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RECEIVED 8-12-76 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

August 6, 1976

RECEIVED AUG 12 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

Director of Nuclear Reactor Regulation
Attn: Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Reactor Licensing
United Stated Nuclear Regulatory Commission
Washington, D. C. 20555

RE: Docket No. 50-247

Dear Mr. Knighton:

In response to your letter dated March 26, 1976, received on March 31, 1976 and the accompanying list of questions to which you requested answers, we have attached hereto responses to questions A: 13, 16, 19, 21, 24, and 25.

The answers to the balance of the questions will be submitted when available, and we intend to complete these answers by the requested date of September 30, 1976.

Sincerely,

Carl L. Newman

Carl L. Newman

jbw/klg

cc: Paul Shemin
Stephen Lewis
Michael Curley
Sarah Chasis

8189

Question A.13:

Define the term "peak standing crop" as used in connection with Atlantic tomcod on page VI-60. In view of this definition and considering the data on pages D-35, D-36, D-85, and D-86, is there still a basis for the statement on page VI-60 that the peak standing crop of Atlantic tomcod in 1974 was about 1000 times greater than in 1973?

Response:

The term "peak standing crop" refers to the highest standing crop estimated to exist during any sample interval when all such intervals are considered.

The statement, which appears on page VI-60, to the effect that peak tomcod standing crop in 1974 was about 1000 times greater than in 1973 is incorrect. Peak standing crop of tomcod in 1974 was about 10 times greater than in 1973.

Question A.16:

Provide a derivation for the equation at the bottom of Page VII-6.

Response:

At any time during the spawning season, while some eggs which will eventually be spawned are still contained within the ovaries of adults, the potential (effective) population of ichthyoplankton is greater than the actual standing crop. Some portion of those unspawned eggs can realistically be considered to belong to the effective standing crop. In the estimation of entrainment impact during the spawning season, it is appropriate to consider entrainment mortality as affecting the effective population, rather than simply the actual standing crop.

In order to determine the effective population, we need an estimate of survival for those unspawned eggs, since it is unrealistic to assume that all unspawned eggs would survive. Our best estimate of survival for individuals to be produced from those unspawned eggs is the survival demonstrated by individuals from eggs spawned from the start of the spawning season up to the time at which sampling occurs. If one assumes that survival of ichthyoplankton is the same whether spawning occurs instantaneously or is distributed through time, then the ratio of the actual standing crop observed during a time interval to the total eggs spawned up to that time is a measure of survival, and is equal to the ratio of the effective standing crop to the total number of eggs produced throughout the spawning period.

$$\frac{N_i}{e} = \frac{N_i^*}{e_t} \qquad (1)$$

Where

$N_i$ = actual standing crop at time i

$N_i^*$ = effective (adjusted) standing crop

$e$ = eggs spawned from the start of the spawning period until time i

$e_t$ = total eggs spawned throughout the spawning season

Estimation of effective population size for any time period requires information on egg production up to the time for which the estimate is made and for the entire spawning season. In order to estimate these parameters, the sampling season was stratified into 2 week periods during 1973 and 1 week periods in 1974. All samples were considered to have been collected at the midpoint of each period. The standing crop of eggs existing at the time of ichthyoplankton sampling must be adjusted to reflect the fact that they represent only a portion of the eggs laid during a sample interval. That portion is a function of sample interval duration and hatching time. If eggs spawned during a sample interval are assumed to be evenly distributed through that interval and sampling occurs at the midpoint of the interval then the ratio of egg standing crop to total egg production is equal to the ratio of hatching time to interval duration. Total eggs produced during the interval can be calculated

$$E_i = e_i \frac{t_i}{h_i} \qquad (2)$$

Where

$E_i$ = total eggs spawned during interval i

$e_i$ = estimated egg standing crop at the midpoint of interval i

$t_i$ = interval duration for interval i

$h_i$ = egg stage duration for interval i

Thus if hatching time is 48 hours, as is commonly the case at temperatures prevailing during spawning in the Hudson River, and sample interval duration is 1 week (168 hours), then only eggs laid within the 48 hour period immediately preceeding sampling would compose the egg standing crop, and they would represent 48/168 (2/7) of the total expected.

Terms e and $e_t$ from Equation 1 can be more precisely defined in terms of the preceeding;

$$e = \tfrac{1}{2} e_i \frac{t_i}{h_i} + \sum_{j=1}^{i-1} e_j \frac{t_j}{h_j} \qquad (3)$$

Where

e = eggs spawned from the start of the spawning period until time i (midpoint of interval i)

$e_i$ = actual standing crop of eggs at the midpoint of interval i

$t_i$ = duration of interval i

$h_i$ = hatching time during interval i

$e_j$ = standing crop of eggs at midpoint of interval j

$t_j$ = duration of interval j

$h_j$ = hatching time during interval j

$$e_t = \sum_{j=1}^{s} e_j \frac{t_j}{h_j} \qquad (4)$$

Where

$e_t$ = total eggs laid throughout the spawning season

s = number of sample intervals through spawning season

Substitution of these terms derived for e and $e_t$ into Equation 1 yields

$$\frac{N_i}{\frac{1}{2} e_i \frac{t_i}{h_i} + \sum_{j=1}^{i-1} e_j \frac{t_j}{h_j}} = \frac{\overset{*}{N}_i}{\sum_{j=1}^{s} e_j \frac{t_j}{h_j}} \qquad (5)$$

Since interval duration has been the same for all intervals during a given year ($t_i = t_j$) and hatching time is assumed to remain constant throughout all sample intervals ($h_i = h_j$), the ratios $t_i/h_i$ and $t_j/h_j$ are equal. These terms can be factored from the denominator on each side of Equation 5 and cancelled.

$$\frac{N_i}{\left(\frac{t_i}{h_i}\right)\left(\frac{1}{2} e_i + \sum_{j=1}^{i-1} e_j\right)} = \frac{\overset{*}{N}_i}{\left(\frac{t_j}{h_j}\right)\left(\sum_{j=1}^{s} e_j\right)} \qquad (6)$$

$$\frac{N_i}{\frac{1}{2} e_i + \sum_{j=1}^{i-1} e_j} = \frac{\overset{*}{N}_i}{\sum_{j=1}^{s} e_j} \qquad (7)$$

Multiplication of both sides of Equation 7 by $\sum_{j=1}^{s} e_j$ yields

$$\overset{*}{N}_i = N_i \frac{\sum_{j=1}^{s} e_j}{\frac{1}{2} e_i + \sum_{j=1}^{i-1} e_j} \qquad (8)$$

Where

$\overset{*}{N}_i$ = effective population size at the midpoint of interval i (adjusted standing crop)

$N_i$ = actual standing crop of ichthyoplankton (eggs, larvae and juveniles) at the midpoint of interval i.

