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REPORT OF THE MEETING OF THE COORDINATORS OF THE STOMACH SAMPLING PROJECT 1981

IJmuiden, 19 - 23 march 1984

1. TERMS OF REFERENCE

During the 71st statutory Meeting in Copenhagen, ICES adopted the following resolution (C. Res. 1983/2:10):

"The coordinators of the Stomach Sampling Project 1981 should meet early in 1984 for four days to

(') estimate the consumption in numbers by age group of exploited fish species by the average predator in 1981 for the various species investigated.

('') implement speedy exchange of the basic stomach content data on tape.

2. PARTICIPATION

The meeting was held in IJmuiden from 19 - 23 March. It was attended by:

N. Daan (Chairman)	- The Netherlands
W. Dekker	- The Netherlands
J.R.G. Hislop	- U.K. (Scotland)
S. Mehl	- Norway
L. Nielsen	- Denmark
J.G. Pope	- U.K. (England)
P. Sparre	- Denmark
J. de la Villemarqué	- France
T. Westgård	- Norway

3. INTRODUCTION

Originally it was intended to have this meeting as early as possible in 1984 in order to provide additional guidance to the ICES Assessment Working Groups in using the results of the project in term of predation mortality. Due to logistic problems, however, it was necessary to delay the meeting to a time when the assessment Working Groups dealing with the species affected had already been or were being held.

As a consequence this task could not be effected and the Group took as its primary objective the provision of the best possible estimate of food consumption of the average predator by age group in 1981, with emphasis on the prey age distribution of exploited fish species, as input for the Ad hoc Multispecies Assessment Working Group meeting in June. In order to meet this aim the demands from the assessment side were discussed (Section 4).

In considering in detail the appropriate procedure in analysing the basic data and particularly in considering various sources of essential additional data such as prey age length keys, it was decided that various changes had to be made. Although in principle the data were available in the right format to do the necessary calculations, it turned out to be a major job to do this by hand and, within the four days allo- cated, this task could not be completed. As a consequence certain members of the Group had to make these calculations at their own laboratories. A strict deadline of the 1st of May was set for inclusion of data in the final report.

4. REQUIREMENTS FROM MULTISPECIES ASSESSMENT

The Ad hoc Multispecies Assessment Working Group is asked in its terms of reference to make trial runs with multispecies virtual population analysis (MSVPA). In doing this that Group will need to have estimates of the amount eaten by the various important predators included in the MSVPA and to make estimates of the suitability for consumption by predator ages of the various prey species and ages. These two requirements must be met by the information to be supplied by the present meeting on the ICES stomach sampling project 1981.

In practice feeding appears to follow a strong seasonal pattern due perhaps in part to the seasonal availability of different prey (e.g. 0-group and I-group fish). For this reason the MSVPA may need to be run by quarters of the year and the results from the 1981 stomach project should thus be similarly organized. In addition, however, total year estimates should be made available.

The input data for MSVPA can be derived from the expression for the estimation of food suitability coefficients (SPARRE, 1980):

$$SUIT(j,b,s,a) = \frac{\dfrac{C(j,b,s,a)}{N(y,s,a)*W(j,b,s,a)}}{\sum_i \sum_d \dfrac{C(j,b,i,d)}{N(y,i,d)*W(j,b,i,d)}} \qquad (1)$$

where s (and i) = index of prey species
a (and d) = index of prey age group
j = index of predator species
b = index of predator age group
y = index of year

C(j,b,s,a) = relative consumption of prey (s,a) by predator (j,b)
N (y,s,a) = mean stock number of prey (s,a) in year y
W (s,a,j,b) = mean body weight of prey (s,a) in the stomach of predator (j,b)

The relative consumption C(j,b,s,a) is given by the consumption of prey (s,a) by predator (j,b) divided by the total consumption by predator (j,b), both in weight units per time unit. Predation mortality, M2, is estimated by

$$M2(y,s,a) = \sum_j \sum_b \frac{N(y,j,b) * R(j,b) * SUIT(s,a,j,b)}{\sum_i \sum_d N(y,i,d) * W(i,d,j,b) * SUIT(i,d,j,b)} \qquad (2)$$

where R(j,b) is the consumption (g) per unit time by predator (j,b).

Thus besides input data for the ordinary single species VPA this version of MSVPA requires as input:

1: relative consumption (C)
2: mean ingested body weight of prey by predator (W)
3: consumption rates (R)

4.1 Relative consumption and ingested body weights.

Equations (1) and (2) are applied to year (or each quarter of the year), so yearly and quarterly tables from which the relative consumption can be derived are required.

The relative consumption may be estimated by :

$$C(j,b,s,a) = \frac{\frac{S(j,b,s,a)}{T(j,b,s,a)}}{\sum_i \sum_d \frac{S(j,b,i,d)}{T(j,b,i,d)}} \qquad (3)$$

where: T(j,b,s,a) = the time it takes predator (j,b) to digest a specimen of (s,a) to a degree where (s,a) can not be identified.
S(j,b,s,a) = the total weight of prey (s,a) in the stomach of (j,b); i.e. the weight of the partially digested stomach contents.

Equation (3) is based on a probabilistic consideration: if the T's for large prey are larger than those for small prey, the probability of finding a large prey is relatively larger than that for a small prey. Since in fact the estimates of T(j,b,s,a) are not known at present, we make the assumption that they are the same for all items and thus eq. (3) reduces to

$$C(j,b,s,a) = \frac{S(j,b,s,a)}{S(j,b)} \qquad (3a)$$

where S(j,b) is the weight of the total stomach contents. Thus, relative consumption becomes equal to relative stomach contents in the case of equation (3a).

Although the mean number of prey in the stomach of a predator are not used as input to the particular MSVPA defined by equations (1) and (2), they might turn out to be essential for alternative versions of MSVPA. However, they can be obtained by dividing S(j,b,s,a) by 0.5 x W(s,a,j,b).

Thus the following two tables are required for each quarter:

1 Mean weight of prey (by species and age group) in the stomach contents: S(j,b,s,a),
2 Mean (round fresh whole) body weight of prey (s,a) in the stomach of predator (j,b): W(j,b,s,a).

4.2. Consumption rates.

For each predator species and age group estimates of total consumption per specimen are required for each quarter of the year (i.e. : R(j,b) = total consumption of one predator (j,b) during a quarter of the year) and similarly for the total year.

5. PRIMARY DATA ANALYSIS

5.1. General comments.

At the outset of the Stomach Sampling Project (ANON.,1981) the various steps involved from collection of the samples up till the ultimate use in multispecies assessment were defined in general terms (Fig 1). Although the first part of the analysis of obtaining average stomach contents by area and quarter and the summation of these over the total North Sea is essentially straight forward, in practice there were specific reasons why for the various species the actual procedures followed deviated from the basic scheme. Before these deviations will be specified in the following sections, the main scheme will be briefly outlined.

The basic strata for collecting samples were quarters of the year, statistical rectangles and predator size classes. If more samples were collected from the same stratum, these samples were added giving each stomach sampled equal weight.

The results were aggregated by Roundfish Area using the abundance (N/hr) per size class derived from the surveys during which the stomachs had been collected as a weighting factor.

During the surveys otolith samples of the predators were collected by Roundfish Area too and these ALK's were used to estimate the contribution

of the various size groups to the average stomach contents by age group. In addition the prey size distributions of exploited fish species were redistributed over the age groups using the same ALK's. For prey species other than those studied as predator as well no special otolith sampling procedures had been arranged in planning the project and therefore in those keys appropriate ALK's had to be selected from other sources.

Before the age compositions of prey were estimated, the weights of each prey size class were adjusted by distributing the unidentified components of the diet proportionally among the various identified components, taking into account the level of identification. Thus the completely unrecognizable items were left out, but weights of unidentified fish were allocated in proportion to all observed fish species, unidentified clupeoids to herring and sprats, etc. Similarly, the remains, which had not been assigned to size classes were allocated to the recorded size classes within each prey species.

The last step in the primary analysis was to combine the areas to obtain an average quarterly North Sea value in terms of both average weights and numbers of prey by age group present in the stomach of a predator of each age group. The weighting factor of each area was defined by the survey index (N/hr), multiplied by the number of squares included in each area.

The methods applied by the various species coordinators in preparing the 1983 ICES contributions on the SSP were critically reviewed during the meeting and in order to gain in terms of uniformity in analysis several changes have been implemented. As a consequence the results presented in this report may deviate to some extent from the earlier estimates of consumption.

5.2 Cod.

In view of the high variances related to research vessel catches, from which it is inferred that single haul estimates of abundance are poor estimates of abundance, the weighting factors used in obtaining average stomach contents per Roundfish Area were the square root of the N per hour fishing. The rationale for this approach is that in this way the factor reflected the differences in abundance while not giving too much weight to accidentally high catches.

Since the fraction of unidentified fish in cod was very low indeed no effort has been made to redistribute this fraction among the various fish species. The reason for this low proportion of unidentified fish showing up in the final figures is that at the time of analysis the decision of redistributing unidentifiable fish remains among the predominant species in the sample was taken whenever possible.

In redistributing the unknown size class fraction among the various size classes, it sometimes happened that this unknown size class was the only fraction present for a particular prey/predator age group/area/quarter set. In such cases no age composition of prey could be calculated, but when summing over the areas an adjustment was made for this unknown age group in proportion of the total North Sea age distribution.

Since weights and numbers were analysed as parallel data sets, the implied average weight of any prey age category at time of ingestion (W) was obtained by dividing the observed weight in the stomach (S), multiplied by 2 (assuming the average prey in the stomach to be halfway digested), by the number (n) in the stomach:

$$W = \frac{2 * S}{n}$$

The estimated total North Sea diet comes out rather differently from those presented in DAAN (1983). For cod the procedure formerly adopted was to obtain a total North Sea average stomach content by predator size class through weighing the samples by the abundance in each rectangle. Then a total North Sea ALK, derived from the summation of the survey catches by size and age over the North Sea, was applied to estimate the stomach contents by predator age group. Similarly, the prey age distribution was based on total North Sea ALK's.

Table V-2-1 provides the average stomach content weight by age group of exploited fish species per 1000 cod by age group and quarter. Similarly, table V-2-2 provides the stomach content composition in terms of numbers. Finally, table V-2-3 gives estimates of implied average weights at time of ingestion according to the equation given above.

In these tables data on the presence of plaice and sole in cod stomachs (cf. DAAN, 1983) have been excluded, because there is a suspicion based on the size distribution of these prey that they represent discarded fish from the commercial trawl fisheries.

5.3 Haddock.

The analysis of the haddock stomachs has been completed and some preliminary results are available. Table V-3 presents information by quarter on sampling intensity and stomach content composition in percentage form for some major taxonomic units and also for the commercially important fish and crustacean species.

These results are based on an arithmetic mean of all samples taken and do not take into account abundance and area effects, so that they are not directly comparable with published data for other species. It is intended that in the near future the abundances will be incorporated in the data base and a standard analysis of the haddock data can be expected in due course.

5.4 Whiting.

The primary data processing of the whiting data was done according to the standard procedure with the following exceptions. When replicate samples were obtained from a statistical rectangle, each sample was worked up separately, and the rectangle value was calculated as the arithmetic mean of the sample values, disregarding sample size. Further, because in cases where hardly recognizable remains were found in the stomach, no

estimates of the number represented by these remains were recorded. Therefore, the analysis of stomach contents in terms of numbers creates difficulties.

In the preliminary report (HISLOP et al,1983) the total North Sea diet-at-age figures were obtained by calculating an average diet-by-size group array for the total North Sea and converting this into terms of age groups by the application of a total North Sea ALK (obtained by weighting Roundfish Area ALK's by catch rates and area size. In addition, the prey were divided between age groups using a total North Sea ALK. As a result of the application of ALK's by Roundfish Area and the weighting procedure over the areas the average total North Sea stomach contents have changed.

The results in terms of weights, numbers and prey weights at time of ingestion are given in tables V-4-1 to 3 respectively. It should be noted that, in contrast to cod, the prey weights of whiting were estimated from the mean weights within each size class of prey and the size distribution. The average number of prey present in the stomachs have been derived by multiplying stomach weights by two and dividing by prey weights (cf the equation given in section 5.2).

5.5 Saithe.

Detailed information on the data processing has been given by GISLASON (1983). Since it was decided to apply a different set of prey ALK's, it was necessary to revise the calculations.

When samples from the same stratum were combined, they were weighted according to the sample size, unless the sample consisted of more than 25 fish. In those cases a maximum weighting factor of 25 was applied.

Due to the low sampling intensity of saithe stomachs, it was decided to deviate from the general flowchart by combining data from 1980, 1981 and 1982 and by not weighting samples by abundance indices. The ALK applied to the saithe size distributions was constructed using quarterly ALK's from Denmark, England, Norway and Scotland.

Tables V-5-1 and 2 provide the weight percentage distributions and the estimated prey weights respectively. The latter have been obtained following the same procedure as described for whiting.

5.6 Mackerel.

Stomachs of mackerel were sampled during 1980 - 1983 by bottom and pelagic trawl, hook and line and gill-net throughout the North Sea. No allowance has been made for possible differences in stomach contents of fish between different gear and all samples were lumped.

The data were then filed and retrieved from the computer as described by WESTGÅRD, 1982. The diet observed in the 3674 stomach sampled in 1981 and 1982 is presented in MEHL and WESTGÅRD, 1983.

In 1980 and 1983 an additional 1271 stomachs were sampled. Much the same

distribution of sampling effort by gear and area was used in 1980 and 1983 as in the other two years. Since the number of stomachs sampled for mackerel in 1981 was low in certain round fish areas and quarters as compared to other species, it was decided to pool the data into four areas and combine all years. The numbers of stomachs sampled in each quarter in each ICES statistical rectangle are shown in Fig 2.

The diet in the various length groups (20 - 29 cm, 30 - 39 cm and 40 - 49 cm) of the mackerel is shown in table V-6 for each quarter of the year and for the four areas, defined in figure 2. The commercial species eaten to any extent are Norway pout and sandeel.

5.7 Prey age length keys applied.

The ALK's applied to the prey species were derived from two sources:

- Those for cod, haddock and whiting were collected during trawling surveys by Roundfish Areas and are in fact the same as used for the transformation from predator size groups to age groups. The data were analysed at the Netherlands Institute for Fishery Investigations following the procedures routinely applied to IYFS data. Copies of these ALK's are available upon request from the Dutch institute.

- The ALK's for Norway pout, herring, sprat and sandeel are based on biological samples and data collected from the Danish industrial fisheries during 1981. For each month and sampling area the biological samples have been weighted by the commercial catch and from these quarterly ALK's for the total North Sea have been derived (Tables V-7-1/4).

The latter set of prey ALK's is not entirely satisfactory, because they have not been split by areas and because the Danish industrial landings may not be representative for the total North Sea populations of the various prey species. When the coordinators are provided with more refined ALK's, these will be included in future analyses.

6. DIGESTION RATES.

6.1 Models of food consumption.

The working group discussed various models for food consumption, i.e. models by which food consumption per time unit can be expressed as a function of the stomach contents.

Different models and methods have been applied to the various predator species (cf. ANON., 1981;, DAAN, 1983; GISLASON, 1983; MEHL and WESTGÅRD, 1983; HISLOP et al, 1983). The Group did not attempt to select a "most dependable" model, but in the following the principal differences and similarities between the models actually applied are reviewed.

The models all take their starting point in the equation :

$$dS/dt = dR/dt - dE/dt$$

where S is the the stomach content (g), R is the food intake and dE/dt is the rate of gastric evacuation. Due to diurnal oscillation in food intake dR/dt may change from hour to hour, and due to body growth of the predator dR/dt changes from year to year. Still, for an appropriate period of time, say one week, it is reasonable to assume that the mean diurnal dR/dt remains constant and that dS/dt equals zero. Thus, in that case

$$dE/dt = dR/dt$$

To model dE/dt we start by a model of digestion rate, dw/dt, where w is the weight of the remaining (undigested) part of a food item. Three models are considered:

1. The linear model (DAAN, 1983)
2. The exponential model (ELLIOTT and PERSSON, 1978)
3. The general model (JOBLING, 1981)

The GENERAL MODEL reads :

$$dw/dt = - c1 * w^{c2} \qquad (4)$$

where c1 and c2 are constants; c2 is supposed to be in the range $0<=c2<=1$.

For c2 = 0 (4) reduces to the LINEAR MODEL :

$$dw/dt = - c1 \qquad (4a)$$

For c2 = 1 (4) reduces to the EXPONENTIAL MODEL :

$$dw/dt = - c1 * w \qquad (4b)$$

The solutions to the three differential equations are:

Linear model : $w(t)=w(0) - c1*t$ for $t < w(0)/c1$
$w(t)=0$ for $t >= w(0)/c1$

Exponential model: $w(t)=w(0)*\exp(-c1*t)$

General model : $w(t)=(w(0)^{1-c2} - c1(1-c2)*t)^{1/(1-c2)}$ for $t < w(0)^{1-c2}/c1(1-c2)$
$w(t)=0$ for $t>=w(0)^{1-c2}/c1(1-c2)$

where w(0) is the weight of the fresh food item.

Models expressing dw/dt as a function of the predator body weight W are of the same type as Eq. 4 when w refers to the total stomach content and W and w are assumed to have a functional relationship of the type :

$w = a*W^b$ (where a and b are constants)

To go from the model Eq. 4 to a model for dR/dt we consider the stomach content at, say, time t :

S(t) = the weight of the remains (undigested parts) of all food items ingested before time t.

$$= \int_{-oo}^{t} (dR/du) * q(t-u)\, du \qquad (5)$$

where q(t-u) is the fraction of the food eaten at time t-u , which remains in the stomach at time t ($0 <= q <= 1.0$).

For the three cases we get :

Linear model : $q(t-u) = MAX(0, 1 - (t-u).c1/w(0))$

Exponential model : $q(t-u) = exp(-c1*(t-u))$

General model : $q(t-u) = MAX(0, (w(0)^{1-c2} - c1(1-c2)(t-u))^{1/(1-c2)} /w(0))$

The time period in which there remains undigested parts of a food item is in the three cases :

Linear model : $D = w(0)/c1$

Exponential model : $D = oo$

General model : $D = w(0)^{1-c2} /c1(1-c2)$

The stomach content (i.e. the integral Eq. 5) becomes :

Linear model : $S = F*D/2$

Exponential model : $S = F/c1$

General model : $S = F*D*(1-c2)/(2-c2)$

where F is the constant food intake per time unit. Notice that c1,c2 and D in the three models are not compatible.

