	3.163933	1.581966	14.185	0.0000	REMAINDR
TIDE	2	0.311843	0.155921	1.398	0.2482	REMAINDR
BARGE	1	0.281885	0.281885	2.527	0.1127	REMAINDR
WIND	1	0.000433	0.000433	0.004	0.9503	REMAINDR
REMAINDER	418	46.618585	0.111528			

ANEH_M

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	104.923749	9.538523	11.390	0.0000	DAY:MO
DAY:MO	89	74.532758	0.837447	5.122	0.0000	REMAINDR
TIME	3	11.394006	3.798002	23.231	0.0000	REMAINDR
UNIT	2	1.411605	0.705802	4.317	0.0139	REMAINDR
TIDE	2	0.460755	0.230377	1.409	0.2455	REMAINDR
BARGE	1	0.362930	0.362930	2.220	0.1370	REMAINDR

REMAINDER 418 [illegible] [illegible]

ARIU_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	242.429238	22.039022	12.676	0.0000	DAY:MO
DAY:MO	89	154.737975	1.738629	11.277	0.0000	REMAINDR
TIME	3	0.939674	0.313225	2.032	0.1088	REMAINDR
UNIT	2	1.717546	0.858773	5.570	0.0041	REMAINDR
TIDE	2	0.313973	0.156987	1.018	0.3621	REMAINDR
BARGE	1	0.126892	0.126892	0.823	0.3648	REMAINDR
WIND	1	0.051126	0.051126	0.332	0.5650	REMAINDR
REMAINDER	418	64.442776	0.154169			

UCCD_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	123.730635	11.248240	10.958	0.0000	DAY:MO
DAY:MO	89	91.358060	1.026495	2.610	0.0000	REMAINDR
TIME	3	9.612920	3.204307	8.147	0.0000	REMAINDR
UNIT	2	40.177024	20.088512	51.076	0.0000	REMAINDR
TIDE	2	0.209415	0.104708	0.266	0.7664	REMAINDR
BARGE	1	2.782734	2.782734	7.075	0.0081	REMAINDR
WIND	1	2.117665	2.117665	5.384	0.0208	REMAINDR
REMAINDER	418	164.401452	0.393305			

CHLO_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	46.427621	4.220693	5.211	0.0000	DAY:MO
DAY:MO	89	72.079436	0.809881	3.308	0.0000	REMAINDR
TIME	3	1.342251	0.447417	1.827	0.1415	REMAINDR
UNIT	2	0.713955	0.356978	1.458	0.2339	REMAINDR
TIDE	2	0.290011	0.145005	0.592	0.5535	REMAINDR
BARGE	1	0.216101	0.216101	0.883	0.3481	REMAINDR
WIND	1	0.020669	0.020669	0.084	0.7715	REMAINDR
REMAINDER	418	102.342232	0.244838			

EUCI_A

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	44.883907	4.080355	6.084	0.0000	DAY:MO
DAY:MO	89	59.685807	0.670627	9.113	0.0000	REMAINDR
TIME	3	0.935179	0.311726	4.236	0.0058	REMAINDR
UNIT	2	0.061529	0.030764	0.418	0.6586	REMAINDR
TIDE	2	0.334189	0.167094	2.271	0.1045	REMAINDR
BARGE	1	1.137609	1.137609	15.459	0.0001	REMAINDR
WIND	1	0.008405	0.008405	0.114	0.7356	REMAINDR
REMAINDER	418	30.759909	0.073588			

EUCI_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	50.922518	4.629229	5.086	0.0000	DAY:MO
DAY:MO	89	80.853951	0.908471	18.454	0.0000	REMAINDR
TIME	3	0.649874	0.216628	4.400	0.0046	REMAINDR
UNIT	2	0.357788	0.178894	3.634	0.0272	REMAINDR
TIDE	2	0.111672	0.055836	1.134	0.3226	REMAINDR
BARGE	1	0.104956	0.104956	2.132	0.1450	REMAINDR
WIND	1	0.001724	0.001724	0.035	0.8516	REMAINDR