$e_i$ = standing crop of eggs at the midpoint of interval i

$e_j$ = standing crop of eggs at the midpoint of interval j

Question A.19:

With respect to the discussion of "previously impinged fish" on pages II-25 and VII-30:

a. Confirm whether the term P on page VII-30 can be more precisely defined as "probability that an impinged fish will be both lost from the screen before collection and reimpinged."

b. Explain how P could be greater than Ø, the probability of an impinged fish being lost before collection; such an inequality is required for values of % collection efficiency to exceed 100%?

Response:

The equation

$$\% \text{ collection efficiency} = (1-\varnothing+P) \times 100$$

was not intended for strict application but rather to demonstrate the fact that under certain circumstances more fish may be collected from the screens at the end of a sampling interval than were actually newly impinged during that interval. Ø may be defined as "the probability that a fish impinged during a time interval will be lost before collection at the end of that interval." If P is defined as "the probability that a fish impinged during a time interval will be both lost before collection at the end of that interval and reimpinged and collected during a subsequent interval" there are 2 components to P.

1. The probability that a fish impinged during a previous time interval will be lost before collection at the end of that interval ($\varnothing_{t-1}$).

2. The probability that a fish lost from a screen during an interval will be reimpinged and collected during a subsequent interval (p).

P is therefore the product $p \times \varnothing_{t-1}$. If collection efficiency is being calculated for a sample interval during which $\varnothing_{t-1}$ is greater than Ø (i.e. proportion of impinged fish lost before collection at the end of the preceding period is greater than proportion lost during sample interval) then P may exceed Ø and the collection efficiency may be greater than 100%.

At plants, other than Indian Point, where samples are taken over a 24-hour period once per week, there is a likelihood $\emptyset_{t-1}$ will exceed $\emptyset$ because of the sampling procedure. Immediately before the beginning of the sample interval, fish accumulated on the screen from previous periods may be washed from the screen into the river. Since in effect all escape collection, $\emptyset_{t-1}$ is 1, and P, the product of $\emptyset_{t-1}$ and p will, in all likelihood, exceed $\emptyset$.

At Indian Point, where collections are made from the screens daily and efforts are made to recover all fish, P could not exceed $\emptyset$ over the long range, and overall collection efficiency could not exceed 100%.

Question A.21:

For each estimate in Tables VII-9 and VII-10 (pp. VII-33 and VII-34), provide a table, similar to Table F-2 (p. F-20), but including as additional entries (a) number marked, not adjusted for 14-days handling mortality; (b) total number of marks recaptured, both with and without impingement; and (c) total number (marked and unmarked combined) captured during recovery period, both with and without impingement. Include any other information needed to reconstruct the estimates. For young-of-the-year white perch, provide data including fin-clipped individuals.

Response:

Tables 1 and 2 provide data needed to reconstruct the Peterson population estimates reported in Tables VII-9 and VII-10 of the First Annual Report for the Multiplant Impact for white perch and striped bass, respectively. Compilation of data upon which Schumacher-Eschmeyer estimates presented in the same tables were based will be available by 15 November 1976.

Question A.24:

In "Hudson River Ecological Study," Texas Instruments, Second Semiannual Report, November 1973, Table V-15, p. V-46, the following results on sexual maturity of female striped bass collected March-May 1973, in the Hudson River are presented: of the 9 fish classified as age 5, none were mature (0%); of the 3 fish classified at age 6, two were mature (67%).

In "First Annual Report for the Multiplant Impact Study of the Hudson River Estuary" Texas Instruments, July 1975, Table VIII-1, p. VIII-6, the following results on percent maturity of female striped bass are presented: age 5 females, 80%; age 6 females, 100%. The following footnote is included: "Determinations of percentages of mature females in the several age classes were based on fish collected in May and June 1973-74 (TI, unpublished data)."

Table 1

Data used to generate Peterson population estimates for white perch in the Hudson River estuary for fall of 1973, as presented in Table VII-9 of the First Annual Report for the Multiplant.

| Population | Estimates from Table VII-9 | River Miles included | Marking dates included | Total marked unadjusted[1] | Marked adjusted[1] for mortality | Recapture dates included | Total recaptures | Recaptures exclusive of impingement | Total capture | Capture exclusive of impingement |
|---|---|---|---|---|---|---|---|---|---|---|
| young-of-year | 7,824,000[1] | 12-153 | mid Aug.-Nov. 1973 | 9794 | 9632 | Jan.-June 1974 | 128 | 26 | 272,264 | 21,119 |
| young-of-year | 1,992,000[2] | 12-62 | Sept.-Oct. 1973 | 8736 | 8284 | Nov.-Dec. 1973 | 58 | -- | 13,946 | ------ |
| young-of-year | 2,340,000[1] | 12-62 | mid Aug.-Sept. 1973 | 5507 | 5362 | mid Oct.-Dec. 1973 | 41 | 31 | 17,804 | 13,529 |
| yearling or older | 7,225,000[1] | 12-153 | mid-Aug.-Nov. 1973 | 6710 | 6262 | Jan.-June 1974 | 14 | 12 | 31,981 | 13,845 |
| yearling or older | 1,467,000[2] | 12-62 | mid Aug.-Oct. 1973 | 3488 | 3426 | Nov.-Dec. 1973 | 17 | -- | 7,278 | ----- |

1. Calculation made exclusive of impingement collection data

2. Calculation includes impingement collection data

Table 2

Data used to generate Peterson population estimates for striped bass young-of-the-year in the Hudson River estuary for fall 1973, as presented in Table VII-10 of the First Annual Report for the Multiplant.

| Population | Estimate[1] from Table VII-10 | River Miles included | Marking dates included | Total marked unadjusted[1] for mortality | Marked adjusted for mortality | Recapture dates included | Total Recaptures | Recaptures exclusive of impingement | total capture | Capture clusive impinge |
|---|---|---|---|---|---|---|---|---|---|---|
| Young-of-year | 1,387,000[1] | 12-153 | Sept.[3]-Nov. 1973 | 14,336 | 14,336 | Jan.-May 1974 | 9 | 9 | 3,927 | |
| Young-of-year | 2,511,000[2] | 12-62 | mid Aug.-Nov. 1973 | 9,616 | 9,355 | Dec. 1973 | 41 | -- | 10,801 | --- |

1. Calculation made exclusive of impingement collection data
2. Estimate of 2,511,000 represents a correction of the value 1,680,000 originally reported, and is calculated with the inclusion of impingement collection data.
3. Marking period erroneously reported as mid-August through November in Table VII-10 of the First Annual Report for the Multiplant.