Finally we obtain the estimate of food consumption as a function of stomach content :

Linear model : $F = 2*S/D$

Exponential model : $F = c1*S$

General model : $F = (2-c2)*S/D/(1-c2)$

The digestion time D depends on the meal size w(0), which on average is related to the size of the predator. The parameter c1 is a function of the environment e.g. the temperature and the season of the year in the general model and in the linear model. DAAN (1973) uses the expression $D = d*L$ where L is the length of the predator and d is a constant.

In the exponential model c1 is a function of temperature nad the size of the predator. GISLASON (1983) uses the expression

$$c1 = c11 * W^{c12}$$

where c11 and c12 are constants and W is the body weight of the predator.

The linear model would imply that digestion rate is independent of meal size and thus independent of predator size (c2=0), or else the effect must be accounted for by a variable c1 as in the formulation of DAAN (1973).

The exponential model (c2=1) implies proportionality between meal size (predator size) and digestion rate.

The general model (0 <= c2 <= 1) implies that digestion rate depends on meal size (predator size) in the way that a small meal is digested at a faster rate than a large meal, or, when meal size is related to predator size : small pre- dators have a relatively larger digestion rate than large predators.

URSIN et al (1984) apply various more elaborate models for food consumption to a variety of cod stocks. These have not been considered here, because there is still a considerable discrepancy between such conceptual models of a higher dgree of complexity and the available experimental data. This may be illustrated by a quote from their lamentations:

"In spite of the extensive literature on cod food consumption and digestion it must be realized that we still have only the vaguest ideas of how food consumption depends on body size and of what determines the stomach evacuation rate."

6.2. Available experimental data.

Because the digestion experiments were still in progress and the results of recent work were not readily available to the group, it appeared to be premature to try to amke a coherent analysis of the experimental data obtained so far and it was decided to leave it to the coordinators to judge which model and parameter values to use in any conversion from stomach contents to food intake.

7. ESTIMATES OF CONSUMPTION.

7.1. Cod.

Since recent digestion experiments involving 75 cod and 167 whiting did not indicate that the exponential model did fit the results any better than the linear one and since at first inspection the digestion times obtained did not deviate substantially from earlier observations on cod, the model developed by DAAN (1973) has been used. If required, this model can easily be adapted to apply directly to numbers in the stomach

and numbers consumed (DAAN, 1983).

In table VII-1-1 the observed mean length according to survey data are given by quarter in comparison with estimated values on the basis of an average North Sea cod growth curve. Although for the older age groups both sets of data compare very well, particularly in the younger age groups the growth curve gives rather different results. For estimating digestion times, which are also given in the table, the observed set of mean length was considered to be more appropriate. Differential temperature effects by seasons and areas have not been taken into account.

In table VII-1-2 the estimated total food consumption of cod by age group and quarter is given. There appears to be one exceptional high value, which could be traced back in the data base to one exceptional sample, but because there appears to be no error involved no effort has been made to exclude this sample. It does indicate, however, that as procedures of analysis are refined smoothing factors are becoming increasingly ineffective.

7.2. Haddock.

Estimates of consumption by the haddock stock had to be postponed to a later stage, because a proper split of fish prey by size class could not yet be made.

7.3 Whiting.

Digestion rate experiments carried out on whiting in Aberdeen indicated that it would be appropriate to use the linear model as the basis for estimating consumption. In the course of these experiments meals of intact sprats, sandeels and 0-group haddock of a size range (6-12 cm) similar to that found in the stomachs were fed to whiting in the size range 27-40 cm. The sandeels and haddock were completely eliminated from the stomach in approximately 2 days and the sprats in 2.5 days. Because the experimental temperatures (9-14 'C) were rather higher than those normally encountered by whiting throughout the greater part of their range, it was thought best to adopt the higher of the two values. The value of D=2.5 was used to estimate the rate of consumption of fish prey of all size groups by whiting of all size groups, quarterly consumption being calculated by the equation:

$$C = 91 * \left(\frac{2 * S}{2.5} \right)$$

where w = weight of fish prey in an average stomach.

Because there is a more or less linear relationship between the weight of the stomach contents of whiting and the weight of the fish, i.e.

$$S = .013\ W^{.98}$$

(HISLOP et al, 1983), it is a simple matter to apply a range of values of D and to examine the effect that this has on the estimated consumption of food in terms of the body weight of the predator. Thus the value of D=2.5 implies an annual consumption corresponding to 3.8 times body weight. If values of D=2.0 and D=3.0 days are substituted, consumption becomes 4.7 and 2.7 times the body weight respectively.

The estimated total food consumption of whiting by age group and quarter is is given in table VII-3.

7.4 Saithe.

Having the quarterly stomach content composition by age and area of prey items, it was possible, using data on ambient temperature (values ranging from 7.2 to 9.8 'C), mean weight at age and digestion rates to calculate an annual consumption of prey items by saithe.

Data on temperature were derived from TOMCZAK and GOEDECKE (1962) and data on mean weight at age and stock size from ANONYMUS (1983).

To arrive at an estimate on digestion rate, aquarium experiments were performed and the analysis of data resulted in the following model for digestion by saithe:

$$w(t) = w(o).EXP(-0.25 \cdot W^{-0.6} .t)$$

where w(t) = weight of a prey item after t time units in the stomach and
w(o) = weight of the prey at time of ingestion and
W = weight of the saithe.

Data on effects of temperature (T) and body weight on digestion were derived from the available literature and the daily consumption (R) was calculated as (GISLASON, 1983):

$$R = 0.0266 \cdot EXP(0.096 \cdot T) \cdot W^{0.74}$$

Combining these models allowed the estimation of the annual consumption of each prey age group by the average North Sea saithe of each age group (table VII-4). Although no changes were made in the estimation procedures of the consumption as compared to GISLASON (1983), the application of different prey ALK's made recalculations necessary.

7.5 Mackerel.

The methods used to compute the consumption of mackerel is described by MEHL and WESTGARD (1983a) and will only be briefly discussed here.

The diet presented in table V-6 for the 20-29, 30-39 and 40-49 cm groups has been assumed to be representative for the 1-2, 3-7 and 8+ year old mackerel respectively. In calculating a total North Sea value the diet in the different areas has been weighted according to a tentaive pattern of abundance as shown in Table VII-5-1 (From MEHL and WESTGARD, 1983a). Since the rate of digestion in mackerel has been shown to be a function

of temperature (MEHL and WESTGÅRD, 1983b) and since the temperature regime to which the North Sea mackerel are exposed to varies considerably in space and time, effects of temperature have been taken into account in the calculations. The temperatures used have been taken from TOMCZAK and GOEDECKE (1964) and the values are shown in table VII-5-2. To convert prey size classes to age groups the ALK's given in tables V-7-1/4 have been used.

The consumption in g by one individual in each age group of mackerel on each prey age group by quarter and for the total year are shown in tables VII-5-3 and 4 respectively.

Using the weight at age data in the catch for the North Sea mackerel stock as given in ANON. (1984), we find that the 1 and 2 year olds consume about 2.5 times their own weight per year; the corresponding figures for the 3-7 and 8-15+ years old are 2.8 and 2.5. These values are reasonable compared to what is known about other species (LAEVASTU and LARKINS, 1981). A critical item of information for computing the mackerels consumption of different prey items is the pattern of distribution since the diet of mackerel varies a lot between areas. The temperature is also quite different from area to area and in the lower and upper part of the water collumn. In future therefore the abundance of mackerel should be better described to improve the estimates.

8. EXCHANGE OF DATA.

During the 1982 meeting of the group of coordinators a format had been drawn up for the exchange of SSP data (table VIII-1), which was based on a similar setup in the IYFS exchange program. Although there have been no objections or comments on this format, experience with the IYFS exchange tape format has taught that in its practical application considerable difficulties and consequently delays in the actual exchange can be anticipated. There might be more effective ways of exchanging particular data sets between laboratories and for instance the IJmuiden laboratory has accepted to help in the analysis of the haddock data set as long as the French data are made available on tape in any text file format.

Still, it was realized that at some stage a complete set of data in a uniform format should be available at ICES head quarters and J.G.Pope offered that Mrs Julie Hunton of the Fisheries Laboratory in Lowestoft took up this task of preparing a tape according to the agreed format containing data for all species, while accepting readily understandable ascii files from the various countries. It would greatly facilitate this work if such files were presented in fixed format or if, alternatively, numeric and alphanumeric data did not occur on the same line.

In order to speed up the exchange a deadline was accepted of the 1st of september for the submission of data tapes to Lowestoft.

9. FUTURE WORK.

The members of the group felt that it might be helpful in the planning of future work if they recorded their views on the 1981 project. In the case of cod, haddock and whiting, no problems had been experienced in the collection of samples and because these species can be captured with standard demersal trawls and because the necessary catch at age data could be collected for weighting the stomach data by predator abundance. The major problem for these species is the absence of appropriate age length keys of some of the prey species by area and in case of a follow up more care must be given that such data are made available.

It is quite clear that cod and whiting are major fish predators and that an appreciable proportion of their diet consists of exploited species. The pre- liminary data for haddock indicate that this species may also consume a large quantity of fish prey (largely sandeels).

The problems encountered with saithe and mackerel were considerable. Because these species cannot be effectively sampled with a bottom trawl, it proved impossible to obtain a sufficient number of stomachs in 1981 and sampling continued in 1982 and 1983. Thus the data obtained for these species do not strictly reflect the situation in 1981 but rather the average diet over some years. Not only was the sampling coverage rather poor but also, because no reliable data were available on the geographical distribution of the predators, some rather large assumptions had to be made when estimating consumption on a total North Sea basis. It appears that the main food of mackerel is invertebrates, the only fish prey that were prominent in the diet were Norway pout and sandeels. Saithe, on the other hand, were eating a wider variety of fish prey. The group was of the opinion that bearing in mind the practical difficulties and the apparently minor predation of fish by mackerel, it might not be profitable to continue work on this species in any future investigation but that it might be worth thinking about a more rational scheme for obtaining further data on saithe.

In discussion the possibility that the ad hoc Multispecies Assessment Working Group might choose to run the MSVPA on a quartely basis was raised. This would have considerable advantages from the point of view of any further stomach sampling schemes, because results which represented the North Sea for any one quarter would be usable in examining the suitability matrix of a species. Thus the strict requirement for coverage of the North Sea for a whole year could be relaxed to coverage during a quarter only. Single laboratories would thus be more capable of providing useful results either individually or in collaboration. Moreover research vessel scheduling might require less central coordination and should be easier to arrange.

The freedom from the constraint of providing annual results also allows some exiting possibilties to be considered for future research. For example stomach sampling surveys might be arranged from 1st of July in one year to the 30th of June in the next so as to allow to follow the predation mortality on a specific year class of prey rather than on the I-group and 0-group of successive year classes. Again such a scheme might be easier to arrange since it would span the research vessel scheduling of two years rather than of one year.

Apart from doing more work of the same type other possibilities were

discussed. First the group considered whetheher there were other predators which might be considered. Herring in the second and third quarters of the year seemed a possibility, even if this only served to identify its relative importance as a predator of pelagic 0-group fish. Apart from this, studies of the processes occurring between larvae and 0-group could be informative in respect of factors determing year class strength, but this would need a parallel modeling input since it seems unlikely that the MSVPA could usefully be extended to younger ages of fish than a notional 6 months.

In general the need was stressed of repeating the exercize in some form or another. Although the evidence provided by DEKKER (1983) that for all practical purposes size suitability of individual prey species is relatively constant was appreciated, there remains a strong need to test the hypothesis that ecological vulnerability is also constant from year to year. Secondly, it was felt that even though the project had provided clear evidence of a considerable higher predation mortality than formerly assumed, it would remain a narrow basis for completely revising the general ideas about the level of predation mortalities. For instance, it is worrying that before this exercize haddock had never been reported in whiting stomachs!

10. REFERENCES.

ANONYMUS, 1981 - Draft Manual for the Stomach Sampling Project, 1981. Internal Report Netherlands Institute for Fishery Investigations.

ANONYMUS, 1983 - Report of the Saithe (Coalfish) Working Group. ICES C.M. 1983/Assess:16.

ANONYMUS, 1984 - The report of the Mackerel Working Group. ICES C.M. 1984/Assess:8.

DAAN,N., 1973 - A quantitative analysis of the food intake of North Sea cod, Gadus morhua. Neth J. Sea Res. 8 (1): 27-48.

DAAN,N., 1983 - Analysis of the cod data collected during the 1981 Stomach Sampling Project. ICES C.M. 1983/G:61.

DEKKER,W., 1983 - An application of the Andersen Consumption model in estimating prey size preference of North Sea cod. ICES C.M. 1983/G:63.

ELLIOTT,J.M. and L.PERSSON, 1978 - The estimation of daily rates of food consumption for fish. J. Anim. Ecol. 47:977-991.

GISLASON,H., 1983 - A preliminary estimate of the yearly intake of fish by Saithe in the North Sea. ICES C.M. 1983/G:52.

HISLOP,J.R.G, A.P.ROBB, M.A.BROWN and D.W.ARMSTRONG, 1983 - A preliminary report on the analysis of the whiting stomachs collected during the 1981 North Sea stomach sampling project. ICES C.M. 1983/G:59.

JOBLING,M. 1981 - Mathematical models of gastric emptying and the estimation of daily rates of food consumption for fish. J. Fish. Biol. 19:245-257.

LAEVASTU,T. and H.A.LARKINS, 1981 - Marine fisheries ecosystems. Its quantitative evaluation and management. Fishing New Books. Ltd. Farnham.

MEHL,S. and T.WESTGÅRD, 1983a - The diet and consumption of mackerel in the North Sea. ICES C.M. 1983/H:34.

MEHL,S. and T.WESTGÅRD, 1983b - Gastric evacuation rate in mackerel. ICES C.M. 1983/H:33.

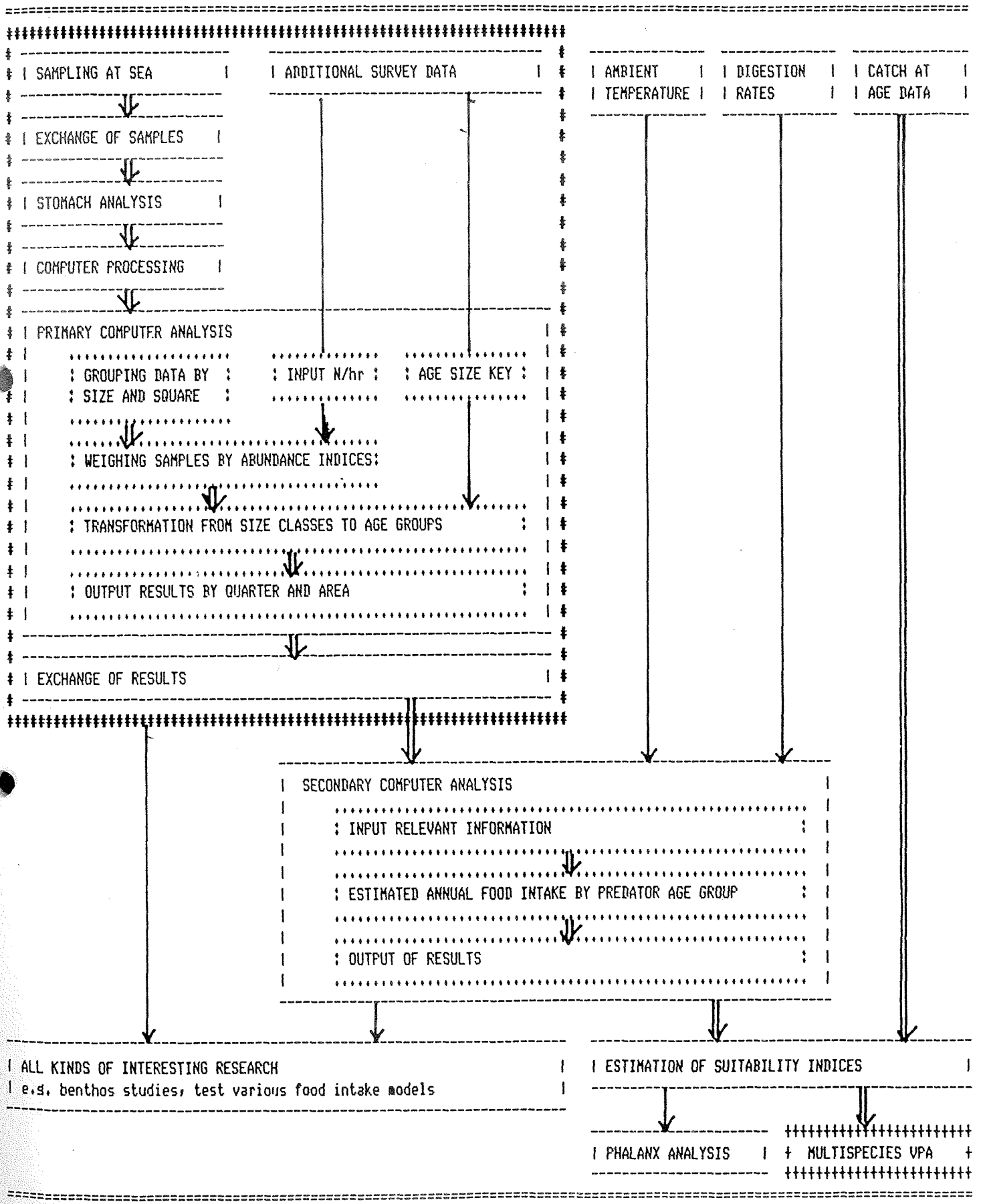
SPARRE, P. 1980 - A goal function of fisheries (Legion analysis). ICES C.M. 1980/G:40.

TOMCZAK,G. and E.GOEDECKE, 1964 - Die thermische Schachtung der Nordsee auf grund der mitteleren Jahresganges der Temperatur in 1/2 und 1 - Feldern. Deutschen Hydrographischen Zeitschrift, Erganzungsheft Reihe B (4) Nr.8.

URSIN,E., M.PENNINGTON and M.GROSSLEIN, 1984 - Stomach Evacuation Rates of Atlantic Cod (Gadus morhua) estimated from Stomach Contents and Growth rates. DANA (in press).

WESTGÅRD,T., 1982 - Programs for handling and analysis of stomach content data. ICES C.M. 1982/H:21.