EAGP_R

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	216.995630	19.726875	17.558	0.0000	DAY:MO
DAY:MO	89	99.994435	1.123533	3.349	0.0000	REMAINDR
TIME	3	18.664534	6.221511	18.548	0.0000	REMAINDR
UNIT	2	11.699924	5.849962	17.440	0.0000	REMAINDR
TIDE	2	0.173315	0.086658	0.258	0.7724	REMAINDR
BARGE	1	0.006959	0.006959	0.021	0.8856	REMAINDR
WIND	1	0.123462	0.123462	0.368	0.5444	REMAINDR
REMAINDER	418	140.212397	0.335436			

BAIR_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	325.464098	29.587645	21.683	0.0000	DAY:MO
DAY:MO	89	121.445439	1.364555	6.569	0.0000	REMAINDR
TIME	3	11.449690	3.816563	18.372	0.0000	REMAINDR
UNIT	2	14.711680	7.355840	35.410	0.0000	REMAINDR
TIDE	2	0.066280	0.033140	0.160	0.8526	REMAINDR
BARGE	1	0.168616	0.168616	0.812	0.3682	REMAINDR
WIND	1	1.764178	1.764178	8.492	0.0038	REMAINDR
REMAINDER	418	86.833065	0.207735			

LEIO_X

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	117.990223	10.726384	12.278	0.0000	DAY:MO
DAY:MO	89	77.350318	0.873599	2.979	0.0000	REMAINDR
TIME	3	10.720323	3.573441	12.187	0.0000	REMAINDR
UNIT	2	11.076892	5.538446	18.889	0.0000	REMAINDR
TIDE	2	0.041043	0.020522	0.070	0.9324	REMAINDR
BARGE	1	0.054452	0.054452	0.186	0.6667	REMAINDR
WIND	1	0.031132	0.031132	0.106	0.7447	REMAINDR
REMAINDER	418	122.565008	0.293218			

CHAF_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	9.199004	0.836282	3.041	0.0017	DAY:MO
DAY:MO	89	24.473682	0.274985	1.916	0.0000	REMAINDR
TIME	3	0.717339	0.239113	1.666	0.1737	REMAINDR
UNIT	2	0.626014	0.313007	2.181	0.1142	REMAINDR
TIDE	2	0.051968	0.025984	0.181	0.8345	REMAINDR
BARGE	1	0.769597	0.769597	5.362	0.0211	REMAINDR
WIND	1	0.002154	0.002154	0.015	0.9026	REMAINDR
REMAINDER	418	59.990748	0.143519			

SCOR_R

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	51.054634	4.641330	7.809	0.0000	DAY:MO
DAY:MO	89	52.894436	0.594320	2.844	0.0000	REMAINDR
TIME	3	0.217582	0.072527	0.347	0.7913	REMAINDR
UNIT	2	0.625472	0.312736	1.497	0.2250	REMAINDR
TIDE	2	0.235003	0.117501	0.562	0.5703	REMAINDR
BARGE	1	0.143096	0.143096	0.685	0.4084	REMAINDR
WIND	1	0.521897	0.521897	2.498	0.1148	REMAINDR
REMAINDER	416	87.345616	0.208961			

ANLY_O

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	58.238374	5.294398	17.316	0.0000	DAY:MO
DAY:MO	89	27.212439	0.305758	3.389	0.0000	REMAINDR
TIME	3	4.448045	1.482682	16.434	0.0000	REMAINDR
UNIT	2	1.403934	0.701967	7.781	0.0005	REMAINDR
TIDE	2	0.051683	0.025841	0.286	0.7511	REMAINDR
BARGE	1	0.249453	0.249453	2.765	0.0971	REMAINDR
WIND	1	0.496294	0.496294	5.501	0.0195	REMAINDR
REMAINDER	418	37.711220	0.090218			