Provide a compilation of all previously published data and of all unpublished data and discuss the apparent contradiction between the results in the Second Semiannual Report and the Multiplant Report.

Also provide all published and unpublished Texas Instruments data on egg count per female striped bass. Discuss the biological reasonableness of the irregularities (i.e., non-monotonic increasing trend) in the fourth column (Mean Egg Count/Female) of Table III-1, p. VIII-6.

Response:

Results on striped bass age and state of maturity presented in the Second Semiannual Report for the Hudson River Ecological Study were based upon fish collected March through May 1973. As Table V-15 from that report indicates, all nine age V fish and two of three age VI fish examined were collected in March. Ovaries were small and difficult to evaluate. The single age VI fish collected in May was clearly mature. In 1974 only fish collected during May and June were examined for determination of maturity, as their status was much more evident in these later spring months. Four of five age V fish examined at this time were clearly mature as were all five age VI fish examined. These later data suggest that development of younger fish (age V and VI) to a state of ripeness occurs later in the spring than that of older fish, and that judgements as to state of maturity, at least for younger fish ( age VII), are best made on fish collected no earlier than May. Confirmation of these observations must await the processing of samples collected during 1975.

Tables 3 and 4 provide data related to fecundity and maturation of female striped bass collected during 1973 and 1974. More complete information on date of capture for 1973 fish will require further time to compile. Irregularities in age specific fecundities reported in Table VII-1 (i.e., non-monotonic increase with age) are at least partially related to the small sample size upon which these estimates are based. It is likely that fecundity in striped bass, like that of many other fishes, is related to size more closely than to age per se. While no formal analysis of size specific fecundity has been carried out for striped bass, irregularities in age specific fecundity may be related to random variation in fish size among specimens representing various age classes, or to real differences in growth between various year classes. Mean lengths of age V (678 mm) and age VI (687 mm) mature females collected during May and June 1973 and 1974

Table 3. Age and fecundity related data for female Striped Bass collected from the Hudson River Estuary during 1973.

FECUNDITY - STRIPED BASS

| ID # | DATE OF COLLECTION | AGE (YEARS) | BODY WEIGHT (g) | TOTAL LENGTH (mm) | OVARY WEIGHT (g) | TOTAL EGGS | STATE OF MATURITY | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| E33 | 5/73 | 2 | 108 | 218 | 11.1 | [illegible] | Immature | |
| E31 | 5/73 | 2 | 107 | 211 | 5.1 | | " | |
| C95 | 4/73 | 3 | 430 | 347 | 1.7 | | " | |
| AA98 | 3/73 | 4 | 1030 | 435 | 4.3 | | " | |
| C98 | 4/73 | 4 | 715 | 420 | 4.4 | | " | |
| XX2 | 4/73 | 4 | 908 | 471 | 8.2 | | " | |
| SSB | 4/73 | 4 | 1952 | 565 | 9.5 | | " | |
| C80 | 4/73 | 4 | 967 | 550 | 7.9 | | " | |
| C79 | 4/73 | 4 | 864 | 516 | 8.8 | | " | |
| D181 | 4/73 | 4 | 1816 | 584 | 9.7 | | " | |
| XX1 | 3/73 | 5 | 1798 | 554 | 17.4 | | " | |
| AA126 | 3/73 | 5 | 1574 | 540 | 9.6 | | " | |
| W23 | 4/73 | 5 | 1544 | 515 | 12.8 | | " | |
| AA105 | 4/73 | 5 | 2724 | 645 | 15.3 | | " | |
| SSA | 4/73 | 5 | 2679 | 626 | 20.7 | | " | |
| AA106 | 4/73 | 5 | 3078 | 675 | 19.8 | | " | |
| SSC | 4/73 | 5 | 2838 | 671 | 27.6 | | " | |
| D116 | 5/73 | 5 | 2270 | 612 | 14.1 | | " | |
| E23 | 5/73 | 5 | 3723 | 709 | 23.9 | | " | |
| AA100 | 3/73 | 6 | 2497 | 626 | 17.8 | | " | |
| AA128 | 3/73 | 6 | 2311 | 582 | 26.9 | 626,000 | mature | |
| 0906969 | 6/73 | 6 | 2724 | 622 | 174.3 | 276,000 | " | |
| CC1 | 4/73 | 7 | 4994 | 765 | 271.1 | 1,009,000 | " | |
| D193 | 4/73 | 7 | 6991 | 850 | 721.0 | 1,099,000 | " | |