Fig. 1
Flow chart of operations necessary to achieve the aim of using stomach content data as input for multispecies assessment.



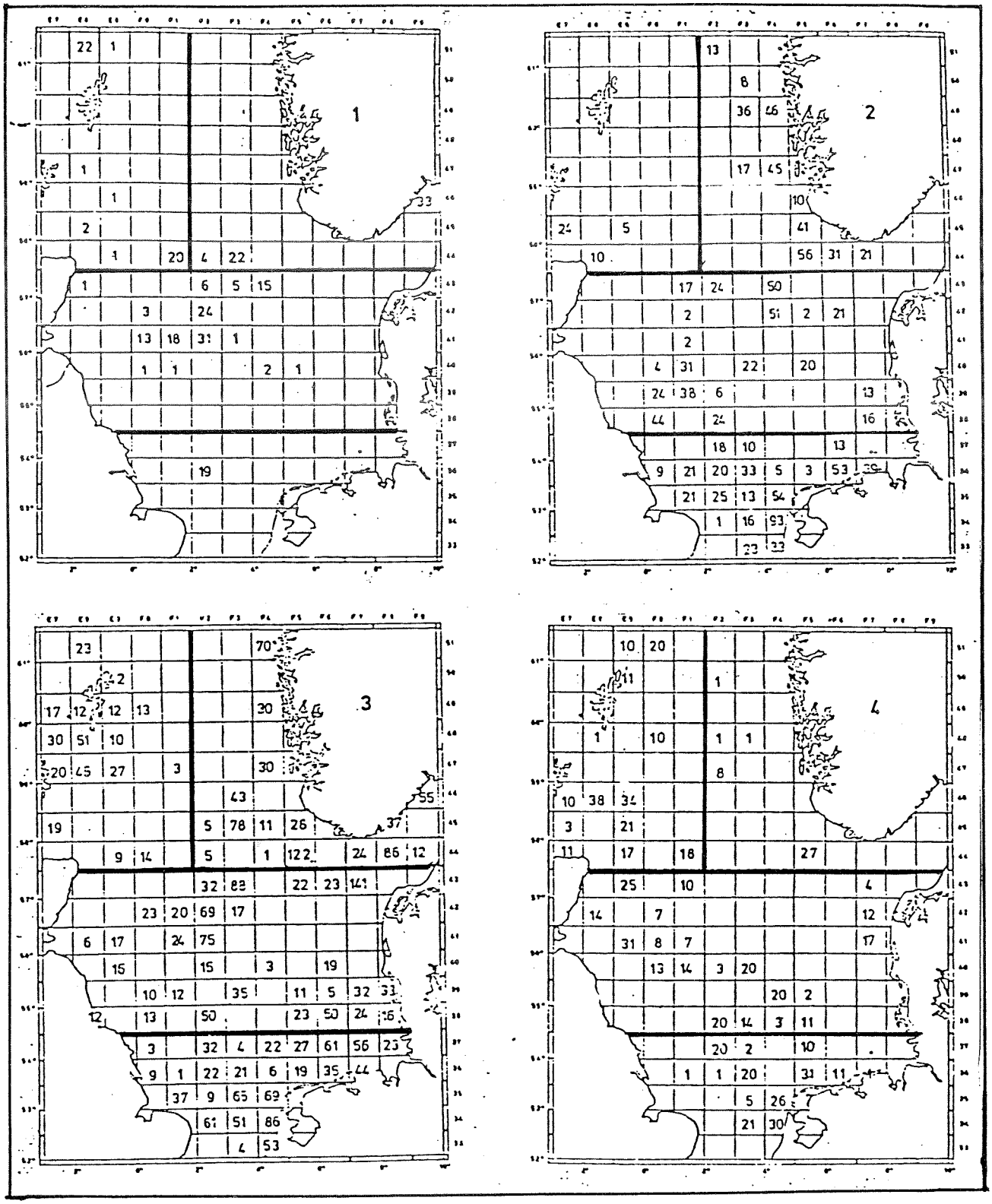


Fig. 2.
Number of mackerel stomachs sampled in the North Sea in 1980-83 by quarter and statistical rectangle.

TABLE V-2-1.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of COD by age group.

A: 1 QUARTER 1981

# PREDATOR								
Age group:	0	1	2	3	4	5	6+	
Tot Wght:	.00	1491.92	7735.33	20023.90	52797.94	78235.44	109011.92	
# Prey:	GADUS MORHUA							
1			116.18	264.91	1157.44	3271.74	3140.73	
2			.99	27.99	662.41	3552.66	6177.41	
3					15.62	58.69	1004.25	
# Prey:	MELANOGRAMMUS AEGLEFINUS							
1		1.00	136.19	1448.59	3144.75	3303.52	3221.26	
2			9.96	1149.47	8262.75	10265.71	7243.64	
3			.52	27.83	436.66	562.45	398.76	
4			.02	5.10	28.38	34.36	25.77	
# Prey:	MERLANGIUS MERLANGUS							
1		15.25	335.02	809.64	2374.47	4764.50	5771.27	
2		.04	221.43	1186.54	7618.67	13330.08	19073.99	
3			18.12	579.68	3330.67	6034.47	7566.88	
4			9.57	296.42	1128.12	1310.81	1233.78	
5			2.25	55.20	218.73	259.44	339.71	
6			.33	10.39	48.15	54.29	113.93	
# Prey:	TRISOPTERUS ESMARKI							
1		2.51	114.99	946.05	1476.09	1090.06	846.88	
2		.23	39.76	927.88	2259.47	1958.23	1554.79	
3			.36	44.49	144.76	132.64	103.03	
# Prey:	CLUPEA HARENGUS							
1		1.89	229.62	502.46	887.34	784.04	1058.31	
2			12.51	258.99	493.74	296.71	1596.89	
3			7.34	470.88	665.14	320.15	1081.78	
# Prey:	CLUPEA SPRATTUS							
0		.07	.64	1.57	5.20	7.03	1.19	
1		122.03	169.55	54.45	156.72	307.37	712.83	
2		109.19	584.54	596.63	1226.96	1586.28	2359.82	
3		2.12	83.06	109.20	211.81	245.09	282.07	
4		.02	1.01	1.33	2.58	2.99	3.44	
# Prey:	AMMODYTIDAE							
0			.09	.00				
1		21.23	308.22	945.59	662.84	211.29	137.70	
2		3.41	176.37	824.66	716.08	115.93	69.88	
3			27.05	232.16	334.39			
4			32.28	277.09	399.11			
5			10.47	89.87	129.44			
6			11.34	97.36	140.73			

TABLE V-2-1. Ctd.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of COD by age group.

B: 2 QUARTER 1981

# PREDATOR								
Age group:	0	1	2	3	4	5	6+	
Tot Wght:	.00	1762.16	11982.71	42028.63	91067.63	101283.83	152915.89	
# Prey:	GADUS MORHUA							
0		24.32	89.68	100.86	32.17	1.10		
1		2.13	59.38	539.33	5388.20	5322.92	819.37	
2			.62	119.97	1159.59	1219.04	328.00	
3				34.18	580.80	616.59	162.05	
# Prey:	MELANOGRAMMUS AEGLEFINUS							
0		.97	12.66	43.92	152.84	154.58	40.63	
1		10.05	148.02	1067.09	780.22	512.41	999.24	
2			27.80	1289.59	2939.39	5100.40	4730.64	
3				9.23	125.14	289.39	288.36	
# Prey:	MERLANGIUS MERLANGUS							
0		.04	6.46	3.77	175.94	165.55	21.90	
1		1.42	102.40	1079.99	2030.53	714.40	4510.78	
2			60.73	1073.20	6072.67	6524.77	12992.40	
3			.26	203.90	2210.25	2775.22	11456.31	
4				57.79	633.23	689.05	1459.40	
5				.64	7.32	24.92	335.67	
6				.36	4.16	14.15	190.72	
# Prey:	TRISOPTERUS ESMARKI							
0			4.66	77.48	34.71	16.68	69.34	
1		.08	83.27	965.40	2107.08	2244.31	1077.41	
2			17.26	691.39	1241.49	1222.49	410.65	
3			.16	7.90	13.94	13.61	4.36	
# Prey:	CLUPEA HARENGUS							
1		9.43	128.71	276.99	976.38	728.87	2044.10	
2		.12	22.05	202.24	1830.46	4797.39	6686.21	
# Prey:	CLUPEA SPRATTUS							
0		14.34	41.11	2.37	16.23	40.78	173.74	
1		14.88	149.67	81.22	394.07	272.82	697.45	
2		26.42	272.90	229.09	1052.31	590.54	1251.93	
3		2.74	33.26	38.36	150.87	62.72	129.07	
# Prey:	AMMODYTIDAE							
0		96.75	1380.42	1232.03	1780.30	1544.66	327.31	
1		169.21	1505.80	1378.20	3608.34	3484.48	1203.34	
2		77.96	401.79	800.07	872.86	776.81	599.41	
3		7.64	116.94	390.87	412.13	237.07	144.22	
4		3.29	63.32	301.02	342.65	170.22	75.19	
5		.70	25.85	110.78	120.70	60.28	29.68	
6		.17	14.41	89.56	104.64	46.84	15.73	

TABLE V-2-1. Ctd.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of COD by age group.

C: 3 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6+
Tot Wght:	217.43	3493.17	15480.81	45180.05	111047.72	157176.37	379465.55
# Prey: GADUS MORHUA							
0		170.65	1039.87	149.32	516.84	1391.51	329.15
1			5.60	160.79	911.38	3062.68	682.72
2				53.85	387.22	1387.22	304.51
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		25.59	744.56	1924.21	1705.67	1483.12	753.60
1		.07	150.85	2276.07	6525.95	5675.36	3493.35
2			23.40	966.02	7779.73	12392.94	73501.64
3			1.18	19.57	223.45	668.65	27618.44
4				.08	.56	4.65	5342.04
5							503.06
# Prey: MERLANGIUS MERLANGUS							
0	.67	339.24	834.15	239.20	26.91		
1		2.12	600.15	750.62	1753.98	981.54	943.45
2			29.14	326.74	1975.85	2096.30	6973.24
3			2.65	158.63	652.01	859.68	1164.56
4			1.16	36.76	118.28	173.40	181.90
5				3.88	14.65	19.46	9.13
6				1.62	6.13	8.14	3.81
# Prey: TRISOPTERUS ESMARKI							
0		18.65	821.49	1357.41	928.28	1286.62	1729.45
1			771.41	8812.07	15266.15	17286.37	9475.85
2			377.17	3216.56	2714.96	2266.58	3212.94
# Prey: CLUPEA HARENGUS							
0		15.57	220.35	160.60	43.81	16.59	
1		.38	221.96	440.99	301.07	330.85	
2		.11	47.81	57.40	21.80	30.64	
3			78.05	3483.46	16604.45	16312.94	7939.24
# Prey: CLUPEA SPRATTUS							
0		.75	.21	.41	6.37	10.08	1.85
1		80.63	246.13	46.99	5.85	.58	
2		16.19	79.51	11.14	.18	.01	
3		1.40	14.13	.51			
# Prey: AMMODYTIDAE							
0	.58	69.93	972.48	1771.00	870.41	754.30	310.85
1		1.30	61.59	106.45	8.37	.73	.30
2		3.27	145.56	217.78	19.36	6.95	2.90
3		.33	15.88	28.66	2.17		
4		.12	5.77	10.42	.79		

TABLE V-2-1. Ctd.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of COD by age group.

D: 4 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6+
Tot Wght:	860.71	7256.54	13407.81	37831.47	499354.93	86354.12	130559.43
# Prey: GADUS MORHUA							
0	2.78	.68	38.55	460.47	669.73		
1			.16	565.89	5914.14	72.22	
2				438.84	3534.68	5308.88	
3				17.95	144.62	217.21	
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		111.51	1875.16	3578.22	65253.12	8023.85	2751.91
1			55.99	779.92	31157.83	3761.94	7676.69
2				424.27	18264.48	2297.08	33761.47
3				19.69	847.80	102.44	4209.22
4				1.19	51.58	6.23	2.19
5				.29	12.62	1.52	.54
# Prey: MERLANGIUS MERLANGUS							
0		8.24	161.36	252.99	765.34	341.75	11.86
1		.00	41.22	735.37	16889.17	2939.93	446.36
2			23.24	659.00	8312.10	5492.51	11373.84
3				220.94	2052.95	2680.96	4010.77
4			1.02	56.23	532.46	598.49	
5				2.93	23.71	35.63	
6				8.02	64.78	97.34	
# Prey: TRISOPTERUS ESMARKI							
0	6.05	34.84	897.75	3107.97	47487.38	6072.25	5805.65
1		1.55	68.34	529.22	6547.94	922.38	274.28
2			17.17	179.30	1881.19	281.79	78.43
# Prey: CLUPEA HARENGUS							
0		21.26	231.51	1204.63	1.62		
1		.43	36.80	115.48	644.47		
2			2.14	10.00	117.48		
3			.76	5.44	18.01		
4			.75	5.31	3.91		
5			.95	6.73			
6			.11	.84			
# Prey: CLUPEA SPRATTUS							
1	.00	10.42	55.32	138.01	611.38	24.89	
2		3.55	59.05	159.91	773.86	31.73	
3		.06	2.54	7.41	42.26	1.75	
4		.01	.85	2.46	14.08	.58	
# Prey: AMMODYTIDAE							
0	1.43	172.67	395.44	558.48	2580.59	1476.23	2457.63
1		17.12	19.78	81.98	571.11	859.20	2621.30
2		22.06	27.40	113.23	786.00	1182.49	3614.01
3		7.16	20.65	83.40	562.75	846.63	2624.52
4		4.33	19.89	79.79	533.92	803.25	2500.56

TABLE V-2-1. Ctd.
Average WEIGHTS of exploited fish species per 1000 stomachs of COD by age group.

E: TOTAL YEAR 1981

# PREDATOR							
Age group:	0	1	2	3	4	5	6+
Tot Wght:	269.53	3500.95	12151.66	36266.02	188567.07	105762.43	192988.20
# Prey:	GADUS MORHUA						
0	.70	48.91	292.04	177.94	307.45	351.85	83.62
1		.53	45.31	382.33	3343.13	2931.13	1163.70
2			.40	160.25	1431.48	2862.46	1698.52
3				13.07	186.65	225.17	291.21
# Prey:	MELANOGRAMMUS AEGLEFINUS						
0		34.47	659.17	1388.83	16792.89	2421.48	887.23
1		2.83	121.75	1391.86	10397.03	3310.17	3850.46
2			15.23	956.19	9301.85	7488.66	29810.10
3			.42	19.05	408.15	405.59	8125.42
4			.00	1.58	20.15	11.36	1341.59
5				.07	3.16	.38	125.81
# Prey:	MERLANGIUS MERLANGUS						
0	.16	86.89	250.62	124.30	242.04	126.82	8.43
1		4.69	269.86	843.56	5761.98	2350.06	2916.68
2		.01	83.38	810.93	5994.84	6860.94	12610.70
3			5.24	291.06	2061.49	3087.59	6044.79
4			2.93	111.95	603.04	692.94	717.92
5			.56	15.70	66.11	84.86	170.93
6			.08	5.11	30.80	43.48	76.98
# Prey:	TRISOPTERUS ESMARKI						
0	1.51	13.37	431.63	1135.69	12112.56	1843.90	1901.12
1		1.04	258.96	2813.30	6349.35	5385.79	2918.61
2		.06	112.72	1253.70	2024.28	1432.25	1314.18
3			.12	13.09	39.67	36.56	26.85
# Prey:	CLUPEA HARENGUS						
0		9.16	113.58	336.80	11.42	4.16	
1		3.08	153.67	332.32	683.25	459.17	769.35
2		.06	21.03	130.67	599.08	1268.11	2043.53
3			21.61	997.66	4357.77	4173.10	2288.75
4			.18	1.30	.91		
5			.24	1.65			
6			.03	.20			
# Prey:	CLUPEA SPRATTUS						
0		3.73	10.48	1.08	5.96	14.08	44.41
1	.00	57.08	155.25	80.13	292.26	151.52	352.84
2		38.82	248.93	249.28	764.09	552.39	902.53
3		1.57	33.23	38.82	101.18	77.42	102.71
4		.01	.46	.96	4.19	.89	.86
# Prey:	AMMODYTIDAE						
0	.50	84.77	686.76	889.97	1307.46	944.54	773.95
1		52.27	474.14	628.28	1212.87	1137.41	990.60
2		26.69	187.82	489.04	598.68	520.74	1071.55
3		3.78	45.13	183.80	327.85	271.13	692.19
4		1.93	30.31	167.11	319.14	243.60	643.94
5		.37	10.52	55.95	100.94	72.90	187.72
6		.26	8.00	52.99	102.82	74.37	199.26

TABLE V-2-2.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of COD by age group.

A: 1 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6+
Tot Nmbr:	.00	2973.19	4951.21	4201.31	5078.93	6488.69	6352.68
# Prey: GADUS MORHUA							
1			3.68	8.19	34.42	86.36	81.17
2			.00	.32	10.60	47.98	73.81
3					.43	.72	11.61
# Prey: MELANOGRAMMUS AEGLEFINUS							
1		.09	14.87	124.29	200.47	179.60	168.98
2			.23	23.53	120.43	137.91	92.98
3			.00	.38	5.57	6.83	4.57
4			.00	.07	.29	.31	.21
# Prey: MERLANGIUS MERLANGUS							
1		6.26	21.69	43.94	119.74	214.17	321.95
2		.00	6.95	27.83	133.08	200.07	472.46
3			.25	7.50	38.51	65.11	105.95
4			.03	2.75	9.96	10.99	10.52
5			.00	.49	1.88	2.12	2.73
6			.00	.10	.37	.37	.68
# Prey: TRISOPTERUS ESMARKI							
1		.53	31.13	183.20	260.68	182.33	131.68
2		.01	4.52	100.79	171.46	125.02	96.11
3			.02	3.62	8.56	6.85	5.22
# Prey: CLUPEA HARENGUS							
1		.18	18.87	30.52	48.61	42.06	53.75
2			.56	13.07	19.93	10.09	82.91
3			.25	9.46	10.55	5.44	27.23
# Prey: CLUPEA SPRATTUS							
0		.10	1.66	2.35	5.98	9.36	2.46
1		82.33	83.06	27.25	70.41	119.66	202.57
2		29.81	102.17	80.91	194.52	255.54	478.83
3		.30	9.73	13.51	28.25	30.92	47.87
4		.00	.11	.16	.34	.37	.58
# Prey: AMMODYTIDAE							
0			.68	.04			
1		10.68	130.68	313.79	254.85	113.76	77.07
2		1.02	30.76	116.46	104.65	35.97	23.73
3			1.12	11.95	21.31		
4			1.34	14.26	25.44		
5			.43	4.62	8.25		
6			.47	5.01	8.94		

TABLE V-2-2. Ctd.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of COD by age group.

