International Commission for the Northwest Atlantic Fisheries

Serial No. 3946
(A.c.4)

ICNAF Res.Doc. 76/VI/119

ANNUAL MEETING - JUNE 1976

Contributions to a manual on ICNAF groundfish surveys

by

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At the 1975 Annual Meeting of the Biological Surveys Subcommittee a general outline of a manual that would serve as a guide for any country wishing to conduct surveys in the ICNAF Area was accepted. It was decided that the manual should contain descriptions of current practices and stress the need of consistency (Redbook 1975, p. 69).

This document gives a general outline of the stratification scheme for Subarea 3 (except Div. 3K), Sections II, D and E of the outline (Redbook 1975, p. 71) and an outline, at least, of some ideas regarding data collections, Section V, 1, 2 and 3 (Redbook 1975, p. 72).

Stratification (ICNAF Subarea 3 except Division 3K) (Figs. 1 & 2 Tables 1(a) & (b).

The delineation of strata was based generally on biological and hydrographical considerations. Thus, in preparing the stratification shceme knowledge of fish distribution in the areas to be stratified was necessary. Additionally of course depth stratification was a major component of the scheme. It was also necessary to have strata fall within ICNAF Division boundaries. However, the distribution patterns of some species were broadly included in the original delineation of ICNAF boundaries.

Depth zonation also delineate stocks; thus the 50 fath contour marks the limit of yellowtail distribution and the 150 fath contour to a large extent effectively marks the deepest limit for plaice. Cod has a very wide

depth range and is included in strata down to 200 fath at least in Division 3L and most of 3N. Redfish on the other hand is principally beyond 200 fath except in Division 3Ø and parts of 3N. Strata, if constructed on steep slopes or include small depth ranges, are extremely narrow. For redfish at present only 3Ps has a stratification scheme to accommodate the necessary depth zones.

The Southeast Shoal (Strata 375 and 376) was separated from the remainder of the Grand Bank since it has depths less than 30 fath and therefore forms a separate natural zone. The southwest slope of the Grand Bank Division 3Ø comes strongly under the influence of the Gulf Stream so that the whole slope was broken down into as many strata as possible to permit detailed analysis of the catches. The stratification of the central parts of the Banks either followed depth contours, were designed to fit distribution patterns, or were broken down arbitrarily by latitude and longitude so as to ensure adequate coverage.

Master charts were prepared using the latest Canadian Hydrographic Services Charts. Since the navigational charts used by the fishing industry are all in fathoms, the latter was used in the stratification scheme.

When the strata boundaries (Level 1) were determined on the general basis described in the previous paragraphs of this Section, they were divided into units of equal area equivalent to 5' latitude and 10' longitude (Level 2). For Subarea 3 (excluding Div. 3K) this would be approximately equivalent to 35 sq nautical miles. These were again subdivided into 10 equal unit areas (Level 3). For the rectangular-shaped strata, e.g. 351, 352, etc., on the Grand Bank the size of the units (Levels 2 and 3) were simply delineated by the appropriate minutes of latitude and longitude; however, for small and irregular-shaped strata on the slopes, e.g. 378 and 379, the object was to keep Level 2 unit areas close to 35 sq nautical miles and if possible, get at least two of these into a stratum. The Level 3 breakdown was always by dividing the latter into 10 equal unit areas.

Ice conditions did not affect the stratification scheme and there was no overlap with other stratifications. However, ice conditions at the regular time of sampling are usually not severe enough to restrict fishing except occasionally in the northern part of the area, Division 3L. In some years, however, certain strata cannot be fished because of ice cover.

In all cases stratification did not include the 12-mile coastal zone.

V. Data Collection

A. Trawl Station Methodology

NOTE: For most groundfish surveys in the ICNAF areas the surveys are designed for the multi-species approach for obvious reasons.

Collection of trawl catch data: multi- vs key-species - Basic data requirements from each catch are estimates of numbers caught, weight caught and length frequencies of each species.

The catch is sorted into species and placed in baskets or other suitable containers. If the catch is small, the entire catch is weighed. Large specimens are often weighed individually if their number is small. It has not been possible to weigh small numbers of small specimens, . . . and these weights are merely estimated. If the catch of a particular species is very large, only a portion of it is weighed and the total weight is then estimated by adjusting by the ratio between baskets weighed and baskets caught.

If time permits, length measurements are obtained for all specimens of the entire catch. If the catch of a particular species is very large, only a portion of it is measured, and the length frequency adjusted by an approximate factor so that it represents the entire catch of that species.