| ID # | DATE OF COLLECTION | AGE (YEARS) | BODY WEIGHT (g) | TOTAL LENGTH (mm) | OVARY WEIGHT (g) | TOTAL EGGS | STATE OF MATURITY | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| CC11 | 4/73 | 7 | 10532 | 925 | 1445.0 | 2,228,000 | mature | |
| D251 | 5/73 | 7 | 4769 | 739 | 303.5 | 1,103,000 | " | |
| D179 | 4/73 | 7 | 7309 | 679 | 351.3 | 1,127,000 | " | |
| D123 | 5/73 | 7 | 3859 | 744 | 103.1 | 59,000 | " | |
| D124 | 5/73 | 7 | 1680 | 549 | 44.5 | 249,000 | " | |
| D121 | 5/73 | 7 | 2497 | 615 | 142.0 | 549,000 | " | |
| PP4 | 5/73 | 7 | 7718 | 865 | 695.0 | 1,151,000 | " | |
| C0610 | 6/73 | 7 | 4630 | 692 | 360.2 | 681,000 | " | |
| D183 | 4/73 | 8 | 9534 | 929 | 1137.0 | 2,285,000 | " | |
| D7 | 4/73 | 8 | 9534 | 897 | 1020.0 | 1,944,000 | " | |
| D152 | 4/73 | 8 | 7673 | 858 | 878.8 | 1,148,000 | " | |
| D198 | 4/73 | 8 | 9988 | 953 | 746.1 | 2,141,000 | " | |
| CC5 | 4/73 | 8 | 10986 | 1002 | 728.0 | 1,953,000 | " | |
| AA101 | 3/73 | 8 | 4568 | 757 | 51.2 | | " | |
| C83 | 4/73 | 8 | 10124 | 927 | 887.0 | 1,152,000 | " | |
| D115 | 4/73 | 8 | 7173 | 859 | 319.2 | 1,137,000 | " | |
| D173 | 4/73 | 8 | 6356 | 822 | 556.7 | 1,487,000 | " | |
| 8279 | 5/73 | 8 | 6420 | 835 | 517.8 | 1,215,000 | " | |
| D125 | 5/73 | 8 | 7082 | 831 | 503.5 | 986,000 | " | |
| D122 | 5/73 | 8 | 7128 | 851 | 653.4 | 1,085,000 | " | |
| PP2 | 5/73 | 8 | 5902 | 800 | 563.0 | 1,318,000 | " | |
| PP1 | 5/73 | 8 | 8399 | 875 | 732.0 | 1,603,000 | " | |
| D154 | 4/73 | 9 | 8126 | 872 | 861.2 | 1,343,000 | " | |
| CC10 | 4/73 | 9 | 8853 | 898 | 802.9 | 1,460,000 | " | |
| CC12 | 4/73 | 9 | 11213 | 969 | 1307.8 | 1,629,000 | " | |
| D153 | 4/73 | 9 | 9443 | 917 | 844.0 | 1,546,000 | " | |
| D250 | 5/73 | 9 | 7400 | 851 | 914.0 | 891,000 | " | |
| D249 | 5/73 | 9 | 13529 | 840 | 1682.0 | 2,428,000 | " | |

| ID# | DATE OF COLLECTION | AGE (YEARS) | BODY WEIGHT (g) | TOTAL LENGTH (mm) | OVARY WEIGHT (g) | TOTAL EGGS | STATE OF MATURITY | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| D182 | 4/73 | 9 | 7446 | 865 | 535.7 | 1,583,000 | mature | |
| D177 | 4/73 | 9 | 4540 | 832 | 484.4 | 1,113,000 | " | |
| CC89 | 5/73 | 9 | 11441 | 964 | 1761.0 | 2,082,000 | " | |
| D197 | 4/73 | 10 | 14165 | 1021 | 1486.0 | 2,156,000 | " | |
| 06389 | 5/73 | 10 | 9988 | 952 | 1578.3 | 1,369,000 | " | |
| 06390 | 5/73 | 10 | 12122 | 1044 | 1108.5 | 2,417,000 | " | |
| PP3 | 5/73 | 10 | ------ | 891 | 855.0 | 1,425,000 | " | Weight no available |
| CC94 | 5/73 | 12 | ----- | 1170 | 1287.0 | 2,707,000 | " | Weight no available |
| CC93 | 5/73 | 12 | 15754 | 1083 | 794.0 | 1,995,000 | " | |
| D192 | 4/73 | 14 | 11350 | 962 | 1164.0 | 2,189,000 | " | |
| D45 | 4/73 | -- | 13166 | 986 | 975.7 | 1,269,000 | " | age not available |
| D252 | 5/73 | -- | 7945 | 881 | 942.3 | 1,030,000 | " | age not available |
| 9856 | 5/73 | -- | 6810 | 850 | 679.2 | 1,678,000 | " | age not available |
| 9858 | 5/73 | -- | 6901 | 855 | 883.6 | 1,380,000 | " | age not available |
| 9835 | 5/73 | -- | 9988 | 970 | 143.5 | apparently sterile | " | age not availabl |
| 9833 | 5/73 | -- | 4449 | 787 | 289.1 | 506,000 | " | age not availabl |
| 9834 | 5/73 | -- | 9534 | 938 | 1345.5 | 1,599,000 | " | age not availabl |
| 8282 | 5/73 | -- | 3450 | 687 | 439.3 | 726,000 | " | age not availabl |

Table 4. Age and fecundity related data for female Striped Bass collected from the Hudson River Estuary during 1974.

| ID # | DATE OF COLLECTION | AGE (YEARS) | BODY WEIGHT (g) | TOTAL LENGTH (mm) | OVARY WEIGHT (g) | TOTAL EGGS | STATE OF MATURITY | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| C21 | 5/15/74 | 4 | 882 | 534 | 9.8 | | Immature | |
| C47 | 5/22/74 | 4 | 793 | 384 | 4.3 | | " | |
| C2 | 5/ 8/74 | 4 | 848 | 505 | 6.2 | | " | |
| C17 | 5/15/74 | 4 | 921 | 550 | 2.4 | | " | |
| C4 | 5/ 8/74 | 4 | 879 | 524 | 7.5 | | " | |
| EP315 | 5/ 9/74 | 4 | 3686 | 477 | 3.2 | | " | |
| C28 | 5/16/74 | 4 | 881 | 527 | 7.4 | | " | |
| C13 | 5/ 9/74 | 4 | 904 | 555 | 1.0 | | " | |
| C11 | 5/ 9/74 | 4 | 857 | 508 | 8.5 | | " | |
| C31 | 5/16/74 | 5 | 862 | 505 | 11.4 | | spent | |
| EP1652 | 5/21/74 | 5 | 3178 | 666 | 419.5 | 810,000 | mature | |
| F21 | 5/ 8/74 | 5 | 3496 | 633 | 176.7 | 371,000 | " | |
| F46 | 5/22/74 | 5 | 615 | 473 | 15.4 | | immature | |
| C106 | 5/23/74 | 5 | 5130 | 735 | 544.2 | 1,155,000 | mature | |
| EP302 | 4/22/74 | 6 | 4005 | 701 | 65.4 | 750,000 | " | |
| F-40 | 5/16/74 | 6 | 2806 | 660 | 77.8 | 582,000 | " | |
| C-42 | 5/22/74 | 6 | 4812 | 741 | 804.8 | 990,000 | " | |
| C-23 | 5/16/74 | 6 | 2951 | 659 | 280.3 | 369,000 | " | |
| C-40 | 5/22/74 | 6 | 4722 | 753 | 501.7 | 942,000 | " | |
| F-35 | 5/22/74 | 7 | 3904 | 745 | 60.9 | 1,644 | spent | |
| EP1658 | 5/21/74 | 7 | ---- | 922 | 216.9 | 1,600,000 | mature | weight not available |
| EP1695 | 5/23/74 | 7 | 5085 | 759 | 784.9 | 615,000 | " | |
| EP1406 | 6/ 3/74 | 7 | ---- | --- | 103.1 | 737,000 | mature | weight and length not available |
| C1016 | 6/12/74 | 7 | 6447 | 849 | 106.3 | 18,600 | spent | |
| C1018 | 6/12/74 | 7 | 5401 | 835 | 63.2 | | spent | |