B: 2 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6+
Tot Nmbr:	.00	3692.09	16773.68	36116.10	66330.01	74178.82	38613.56
# Prey: GADUS MORHUA							
0		51.47	127.96	85.35	24.04	3.26	
1		.27	2.87	20.47	151.43	151.15	32.60
2			.00	1.24	10.37	10.81	3.56
3				.10	1.83	1.95	.51
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		.09	4.15	7.81	30.14	30.25	7.95
1		.89	9.67	33.29	47.79	39.62	69.96
2			.86	24.39	40.48	78.27	97.19
3				.07	.87	1.99	1.98
# Prey: MERLANGIUS MERLANGUS							
0		.00	7.84	5.33	47.33	43.57	5.29
1		.13	10.15	89.50	60.96	21.23	77.33
2			1.18	20.61	120.64	130.47	163.71
3			.00	2.64	28.46	31.42	115.76
4				.71	7.24	7.13	14.48
5				.00	.05	.16	3.34
6				.00	.03	.09	1.90
# Prey: TRISOPTERUS ESMARKI							
0			3.24	112.68	36.35	9.27	63.33
1		.01	7.55	67.01	137.50	164.06	99.87
2			.76	16.93	42.51	45.50	17.82
3			.00	.16	.43	.45	.15
# Prey: CLUPEA HARENGUS							
1		26.94	10.39	11.79	18.86	8.94	56.07
2		.05	.95	3.16	16.28	27.45	65.77
# Prey: CLUPEA SPRATTUS							
0		28.51	15.97	6.97	2.49	5.10	23.02
1		4.61	24.77	21.88	27.18	20.54	65.19
2		3.17	29.50	55.12	66.37	36.94	91.88
3		.28	3.07	7.73	8.67	3.81	9.01
# Prey: AMMODYTIDAE							
0		251.09	2703.10	2501.29	4109.12	3565.43	682.11
1		63.87	995.42	861.94	2992.75	2695.06	1051.31
2		19.47	62.82	116.23	582.01	110.90	1428.40
3		1.63	12.46	33.88	209.70	19.14	500.66
4		.73	5.99	22.74	86.43	11.30	177.10
5		.10	2.29	8.26	43.94	3.65	99.20
6		.02	1.06	6.00	15.75	2.38	25.18

TABLE V-2-2. Ctd.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of COD by age group.

C: 3 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6+
Tot Nmbr:	1534.05	5295.66	11269.19	29298.68	18475.60	10724.06	6309.21
# Prey: GADUS MORHUA							
0		31.36	208.65	9.12	53.75	182.76	40.62
1			.09	1.86	9.49	30.74	6.91
2				.16	1.18	4.24	.93
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		8.98	140.54	270.24	244.00	199.92	164.56
1		.01	2.48	29.52	86.67	76.65	44.36
2			.32	9.44	82.42	92.18	261.26
3			.02	.26	2.60	4.20	77.96
4				.00	.00	.02	8.41
5							.56
# Prey: MERLANGIUS MERLANGUS							
0	.13	82.44	220.43	52.11	1.13		
1		.07	15.99	18.28	22.95	11.68	8.04
2			.42	3.60	21.64	15.90	36.35
3			.03	.75	3.52	3.87	5.47
4			.00	.16	.47	.71	.80
5				.01	.05	.07	.03
6				.00	.02	.03	.01
# Prey: TRISOPTERUS ESMARKI							
0		10.63	335.96	514.56	381.13	520.16	657.71
1			55.01	533.09	954.76	1109.33	543.13
2			16.70	116.79	98.08	83.83	87.84
# Prey: CLUPEA HARENGUS							
0		1.19	20.55	19.26	5.56	1.41	
1		.02	4.27	12.76	9.90	9.61	
2		.00	.71	.88	.38	.46	
3			3.25	40.42	103.79	87.60	42.23
# Prey: CLUPEA SPRATTUS							
0		.31	.14	.27	2.76	5.04	.98
1		12.76	21.86	7.44	2.26	.26	
2		1.09	5.18	1.51	.07	.00	
3		.06	.61	.07			
# Prey: AMMODYTIDAE							
0	.45	70.56	699.13	1371.78	674.25	518.48	221.84
1		.19	7.62	10.81	.95	.28	.12
2		.74	31.41	42.27	4.33	2.72	1.17
3		.04	1.48	2.18	.17		
4		.01	.54	.79	.06		

TABLE V-2-2. Ctd.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of COD by age group.

D: 4 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6+
Tot Nmbr:	2161.14	5495.93	4479.78	4833.53	28130.37	5350.30	5990.25
# Prey: GADUS MORHUA							
0	.17	.04	2.78	17.15	24.70		
1			.00	2.41	24.96	.16	
2				.99	7.89	11.76	
3				.04	.32	.48	
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		13.61	249.89	370.25	8238.51	1041.37	345.17
1			1.86	11.32	412.47	50.09	90.11
2				3.53	153.57	18.68	198.05
3				.21	9.45	1.15	24.26
4				.01	.57	.07	.02
5				.00	.14	.01	.00
# Prey: MERLANGIUS MERLANGUS							
0		2.20	12.82	12.53	20.67	12.40	.19
1		.00	.53	11.49	269.36	62.19	7.32
2			.16	5.78	81.72	52.52	157.97
3				1.61	15.21	19.25	55.71
4			.00	.26	2.90	2.55	
5				.01	.10	.15	
6				.03	.27	.41	
# Prey: TRISOPTERUS ESMARKI							
0	1.51	8.91	221.75	689.32	8144.43	1128.03	1087.05
1		.34	4.70	21.08	308.00	39.93	12.94
2			.45	4.53	52.15	7.52	2.17
# Prey: CLUPEA HARENGUS							
0		4.58	17.75	123.90	.10		
1		.04	1.15	4.73	44.86		
2			.05	.22	8.18		
3			.00	.07	1.25		
4			.00	.06	.27		
5			.01	.07			
6			.00	.00			
# Prey: CLUPEA SPRATTUS							
1	.03	14.79	18.88	18.88	57.92	2.62	
2		.82	6.74	18.47	73.17	3.34	
3		.00	.22	.68	3.98	.18	
4		.00	.08	.22	1.32	.06	
# Prey: AMMODYTIDAE							
0	5.24	72.21	324.70	422.56	944.52	435.88	1178.48
1		2.28	3.35	9.26	63.33	95.33	200.34
2		2.92	4.37	12.15	83.18	125.22	264.62
3		.80	1.74	5.32	36.60	55.11	125.34
4		.39	1.26	4.09	28.21	42.47	100.70
5		.05	.29	1.00	6.95	10.46	25.71
6		.05	.31	1.08	7.53	11.33	27.85

TABLE V-2-2. Ctd.
Average NUMBERS of exploited fish species per 1000 stomachs of COD by age group.

E: TOTAL YEAR 1981

# PREDATOR							
Age group:	0	1	2	3	4	5	6+
Tot Nmbr:	923.80	4364.22	9368.47	18612.40	29503.73	24185.46	2885.76
# Prey:	GADUS MORHUA						
0	.04	20.71	84.91	28.47	27.45	52.23	12.65
1		.07	1.60	7.69	54.22	64.89	30.05
2			.00	.66	6.55	15.17	17.53
3				.04	.63	.80	2.70
# Prey:	MELANOGRAMMUS AEGLEFINUS						
0		5.63	99.07	163.37	2128.35	317.37	129.48
1		.29	6.81	48.51	186.71	86.68	93.23
2			.35	15.02	99.18	82.08	162.40
3			.00	.22	4.62	3.55	27.22
4			.00	.02	.21	.10	2.16
5				.00	.03	.00	.14
# Prey:	MERLANGIUS MERLANGUS						
0	.03	22.16	60.88	18.31	16.19	12.93	1.40
1		.62	11.64	40.06	120.69	79.45	101.40
2		.00	2.02	14.36	88.22	98.73	208.79
3			.07	3.14	21.18	29.89	71.80
4			.01	.98	5.07	5.29	6.44
5			.00	.13	.54	.65	1.51
6			.00	.03	.18	.23	.65
# Prey:	TRISOPTERUS ESMARKI						
0	.38	4.89	140.64	328.96	2140.47	414.45	452.11
1		.21	24.22	201.25	415.26	373.88	196.86
2		.00	5.57	59.79	91.04	65.41	50.94
3			.00	.95	2.24	1.82	1.34
# Prey:	CLUPEA HARENGUS						
0		2.26	9.74	35.29	1.62	.35	
1		5.98	8.51	15.24	26.24	15.04	27.19
2		.01	.56	4.44	11.01	9.42	36.98
3			.89	12.59	33.22	23.45	17.81
4			.00	.01	.03		
5			.00	.01			
6			.00	.00			
# Prey:	CLUPEA SPRATTUS						
0		6.64	3.96	1.59	2.43	4.77	6.86
1	.00	29.12	37.58	20.00	39.53	35.81	67.07
2		8.82	35.95	38.75	83.82	74.01	142.34
3		.16	3.40	5.38	10.20	8.73	14.18
4		.00	.05	.13	.43	.11	.14
# Prey:	AMMODYTIDAE						
0	1.42	98.30	931.60	1074.05	1431.93	1130.01	294.62
1		19.41	284.57	298.87	828.02	726.13	50.09
2		6.06	32.35	71.74	193.54	68.67	66.16
3		.61	4.20	13.33	66.95	18.54	31.33
4		.28	2.28	10.46	35.03	13.42	25.17
5		.04	.76	3.47	14.78	3.52	6.43
6		.02	.46	3.02	8.05	3.42	6.96

TABLE V-2-3.
Average ingested prey weights in COD by age group.

A: 1 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6+
Tot W/N:	****.**	1.00	3.12	9.53	20.79	24.11	34.32
# Prey:	GADUS MORHUA						
1			63.07	64.73	67.26	75.77	77.38
2			289.31	175.82	124.94	148.08	167.39
3					72.39	163.40	172.97
# Prey:	MELANOGRAMMUS AEGLEFINUS						
1		21.56	18.32	23.31	31.37	36.78	38.12
2			85.56	97.68	137.22	148.87	155.81
3			147.54	146.37	156.80	164.70	174.25
4			143.76	140.32	192.08	222.08	235.66
# Prey:	MERLANGIUS MERLANGUS						
1		4.87	30.89	36.85	39.65	44.49	35.85
2		19.43	63.74	85.27	114.49	133.25	80.74
3			141.81	154.48	172.94	185.36	142.82
4			580.57	215.01	226.52	238.54	234.52
5			591.87	222.63	232.15	244.08	248.88
6			597.65	214.21	257.30	289.64	333.32
# Prey:	TRISOPTERUS ESMARKI						
1		9.43	7.39	10.32	11.32	11.95	12.86
2		24.98	17.60	18.41	26.35	31.32	32.35
3			31.93	24.58	33.83	38.73	39.46
# Prey:	CLUPEA HARENGUS						
1		20.04	24.33	32.93	36.50	37.28	39.38
2			44.99	39.61	49.52	58.77	38.52
3			57.13	99.55	126.03	117.65	79.45
# Prey:	CLUPEA SPRATTUS						
0		1.25	.78	1.34	1.74	1.50	.97
1		2.96	4.08	3.99	4.45	5.14	7.04
2		7.32	11.44	14.75	12.61	12.41	9.86
3		13.99	17.06	16.16	14.99	15.85	11.78
4		13.99	17.06	16.16	14.99	15.85	11.78
# Prey:	AMMODYTIDAE						
0			.25	.26			
1		3.97	4.71	6.03	5.20	3.71	3.57
2		6.66	11.46	14.16	13.68	6.45	5.89
3			47.96	38.85	31.37		
4			47.96	38.85	31.37		
5			47.96	38.85	31.37		
6			47.96	38.85	31.37		

TABLE V-2-3. Ctd.
Average ingested prey weights in COD by age group.

B: 2 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6+
Tot W/N:	****.**	.95	1.43	2.32	2.74	2.73	7.92
# Prey:	GADUS MORHUA						
0		.95	1.40	2.36	2.67	.68	
1		15.46	41.28	52.68	71.16	70.43	50.27
2			171.68	192.09	223.53	225.53	183.95
3				631.35	632.19	632.00	632.00
# Prey:	MELANOGRAMMUS AEGLEFINUS						
0		22.70	6.10	11.25	10.14	10.22	10.22
1		22.70	30.60	64.10	32.65	25.86	28.56
2			64.90	105.72	145.20	130.32	97.35
3				277.29	287.77	290.00	290.02
# Prey:	MERLANGIUS MERLANGUS						
0		21.20	1.64	1.41	7.43	7.60	8.28
1		21.20	20.16	24.13	66.62	67.29	116.66
2			102.43	104.12	100.67	100.01	158.71
3			119.56	154.59	155.32	176.66	197.92
4				163.12	174.98	193.28	201.48
5				317.26	300.34	301.85	200.73
6				317.26	300.34	301.85	200.73
# Prey:	TRISOPTERUS ESMARKI						
0			2.88	1.37	1.91	3.60	2.19
1		13.20	22.07	28.81	30.65	27.36	21.57
2			45.25	81.68	58.41	53.74	46.09
3			68.21	95.55	64.07	59.87	55.60
# Prey:	CLUPEA HARENGUS						
1		.70	24.77	46.96	103.49	162.98	72.91
2		4.76	46.66	127.71	224.86	349.52	203.31
# Prey:	CLUPEA SPRATTUS						
0		1.00	5.15	.68	13.00	16.00	15.09
1		6.45	12.08	7.42	28.99	26.56	21.39
2		16.64	18.50	8.31	31.71	31.97	27.25
3		19.10	21.66	9.92	34.82	32.92	28.64
# Prey:	AMMODYTIDAE						
0		.77	1.02	.99	.87	.87	.96
1		5.30	3.02	3.20	2.41	2.58	2.29
2		8.01	12.79	13.76	3.00	14.00	.84
3		9.36	18.76	23.07	3.93	24.76	.58
4		8.97	21.13	26.46	7.93	30.12	.85
5		12.88	22.50	26.84	5.49	32.98	.60
6		12.88	27.19	29.86	13.28	39.36	1.24

TABLE V-2-3. Ctd.
Average ingested prey weights in COD by age group.

C: 3 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6+
Tot W/N:	.28	1.32	2.74	3.08	12.02	29.31	120.29
# Prey: GADUS MORHUA							
0		10.88	9.97	32.74	19.23	15.22	16.20
1			123.09	172.11	192.06	199.24	197.54
2				651.47	653.93	654.01	654.36
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		5.70	10.59	14.24	13.98	14.83	9.16
1		13.42	121.33	154.17	150.58	148.08	157.47
2			145.78	204.69	188.78	268.90	562.66
3			106.50	149.93	171.84	318.32	708.50
4				191.12	193.36	348.16	1270.39
5							1795.98
# Prey: MERLANGIUS MERLANGUS							
0	10.03	8.23	7.57	9.18	47.50		
1		62.47	75.06	82.10	152.85	167.94	234.76
2			139.49	181.45	182.55	263.57	383.66
3			170.99	421.35	370.22	444.38	425.83
4			261.34	451.62	505.52	491.57	452.43
5				553.55	551.69	552.22	552.23
6				553.55	551.69	552.22	552.23
# Prey: TRISOPTERUS ESMARKI							
0		3.51	4.89	5.28	4.87	4.94	5.26
1			28.04	33.06	31.98	31.16	34.89
2			45.15	55.08	55.36	54.07	73.15
# Prey: CLUPEA HARENGUS							
0		26.02	21.44	16.67	15.77	23.44	
1		36.85	103.90	69.09	60.84	68.84	
2		36.85	135.23	130.88	113.22	132.62	
3			48.00	172.35	319.95	372.45	375.95
# Prey: CLUPEA SPRATTUS							
0		4.78	3.04	2.97	4.61	4.00	3.79
1		12.63	22.51	12.62	5.17	4.49	
2		29.57	30.71	14.74	5.17	4.49	
3		46.40	46.57	15.14			
# Prey: AMMODYTIDAE							
0	2.58	1.98	2.78	2.58	2.58	2.91	2.80
1		13.20	16.15	19.69	17.60	5.10	4.96
2		8.80	9.27	10.30	8.93	5.10	4.96
3		16.08	21.43	26.25	25.61		
4		16.08	21.43	26.25	25.61		

TABLE V-2-3. Ctd.
Average ingested prey weights in COD by age group.

D: 4 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6+
Tot W/N:	.80	2.64	5.99	15.65	35.50	32.28	43.59
# Prey: GADUS MORHUA							
0	31.90	31.66	27.70	53.70	54.22		
1			392.34	468.86	473.82	902.20	
2				882.75	895.91	902.20	
3				882.75	895.91	902.20	
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		16.38	15.00	19.32	15.84	15.41	15.94
1			60.15	137.76	151.07	150.20	170.38
2				240.31	237.86	236.21	340.92
3				181.27	179.50	178.26	346.94
4				181.27	179.50	178.26	180.26
5				181.27	179.50	178.26	180.26
# Prey: MERLANGIUS MERLANGUS							
0		7.48	25.16	40.37	74.04	55.10	122.00
1		****.**	154.39	127.98	125.40	94.55	122.00
2			279.05	228.04	203.43	209.15	144.00
3				274.64	269.92	278.55	144.00
4			262.77	423.48	367.21	468.03	
5				461.47	468.07	468.03	
6				461.47	468.07	468.03	
# Prey: TRISOPTERUS ESMARKI							
0	8.00	7.82	8.10	9.02	11.66	10.76	10.68
1		9.00	29.06	50.19	42.52	46.20	42.37
2			76.25	79.19	72.15	74.91	72.00
# Prey: CLUPEA HARENGUS							
0		9.29	26.09	19.44	32.59		
1		21.44	63.95	48.75	28.73		
2			89.27	90.43	28.72		
3			163.53	150.05	28.72		
4			185.25	172.19	28.72		
5			192.47	179.79			
6			192.47	179.79			
# Prey: CLUPEA SPRATTUS							
1	.34	1.41	5.86	14.61	21.11	19.01	
2		8.72	17.51	17.31	21.15	19.01	
3		20.57	22.51	21.88	21.22	19.01	
4		20.57	22.51	21.88	21.22	19.01	
# Prey: AMMODYTIDAE							
0	.55	4.78	2.43	2.64	5.46	6.77	4.17
1		15.00	11.80	17.71	18.03	18.02	26.17
2		15.12	12.53	18.63	18.89	18.88	27.31
3		17.82	23.67	31.33	30.74	30.72	41.87
4		21.85	31.52	39.02	37.85	37.83	49.66
5		33.12	39.47	45.92	44.20	44.17	56.10
6		33.12	39.47	45.92	44.20	44.17	56.10

TABLE V-2-3. Ctd.
Average ingested prey weights in COD by age group.