AEUT_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	14.890814	1.353710	2.409	0.0114	DAY:MO
DAY:MO	89	50.020731	0.562031	3.089	0.0000	REMAINDR
TIME	3	1.058982	0.352994	1.940	0.1224	REMAINDR
UNIT	2	3.854251	1.927126	10.593	0.0000	REMAINDR
TIDE	2	0.124158	0.062079	0.341	0.7111	REMAINDR
BARGE	1	0.284060	0.284060	1.561	0.2122	REMAINDR
WIND	1	0.005104	0.005104	0.028	0.8671	REMAINDR
REMAINDER	418	76.043527	0.181922			

LACT_O

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	334.594168	30.417652	21.939	0.0000	DAY:MO
DAY:MO	89	123.394111	1.386451	5.569	0.0000	REMAINDR
TIME	3	2.120034	0.706678	2.838	0.0378	REMAINDR
UNIT	2	2.499819	1.249910	5.020	0.0070	REMAINDR
TIDE	2	0.155980	0.077990	0.313	0.7312	REMAINDR
BARGE	1	2.937724	2.937724	11.800	0.0007	REMAINDR
WIND	1	0.088399	0.088399	0.355	0.5516	REMAINDR
REMAINDER	418	104.068416	0.248968			

SPHP_N

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	79.899359	7.263578	12.025	0.0000	DAY:MO
DAY:MO	89	53.759817	0.604043	3.665	0.0000	REMAINDR
TIME	3	1.589999	0.530000	3.215	0.0228	REMAINDR
UNIT	2	1.153917	0.576959	3.500	0.0310	REMAINDR
TIDE	2	0.426860	0.213430	1.295	0.2750	REMAINDR
BARGE	1	0.132458	0.132458	0.804	0.3705	REMAINDR
WIND	1	0.053847	0.053847	0.327	0.5679	REMAINDR
REMAINDER	418	68.901450	0.164836			

CHIL_S

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	156.037158	14.185196	9.818	0.0000	DAY:MO
DAY:MO	89	[illegible]583436	1.444758	2.986	0.0000	REMAINDR
TIME	3	0.312356	0.104119	0.215	0.8859	REMAINDR
UNIT	2	14.992905	7.496452	15.492	0.0000	REMAINDR
TIDE	2	2.041291	1.020646	2.109	0.1226	REMAINDR
BARGE	1	3.164658	3.164658	6.540	0.0109	REMAINDR
WIND	1	0.209483	0.209483	0.433	0.5109	REMAINDR
REMAINDER	418	202.269591	0.483898			

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	8.656528	0.786957	2.600	0.0065	DAY:MO
DAY:MO	89	26.942507	0.302725	4.802	0.0000	REMAINDR
TIME	3	3.308843	1.102948	17.495	0.0000	REMAINDR
UNIT	2	0.225800	0.112900	1.791	0.1681	REMAINDR
TIDE	2	0.501927	0.250964	3.981	0.0193	REMAINDR
BARGE	1	0.275103	0.275103	4.364	0.0373	REMAINDR
WIND	1	0.006125	0.006125	0.097	0.7554	REMAINDR
REMAINDER	418	26.352490	0.063044			

ALPH_N

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	27.919370	2.538125	11.720	0.0000	DAY:MO
DAY:MO	89	19.273495	0.216556	4.334	0.0000	REMAINDR
TIME	3	1.887838	0.629279	12.595	0.0000	REMAINDR
UNIT	2	0.365509	0.182754	3.658	0.0266	REMAINDR
TIDE	2	0.168764	0.084382	1.689	0.1860	REMAINDR
BARGE	1	0.056604	0.056604	1.133	0.2878	REMAINDR
WIND	1	0.335300	0.335300	6.711	0.0099	REMAINDR
REMAINDER	416	20.884524	0.049963			