Table 4 Continued

| ID # | DATE OF COLLECTION | AGE (YEARS) | BODY WEIGHT (g) | TOTAL LENGTH (mm) | OVARY WEIGHT (g) | TOTAL EGGS | STATE OF MATURITY | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| C113 | 5/23/74 | 8 | 8172 | 895 | 1279.4 | 1,119,000 | mature | |
| CEG1 | 5/ 8/74 | 8 | 8081 | 837 | 854.3 | 1,827,000 | " | |
| CEG7 | 5/14/74 | 8 | 7082 | 843 | 915.9 | 1,520,000 | " | |
| C41 | 5/22/74 | 8 | 8444 | 882 | 979.7 | 1,180,000 | " | |
| C43 | 5/22/74 | 8 | 7309 | 845 | 564.4 | 1,245,000 | " | |
| EP1686 | 5/23/74 | 8 | 4585 | 755 | 453.3 | 853.000 | " | |
| C15 | 5/15/74 | 8 | 4041 | 694 | 271.1 | 762,000 | " | |
| F33 | 5/15/74 | 8 | 3042 | 660 | 64.8 | 817,000 | " | |
| CEG201 | 5/30/74 | 8 | 7082 | 860 | 108.4 | 17,560 | spent | |
| EP388 | 5/30/74 | 8 | 6673 | 891 | 141.6 | 1,416 | spent | |
| EP1485 | 5/30/74 | 8 | ---- | 930 | 83.4 | | " | |
| F38 | 5/22/74 | 8 | 7219 | 864 | 965.5 | 1,162,000 | mature | |
| F29 | 5/10/74 | 8 | 7491 | 848 | 942.9 | 1,355,000 | " | |
| C107 | 5/23/74 | 8 | 6084 | 817 | 1300.6 | 1,081,000 | " | |
| C101 | 5/23/74 | 8 | 7309 | 850 | 1308.3 | 1,472,000 | " | |
| C1004 | 6/10/74 | 8 | 7900 | 850 | 931.2 | 1,010,000 | " | |
| F23 | 5/ 9/74 | 9 | 8127 | 843 | 1150.9 | 2,087,000 | " | |
| F31 | 5/10/74 | 9 | 11214 | 915 | 1150.7 | 1,588,000 | " | |
| EP1403 | 5/31/74 | 9 | 8127 | 871 | 1345.0 | 1,555,000 | " | |
| EP352 | 5/ 3/74 | 9 | 12258 | 973 | 1292.1 | 1,899,000 | " | |
| CEG9 | 5/15/74 | 9 | 7264 | 855 | 888.0 | 1,369,000 | " | |
| C109 | 5/23/74 | 9 | 10533 | 917 | 1516.7 | 2,500,000 | " | |
| C44 | 5/22/74 | 9 | 9080 | 923 | 1055.1 | 1,394,000 | " | |
| F24 | 5/ 9/74 | 9 | 7037 | 816 | 669.9 | 947,000 | " | |
| EP1486 | 5/30/74 | 9 | 11077 | 957 | 1159.7 | 2,315,000 | " | |
| CEG203 | 5/30/74 | 9 | 9080 | 925 | 124.0 | 10,700 | spent | |

| ID # | DATE COLLECTION | AGE (YEARS) | BODY WEIGHT (g) | TOTAL LENGTH (mm) | OVARY WEIGHT (g) | TOTAL EGGS | STATE OF MATURITY | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| C116 | 5/23/74 | 9 | 9534 | 919 | 561.8 | 1,125,000 | mature | |
| EP1653 | 5/21/74 | 9 | 9534 | 961 | 1325.1 | 1,309,000 | " | |
| EP1668 | 5/22/74 | 9 | 6855 | 898 | 337.3 | 931,000 | " | |
| EP1694 | 5/23/74 | 9 | 6674 | 852 | 608.2 | 1,129,000 | " | |
| EP1688 | 5/23/74 | 9 | 6356 | 801 | 725.3 | 1,422,000 | " | |
| F30 | 5/10/74 | 9 | 8853 | 886 | 823.6 | 1,344,000 | " | |
| C1005 | 6/11/74 | 9 | 6765 | 870 | 106.4 | 28 | spent | |
| C1027 | 6/13/74 | 9 | 5720 | 832 | 69.7 | | " | |
| F37 | 5/22/74 | 10 | 9352 | 928 | 1101.5 | 997,000 | mature | |
| EP1687 | 5/23/74 | 10 | ---- | 1045 | 1297.1 | 2,336,000 | " | weight no available |
| F28 | 5/10/74 | 10 | 10669 | 940 | 1188.1 | 2,225,000 | " | |
| EP324 | 5/16/74 | 10 | 12212 | 980 | 2068.8 | 2,478,000 | " | |
| CEG6 | 5/14/74 | 10 | 11214 | 965 | 2125.2 | 1,989,000 | " | |
| C102 | 5/23/74 | 10 | 11531 | 971 | 2335.8 | 1,549,000 | " | |
| F25 | 5/10/74 | 10 | 8989 | 886 | 783.6 | 1,345,000 | " | |
| C34 | 5/21/74 | 10 | 9080 | 915 | 2843.0 | 1,936,000 | " | |
| C103 | 5/23/74 | 10 | 16571 | 1073 | 3953.3 | 2,332,000 | " | |
| C118 | 5/23/74 | 10 | ----- | 943 | 151.6 | | spent | |
| F41 | 5/23/74 | 10 | 14755 | 1085 | 3366.4 | 3,097,000 | mature | |
| EP317 | 5/15/74 | 10 | 10170 | 937 | 2402.0 | 1,864,000 | " | |
| EP1697 | 5/23/74 | 10 | 9761 | 974 | 1578.8 | 1,167,000 | " | |
| F27 | 5/10/74 | 10 | 7990 | 829 | 802.5 | 1,124,000 | " | |
| CEG8 | 5/14/74 | 10 | 7082 | 860 | 759.2 | 1,355,000 | " | |
| EP1482 | 5/30/74 | 10 | 7763 | 893 | 403.7 | 1,209,000 | " | |
| EP397 | 4/ 2/74 | 11 | 11441 | 980 | 2300.6 | 2,616,000 | " | |
| CEG3 | 5/ 9/74 | 11 | 11440 | 1000 | 254.6 | | spent | |