E: TOTAL YEAR 1981

# PREDATOR Age group:	0	1	2	3	4	5	6+
Tot W/N:	.58	1.60	2.59	3.89	12.78	8.75	66.88
# Prey: GADUS MORHUA							
0	31.90	4.72	6.88	12.50	22.39	13.47	13.22
1		15.46	56.42	99.47	123.31	90.34	77.45
2			236.12	483.20	436.77	377.22	193.75
3				690.21	588.68	564.47	215.89
# Prey: MELANOGRAMMUS AEGLEFINUS							
0		12.25	13.30	17.00	15.78	15.26	13.70
1		19.47	35.75	57.38	111.37	76.37	82.60
2			87.34	127.27	187.57	182.47	367.11
3			118.65	166.59	176.78	228.15	596.93
4			157.89	150.83	184.35	223.77	1238.61
5				180.28	179.72	179.76	1775.10
# Prey: MERLANGIUS MERLANGUS							
0	10.03	7.84	8.23	13.57	29.90	19.60	12.02
1		15.19	46.34	42.11	95.48	59.16	57.53
2		53.76	82.30	112.94	135.90	138.98	120.79
3			155.81	185.48	194.59	206.60	168.38
4			501.86	229.27	237.99	262.17	222.81
5			645.31	235.51	244.95	262.84	225.18
6			651.61	286.47	340.26	371.85	235.95
# Prey: TRISOPTERUS ESMARKI							
0	8.00	5.47	6.14	6.90	11.31	8.90	8.41
1		9.60	21.37	27.96	30.58	28.81	29.65
2		26.27	40.46	41.94	44.47	43.79	51.59
3			39.08	27.67	35.31	40.12	40.01
# Prey: CLUPEA HARENGUS							
0		8.09	23.32	19.08	14.07	23.30	
1		1.03	36.12	43.59	52.07	61.06	56.58
2		8.70	75.61	58.80	108.76	269.32	110.50
3			48.74	158.49	262.30	355.83	256.98
4			182.03	172.30	65.40		
5			189.11	179.90			
6			189.11	179.90			
# Prey: CLUPEA SPRATTUS							
0		1.12	5.29	1.35	4.89	5.90	12.95
1	.34	3.92	8.26	8.01	14.78	8.46	10.52
2		8.80	13.85	12.86	18.23	14.92	12.68
3		19.62	19.53	14.44	19.82	17.73	14.48
4		15.83	18.48	14.29	19.61	16.29	11.87
# Prey: AMMODYTIDAE							
0	.71	1.72	1.47	1.65	1.82	1.67	2.63
1		5.38	3.33	4.20	2.93	3.13	19.78
2		8.81	11.61	13.63	6.19	15.16	16.20
3		12.32	21.47	27.57	9.79	29.24	22.09
4		13.65	26.56	31.93	18.22	36.29	25.58
5		19.33	27.82	32.24	13.65	41.36	29.19
6		27.06	34.64	35.06	25.54	43.44	28.63

Preliminary average quarterly stomach content data for HADDOCK by size class (TOTAL NORTH SEA).

A: 1st QUARTER 1981

SIZECLASS	10-15	15-20	20-25	25-30	30-40	40-50	50-70	70-100
SAMPLING INFORMATION								
Nr SQUARES sampled	24	55	68	60	90	41	23	0
Nr STOMACHS sampled	248	456	558	612	708	204	53	0
Nr of Stomachs with FOOD	195	341	414	411	489	147	46	
Nr of REGURGITATED Stom.	53	118	150	206	175	33	5	
Nr of EMPTY Stomachs	0	11	20	22	49	25	2	
GENERAL RESULTS								
% EMPTY	.00	2.41	3.58	3.59	6.92	12.25	3.77	
Mean W Stomach Contents	.12	.20	1.02	1.23	1.39	4.36	8.83	
Mean NR of Prey Items	1.14	2.82	5.50	6.39	5.46	11.43	14.84	
AVERAGE W per PREY ITEM	.10	.07	.18	.19	.25	.38	.59	
WEIGHT % Major Taxa								
ANNELLIDA	30.31	35.82	11.72	11.14	13.94	6.61	12.61	
GASTROPODA	1.78	1.53	54.79	.80	1.63	2.04	2.64	
BIVALVIA	.81	2.33	3.40	5.45	4.90	1.75	2.29	
CEPHALOPODA	5.75	4.25	.71	.96	.22	1.53		
PYCNOGONIDA			.01	.01		.01		
CRUSTACEA	22.57	19.36	10.86	50.42	11.32	11.70	22.88	
ECHINODERMATA	23.44	28.19	7.23	6.61	12.68	10.68	5.85	
CEPHALOCHORDATA					.07			
GNATHOSTOMATA	7.84	3.05	7.09	20.34	49.65	62.04	47.86	
UNKNOWN	7.50	5.47	4.19	4.28	5.59	3.64	5.86	
WEIGHT % Commercial Species								
CLUPEA SPRATTUS			.27	.18	6.50	1.84	3.06	
AMMODYTIDAE		1.83	5.51	9.52	16.34	16.98	4.23	
PLEURONECTIDAE					.10		2.58	
PANDALUS MONTAGUI			.76	.70	.97	.51		
CRANGON CRANGON		.98	.20		.37	.04		

B: 2nd QUARTER 1981

SIZECLASS	10-15	15-20	20-25	25-30	30-40	40-50	50-70	70-100
SAMPLING INFORMATION								
Nr SQUARES sampled	36	52	62	68	70	51	17	1
Nr STOMACHS sampled	398	565	692	789	843	370	40	1
Nr of Stomachs with FOOD	180	324	410	462	411	171	20	1
Nr of REGURGITATED Stom.	79	113	183	230	309	136	14	0
Nr of EMPTY Stomachs	141	128	100	110	125	64	6	0
GENERAL RESULTS								
% EMPTY	35.42	22.65	14.45	13.94	14.82	17.29	15.00	.00
Mean W Stomach Contents	.13	.28	.87	1.30	2.14	4.31	6.99	30.23
Mean NR of Prey Items	1.76	4.54	10.16	15.98	25.00	17.94	3.70	10.00
AVERAGE W per PREY ITEM	.07	.06	.08	.08	.08	.24	1.89	3.02
Food Composition in WEIGHT % by Major Taxa								
ANNELLIDA	13.71	14.43	8.18	5.50	8.46	4.00	3.16	
GASTROPODA		.07		.47	.42	.35		4.46
BIVALVIA	6.51	4.55	5.36	4.69	4.99	3.47	.22	
SCAPHOPODA					.04			
CEPHALOPODA			.21	1.26	.40			
CRUSTACEA	31.62	25.98	24.91	28.68	24.28	15.57	2.69	11.54
ECHINODERMATA	19.01	18.78	11.72	11.17	11.13	7.79	15.91	26.59
CEPHALOCHORDATA						.01		
GNATHOSTOMATA	3.65	21.15	26.81	42.37	44.59	64.68	74.44	32.84
UNKNOWN	25.50	15.03	22.81	5.85	5.69	4.13	3.58	24.57
WEIGHT % Commercial Species								
TRISOPTERUS ESMARKI						3.43		
CLUPEA SPRATTUS						.71		
AMMODYTIDAE		11.79	22.57	39.54	41.05	58.59	62.64	32.84
PLEURONECTIDAE		4.90	2.16	.78	.47			
BOTHIDAE		1.27			.06			
PANDALUS MONTAGUI			1.96	1.96	.91			

TABLE V-3. Ctd.
Preliminary average quarterly stomach content data for HADDOCK by size class (TOTAL NORTH SEA).

C: 3rd QUARTER 1981

SIZECLASS	10-15	15-20	20-25	25-30	30-40	40-50	50-70	70-100
SAMPLING INFORMATION								
Nr SQUARES sampled	60	62	74	88	93	54	19	1
Nr STOMACHS sampled	791	679	1062	1324	1479	482	82	4
Nr of Stomachs with FOOD	274	306	432	534	582	184	73	2
Nr of REGURGITATED Stom.	320	234	472	665	779	248	2	0
Nr of EMPTY Stomachs	197	139	170	134	117	50	7	2
GENERAL RESULTS								
% EMPTY	24.90	20.47	16.00	10.12	7.91	10.37	8.53	100.00
Mean W Stomach Contents	.10	.34	.63	1.01	1.57	3.84	293.04	29.49
Mean NR of Prey Items	2.73	10.99	8.49	11.95	7.80	8.24	14.21	13.00
AVERAGE W per PREY ITEM	.04	.03	.07	.08	.20	.46	20.60	2.26
WEIGHT % Major Taxa								
CNIDARIA						.08		
CTENOPHORA					.01		.01	
ANNELLIDA	11.06	11.04	7.71	6.40	5.43	3.49	71.07	
GASTROPODA	.03	.01	.37	.20	.37	.39		
BIVALVIA	.61	1.53	5.10	4.09	3.75	1.14	.03	
SCAPHOPODA					.05			
CEPHALOPODA				.42	.22			
CRUSTACEA	34.42	19.59	26.89	29.75	23.53	15.71	.86	17.54
ECHINODERMATA	2.26	11.46	8.82	9.88	12.96	7.75	.34	82.46
UROCHORDATA	4.49	6.27	3.27	2.16	.54			
GNATHOSTOMATA	35.59	43.60	41.51	41.63	48.32	69.38	27.58	
UNKNOWN	11.54	6.50	6.32	5.47	4.83	2.06	.11	
WEIGHT % Commercial Species								
MELANOGRAMMUS AEGLEFINUS				.21	.11	1.09		
MERLANGIUS MERLANGUS							.03	
TRISOPTERUS ESMARKI				2.75	10.45	17.45	.38	
CLUPEA SPRATTUS					.56	.18	.05	
AMMODYTIDAE	6.06	16.26	18.17	20.30	24.13	38.35	26.63	
PLEURONECTIDAE		.72	1.05	.19	.34			
CRANGON CRANGON	1.15	.61	.19		.09			

D: 4th QUARTER 1981

SIZECLASS	10-15	15-20	20-25	25-30	30-40	40-50	50-70	70-100
SAMPLING INFORMATION								
Nr SQUARES sampled	63	95	82	76	87	64	19	1
Nr STOMACHS sampled	698	834	910	947	1040	536	80	1
Nr of Stomachs with FOOD	492	602	553	495	529	252	46	0
Nr of REGURGITATED Stom.	160	169	319	390	429	257	33	0
Nr of EMPTY Stomachs	40	63	37	52	81	27	1	1
GENERAL RESULTS								
% EMPTY	5.73	7.55	4.06	5.49	7.78	5.03	1.25	100.00
Mean W Stomach Contents	.12	.28	.63	.83	1.61	5.34	7.69	
Mean NR of Prey Items	2.55	8.40	2.66	3.47	4.46	8.28	14.58	
AVERAGE W per PREY ITEM	.04	.03	.23	.24	.36	.64	.52	
WEIGHT % Major Taxa								
ANNELLIDA	12.48	10.76	11.37	12.05	10.96	42.97	7.20	
GASTROPODA	.54	2.09	.78	.50	.77	.89		
BIVALVIA	.05	6.41	3.56	2.29	4.82	.77	.35	
SCAPHOPODA				.04		.01		
CEPHALOPODA		.57	.34	1.41	1.80	1.79	.18	
CRUSTACEA	32.07	22.92	15.21	14.95	14.76	5.46	19.00	
ECHINODERMATA	10.93	14.44	9.68	10.45	9.40	4.12	15.14	
UROCHORDATA					.02	.12		
GNATHOSTOMATA	29.21	31.98	52.86	52.94	52.80	42.37	56.63	
UNKNOWN	14.72	10.83	6.19	5.38	4.67	1.51	1.50	
WEIGHT % Commercial Species								
MELANOGRAMMUS AEGLEFINUS				.79				
MERLANGIUS MERLANGUS					.26	.43		
TRISOPTERUS ESMARKI			4.50	5.54	3.47	4.45	18.12	
CLUPEA HARENGUS						.30		
AMMODYTIDAE		.59		12.43	12.21	8.97	12.57	
PLEURONECTIDAE	.19	.02	1.33	1.01	.48	.03		
BOTHIDAE		.39						
PANDALUS MONTAGUI		.05		.06	.19			

TABLE V-4-1.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of WHITING by age group.

A: 1 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	-	-	-	-	-	-
	1	.045	1.616	.671	-	-	-
Haddock	0	-	-	-	-	-	-
	1	5.211	1.734	28.587	65.821	85.585	152.200
	2	-	.092	2.508	6.601	8.135	26.444
	3	-	-	-	-	-	-
Whiting	0	-	-	-	-	-	-
	1	-	3.464	42.997	165.213	554.461	338.751
	2	-	.029	.467	1.991	7.537	4.583
Norway Pout	0*	.076	.095	.085	-	-	-
	1	12.624	33.049	200.382	419.201	468.242	746.756
	2	1.132	16.607	184.487	451.030	555.046	976.573
	3	-	.311	7.462	19.812	24.599	41.717
	4	-	-	-	-	-	-
Herring	0	-	-	-	-	-	-
	1	-	111.073	231.071	455.980	345.881	767.215
	2	-	.151	2.135	5.384	6.833	2.889
Sprat	0*	11.529	4.396	3.467	3.631	4.160	2.227
	1	37.890	104.146	146.340	73.936	89.921	59.975
	2	20.014	136.078	215.626	290.104	281.584	251.326
	3	.724	15.257	30.966	46.392	43.375	41.849
	4	.009	.186	.378	.566	.529	.510
Sandeels	0*	.021	.550	1.566	.870	.221	-
	1	80.781	44.266	49.402	53.727	44.786	61.855
	2	7.93	11.914	25.333	16.208	34.060	41.944
	3	-	.334	4.305	11.897	20.692	16.018
	4	-	.399	5.138	14.199	24.698	19.118
	5	-	.129	1.666	4.605	8.010	6.201
	6+	-	.140	1.798	4.989	8.677	6.717
Total Stomach Content		440	909	1866	2910	3565	4530

* < 50mm

TABLE V-4-1. Ctd.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of WHITING by age group.

B: 2 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	4.256	5.415	17.979	4.857	.732	9.316
	1	-	-	-	-	-	-
Haddock	0	.442	2.277	79.455	104.502	34.551	288.566
	1	-	4.154	33.246	25.255	22.513	27.485
	2	-	.081	6.784	9.688	7.425	9.008
	3	-	-	-	-	-	-
Whiting	0	.001	.005	.015	.039	.015	.024
	1	.035	8.688	87.348	105.510	88.462	111.203
	2	-	-	-	-	-	-
Norway Pout	0	2.454	32.806	3.499	.224	-	-
	1	.902	82.559	443.985	361.435	307.812	445.152
	2	-	8.647	92.964	180.855	558.562	207.686
	3	-	.068	.903	2.015	6.695	2.282
	4	-	-	-	-	-	-
Herring	0	-	-	-	-	-	-
	1	2.210	13.560	15.817	12.100	.137	.178
	2	-	-	-	-	-	-
Sprat	0	8.134	13.247	10.912	35.293	26.499	18.559
	1	2.871	16.690	17.894	67.721	52.657	35.908
	2	4.693	8.052	10.591	59.264	44.893	28.803
	3	.490	.436	.700	4.975	3.721	2.318
	4	-	-	-	-	-	-
Sandeels	0	221.639	345.404	243.446	155.336	177.141	375.288
	1	108.467	478.614	818.514	536.120	483.190	958.841
	2	10.179	158.286	443.150	265.640	181.783	381.237
	3	.837	35.123	100.395	42.744	26.170	39.935
	4	.379	12.983	37.009	16.593	10.367	16.949
	5	.053	6.105	17.585	6.372	3.624	4.024
	6+	.013	1.526	4.396	1.593	.906	1.006
Total Stomach Content		711	1675	3059	2676	2758	3898

TABLE V-4-1. Ctd.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of WHITING by age group.

C: 3 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	.152	.036	.016	-	-	-
	1	-	-	-	-	-	-
Haddock	0	14.649	418.269	850.189	786.181	908.330	911.782
	1	.017	4.779	6.765	4.013	4.474	2.510
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
Whiting	0	63.205	163.284	181.946	176.492	250.684	185.822
	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
Norway Pout	0	45.736	202.506	478.184	367.920	305.288	250.174
	1	-	1.219	11.708	11.494	7.857	11.456
	2	-	.012	.118	.116	.079	.116
	3	-	-	-	-	-	-
	4	-	-	-	-	-	-
Herring	0	15.577	713.572	1088.621	942.323	913.080	665.222
	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
Sprat	0	1.202	1.802	.764	.875	1.598	.835
	1	25.649	152.185	289.405	1099.286	1984.496	1191.148
	2	1.031	33.853	67.584	265.136	478.515	288.049
	3	.011	1.529	3.078	12.134	21.899	13.188
	4	-	-	-	-	-	-
Sandeels	0	358.344	250.822	276.115	287.563	150.910	391.622
	1	1.634	51.576	62.133	24.418	12.299	14.352
	2	2.249	70.365	85.485	33.679	16.809	19.863
	3	.481	15.208	18.295	7.187	3.626	4.222
	4	.175	5.530	6.653	2.613	1.318	1.535
	5	-	-	-	-	-	-
	6+	-	-	-	-	-	-
Total Stomach Content		916	2442	3714	4534	5570	4787

TABLE V-4-1. Ctd.
Quarterly average WEIGHTS of exploited fish species per 1000 stomachs of WHITING by age group.