PALA_F

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	14.400835	1.309092	6.767	0.0000	DAY:MO
DAY:MO	89	17.217563	0.193456	5.303	0.0000	REMAINDR
TIME	3	1.027780	0.342593	9.392	0.0000	REMAINDR
UNIT	2	0.492177	0.246089	6.746	0.0013	REMAINDR
TIDE	2	0.067101	0.033550	0.920	0.3994	REMAINDR
BARGE	1	0.007813	0.007813	0.214	0.6438	REMAINDR
WIND	1	0.143478	0.143478	3.933	0.0480	REMAINDR
REMAINDER	418	15.247602	0.036478			

PORT_C

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	193.035648	17.548695	29.433	0.0000	DAY:MO
DAY:MO	89	53.063347	0.596217	4.251	0.0000	REMAINDR
TIME	3	10.492851	3.497617	24.940	0.0000	REMAINDR
UNIT	2	2.579685	1.289843	9.197	0.0001	REMAINDR
TIDE	2	5.830304	2.915152	20.787	0.0000	REMAINDR
BARGE	1	1.528222	1.528222	10.897	0.0011	REMAINDR
WIND	1	0.059135	0.059135	0.422	0.5165	REMAINDR
REMAINDER	418	58.620244	0.140240			

NEUP_T

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	24.374201	2.215836	8.030	0.0000	DAY:MO
DAY:MO	89	24.558143	0.275934	3.555	0.0000	REMAINDR
TIME	3	0.410880	0.136960	1.764	0.1533	REMAINDR
UNIT	2	0.771660	0.385830	4.970	0.0073	REMAINDR
TIDE	2	0.156795	0.078397	1.010	0.3651	REMAINDR
BARGE	1	0.005664	0.005664	0.073	0.7872	REMAINDR
WIND	1	0.263410	0.263410	3.393	0.0662	REMAINDR
REMAINDER	418	32.447134	0.077625			

LIBI_D

MONTH	11	36.139342	3.285395	13.181	0.0000	DAY:MO
DAY:MO	89	22.183076	0.249248	1.267	0.0663	REMAINDR
TIME	3	1.520838	0.506959	2.577	0.0534	REMAINDR
UNIT	2	10.821724	5.410862	27.504	0.0000	REMAINDR
TIDE	2	0.204539	0.102270	0.520	0.5950	REMAINDR
BARGE	1	0.000718	0.000718	0.004	0.9519	REMAINDR
WIND	1	0.371589	0.371589	1.889	0.1701	REMAINDR
REMAINDER	418	82.233857	0.196732			

METD_E

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	104.971046	9.542822	45.265	0.0000	DAY:MO
DAY:MO	89	18.763019	0.210820	4.244	0.0000	REMAINDR
TIME	3	1.090099	0.363366	7.314	0.0001	REMAINDR
UNIT	2	1.334462	0.667231	13.431	0.0000	REMAINDR
TIDE	2	0.367288	0.183644	3.697	0.0256	REMAINDR
BARGE	1	0.074898	0.074898	1.508	0.2202	REMAINDR
WIND	1	0.001803	0.001803	0.036	0.8490	REMAINDR
REMAINDER	418	20.766180	0.049680			

SQUI_E

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F	PROB	ERROR LINE
MONTH	11	12.647109	1.149737	3.485	0.0005	DAY:MO
DAY:MO	89	29.363835	0.329931	2.838	0.0000	REMAINDR
TIME	3	3.599863	1.199954	10.323	0.0000	REMAINDR
UNIT	2	0.316104	0.158052	1.360	0.2578	REMAINDR
TIDE	2	0.428997	0.214498	1.845	0.1593	REMAINDR
BARGE	1	0.000004	0.000004	0.000	0.9955	REMAINDR
WIND	1	0.032724	0.032724	0.282	0.5960	REMAINDR
REMAINDER	418	48.588741	0.116241			