| ID # | DATE COLLECTION | AGE (YEARS) | BODY WEIGHT (g) | TOTAL LENGTH (mm) | OVARY WEIGHT (g) | TOTAL EGGS | STATE OF MATURITY | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| EP1426 | 5/31/74 | 11 | 11895 | 1035 | 1376.7 | 2,530,000 | mature | |
| C37 | 5/21/74 | 11 | 5630 | 835 | 260.5 | 768,000 | " | |
| C104 | 5/23/74 | 11 | ---- | 1027 | 2258.7 | 1,565,000 | " | weight not available |
| C14 | 5/15/74 | 11 | 7491 | 862 | 584.8 | 1,359,000 | " | |
| C1000 | 6/10/74 | 11 | 11259 | 1120. | 166.0 | 1,660 | spent | |
| T2 | 4/30/74 | -- | 7892 | 867 | 540.3 | 1,182,000 | mature | age not available |
| C27 | 5/16/74 | -- | 770 | 443 | 1.1 | | immature | " |
| EP1674 | 5/22/74 | -- | 3405 | 711 | 52.1 | | " | " |
| EP353 | 5/ 3/74 | -- | 9717 | 942 | 744.8 | 2,282,000 | mature | " |
| T15 | 5/ 1/74 | -- | 9480 | 903 | 724.2 | 1,486,000 | " | " |
| EP322 | 5/16/74 | -- | 8535 | 861 | 1742.3 | 1,734,000 | " | " |
| T14 | 5/ 1/74 | -- | 9707 | 908 | 1107.3 | 2,534,000 | " | " |
| 115 | 5/23/74 | -- | 11577 | 995 | 2612.6 | 1,892,000 | " | " |
| T13 | 5/ 1/74 | -- | 11385 | 960 | 1316.0 | 1,354,000 | " | " |
| ORN 3 | 5/29/74 | -- | 14528 | 1052 | 2488.7 | 3,778,000 | " | |
| EP325 | 5/26/74 | -- | 8126 | 825 | 1444.1 | 1,545,000 | " | age not available |
| EG204 | 5/30/74 | -- | 7445 | 846 | 784.0 | 1,250,000 | " | " |
| 42 | 5/23/74 | -- | 5030 | 805 | 631.2 | 885,000 | " | " |
| P1693 | 5/23/74 | -- | 4676 | 734 | 795.5 | 959,000 | " | " |
| P1484 | 5/30/74 | -- | 8853 | 910 | 1102.1 | 1,969,000 | " | " |
| EG50 | 6/ 4/74 | -- | 7491 | 870 | 119.1 | 96,100 | " | " |

differed very little, while the mean length of age X gravid females (954 mm) slightly exceeded that of age XI individuals (948 mm). Most pronounced irregularities in age specific fecundity reported in Table VIII-1 of the Multiplant Report occur between ages V and VI and X and XI.

Question A.25:

With respect to the analysis of density-dependent growth beginning on p. VIII-8:

a. Provide the raw data for striped bass and white perch for each year 1965-1974 (except 1966 and 1971) on July and August total lengths. Provide the analysis leading to estimates of young-of-the-year striped bass and white perch growth from July to August.

b. Provide the raw data for striped bass and white perch for each year 1965-1974 (except 1971) on beach seine catch and beach seine effort. Provide the analysis leading to estimates of young-of-the-year striped bass and white perch catch per catch per unit area (CPUA).

c. Provide a table of the data in Fig. VIII-4, p. VII-11, including a tabulation, by year, of minimal daily mean centigrade surface-water temperature in June, in July and in August. Provide a figure for white perch comparable to Fig. VIII-4 for striped bass, including a tabulation of the data plotted in such a figure.

Response:

a. Table 5 provides data on mean total length for white perch and striped bass in July and August from 1965 through 1974. Growth of each species from July to August was calculated as

growth = August mean TL - July mean TL

b. Tables 6 and 7 provide data requested concerning beach seine catch per unit area (CPUA) for striped bass and white perch, respectively.

c. Table 8 provides the data requested from which Figure VIII-4 in the First Annual Report for the Multiplant was generated for striped bass. Similar data are presented in Table 8 for white perch. Catch per unit area and July-August growth for young-of-the-year white perch are presented in Figure 1 for the years 1965-1974. The resulting regression equation for white perch abundance and growth is

growth = 0.0060 CPUA + 12.54

with an r value of 0.034.