D: 4 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	1.103	3.780	14.059	21.529	32.446	24.290
	1	-	-	-	-	-	-
Haddock	0	33.142	193.984	564.183	705.321	1146.273	1435.818
	1	1.277	2.703	5.048	13.014	25.364	43.907
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
Whiting	0	32.110	53.422	100.375	89.226	328.425	146.119
	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
Norway Pout	0	100.668	397.482	1161.049	1321.651	989.529	1055.035
	1	.490	3.103	11.052	15.693	17.886	24.824
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
	4	-	-	-	-	-	-
Herring	0	64.358	110.340	62.673	249.543	422.612	516.813
	1	.036	.128	.082	42.069	123.101	258.407
	2	-	-	-	1.654	4.855	10.211
Sprat	0	17.046	13.323	23.346	9.916	87.525	19.085
	1	101.523	120.618	72.755	106.368	78.690	14.414
	2	100.779	144.211	90.537	132.536	88.104	17.594
	3	3.026	7.176	4.848	7.113	3.807	.910
	4	1.009	2.392	1.616	2.371	1.269	.304
Sandeels	0	241.188	233.525	154.972	141.021	363.068	44.063
	1	8.948	65.335	100.468	68.157	12.848	84.855
	2	11.608	84.759	130.336	88.419	16.668	110.082
	3	2.660	19.424	28.869	20.263	3.820	25.227
	4	.967	7.063	10.861	7.368	1.389	9.173
	5	-	-	-	-	-	-
	6+	-	-	-	-	-	-
Total Stomach Content		1060	1829	2845	3597	4819	4957

TABLE V-4-1. Ctd.
Average WEIGHTS of exploited fish species per 1000 stomachs of WHITING by age group.

E: TOTAL YEAR 1981

		Age of predator					
Prey Species	Prey age	1	2	3	4	5	6+
Cod	0	1.378	2.308	8.014	6.597	8.295	8.402
	1	.011	.404	.168	-	-	-
Haddock	0	12.058	153.633	373.457	399.001	522.289	659.042
	1	1.626	3.343	18.412	27.026	34.484	56.526
	2	-	.043	2.323	4.072	3.890	8.863
	3	-	-	-	-	-	-
Whiting	0	23.829	54.178	70.584	66.439	144.781	82.991
	1	.009	3.038	32.586	67.681	160.731	112.489
	2	-	.007	.117	.498	1.884	1.146
Norway Pout	0	37.234	158.222	410.704	422.449	323.704	326.302
	1	3.504	29.983	166.782	201.956	200.449	307.042
	2	.283	6.317	69.392	158.000	278.422	296.094
	3	-	.095	2.091	5.457	7.824	11.000
	4	-	-	-	-	-	-
Herring	0	19.984	205.978	287.824	297.967	333.923	295.509
	1	.562	31.190	61.743	127.537	117.280	256.450
	2	-	.038	.534	1.760	2.922	3.275
Sprat	0	9.478	8.192	9.622	12.429	29.946	10.177
	1	41.983	98.410	131.599	366.828	551.441	325.361
	2	31.629	80.549	96.085	186.760	223.274	146.443
	3	1.063	6.100	9.898	17.654	18.201	14.566
	4	.255	.645	.499	.734	.450	.204
Sandeels	0	205.298	207.575	169.025	146.198	172.835	202.743
	1	49.958	159.948	257.629	170.606	138.281	279.976
	2	7.992	81.331	171.076	100.987	62.330	138.282
	3	.995	17.522	37.966	20.523	13.577	21.351
	4	.380	6.494	14.915	10.193	9.443	11.694
	5	.013	1.559	4.813	2.744	2.909	2.556
	6+	.003	.417	1.549	1.646	2.396	1.931
Total Stomach Contents		782	1714	2871	3429	4178	4543

TABLE V-4-2.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of WHITING by age group.

A: 1 QUARTER 1981

Prey Sepcies	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	-	-	-	-	-	-
	1	.006	.200	.042	-	-	-
Haddock	0	-	-	-	-	-	
	1	2.358	.896	5.024	10.516	12.682	20.246
	2	-	.004	.118	.312	.384	1.250
	3	-	-	-	-	-	-
Whiting	0	-	-	-	-	-	-
	1	-	.394	4.376	15.262	43.328	26.148
	2	-	.002	.022	.092	.350	.214
Norway pout	0	8.000	10.000	8.948	-	-	-
	1	9.348	10.996	60.128	120.006	124.516	171.994
	2	.210	2.418	21.444	50.288	61.474	109.842
	3	-	.018	.418	1.110	1.378	2.338
	4	-	-	-	-	-	-
Herring	0	-	-	-	-	-	-
	1	-	31.346	59.678	155.036	58.920	363.466
	2	-	.008	.124	.312	.396	.168
Sprat	0	47.002	14.104	15.204	16.588	19.176	9.240
	1	51.036	130.480	198.086	81.710	103.542	69.458
	2	9.558	43.580	54.994	64.190	65.732	52.176
	3	.102	2.170	4.408	6.600	6.170	5.952
	4	.002	.026	.054	.080	.076	.072
Sandeels	0	.176	10.074	29.000	11.682	4.092	-
	1	124.550	48.052	48.214	89.114	41.346	59.356
	2	3.304	4.316	7.544	4.392	8.146	10.270
	3	-	.016	.214	.592	1.030	.798
	4	-	.020	.256	.708	1.230	.952
	5	-	.006	.084	.230	.400	.308
	6+	-	.006	.090	.250	.432	.336

TABLE V-4-2. Ctd.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of WHITING by age group.

B: 2 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	116.710	20.806	49.754	31.320	8.316	29.198
	1	-	-	-	-	-	-
Haddock	0	2.272	1.114	9.798	13.116	5.482	36.260
	1	-	.208	1.928	1.654	1.414	1.722
	2	-	.004	.320	.458	.350	.426
	3	-	-	-	-	-	-
Whiting	0	.0002	.0006	.002	.004	.002	.004
	1	.004	1.102	11.072	12.864	9.516	13.418
	2	-	-	-	-	-	-
Norway pout	0	8.006	107.942	14.712	1.720	-	-
	1	.420	22.674	105.380	76.446	51.104	88.726
	2	-	1.058	9.722	16.354	45.854	19.098
	3	-	.066	.072	.162	.536	.182
	4	-	-	-	-	-	-
Herring	0	-	-	-	-	-	-
	1	12.380	49.872	62.078	47.538	.876	1.142
	2	-	-	-	-	-	-
Sprat	0	11.424	9.238	5.482	17.232	11.648	8.148
	1	1.008	7.064	7.152	24.512	19.140	13.288
	2	.628	2.264	2.608	11.488	8.840	5.876
	3	.058	.052	.084	.596	.446	.278
	4	-	-	-	-	-	-
Sandeels	0	1532.868	1345.928	598.138	463.700	419.300	917.024
	1	123.028	440.446	582.846	327.334	353.262	611.116
	2	3.318	35.466	97.788	71.354	51.080	118.044
	3	.226	5.100	14.428	7.406	4.846	9.100
	4	.108	2.022	5.690	3.150	2.110	4.200
	5	.006	.706	2.032	.736	.418	.466
	6+	.0015	.176	.508	.184	.104	.116

TABLE V-4-2. Ctd.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of WHITING by age group.

C: 3 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	.120	.032	.016	-	-	-
	1	-	-	-	-	-	-
Haddock	0	8.556	127.270	383.116	338.340	316.700	368.820
	1	.002	.602	.852	.504	.564	.316
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
Whiting	0	45.414	169.178	235.590	109.732	154.824	94.648
	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
Norway pout	0	54.582	259.314	596.906	419.884	341.892	264.982
	1	-	.138	1.324	1.300	.888	1.296
	2	-	.002	.014	.014	.008	.014
	3	-	-	-	-	-	-
	4	-	-	-	-	-	-
Herring	0	2.360	125.242	207.302	218.244	171.444	191.612
	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
Sprat	0	.784	1.796	.502	.390	.712	.372
	1	11.112	25.020	42.850	150.338	271.582	161.784
	2	.382	4.534	8.888	34.444	62.170	37.384
	3	.002	.198	.396	1.564	2.820	1.700
	4	-	-	-	-	-	-
Sandeels	0	488.778	314.558	391.742	449.022	237.604	626.122
	1	.194	6.080	7.344	2.888	1.450	1.698
	2	.296	9.044	11.160	4.416	2.166	2.620
	3	.056	1.766	2.124	.834	.420	.490
	4	.020	.642	.772	.304	.152	.178
	5	-	-	-	-	-	-
	6+	-	-	-	-	-	-

TABLE V-4-2. Ctd.
Quarterly average NUMBERS of exploited fish species per 1000 stomachs of WHITING by age group.

D: 4 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	.028	.770	3.076	5.086	11.546	4.184
	1	-	-	-	-	-	-
Haddock	0	9.456	58.416	168.592	178.440	229.162	232.138
	1	.060	.128	.238	.616	1.198	2.076
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
Whiting	0	6.550	8.338	21.262	20.266	63.126	19.304
	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
Norway pout	0	63.150	182.274	522.884	581.590	410.892	414.204
	1	.076	.484	1.726	2.450	2.792	3.876
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
	4	-	-	-	-	-	-
Herring	0	43.422	72.710	41.044	113.064	129.000	27.726
	1	.006	.018	.012	2.278	6.626	13.864
	2	-	-	-	.088	.260	.548
Sprat	0	17.046	13.324	23.346	9.916	87.526	19.086
	1	30.374	21.446	10.812	15.704	17.566	2.348
	2	26.660	23.314	12.850	18.728	17.252	2.662
	3	.394	.936	.632	.928	.496	.118
	4	.132	.312	.210	.310	.166	.040
Sandeels	0	609.452	452.806	287.182	220.338	187.966	51.360
	1	1.046	7.638	11.744	7.966	1.502	9.918
	2	1.356	9.908	15.236	10.336	1.948	12.868
	3	.310	2.272	3.492	2.368	.446	2.948
	4	.114	.826	1.270	.862	.162	1.072
	5						
	6+						

TABLE V-4-2. Ctd.
Average NUMBERS of exploited fish species per 1000 stomachs of WHITING by age group.

E: TOTAL YEAR 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	29.214	5.402	13.212	9.080	4.966	8.346
	1	.0015	.050	.021	-	-	-
Haddock	0	5.072	46.700	140.376	132.474	137.836	159.304
	1	.606	.458	2.010	3.322	3.964	6.090
	2	-	.002	.110	.192	.184	.420
	3	-	-	-	-	-	-
Whiting	0	12.992	44.380	64.214	32.490	54.488	28.490
	1	.001	.374	3.862	7.032	13.212	9.892
	2	-	.0005	.0055	.023	.088	.027
Norway pout	0	33.434	139.882	285.862	250.798	188.196	169.796
	1	2.462	8.574	42.140	50.050	44.826	66.474
	2	.052	.870	7.796	16.664	26.834	32.238
	3	-	.006	.122	.318	.478	.630
	4	-	-	-	-	-	-
Herring	0	11.446	49.488	62.086	82.828	75.112	54.834
	1	3.096	20.310	30.442	51.214	16.606	94.618
	2	-	.002	.032	.100	.164	.180
Sprat	0	19.064	9.616	11.314	11.032	29.766	9.214
	1	23.382	46.002	64.736	68.066	102.880	61.720
	2	9.308	18.424	19.826	32.212	38.498	24.524
	3	.140	.840	1.380	2.422	2.484	2.012
	4	.034	.084	.066	.098	.060	.028
Sandeels	0	657.818	530.842	326.516	286.093	212.240	398.626
	1	62.204	125.554	162.538	106.826	99.390	170.518
	2	2.068	14.684	32.932	22.624	15.836	35.950
	3	.148	2.288	5.064	2.800	1.686	3.334
	4	.060	.878	1.998	1.256	.914	1.600
	5	.0015	.178	.530	.242	.204	.194
	6+	.0004	.046	.150	.108	.134	.114

TABLE V-4-3.
Average ingested prey weights in WHITING by age group.

A: 1 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0						
	1	16.100	16.100	16.100			
Haddock	0						
	1	4.420	3.871	11.380	12.518	13.497	15.035
	2		42.320	42.320	42.320	42.320	42.320
	3						
Whiting	0						
	1		17.584	19.651	21.650	25.954	25.910
	2		42.980	42.980	42.980	42.980	42.980
Norway Pout	0	.019	.019	.020			
	1	2.701	6.011	6.665	6.986	7.521	8.684
	2	10.781	13.736	17.206	17.938	18.058	17.781
	3		35.680	35.680	35.680	35.680	35.680
	4						
Herring	0						
	1		7.087	7.744	5.882	11.741	4.222
	2		34.550	34.550	34.550	34.550	34.550
Sprat	0	.491	.623	.456	.438	.434	.482
	1	1.485	1.596	1.478	1.810	1.737	1.727
	2	4.188	6.245	7.842	9.039	8.568	9.634
	3	14.060	14.060	14.060	14.060	14.060	14.060
	4	14.060	14.060	14.060	14.060	14.060	14.060
Sandeels	0	.238	.019	.108	.149	.108	
	1	1.297	1.842	2.049	1.206	7.004	2.084
	2	4.800	5.521	6.716	7.381	8.362	8.168
	3		40.140	40.140	40.140	40.140	40.140
	4		40.140	40.140	40.140	40.140	40.140
	5		40.140	40.140	40.140	40.140	40.140
	6+		40.140	40.140	40.140	40.140	40.140

TABLE V-4-3. Ctd.
Average ingested prey weights in WHITING by age group.

B: 2 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	.073	.521	.723	.311	.176	.638
	1						
Haddock	0	.389	4.088	16.219	15.935	12.605	15.916
	1		39.942	34.488	30.538	31.843	31.922
	2		42.319	42.319	42.306	42.489	42.319
	3						
Whiting	0	15.778	15.778	15.778	19.500	15.000	12.000
	1	15.778	15.778	15.778	16.404	18.592	16.575
	2						
Norway Pout	0	.613	.608	.476	.260		
	1	4.300	7.282	8.426	9.456	12.046	10.034
	2		16.346	19.124	22.118	24.363	21.750
	3		24.993	25.083	24.993	24.981	24.993
	4						
Herring	0						
	1	.357	.544	.510	.509	.313	.312
	2						
Sprat	0	1.424	2.868	3.981	4.096	4.550	4.550
	1	5.696	4.725	5.004	5.526	5.502	5.405
	2	14.946	7.113	8.122	10.318	10.157	9.804
	3	16.720	16.720	16.720	16.720	16.686	16.720
	4						
Sandeels	0	.289	.513	.814	.670	.845	.818
	1	1.763	2.173	2.809	3.276	2.736	3.138
	2	6.136	8.926	9.063	7.446	7.118	6.459
	3	7.407	13.774	13.917	11.543	10.801	8.777
	4	7.018	12.842	13.008	10.535	9.827	8.071
	5	17.300	17.300	17.300	17.300	17.300	17.300
	6+	17.300	17.300	17.300	17.300	17.300	17.300

TABLE V-4-3. Ctd.
Average ingested prey weights in WHITING by age group.

C: 3 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	2.533	2.250	2.000			
	1						
Haddock	0	3.424	6.573	4.438	4.648	5.736	4.944
	1	15.875	15.875	15.875	15.875	15.875	15.875
	2						
	3						
Whiting	0	2.784	1.930	1.545	3.217	3.238	3.927
	1						
	2						
Norway Pout	0	1.676	1.562	1.602	1.752	1.786	1.888
	1		17.680	17.680	17.680	17.680	17.680
	2		17.680	17.680	17.680	17.680	17.680
	3						
	4						
Herring	0	13.200	11.395	10.503	8.635	10.652	6.943
	1						
	2						
Sprat	0	3.066	2.007	3.044	4.487	4.489	4.489
	1	4.616	12.165	13.508	14.624	14.614	14.725
	2	5.398	14.933	15.208	15.395	15.394	15.410
	3	15.520	15.520	15.520	15.520	15.520	15.520
	4						
Sandeels	0	1.466	1.595	1.410	1.281	1.270	1.251
	1	16.845	16.966	16.920	16.910	16.964	16.905
	2	15.196	15.561	15.320	15.253	15.521	15.163
	3	17.230	17.230	17.230	17.230	17.230	17.230
	4	17.230	17.230	17.230	17.230	17.230	17.230
	5						
	6+						

TABLE V-4-3. Ctd.
Average ingested prey weights in WHITING by age group.

D: 4 QUARTER 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	.194	9.818	9.140	8.466	5.620	11.611
	1						
Haddock	0	7.010	6.641	6.693	7.905	10.004	12.370
	1	34.419	42.320	42.320	42.320	42.320	42.320
	2						
	3						
Whiting	0	9.805	12.814	9.442	8.823	10.405	14.932
	1						
	2						
Norway Pout	0	3.188	4.361	4.441	4.545	4.816	5.094
	1	12.810	12.810	12.810	12.810	12.810	12.810
	2						
	3						
	4						
Herring	0	2.964	3.035	3.054	4.414	6.552	37.280
	1	13.490	13.490	13.490	36.935	13.157	37.280
	2				37.280	37.280	37.280
Sprat	0	2.000	2.000	2.000	2.000	2.000	2.000
	1	6.685	11.249	13.458	13.547	8.959	12.278
	2	7.560	12.371	14.091	14.154	10.214	13.219
	3	15.340	15.340	15.340	15.340	15.340	15.340
	4	15.340	15.340	15.340	15.340	15.340	15.340
Sandeels	0	.791	1.031	1.079	1.280	3.863	1.716
	1	17.110	17.110	17.110	17.110	17.110	17.110
	2	17.110	17.110	17.110	17.110	17.110	17.110
	3	17.110	17.110	17.110	17.110	17.110	17.110
	4	17.110	17.110	17.110	17.110	17.110	17.110
	5						
	6+						

TABLE V-4-3. Ctd.
Average ingested prey weights in WHITING by age group.