Exact criteria for the decision on when to subsample and on the size of the subsample are difficult to formulate and depend on the species involved,

the size composition and time available. Grosslein (1974) suggested the following minimum sample size for a particular fishing set for length frequency measurements for a given species (or sex if separate).

Length Range (cm)	Min. Sample Size (No. Fish)
1-5	25
6-10	50
11-15	75
>15	100

It should be remembered that for each species you need a total sample large enough to be properly representative of the stock (or division, etc.). Hence, the number of sets in which a particular species will probably occur is a factor in determining the minimum number to be sampled from a particular set. In some cases, sufficient samples may be required to do an analysis by depth or by some other criterion. In practice, about 200-300 measurements per set of each commercial species is perhaps a minimum.

For the actual subsampling technique one method is to fill a quantity of numbered baskets with fish and then randomly draw a basket from a matching set of numbers. However, there is a major complication in this since catches on the deck are frequently segregated by size either because of segregation in the codend or in the process of depositing on deck. The larger fish are usually on top. Thus a better system might be to arrange a second set of baskets and put an equal fraction from each full basket into the second set (i.e. if there are 10 baskets of fish, put 1/10 of each into the 2nd set of baskets until all are filled with fish that should be representative of the total catch). Another difficulty arises when the catch contains perhaps 30-40 very large fish, say 80-cm and larger cod, and the remainder of the catch of this species is composed of several hundred small fish (<30 cm). It has been the practice of certain research establishments to sample the large and small separately. However, this may be

a questionable practice statistically.

If the catch contains more than ten baskets of a particular species, the sample should be stratified to contain a sample from each 1/3 of the total catch (first, middle and last segments of the catch).

Biological samples for ageing - The number of fish required for age-length keys that will be representative of the population (or segment) will depend on the length and age range of the species and also if the sexes have to be kept separated. A length stratification system is preferred and the numbers required for each length interval can be calculated (Gulland 1955). The latter information may be available for a number of groundfish species in the ICNAF area.

Since the age-length keys are supposed to be representative of the population, it is necessary to secure samples from each set in which the species is recorded, hence some judgement is required to determine how many fish to select from each set and still get a sufficiently large sample for the entire population.

For fish sampled for ageing additional biological data such as sex and maturity stage, parasite infestation, and if possible, also weight may be recorded.

Need for standardized log form/assigned area - It might be desirable to have a standardized form for recording biological data; however, for established survey series, changing the present log form might present some difficulties.

Sampling conventions

Length - (See ICNAF Sampling Yearbook 1974, p. 8)

1) Fork Length from the tip of the snout to the apex of the V forming the fork of the tail, for species with forked tails.

2) Total Length from the tip of the snout to the tip of the longest lobe of the tail when the lobe is extended posterially in line with

the body. This is sometimes referred to as the greatest total length.

3) Other length measurements, mantle length of squid, carapace length for crabs and lobster, greatest diameter of valve for mollusks.

Grouping of lengths, when necessary, could also follow the ICNAF convention (See 1974 Sampling Yearbook, p. 9 and 10) or could be done in single length groups. Small fish such as capelin should be measured in mm, or ½ cm groups also invertebrate species. Lengths should be recorded for each sex separately for the commercial species; this includes all the flatfish, redfish, silver hake, capelin and grenadiers (see 1974 Sampling Yearbook, p. 9 and 10). Other species such as dogfish, skate and anglers and many other species that occur infrequently should also have the sex recorded.

Weights - Weighing of individual fish at sea is difficult with most of the presently available equipment. If possible, however, weights should be recorded to nearest 10th of a kilogram (?) and to nearest gram for small fish such as capelin (?) or in pounds to nearest 1/10 or in pounds and ounces which are converted to metric units.

As a general rule, otoliths are more usually acceptable for ageing of fish than scales; however, for some localities and species scales are commonly used.

Otoliths should preferably be collected dry in envelopes or other suitable container with either the full information: set no., length, sex and maturity written on the envelope or with a number recorded on the envelope corresponding to a similar number on a detailed data sheet.

Scales should be collected in envelopes between folded blotting paper.

Collection of trawl station data

1) Position

Starting position - Lat. Long.

End position - Lat. Long.

2) Depth of Trawl (metres or fath) - maximum depth

   Depth of Trawl - minimum depth

   Depth of Trawl - modal depth

3) Bottom Temperature

4) Weather Conditions

   a) Wind force and direction

   b) Sea state

5) Time, Start of Tow - local and GMT

   Duration (min.)