Table 5

July and August mean total lengths for young-of-the-year striped bass and white perch, 1965-1974 (except 1971). Fish collected in the Indian Point area of the Hudson River.

| Year | July: Striped Bass | July: White Perch | August: Striped Bass | August: White Perch |
|---|---|---|---|---|
| | Mean Total Length (mm) | | | |
| 1965 | 36.2 | 30.9 | 60.4 | 56.9 |
| 1966 | ----[a] | 38.0 | ---[a] | 49.4 |
| 1967 | 35.6 | 27.0 | 60.8 | 36.8 |
| 1968 | 45.8 | 24.8 | 69.0 | 32.9 |
| 1969 | 49.8 | 44.9 | 57.1 | 49.9 |
| 1970 | 33.3 | 37.3 | 57.4 | 55.6 |
| 1972 | 40.4 | 33.7 | 61.5 | 35.8 |
| 1973 | 45.4 | 33.7 | 62.1 | 45.1 |
| 1974 | 47.5 | 29.7 | 66.1 | 51.2 |

Note:

[a] No young-of-year striped bass collected in Indian Point area during July-August 1966

Table 6 - Beach seine catch and effort data for striped bass collected in the Indian Point region of the Hudson River during the months of July and August for the years 1965-1974. Catch and effort are indicated by station; a blank space indicates no sample taken.

| Month and Year | II W1 Catch | II W1 $ft^2$ Swept | II E1 Catch | II E1 $ft^2$ Swept | 34 Catch | 34 $ft^2$ Swept | 35 Catch | 35 $ft^2$ Swept | 36 Catch | 36 $ft^2$ Swept | 38 Catch | 38 $ft^2$ Swept | 8 Catch | 8 $ft^2$ Swept | 9 Catch | 9 $ft^2$ Swept | 10 Catch | 10 $ft^2$ Swept | 11 Catch | 11 $ft^2$ Swept | Total Catch | Total Effort ($ft^2$) | Total CPUA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July '65[1] | 11 | 10,750 | | | | | | | | | | | | | | | | | | | 114 | 10,750 | 105.0[a] |
| July '66[1] | 0 | 12,500 | 0 | 31,250 | | | | | | | | | | | | | | | | | 11 | 43,750 | 2.5[a] |
| July '67[1] | 24 | 30,000 | | | | | | | | | | | | | | | | | | | 468 | 30,000 | 156.0[a] |
| July '68[1] | 5 | 35,000 | 0 | 1,250 | | | | | | | | | | | | | | | | | 83 | 36,250 | 22.9[a] |
| July '69[1,2] | 36 | 5,000 | 19 | 2,500 | 173 | 5,426 | 4 | 5,426 | 5 | 2,713 | 0 | 0 | | | | | | | | | | | 15.3[b] |
| July '70[2] | | | | | 250 | 53,294 | 21 | 29,064 | 261 | 38,752 | 77 | 48,440 | | | | | | | | | 136 | 169,550 | 8.0[a] |
| July '72[3] | | | | | | | | | | | | | 1 | 29,064 | 3 | 29,064 | 0 | 29,064 | 0 | 29,064 | 3 | 116,256 | 0.3[a] |
| July '73[3] | | | | | | | | | | | | | 4 | 24,220 | 28 | 24,220 | 29 | 24,220 | 68 | 19,376 | 153 | 92,036 | 16.6[a] |
| July '74[3] | | | | | | | | | | | | | 13 | 24,220 | 33 | 24,220 | 0 | 24,220 | 0 | 24,220 | 21 | 96,880 | 2.2[a] |
| Aug. '65[1] | 8 | 10,000 | | | | | | | | | | | | | | | | | | | 2 | 10,000 | 2.0[a] |
| Aug. '66[1] | 0 | 12,500 | 0 | 16,250 | | | | | | | | | | | | | | | | | 42 | 28,750 | 14.6[a] |
| Aug. '67[1] | 13 | 15,000 | | | | | | | | | | | | | | | | | | | 197 | 15,000 | 131.3[a] |
| Aug. '68[1] | 2 | 35,000 | 5 | 1,250 | | | | | | | | | | | | | | | | | 80 | 34,700 | 23.1[a] |
| Aug. '69[1,2] | 36 | 5,000 | 4 | 1,500 | 121 | 10,852 | 3 | 10,852 | 32 | 10,852 | 0 | 0 | | | | | | | | | | | 25.7[b] |
| Aug. '70[2] | | | | | 185 | 33,908 | 46 | 33,908 | 115 | 38,752 | 35 | 33,908 | | | | | | | | | 375 | 140,476 | 26.7[a] |
| Aug. '72[3] | | | | | | | | | | | | | 6 | 33,908 | 14 | 33,908 | 7 | 29,064 | 1 | 33,908 | 77 | 130,768 | 5.3[a] |
| Aug. '73[3] | | | | | | | | | | | | | 44 | 29,064 | 51 | 29,064 | 307 | 29,064 | 51 | 29,064 | 406 | 116,256 | 34.9[a] |
| Aug. '74[3] | | | | | | | | | | | | | 19 | 14,532 | 45 | 19,376 | 6 | 19,376 | 1 | 19,376 | 29 | 72,660 | 4.0[a] |

[1] NYU, source of data
[2] Raytheon Inc., source of data
[3] Texas Instruments Inc., source of data

## CPUA Methods

[a] Monthly CPUA = total catch for that month/total $ft^2$ swept x $10^{-4}$ = catch per 10,000 $ft^2$

[b] Monthly CPUA (1969) adjusted for differences in effort by NYU and Raytheon as follows

EX. July CPUA ('69) = $\left(\text{NYU CPUA (JULY)} \times \frac{\text{NYU } ft^2}{\text{NYU + RAY } ft^2}\right) + \left(\text{RAY CPUA (JULY)} \times \frac{\text{RAY } ft^2}{\text{RAY + NYU } ft^2}\right)$

Table 7 - Beach seine catch and effort data for white perch collected in the Indian Point region of the Hudson River during the months of July and August for the years 1965-1974. Catch and effort are indicated by station; a blank indicates no samples taken.