E: TOTAL YEAR 1981

Prey Species	Prey age	Age of predator 1	2	3	4	5	6+
Cod	0	.094	.854	1.213	1.453	3.341	2.013
	1	14.666	16.160	16.000			
Haddock	0	4.755	6.580	5.321	6.024	7.578	8.274
	1	5.366	14.598	18.320	16.271	17.399	18.564
	2	-	43.000	42.236	42.417	42.283	42.204
	3	-	-	-	-	-	-
Whiting	0	3.668	2.442	2.198	4.090	5.314	5.826
	1	18.000	16.246	16.875	19.249	24.331	22.743
	2	-	28.000	42.545	43.304	42.818	42.444
Norway pout	0	2.227	2.262	2.873	3.369	3.440	3.844
	1	2.846	6.994	7.916	8.070	8.943	9.238
	2	10.885	14.522	17.802	18.963	20.751	18.369
	3	-	31.667	34.279	34.321	32.736	34.921
	4	-	-	-	-	-	-
Herring	0	3.492	8.324	9.272	7.195	8.891	10.778
	1	.363	3.071	4.056	4.981	14.125	5.421
	2	-	38.000	33.375	35.200	35.634	36.389
Sprat	0	.994	1.704	1.728	2.253	2.012	2.209
	1	3.591	4.279	4.066	10.779	10.720	10.543
	2	6.796	8.744	9.688	11.596	11.599	11.943
	3	15.186	14.520	14.345	14.578	14.655	14.479
	4	15.000	15.357	15.121	14.980	15.000	14.571
Sandeels	0	.624	.782	1.035	1.022	1.629	1.017
	1	1.606	2.549	3.170	3.194	2.783	3.284
	2	7.729	11.077	10.390	8.927	7.872	7.693
	3	13.446	15.316	14.994	14.659	16.106	12.808
	4	12.667	14.793	14.930	16.231	20.663	14.618
	5	17.333	17.517	18.161	22.678	28.250	26.351
	6+	15.000	18.130	20.653	30.481	35.761	33.877

TABLE V-5-1.
Quarterly average WEIGHT PERCENTAGES of exploited fish species per 1000 stomachs of SAITHE by age group.

A: 1 QUARTER 1981

# PREDATOR														
Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey:	GADUS MORHUA												
# Prey:	MELANOGRAMMUS AEGLEFINUS												
1			.21	1.21	7.49	5.22	4.55	4.41	4.40	4.41	4.42	4.46	4.51
2				.02	.28	.14	.10	.10	.10	.13	.15	.26	.58
# Prey:	MERLANGIUS MERLANGUS												
1					.0021	.07	.09	.10	.10	.10	.10	.10	.10
2					.02	.51	.65	.68	.68	.72	.72	.83	1.11
3						.0011	.0021	.0021	.0021	.03	.05	.17	.52
4										.0081	.02	.05	.14
5										.0011	.0011	.0041	.01
# Prey:	TRISOPTERUS ESMARKI												
1			.4	2.4	20.0	26.1	27.8	28.2	28.2	28.0	27.8	27.0	24.5
2			.4	2.9	30.4	37.4	39.3	39.7	39.7	39.8	39.9	40.4	41.8
3				.2	1.6	1.7	1.7	1.7	1.7	1.7	1.8	2.0	2.5
4												.1	.3
# Prey:	CLUPEA HARENGUS												
1						.4	1.1	1.2	1.2	1.2	1.2	1.1	.8
2						.2	.3	.3	.3	.3	.3	.3	.2
3						.1	.2	.2	.2	.2	.2	.2	.1
4						.1	.2	.2	.2	.2	.2	.2	.1
5						.2	.3	.3	.3	.3	.3	.3	.2
# Prey:	CLUPEA SPRATTUS												
2			.5	1.8	.3	.2	.2	.2	.2	.2	.2	.2	.1
3			.1	.4									
# Prey:	AMMODYTIDAE												
1		69.4	65.2	51.8		.5	.7	.7	.7	.7	.8	.9	1.4
2						.2	.3	.3	.3	.3	.4	.6	1.3
3						.1	.1	.1	.1	.1	.1	.1	.2
4						.1	.1	.1	.1	.1	.1	.1	.2
5													.1
6													.1

TABLE V-5-1. Ctd.
Quarterly average WEIGHT PERCENTAGES of exploited fish species per 1000 stomachs of SAITHE by age group.

B: 2 QUARTER 1981

# PREDATOR													
Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey:	GADUS MORHUA												
0		.5	.4	.1	.2	.3	.3	.2	.2	.2	.2	.2	.2
# Prey:	MELANOGRAMMUS AEGLEFINUS												
0		40.4	36.4	12.9	5.12	5.51	5.93	7.39	7.36	7.32	7.41	7.42	7.46
1			.27	1.31	2.05	2.02	1.81	1.23	1.25	1.22	1.71	1.33	3.55
# Prey:	MERLANGIUS MERLANGUS												
0			.0031	.04	.23	.25	.19	.0021	.0011				
# Prey:	TRISOPTERUS ESMARKI												
0		8.0	10.0	14.3	9.2	2.1	1.6				.1	.1	.2
1			5.4	22.7	16.7	8.5	9.7	13.0	13.0	13.0	13.4	13.8	14.7
2				.2	.9	5.0	6.7	11.6	11.6	11.6	11.0	10.3	8.8
3				.3	1.5	1.7	1.3	.1	.1	.1	.1	.1	.1
# Prey:	CLUPEA HARENGUS												
3									.1		1.1	2.5	5.3
# Prey:	CLUPEA SPRATTUS												
0		.3	.2	.1									
# Prey:	AMMODYTIDAE												
0		7.9	7.0	3.5	1.4	.5	.5	.6	.6	.6	.6	.5	.5
1		17.5	12.1	3.0	.4	.9	1.1	1.8	1.8	1.8	1.7	1.6	1.3
2		6.6	5.8	1.4	.1	.1							
3		2.3	2.0	.5									
4		.8	.7	.2									
5		.5	.4	.1									
6		.1	.1										

TABLE V-5-1. Ctd.
Quarterly average WEIGHT PERCENTAGES of exploited fish species per 1000 stomachs of SAITHE by age group.

C: 3 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey: GADUS MORHUA													
0		.5	.5	.3	.4	.4	.3	.2	.2	.2	.2	.2	.1
# Prey: MELANOGRAMMUS AEGLEFINUS													
0	41.9	36.2	24.2	7.32	8.71	7.62	8.52	8.64	8.68	9.01	9.32	10.05	
1								.06	.08	.48	.83	1.70	
# Prey: MERLANGIUS MERLANGUS													
0		.14	.30	.09	.004	.003	.001						
1		.001	.03	.31	.25	.20	.02	.001					
# Prey: TRISOPTERUS ESMARKI													
0	8.3	16.0	24.6	10.1	6.2	5.0	.9	.7	.5	.5	.6	.6	
1		.5	1.1	1.8	5.1	7.5	15.5	16.1	16.3	16.6	16.9	17.6	
2			.2	2.4	3.8	4.8	7.7	7.9	7.9	7.2	6.7	5.3	
3				1.2	1.0	.8	.1						
4				.1	1.0	.1							
# Prey: CLUPEA HARENGUS													
3									.2	.4	2.0	3.4	6.5
# Prey: CLUPEA SPRATTUS													
0	.3	.2	.1										
# Prey: AMMODYTIDAE													
0	20.4	17.4	11.4	1.2	1.5	1.5	2.3	2.4	2.4	2.2	2.0	1.6	
1	6.4	3.7	2.6	.1	.1								
2	5.9	4.9	2.9	.2	.2	.1							
3	1.4	1.1	.7										
4	.6	.5	.3										

TABLE V-5-1. Ctd.
Quarterly average WEIGHT PERCENTAGES of exploited fish species per 1000 stomachs of SAITHE by age group.

D: 4 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey: GADUS MORHUA													
# Prey: MELANOGRAMMUS AEGLEFINUS													
0		1.19	2.34	7.47	6.55	4.73	4.46	4.47	4.46	4.47	4.47	4.49	
1		.005	.04	.22	.17	.07	.06	.08	.11	.22	.22	.36	
2							.001	.002	.005	.014	.013	.024	
# Prey: MERLANGIUS MERLANGUS													
1								.01	.03	.06	.17	.16	.30
2								.02	.04	.08	.23	.23	.41
3								.003	.006	.012	.04	.04	.07
# Prey: TRISOPTERUS ESMARKI													
0		2.8	9.7	31.6	36.1	43.3	44.3	44.1	43.9	42.8	42.8	41.7	
1		1.3	4.7	15.8	16.9	15.6	18.9	19.0	19.2	19.7	19.7	20.4	
2		.4	1.6	5.4	5.8	6.3	6.3	6.4	6.5	6.8	6.8	7.3	
# Prey: CLUPEA HARENGUS													
0				.1	.3	.9	1.0	1.0	1.0	.9	.9	.8	
1				.1	.4	1.0	1.1	1.1	1.1	1.0	1.0	.9	
2						.1	.1	.1	.1	.1	.1	.1	
# Prey: CLUPEA SPRATTUS													
0					.1	.1	.1	.1	.1	.1	.1	.1	
1	1.2	2.2	.1		.1	.1	.1	.1	.1	.1	.1	.1	
2	1.5	2.8	.1										
3	.1	.1											
# Prey: AMMODYTIDAE													
0	69.2	50.2	23.1		.3	.7	.7	.7	.8	.9	.9	1.0	
1					.1	.3	.3	.3	.4	.6	.6	.8	
2						.1	.1	.1	.1	.1	.1	.2	
3						.1	.1	.1	.1	.1	.1	.2	
4												.1	
5												.1	

TABLE V-5-2.
Average ingested prey weights in SAITHE by age group.

A: 1 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey: GADUS MORHUA													
# Prey: MELANOGRAMMUS AEGLEFINUS													
1			13.7	13.7	13.7	14.4	15.0	15.0	15.0	15.0	15.1	15.3	15.9
2				91.5	91.5	91.5	91.5	91.5	91.5	91.5	91.5	91.5	91.5
# Prey: MERLANGIUS MERLANGUS													
1						38.2	38.2	38.2	38.2	38.2	38.5	38.9	40.6	46.4
2						82.5	82.5	82.5	82.5	82.5	82.5	91.1	104.2	123.3
3							162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0
4											162.0	162.0	162.0	162.0
5											162.0	162.0	162.0	162.0
# Prey: TRISOPTERUS ESMARKI													
1			6.9	8.3	10.1	10.7	10.9	10.9	10.9	11.0	11.1	11.0	11.2
2			28.3	27.0	26.2	24.4	24.0	23.9	23.9	24.0	24.1	24.5	25.6
3				35.7	35.7	35.7	35.7	35.7	35.7	36.1	36.5	35.1	41.3
4												45.6	45.6
# Prey: CLUPEA HARENGUS													
1						34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6
2						34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6
3						164.9	164.9	164.9	164.9	164.9	164.9	164.9	164.9
4						164.9	164.9	164.9	164.9	164.9	164.9	164.9	164.9
5						164.9	164.9	164.9	164.9	164.9	164.9	164.9	164.9
# Prey: CLUPEA SPRATTUS													
2			14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
3			14.1	14.1									
# Prey: AMMODYTIDAE													
1		1.3	1.3	1.3		3.5	3.5	3.5	3.5	3.6	3.7	4.1	4.8
2						9.5	9.5	9.5	9.5	9.7	9.5	10.1	10.5
3						40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1
4						40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1
5													40.1
6													45.6

TABLE V-5-2. Ctd.
Average ingested prey weights in SAITHE by age group.

B: 2 QUARTER 1981

# PREDATOR / Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey: GADUS MORHUA													
0	1.4	1.4	1.2	.7	.7	.7	.7	.7	.7	.7	.7	.7	.7
# Prey: MELANOGRAMMUS AEGLEFINUS													
0	3.3	3.3	3.3	3.2	2.2	2.0	1.5	1.5	1.5	1.5	1.5	1.6	
1		11.1	11.8	13.9	15.1	15.0	14.9	14.9	14.9	15.2	15.4	15.8	
# Prey: MERLANGIUS MERLANGUS													
0		8.0	8.0	8.0	8.0	8.0	8.0	8.0					
# Prey: TRISOPTERUS ESMARKI													
0	1.5	1.5	1.5	1.5	1.5	1.5				.7	.7	.7	
1		4.8	4.8	5.1	11.3	12.9	15.8	15.8	15.8	15.5	15.2	14.6	
2			35.4	42.7	35.0	34.0	32.8	32.8	32.8	32.7	32.5	32.2	
3			48.0	48.0	47.7	47.4	33.8	33.8	33.8	33.8	33.8	33.8	
# Prey: CLUPEA HARENGUS													
3									179.5		179.5	179.5	179.5
# Prey: CLUPEA SPRATTUS													
0	1.4	1.4	1.4										
# Prey: AMMODYTIDAE													
0	1.0	1.0	.9	.8	.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
1	3.3	3.7	3.6	2.7	2.3	2.0	1.7	1.7	1.7	1.7	1.7	1.7	
2	16.7	16.7	16.6	5.9	5.9								
3	17.2	17.2	17.2										
4	17.1	17.1	17.1										
5	17.3	17.3	17.3										
6	17.3	17.3											

TABLE V-5-2. Ctd.
Average ingested prey weights in SAITHE by age group.

C: 3 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey: GADUS MORHUA													
0		1.4	1.3	1.3	.7	.7	.7	.7	.7	.7	.7	.7	.7
# Prey: MELANOGRAMMUS AEGLEFINUS													
0	10.0	9.8	9.3	7.2	6.6	5.8	4.4	4.4	4.5	5.1	5.8	7.3	
1								43.8	43.8	43.8	43.8	43.8	
# Prey: MERLANGIUS MERLANGUS													
0		14.9	17.4	37.9	41.5	41.5	41.5						
1		41.5	41.5	41.5	41.5	41.5	41.5	41.5					
# Prey: TRISOPTERUS ESMARKI													
0	1.5	2.2	2.6	2.8	2.8	2.8	3.3	2.9	3.6	3.2	2.9	2.2	
1		17.7	17.7	19.8	23.3	23.8	24.4	24.3	24.4	23.6	23.0	21.7	
2			72.6	68.5	53.4	47.5	37.7	37.2	37.2	37.1	37.1	36.9	
3				72.8	72.8	72.8	72.8						
4				72.8	72.8	72.8							
# Prey: CLUPEA HARENGUS								179.5	179.5	179.5	179.5	179.5	
# Prey: CLUPEA SPRATTUS													
0	1.4	1.4	1.4										
# Prey: AMMODYTIDAE													
0	1.6	1.6	1.5	2.1	2.0	1.9	1.5	1.5	1.5	1.5	1.5	1.5	
1	12.6	17.2	14.9	17.2	17.2								
2	16.8	16.8	16.8	10.4	11.1	6.0							
3	17.2	17.2	17.2										
4	17.2	17.2	17.2										

TABLE V-5-2. Ctd.
Average ingested prey weights in SAITHE by age group.

D: 4 QUARTER 1981

# PREDATOR Age group:	0	1	2	3	4	5	6	7	8	9	10	11	12+
# Prey: GADUS MORHUA													
# Prey: MELANOGRAMMUS AEGLEFINUS													
0		14.7	15.8	17.9	17.3	15.8	15.5	15.6	15.7	16.1	16.1	16.6	
1		35.9	35.9	35.9	35.9	35.9	35.9	35.9	105.5	105.5	105.5	105.5	
2							160.0	160.0	160.0	160.0	160.0	160.0	
# Prey: MERLANGIUS MERLANGUS													
1							90.7	91.1	91.9	94.7	94.6	97.5	
2							165.4	165.4	165.4	165.4	165.4	165.4	
3							167.4	167.4	167.4	167.4	167.4	167.4	
# Prey: TRISOPTERUS ESMARKI													
0		9.0	10.1	11.4	11.8	12.0	12.0	12.0	12.0	12.1	12.1	12.1	
1		35.8	35.4	34.8	34.5	33.9	33.9	34.0	33.9	34.0	34.0	34.1	
2		38.7	38.7	38.7	38.7	38.7	38.7	38.8	39.0	39.6	39.6	40.1	
# Prey: CLUPEA HARENGUS													
0				37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	
1				52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	
2							72.3	72.3	72.3	72.3	72.3	72.3	
# Prey: CLUPEA SPRATTUS													
0					15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	
1	15.3	15.3	15.3		15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	
2	15.3	15.3	15.3										
3	15.3	15.3											
# Prey: AMMODYTIDAE													
0	1.5	1.5	1.5		3.5	3.5	3.6	3.6	3.7	4.1	4.1	4.4	
1					9.7	9.7	9.8	9.8	9.9	10.2	10.2	10.4	
2						40.1	40.1	40.1	40.1	40.1	40.1	40.1	
3						40.1	40.1	40.1	40.1	40.1	40.1	40.1	
4												40.1	
5												40.1	

TABLE V-6.
Average weight of stomach contents in grams of MACKEREL by size class and area (Nr of stomachs in brackets).

A: 1st QUARTER

AREA		NORTHWESTERN			NORTHEASTERN PREDATOR SIZE CLASSES			CENTRAL			SOUTHERN		
PREY CATEGORIES	PREY SIZE	20-29 (13)	30-39 (27)	40-49 (8)	20-29 (25)	30-39 (14)	40-49 (20)	20-29 (89)	30-39 (30)	40-49 (0)	20-29 (15)	30-39 (4)	40-49 (0)
Ammodytidae	5-9		.62										
Teleostei	unknown		.33		.14	.07		.04	.03				
'OTHER'		3.24	4.12	13.47	1.57	.57	.22	1.40	2.57		.16	.43	
TOTAL		3.24	5.07	13.47	1.71	.64	.22	1.44	2.60		.16	.43	

B: 2nd QUARTER

AREA		NORTHWESTERN			NORTHEASTERN PREDATOR SIZE CLASSES			CENTRAL			SOUTHERN		
PREY CATEGORIES	PREY SIZE	20-29 (13)	30-39 (24)	40-49 (2)	20-29 (10)	30-39 (117)	40-49 (162)	20-29 (30)	30-39 (188)	40-49 (193)	20-29 (197)	30-39 (227)	40-49 (76)
Trisopterus esmarkii	0-4	.07											
	5-9	.04							.01				
Gadidae	0-4					.01	+		+			+	
	unknown						.01						
Clupea harengus	10-14								.08	.05			.19
Clupea sprattus	eggs										+		+
	5-9								.02		.08	.15	.29
	10-14												.25
Clupeidae	5-9								.01			.03	
	unknown							+	.01	+	+		
Ammodytidae	0-4	.98	.35	1.93					.69	.52	+		.14
	5-9	.87	.70	1.25				.17	.38	.91	.37	.59	.88
	10-14							2.72	.67	.02	.34	1.68	2.35
	15-19							.40			.07	.37	.82
	unknown		.17						.06	.02	.06	.22	1.60
Teleostei	0-4					.05	.09						
	5-9					.01	.07	.04		.02		.21	.21
	10-14											.09	.05
	unknown	.27	1.96			.20	.16	.01	.30	.20	1.09	.99	.04
'OTHER'		.10	.46	.87	.01	6.23	9.36	.62	3.73	6.09	.48	.93	1.23
TOTAL		2.33	3.64	4.05	.01	6.50	9.69	3.96	5.96	7.83	2.49	5.26	8.05

TABLE V-6. Ctd.
Average weight of stomach contents in grams of MACKEREL by size class and area (Nr of stomachs in brackets).