6) Tow Direction

   Distance Towed

   Speed of Ship

7) Trawl Performance - Presumably only successful sets would be used, however would be based presumably on some criterion from Section IV.

8) Bottom Type and Condition of Gear - As previously mentioned damage would be noted, but classification of bottom is rather difficult.

Concurrent Sampling Programs

1) Enviromental - hydrography, meteorology

   a) Normally a bathythermograph cast will be required for each fishing station; also probably a surface and bottom temperature should be recorded. Water samples could also be taken at bottom and surface. Additional hydrographic information could be obtained at each fishing station such as water samples from various depth layers; also X-BT's and/or regular bathythermograph casts could be taken between stations.

b) Meteorological data such as air temperature, barometric pressure, wind speed, etc., could be recorded.

2) Plankton - Certain types of plankton tows could be made during ordinary fishing operations and between stations in some cases. Vertical and/or oblique hauls could be done during the regular BT operation.

NOTE: Any additional requirements beyond the minimal hydrography essential for fishing operations requires additional time and this has to be considered.

3) Biological

a) Sexual maturity - The suggestion was made in a previous paragraph that maturity stages could be determined for all fish sampled for ageing. However, it might be necessary, and desirable, to take additional samples for determining of maturity. It might be desirable to have an agreed method of determining maturity stages for particular species.

b) Food habits - Stomach contents can be recorded either in a detailed quantative and qualitative way or by a gross examination to give an indication of the main food components and estimates of volumes or weights and probably percentage fullness. A detailed examination which involves sorting and weighing the food components is difficult for many research vessels because of lack of personnel and facilities, hence probably can be done best at the laboratory. The selection of specimens for food analysis will depend on the investigator, but it usually is desirable to spread the sampling from each station throughout the complete length range so that selection by size categories is desirable.

C) Parasites - Certain external parasites could (should?) be recorded for fish selected for ageing or for other purposes and indeed could be recorded during the length measurement operation. Internal parasites require more specialized personnel and also require more time and equipment. Details of such an operation are beyond the scope of this manual.

References

Grosslein, M.D. 1974. Bottom Trawl Survey methods of the Northeast Fisheries Center Wood Hole Mass. USA, ICNAF Res. Doc. 74/96, Serial No. 3332 27P.

Gulland, J.A. 1955. Estimation of growth and mortality in commercial fish populations. *U.K. Min. Agr. Fish. Invest.*, Ser. 2, 18(9).

Table 1(a). List of strata areas for Subdiv. 3Ps (total area - 17,575 sq nautical miles).

Strata No.	Area Sq Miles	Depth Range (fath)	No. Units
306	419	101-150	80
307	395	51-100	110
308	112	31-50	30
309	296	101-150	80
310	170	101-150	50
311	317	51-100	90
312	272	31-50	80
313	165	101-150	50
314	974	0-30	280
315	827	31-50	240
316	189	101-150	50
317	193	51-100	50
318	123	101-150	30
319	984	51-100	280
320	1320	0-30	390
321	1189	31-50	340
322	1567	51-100	450
323	696	51-100	200
324	494	51-100	140
325	944	31-50	280
326	166	31-50	50
705	195	151-200	50
706	476	151-200	140
707	93	151-200	30
708	117	201-300	30
709	96	301-400	30
710	36	301-400	10
711	961	201-300	260
712	973	201-300	270
713	950	201-300	230
714	1195	201-300	340
715	132	151-200	40
716	539	151-200	150

Table 1(b). List of strata for Div. 3L, 3N, 30 (total area - 71,289 sq miles).

Strata No.	ICNAF Division	Area Sq. Miles	Depth Range (fath)	No Units
328	3L	1519	51-100	380
329	3-O	1721	"	450
330	"	2089	31-50	540
331	"	456	"	120
332	"	1047	51-100	280
333	"	151	101-150	40
334	"	92	151-200	20
335	"	58	"	20
336	"	121	101-150	30
337	"	948	51-100	250
338	"	1898	31-50	500
339	"	585	51-100	170
340	"	1716	31-50	490
341	3L	1574	51-100	440
342	"	585	"	170
343	"	525	"	150
344	"	1494	101-150	450
345	"	1432	151-200	430
346	"	865	"	260
347	"	983	101-150	300
348	"	2120	51-100	630
349	"	2114	"	610
350	"	2071	31-50	610
351	3-O	2520	"	720
352	"	2580	"	720
353	"	1282	"	340
354	"	474	51-100	130
355	"	103	101-150	30
356	"	61	151-200	20
357	3N	164	151-200	40
358	"	225	101-150	50
359	"	421	51-100	110