| Month and Year | Stations | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | II W1 | | II E1 | | 34 | | 35 | | 36 | | 38 | | 8 | | 9 | | 10 | | 11 | | Total | |
| | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | $ft^2$ Swept | Catch | Effort ($ft^2$) | |
| July '65[1] | 114 | 10,750 | | | | | | | | | | | | | | | | | | | 11 | 10,750 | 10.2[a] |
| July '66[1] | 8 | 12,500 | 3 | 31,250 | | | | | | | | | | | | | | | | | 0 | 43,750 | 0 |
| July '67[1] | 468 | 30,000 | | | | | | | | | | | | | | | | | | | 24 | 30,000 | 8.0[a] |
| July '68[1] | 83 | 35,000 | 0 | 1,250 | | | | | | | | | | | | | | | | | 5 | 36,250 | 1.4[a] |
| July '69[1,2] | 0 | 5,000 | 17 | 2,500 | 14 | 5,426 | 0 | 5,426 | 1 | 2,713 | 0 | 0 | | | | | | | | | | | 112.5[b] |
| July '70[2] | | | | | 9 | 53,294 | 17 | 29,964 | 103 | 38,752 | 7 | 48,440 | | | | | | | | | 609 | 169,550 | 35.9[a] |
| July '72[3] | | | | | | | | | | | | | 0 | 29,064 | 3 | 29,064 | 25 | 29,064 | 114 | 29,064 | 143 | 116,256 | 12.3[a] |
| July '73[3] | | | | | | | | | | | | | 1 | 24,220 | 55 | 24,220 | 34 | 24,220 | 22 | 19,376 | 88 | 92,036 | 9.6[a] |
| July '74[3] | | | | | | | | | | | | | 0 | 24,220 | 21 | 24,220 | 35 | 24,220 | 57 | 24,220 | 138 | 96,880 | 14.2[a] |
| Aug. '65[1] | 2 | 10,000 | | | | | | | | | | | | | | | | | | | 8 | 10,000 | 8.0[a] |
| Aug. '66[1] | 26 | 12,500 | 16 | 16,250 | | | | | | | | | | | | | | | | | 0 | 28,750 | 0 |
| Aug. '67[1] | 197 | 15,000 | | | | | | | | | | | | | | | | | | | 13 | 15,000 | 8.7[a] |
| Aug. '68[1] | 77 | 31,500 | 3 | 3,200 | | | | | | | | | | | | | | | | | 7 | 36,250 | 1.9[a] |
| Aug. '69[1,2] | 0 | 5,000 | 4 | 1,500 | 25 | 10,852 | 3 | 10,852 | 80 | 10,852 | 0 | 0 | | | | | | | | | | | 53.1[b] |
| Aug '70[2] | | | | | 20 | 33,908 | 121 | 33,908 | 233 | 38,752 | 1 | 33,908 | | | | | | | | | 381 | 140,476 | 27.1[a] |
| Aug. '72[3] | | | | | | | | | | | | | 9 | 33,908 | 60 | 33,908 | 82 | 29,064 | 193 | 33,908 | 295 | 130,788 | 22.5[a] |
| Aug. '73[3] | | | | | | | | | | | | | 35 | 29,064 | 48 | 29,064 | 702 | 29,064 | 814 | 29,064 | 1611 | 116,256 | 138.6[a] |
| Aug. '74[3] | | | | | | | | | | | | | 5 | 14,532 | 17 | 19,376 | 39 | 19,376 | 80 | 19,376 | 183 | 72,660 | 25.2[a] |

[1] NYU, source of data
[2] Raytheon Inc., source of data
[3] Texas Instruments Inc., source of data

## CPUA Methods

[a] Monthly CPUA = total catch for that month/total $ft^2$ swept x $10^{-4}$ = catch per 10,000 $ft^2$

[b] Monthly CPUA (1969) adjusted for differences in effort by NYU and Raytheon as follows

$$\text{EX. July CPUA ('69)} = \left(\text{NYU CPUA (JULY)} \times \frac{\text{NYU } ft^2}{\text{NYU + RAY } ft^2}\right) + \left(\text{RAY CPUA (JULY)} \times \frac{\text{RAY } ft^2}{\text{RAY + NYU } ft^2}\right)$$

Table 8 - Mean catch per unit area (CPUA) and growth data for striped bass and white perch during the months of July and August from 1965 through 1974 from which Figure VIII-4 was generated for striped bass.

| | Striped Bass | | White Perch | | Mean Biweekly Surface Water Temp (C) in IP area[d] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Jul.-Aug. CPUA[a] | Jul.-Aug. Growth (mm)[b] | Jul.-Aug. CPUA[a] | Jul.-Aug. Growth (mm)[b] | Jun. 1-15 | Jun. 16-30 | Jul. 1-15 | Jul. 16-31 | Aug. 1-15 | Aug. 16-31 |
| 1965 | 9.1 | 24.2 | 54.0 | 26.0 | 18.5 | 21.5 | 23.0 | 23.5 | 24.6 | 24.7 |
| 1966 | 0[c] | | 8.6 | 11.4 | 19.2 | 22.7 | 25.5 | 25.5 | 25.1 | 25.6 |
| 1967 | 8.4 | 25.2 | 143.7 | 9.8 | 18.0 | 22.0 | 24.0 | 25.6 | 26.6 | 25.4 |
| 1968 | 1.4 | 23.6 | 23.0 | 8.1 | 19.0 | 22.3 | 24.5 | 25.8 | 25.8 | 25.2 |
| 1969 | 81.3 | 7.3 | 22.0 | 5.0 | 20.5 | 22.5 | 23.3 | 24.0 | 25.7 | 25.5 |
| 1970 | 31.5 | 24.1 | 17.3 | 18.3 | 19.0 | 21.5 | 23.0 | 24.0 | 25.9 | 25.5 |
| 1972 | 17.4 | 21.1 | 3.1 | 2.1 | 19.7 | 19.7 | 20.5 | 23.5 | 24.5 | 23.8 |
| 1973 | 74.1 | 16.7 | 25.8 | 11.7 | 16.5 | 20.5 | 22.0 | 23.5 | 24.7 | 24.6 |
| 1974 | 19.7 | 18.6 | 3.1 | 21.5 | 20.0 | 21.5 | 23.5 | 24.8 | 25.1 | 25.3 |

[a] $\text{Jul.-Aug. CPUA} = \frac{\text{Jul. CPUA} + \text{Aug. CPUA}}{2}$ (From Table 5, 6, and 7)

[b] Jul.-Aug. growth (mm) = August $\bar{x}$ TL (mm) - July $\bar{x}$ TL (mm) - (From Table 5)

[c] No yoy SB captured during Jul.-Aug. in IP area

[d] Minimum daily temps. are not available for all years between '65 and 74, however, for those years where daily minima and maxima are available, the difference rarely exceeds 2°C.

Figure 1. Young-of-the-year white perch growth versus abundance in July and August for the years 1965-1974.