B: 3rd QUARTER

AREA		NORTHWESTERN			NORTHEASTERN PREDATOR SIZE CLASSES			CENTRAL			SOUTHERN		
PREY CATEGORIES	PREY SIZE	20-29 (102)	30-39 (206)	40-49 (36)	20-29 (88)	30-39 (407)	40-49 (142)	20-29 (260)	30-39 (518)	40-49 (158)	20-29 (314)	30-39 (388)	40-49 (118)
Gadus morhua	5-9								.01				
	10-14								.02				
Melanogrammus aeglef.	10-14		.04										
Merlangius merlangus	5-9											.01	
Trisopterus esmarkii	0-4	.16	.15	.25		+							
	5-9	.35	.84	1.78		.01		+	.01	.24			.09
	unknown		.07	.20									
Gadidae	5-9		.05										
Clupea harengus	5-9							.03	.08		.05	.03	.27
	10-14								.13	.28		.16	.29
	15-19												.39
Clupea sprattus	5-9								.01			.06	.57
	10-14					.10		.02	.05				.45
	unknown					.06	.07				+		
Clupeidae	5-9						.07	.05	.03	.20			.08
	10-14								.03	.31			.12
	unknown					.01	.01						
Ammodytidae	0-4	.08	.04	.04							.02	.02	
	5-9	1.06	1.08						.13	.05	.01		
	10-14	.05	.03					.01			.02		
	15-19										.16	.13	
	unknown	.14	.18								+		
Teleostei	0-4	+	.01		+	+		+	+		+	+	
	5-9	.03	.01	.07		.01	.06		.07		.03	.11	.10
	10-14								.02				
	unknown	.51	1.26	.31	+	.01	.01	.06	.04	.05	.02	.07	.13
'OTHER'		.75	1.43	2.53	1.25	1.57	2.73	2.00	2.97	3.32	1.09	1.34	2.22
TOTAL		3.13	5.19	5.18	1.25	1.78	2.94	2.16	3.61	4.45	1.39	1.91	4.71

B: 4th QUARTER

AREA		NORTHWESTERN			NORTHEASTERN PREDATOR SIZE CLASSES			CENTRAL			SOUTHERN		
PREY CATEGORIES	PREY SIZE	20-29 (102)	30-39 (206)	40-49 (36)	20-29 (88)	30-39 (407)	40-49 (142)	20-29 (260)	30-39 (518)	40-49 (158)	20-29 (314)	30-39 (388)	40-49 (118)
Trisopterus esmarkii	5-9	.32	.14	.53			.27	.08	.06	.22			
	10-14		.12	.16				.11		1.17			
	15-19			.46									
Clupea harengus	5-9											.05	.10
	10-14								.06			.51	.33
Clupea sprattus	10-14											.15	
Ammodytidae	0-4			+				.01	.02		.10		
	5-9								+				
	10-14											.06	
Teleostei	0-4		+	+				.01				+	
	5-9			.05								.14	
	unknown		.06	.01		.01		.03	.04	.01	.06	.02	.10
'OTHER'		.53	3.53	3.74		2.74	4.77	1.85	2.23	1.70	.50	1.22	1.12
TOTAL		.85	3.86	4.96		2.76	5.03	2.10	2.43	3.10	.65	2.16	1.66

TABLE V-7-1
NORWAY POUT ALK's by quarter derived from Danish Industrial Fisheries.

SIZE GROUP	AGE GROUP						
	0	1	2	3	4	Mean Wt
QUARTER 1						
<= 7	100					1.49
7 - 10	99	1				4.23
10 - 15	55	45				12.04
15 - 20		92	8			35.68
20 - 25 cm			63	37		68.05
QUARTER 3						
<= 7	100					1.49
7 - 10	100					3.71
10 - 15	92	8				12.81
15 - 20		41	59			37.42
20 - 25 cm			63	34	3	72.79

SIZE GROUP	AGE GROUP						
	0	1	2	3	4	Mean Wt
QUARTER 2						
<= 5	100					1.49
5 - 7	95	5				4.30
7 - 10		100				12.31
10 - 15		95	5			33.72
15 - 20		17	82	1		45.00
20 - 25 cm			33	67		
QUARTER 4						
<= 7	100					4.18
7 - 10	100					17.68
10 - 15		99	1			38.66
15 - 20		71	29			75.79
20 - 25 cm			83	9	8	

TABLE V-7-2.
HERRING ALK's by quarter derived from Danish Industrial Fisheries.

SIZE GROUP	AGE GROUP				
	0	1	2	3	Mean Wt
QUARTER 1					
10 - 15		100			11.23
15 - 20		79	21		34.55
20 - 25			88.91	11.11	72.61
QUARTER 3					
10 - 15	100				11.23
15 - 20	4	95	1		34.55
20 - 25			23		72.61
25 - 30 cm				100	179.50

SIZE GROUP	AGE GROUP							
	0	1	2	3	4	5	6	Mean Wt
QUARTER 2								
10 - 15		100						17.59
15 - 20		97.31	2.71					37.46
20 - 25 cm		54.51	36.41					69.10
QUARTER 4								
10 - 15	98.01	2.01						13.49
15 - 20	65.81	32.91	1.31					37.28
20 - 25 cm		82.21	15.01	2.31				82.60
25 - 30 cm				25.01	30.01	40.01	5.01	164.89

TABLE V-7-3.
SPRAT ALK's by quarter derived from Danish Industrial Fisheries.

SIZE GROUP	AGE GROUP						
	0	1	2	3	4	Mean Wt
QUARTER 1						
< 5	100					1.23
5 - 7	100					3.62
7 - 10	37.51	62.51				14.06
10 - 15	.61	82.81	16.41	.21		
QUARTER 3						
5 - 7	100					4.49
7 - 10	3.01	93.91	3.01			15.52
10 - 15		79.51	19.61	.91		

SIZE GROUP	AGE GROUP						
	0	1	2	3	4	Mean Wt
QUARTER 2						
< 5	100					1.38
5 - 7	94.41	5.61				4.55
7 - 10	34.21	51.81	14.01			16.72
10 - 15		24.91	67.71	7.41		
QUARTER 4						
5 - 7	100					2.0
7 - 10	55.91	44.11				4.75
10 - 15	42.61	54.31	3.01	1.01		15.34

TABLE V-7-4.
SANDEEL ALK's by quarter derived from Danish Industrial Fisheries.

SIZE GROUP	AGE GROUP								
	0	1	2	3	4	5	6+	Mean Wt	
QUARTER 1									
< 5	100								
5 - 7		100						1.31	
7 - 10		100							
10 - 15		68	32					4.76	
15 - 20		13	87					11.86	
20 - 25		1	6	31	37	12	13	40.14	
25 - 30							100	57.50	
QUARTER 2									
< 5	100							.81	
5 - 7	95	5						1.68	
7 - 10	10	90						5.85	
10 - 15		64	33	2	1			17.30	
15 - 20		14	54	20	7	4	1	40.14	*)
20 - 25		1	6	31	37	12	13	57.50	*)
25 - 30							100		
QUARTER 3									
5 - 7	100							1.00	
7 - 10	100							1.60	
10 - 15	79	2	19					5.97	
15 - 20		37	47	11	4			17.23	
20 - 25		1	6	31	37	12	13	40.14	*)
25 - 30							100	57.50	*)
QUARTER 4									
7 - 10	100							1.79	
10 - 15	100							4.90	
15 - 20		37	47	11	4			17.23	**)
20 - 25		1	6	31	37	12	13	40.14	*)
25 - 30							100	57.50	*)

*) Copied from 1st Quarter.
**) Copied from 3rd Quarter.

TABLE VII-1-1.
Observed mean length of COD per age group in each quarter in 1981 according to survey data (L[o]) and estimated digestion times (D in days). Estimated mean lengths from a Bertalanffy growth equation (L[e]) for North Sea cod (L_∞ = 115; K = .30; t_o = .82) are given for comparison.

Age	Qu	L[o]	L[e]	D
0	1			
	2	5.6		.3
	3	10.7		.6
	4	18.5		1.1
1	1	20.2	10.1	1.2
	2	24.9	17.6	1.5
	3	29.5	24.7	1.8
	4	35.5	31.2	2.1
2	1	32.7	37.3	2.0
	2	37.8	42.9	2.3
	3	41.2	48.1	2.5
	4	42.2	52.9	2.5
3	1	52.9	57.4	3.2
	2	59.1	61.6	3.6
	3	55.5	65.4	3.3
	4	56.5	69.0	3.4
4	1	72.4	72.3	4.3
	2	76.4	75.4	4.6
	3	75.5	78.3	4.5
	4	79.4	80.9	4.8
5	1	84.6	83.4	5.1
	2	89.4	85.7	5.4
	3	87.1	87.8	5.2
	4	95.1	89.8	5.7
6+	1	97.5		5.9
	2	100.6		6.0
	3	106.9		6.4
	4	103.3		6.2

TABLE VII-1-2.
Total food (g) consumed by an individual COD of each age in each quarter of 1981.

AGE \ QUARTER	1	2	3	4	TOTAL
0	-	-	66	142	<208>'
1	226	214	353	629	1422
2	704	948	1127	976	3755
3	1139	2125	2492	2025	7781
4	2235	3603	4491	<18934>*	<29263>*
5	2792	3414	5501	2757	14464
6+	3363	4638	10791	3833	22627

' : Second half year only.
* : Unrealistic value largely due to an exceptional sample, where one 70 cm cod containing 2 squid with a total weight of approximately 2 kg happened to affect age group 4 particularly.

TABLE VII-3.
Total food (g) consumed by an individual WHITING of each age in each quarter of 1981.

AGE \ QUARTER	1	2	3	4	TOTAL
1	32.0	51.8	66.7	77.2	227.6
2	66.2	121.9	177.8	133.2	499.0
3	135.8	222.7	270.4	207.1	836.0
4	211.8	194.8	330.5	261.9	998.6
5	259.5	200.8	405.5	350.8	1216.6
6+	333.7	283.8	348.5	360.9	1326.9

TABLE VII-4.
Total food (g) consumed by an individual SAITHE of each age in each quarter of 1981 (GISLASON, 1983).

AGE \ QUARTER	1	2	3	4	TOTAL
1	309	324	397	382	1412
2	510	535	654	629	2328
3	728	763	934	899	3324
4	1133	1189	1455	1400	5177
5	1548	1625	1987	1913	7073
6	1936	2031	2485	2391	8843
7	2362	2478	3032	2917	10789
8	2724	2858	3497	3365	12444
9	3093	3245	3969	3820	14127
10	3424	3593	4396	4230	15643
11	3509	3681	4503	4334	16027
12	3664	3844	4703	4526	16737
13	3921	4114	5033	4844	17912
14	3895	4086	4999	4810	17790
15+	3934	4128	5050	4860	17972

TABLE VII-5-1.
Tentative estimates of relative abundance of mackerel in 1981 in the four areas distinguished (Percentages).

AREA	DEPTH ZONE	QUARTER			
		1	2	3	4
Northwestern	Pelagic	-	-	40.7	18.5
	Demersal	16.5	-	4.5	18.5
Northeastern	Pelagic	-	39.4	40.7	29.6
	Demersal	83.5	5.6	4.5	29.6
Central	Pelagic	-	49.5	3.4	2.2
	Demersal	-	4.5	2.3	1.5
Southern	Pelagic	-	0.7	2.3	-
	Demersal	-	0.2	1.7	-

TABLE VII-5-2.
Approximate mean temperatures (C) at the bottom and at 10 m depth in the four areas distinguished (Compiled from TOMCZAK & GOEDECKE, 1964).

AREA	DEPTH ZONE	QUARTER			
		1	2	3	4
Northwestern	10 m	6	8	14	9
	Bottom	7	7	7	8
Northeastern	10 m	7	8	12	9
	Bottom	7	7	10	9
Central	10 m	5	8	15	10
	Bottom	5	6	8	9
Southern	10 m	5	8	16	11
	Bottom	5	8	16	11

TABLE VII-5-3
Average consumption of exploited fish prey by age group per mackerel by age group by quarter (Total North Sea).

QUARTER		1			2			3			4		
# PREDATOR													
AGE GROUP	1/2	3/7	8+	1/2	3/7	8+	1/2	3/7	8+	1/2	3/7	8+
Tot wsht	86.8	150.6	224.6	175.8	342.9	454.1	320.8	519.0	566.1	84.0	205.3	317.7
# Prey : COD												
Age group : 0								.3				
# Prey : HADDOCK												
Age group : 0								3.8				
# Prey : WHITING												
Age group : 0								.1				
# Prey : N.POUT												
Age group : 0				.008	.6	.3	48.8	126.0	183.8	7.6	9.4	33.4
1				.003	.1					.02	.3	8.5
2												2.9
# Prey : HERRING												
Age group : 0							.9	3.5	5.3		.3	.09
1					2.3	1.4			.4		.005	.002
2									.04			
# Prey : SPRAT												
Age group : 0				.03	.6	.1		.02	.3			
1				.01	.3	.1	.1	11.0	11.7		.01	
2				.004	.1	.1	.03	2.6	1.0		.01	
3						.008	.002	.1	.03		+	
4											+	
# Prey : SANDEEL												
Age group : 0				3.5	39.2	38.8	129.0	150.2	2.9	.5	.1	
1	5.0	18.8	.005	55.0	21.2	18.1	.2	.1				
2				31.9	17.3	.7	.9	.7				
3				3.8	.5	.1	.02	.02				
4				1.6	.2	.04	.008	.007				
5				.5	.006	.01						
6				.1	.002	.004						
OTHER PREY	81.8	131.8	244.6	79.3	260.5	394.3	140.8	220.6	360.6	75.9	195.2	272.3

TABLE VII-5-4
Average annual consumption of exploited fish prey by age group per mackerel by age group (Total North Sea).

# PREDATOR				
AGE GROUP		1/2	3/7	8+
Tot wght		667.3	1217.9	1582.4
# Prey : COD				
Age group : 0			.3	
# Prey : HADDOCK				
Age group : 0			3.8	
# Prey : WHITING				
Age group : 0			.1	
# Prey : N.POUT				
Age group : 0		56.41	136.0	217.5
1		.023	.4	8.5
2				2.9
# Prey : HERRING				
Age group : 0		.9	3.8	5.4
1			2.31	1.8
2				.04
# Prey : SPRAT				
Age group : 0		.03	.62	.4
1		.11	11.31	11.8
2		.034	2.71	1.1
3		.002	.1	.038
4			+	
# Prey : SANDEEL				
Age group : 0		133.	189.5	41.7
1		60.2	40.1	18.1
2		32.8	18.0	.7
3		3.82	.52	.1
4		1.61	.207	.008
5		.5	.006	.01
6		.1	.002	.004
OTHER PREY		377.8	808.1	1272.3

TABLE VIII-1
Specification of record format for exchange of stomach content data.

POSITION	NAME	TYPE 1)	M/O 2)	RANGE	COMMENTS
1 - 2	Record type	2 A	M		Fixed value SS
3	Quarter	1 N	M	1 to 4	
4 - 6	Country	3 A	M		ICES alpha code 3) ; default XXX
7 - 9	Ship	3 A	M		ICES alpha code 3) ; default XXX
10 - 12	Gear	3 A	M		ICES alpha code 3) ; default XXX
13 - 14	Year	2 N	M	65 to 99	
15 - 16	Month	2 N	M	1 to 12	
17 - 18	Day	2 N	O	1 to 28/29/30/31	Not known: 99
19 - 22	Time hauled	4 N	M	0 to 2400,9999	In GMT, not known: 9999
23 - 25	Fishing depth	3 N	O	0 to 999	In metre, 0 decimal
26 - 29	Square	4 AN	M		ICES statistical rectangle
30 - 39	Predator code	10 N	M		NODC 10 digit code
40 - 44	Predator size code	5 N	M	-1 to 99999	See Appendix I
45 - 51	Number per hour fishing	7 N	O		
52 - 54	Number with food	3 N	M		
55 - 57	Number regurgitated	3 N	M		
58 - 60	Number empty	3 N	M		
61 - 70	Prey species code	10 N	M		NODC 10 digit code
71 - 77	Prey size code	7 N	M	-1 to 99999	See Appendix I
78 - 85	Prey weight	8 N	M		In mg
86 - 91	Number of prey	6 N	O		No information: space filled
92 - 100	Paddingsfield	9 N			Space filled

(1) All numeric fields (N) right justified, zero filled;
All alpha (A) and mixed alpha/numeric fields (AN) left justified, space filled.
(2) M : mandatory ; O : optional.
(3) See ICES IYFS exchange tape specifications.

APPENDIX I

List of size class codes to be used on the exchange tape for stomach content data.

-1	=	Nauplii		
0	=	Eggs		
1	=	.01	- .02	cm
2	=	.02	- .03	cm
3	=	.03	- .04	cm
4	=	.04	- .05	cm
5	=	.05	- .06	cm
6	=	.06	- .07	cm
7	=	.07	- .08	cm
8	=	.08	- .09	cm
9	=	.09	- .10	cm
10	=	.10	- .15	cm
15	=	.15	- .20	cm
20	=	.20	- .25	cm
25	=	.25	- .3	cm
30	=	.3	- .4	cm
40	=	.4	- .5	cm
50	=	.5	- .7	cm
70	=	.7	- 1.0	cm
100	=	1.0	- 1.5	cm
150	=	1.5	- 2.0	cm
200	=	2.0	- 2.5	cm
250	=	2.5	- 3	cm
300	=	3	- 4	cm
400	=	4	- 5	cm
500	=	5	- 7	cm
700	=	7	- 10	cm
1000	=	10	- 15	cm
1500	=	15	- 20	cm
2000	=	20	- 25	cm
2500	=	25	- 30	cm
3000	=	30	- 40	cm
4000	=	40	- 50	cm
5000	=	50	- 70	cm
7000	=	70	- 100	cm
10000	=	100	- 150	cm
99999	=	Unknown		