Table 1(b). (Continued)

Strata No.	ICNAF Division	Area Sq. Miles	Depth Range (fath)	No Units
360	3N	2992	31-50	840
361	"	1853	"	480
362	"	2520	"	720
363	3L	1780	"	520
364	"	2817	51-100	820
365	"	1041	"	310
366	"	1394	101-150	410
368	"	334	151-200	100
369	"	961	101-150	290
370	"	1320	51-100	400
371	"	1121	31-50	320
372	"	2460	"	720
373	3N	2520	"	720
374	"	931	"	240
375	"	1593	<30	420
376	"	1499	"	400
377	"	100	51-100	30
378	"	139	101-150	40
379	"	106	151-200	30
380	"	116	"	30
381	"	182	101-150	50
382	"	647	51-100	180
383	"	674	31-50	190
384	3L	1120	"	320
385	"	2356	51-100	660
386	"	983	101-150	290
387	"	718	151-200	210
388	"	361	"	100
389	"	821	101-150	230
390	"	1481	51-100	420
391	"	282	101-150	80
392	"	145	151-200	40

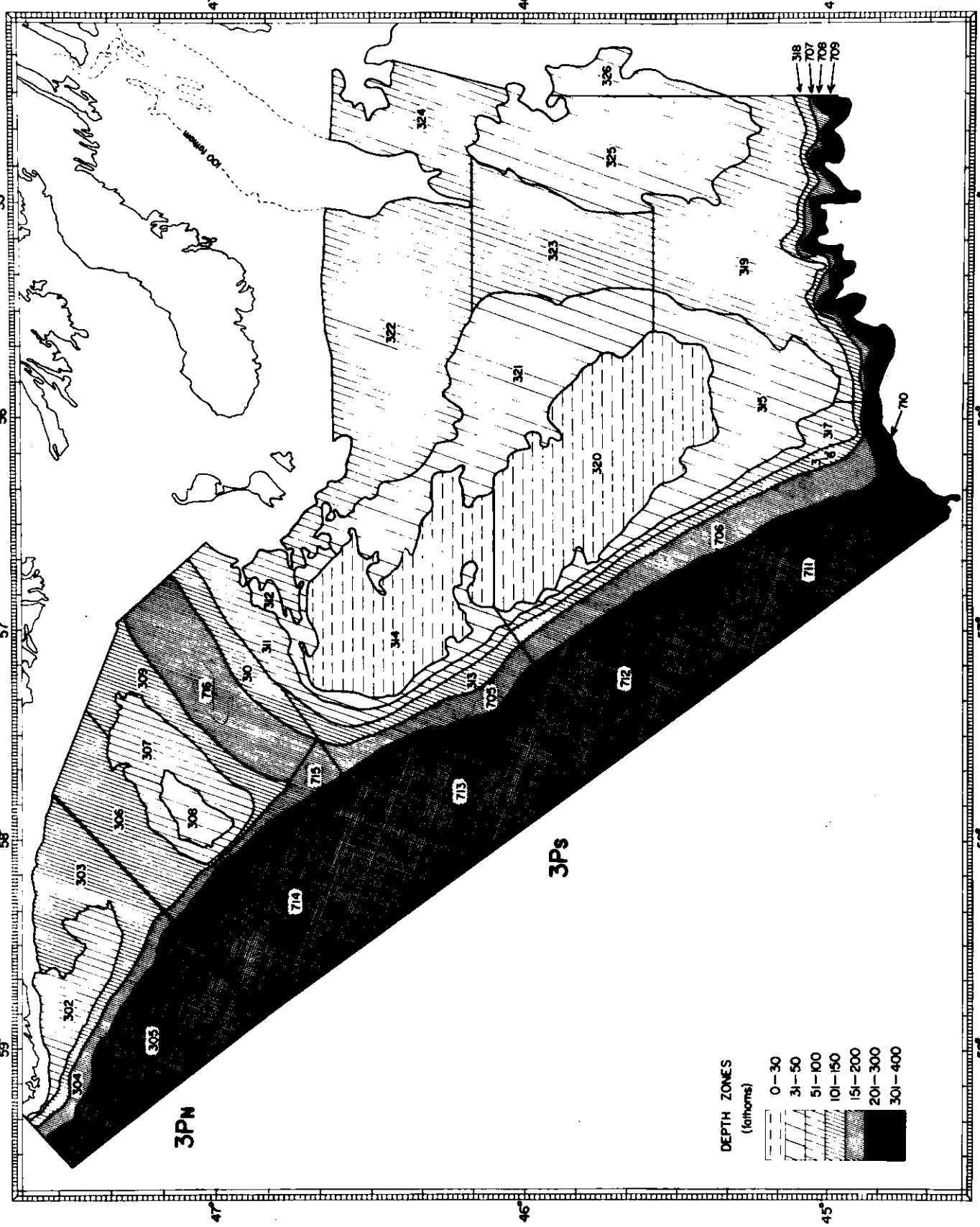

Fig. 1. Strata map for Subdiv. 3Ps.

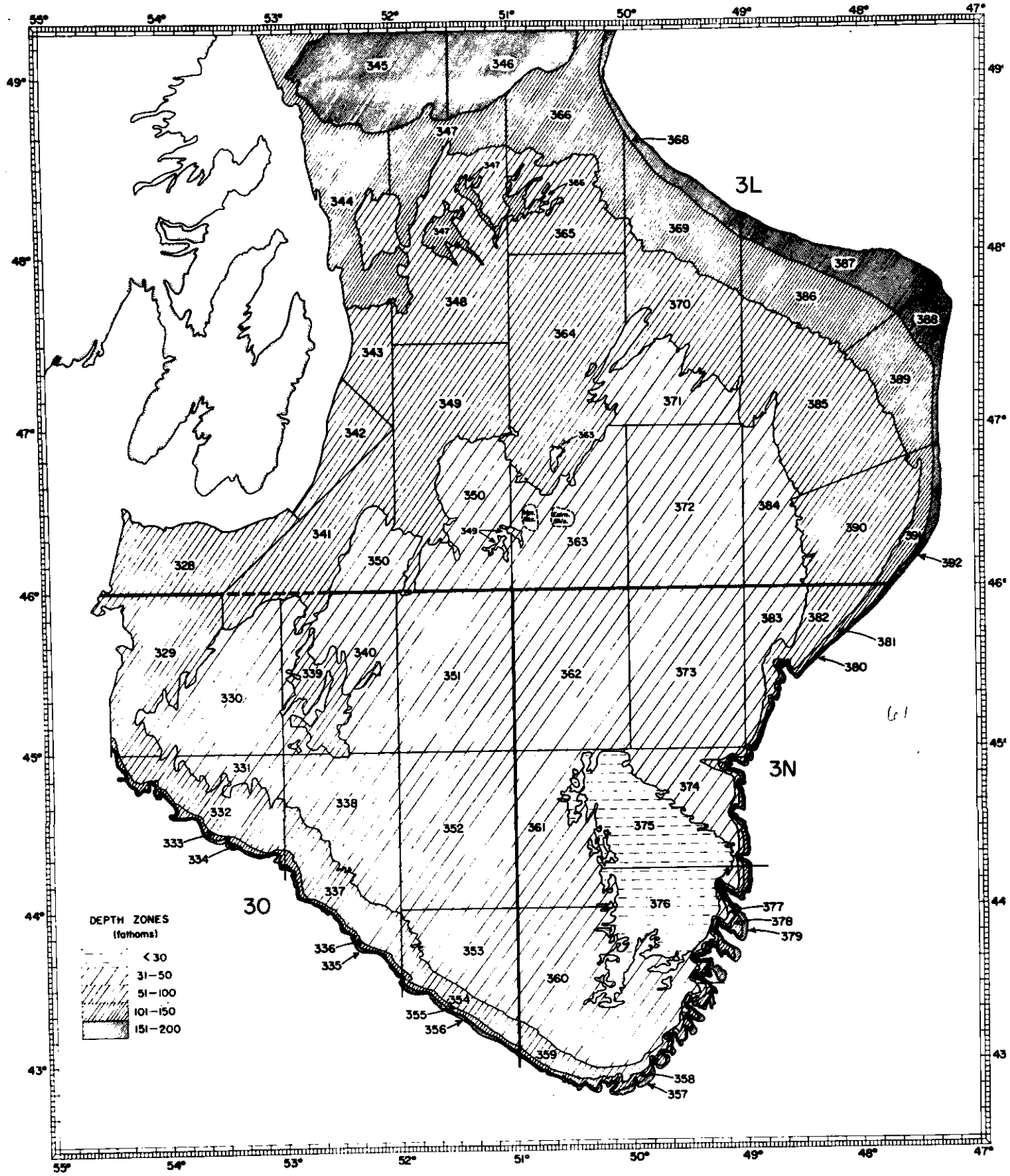

Fig. 2. Strata map for Div. 3L, 3N and 30.