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Distribution of Redfish in NAFO Divisions 3LNO Based on Canadian Research Surveys from 1991-2002

by

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Abstract

Information of catch and size distribution from Canadian Research surveys from 1991-2002 are presented for consideration relative to a NAFO Scientific Council recommendation to further clarify stock structure of redfish, particularly on the appropriateness of Div. 3LN and Div. 3O as management units. Recent biological studies suggest Div. 3O is similar to Div. 3LN, the closest affinity being with neighbouring Div. 3N. Canadian research survey results indicate a contiguous distribution of redfish between Div. 3L, Div. 3N and Div. 3O. The most abundant catches occurred in Div. 3O with length frequency modes that tend to be more similar to Div. 3N than Div. 3L. One major disadvantage to addressing this puzzle is the inability to use conventional tagging because of the high mortality caused in bringing redfish to the surface. Recent improvements in tagging technology where fish are tagged on bottom may be a useful tool in future to unravelling this long-standing issue.

Introduction

There are two species of Sebastes that have been commercially fished in Div. 3LN and Div. 3O, the deep sea redfish (*Sebastes mentella*) and the Acadian redfish (*Sebastes fasciatus*). Both are managed as "redfish" because their external characteristics are very similar, making them difficult to separate in both commercial fisheries and during research vessel surveys. Although this is an additional caveat to the proper management of the redfish resources in the area, of more concern is whether the current management units are the most appropriate. A recent genetic analysis suggests that for S. mentella, no genetic difference could be detected among samples from Div. 3O, Div. 3LN and those from Subarea 2 and Div. 3K (Roques *et. al*., 2001). A study of parasite fauna reported the existence of seven isolated and poorly intermingling groupings that exist along the coast of Canada and suggested that Div. 3O and Div. 3N are the areas of closest similarity (Bakey and Bakay, MS 2002). The purpose of this paper is to provide a graphical representation of the results of Canadian research surveys since 1991 to use as information to address the issue of the most appropriate way to manage the redfish resource in Div. 3LNO.

Materials and Methods

Stratified-random surveys have been conducted by Canada in Div. 3L in various years and seasons from 1978 to 2002 in which strata to at least 732 m (400 fathoms) were sampled. Stratified-random surveys have also been conducted primarily in spring and autumn by Canada in Div 3N from 1991-2002, which also cover to at least (732 m or 400 fathoms). Only the synoptic surveys are considered here, which are the spring and autumn surveys since 1991. The survey stratification is presented in Fig. 1.

Up until the autumn of 1995 these surveys were conducted with an Engels 145 high lift otter trawl with a small mesh liner (29mm) in the codend and tows planned for 30-minute duration. Starting with the autumn 1995 survey in Div. 3LN, a Campelen 1800 survey gear was adopted with a 12mm liner in the codend and 15 minute tows utilizing SCANMAR hydroacoustic sensors to monitor net configuration during tows. Only Campelen data and Engel data converted into Campelen equivalents were utilized are considered here. A comparison of the generated data with the original Engel data suggested overall trends in abundance were the same except that the relative measure of abundance estimated for the Campelen trawl conversions were higher (Power and Maddock Parsons, MS 1998). Graphical representations of the survey results are expressed as mean number per standard tow, which is a 15-minute tow at a speed of 3.0 knots (0.75 n. mi).

Results and Discussion

The graphical representation of the redfish catches by position is presented in Fig. 2 for the spring surveys and Fig. 3 for autumn surveys. The largest catches throughout both series occur beyond 100 m in the slope areas of Div. 3O and Div. 3N. Over the period covered by the surveys, comparably large catches in Div. 3L were infrequent. Length distributions in terms of percent, derived from the stratified mean number per tow at length from 1991-1996 (Fig. 4) and 1997-2002 (Fig. 5) are plotted for the spring and autumn surveys. A comparison of the modes in the length distributions suggest that over the period of the surveys, the relative size distribution in Div 3N was more similar to Div. 3O than to Div. 3L (Table 1). This occurred in 20 of the 24 surveys conducted. The Div. 3O and Div. 3N surveys are characterized by a smaller size distribution of fish than Div. 3L. This may be related to a higher percentage of shallower water area in Div. 3N and Div. 3O compared to Div. 3L for areas where redfish are consistently found (Table 2), coupled with an increasing size-depth relationship which redfish demonstrate.

The nature of the relationship of redfish in Div. 3LNO has been questioned for some time. The most recent biological studies have not clarified the relationship to suggest an alternative to the existing management units. The survey information suggests Div. 3O is more similar to Div. 3N. If redfish in Div. 3O and Div. 3N constitute a biological stock, managing these divisions separately may not be harmful. What is of more concern is the relationship with Div. 3L, given that it has experienced poor recruitment since the early 1980s while Div. 3N and Div. 3O have experienced improved recruitment from the year classes born in the 1986-1988 period. One major disadvantage to addressing this puzzle is the inability to use conventional tagging because of the high mortality caused in bringing redfish to the surface. Recent improvements in tagging technology where fish are tagged on bottom may be a useful tool in future to unravelling this long-standing issue.

References

Bakey, Yu. I. And I V. Bakay. Ecological and geographical description of parasite fauna of Acadian redfish *Sebastes fasciatus* Storer. *NAFO SCR Doc*., No. 13, Serial No. N4614, 16 p.

Power, D. and D. Maddock Parsons. MS 1998. Canadian Research Survey Data Conversions for Redfish in Div. 3LN based on Comparative Fishing Trials between an Engel 145 Otter Trawl and a Campelen 1800 Shrimp Trawl. *NAFO SCR Doc*. 98/71. Serial No. N3063. 21 p.

Roques, S., J. M. Sevigny and L. Bernatchez. 2001. Evidence of broadscale introgressive hybridization between two redfish (genus *Sebastes*) in the North-west Atlantic: a rare marine example. *Mol. Ecol*., **10**: 149-165.

Table 1. Tabulation of area (sq. n. miles) by depthzone for Div. 3LNO where redfish are consistently caught.

Depth Zone	3L	%	3N	%	3O	%
093-183			1168	40.7	4775	82.3
185-274	5424	48.3	546	19.0	375	6.5
275-366	3855	34.3	386	13.4	211	3.6
367-549	1142	10.2	420	14.6	245	4.2
550-731	804	7.2	352	12.3	198	3.4
Total	11225	100	2872	100	5804	100

Table 2. Summary of comparisons of modes of length distributions between Div. 3L, Div. 3N and Div. 3O from spring (S) and autumn (A) Canadian RV surveys from 1991-2002. An asterisk denotes instances where modes correspond but proportions may be different.

Similarity	91	92	93	94	95	96	97	98	99	00	01	02
3N=3O	S*A	S*A	S*A	SA	SA		SA	SA	SA	SA	S*	S
3N=3L												A*
3L=3O												
3L=3N=3O						A					A	
3L≠3N≠3O						S						

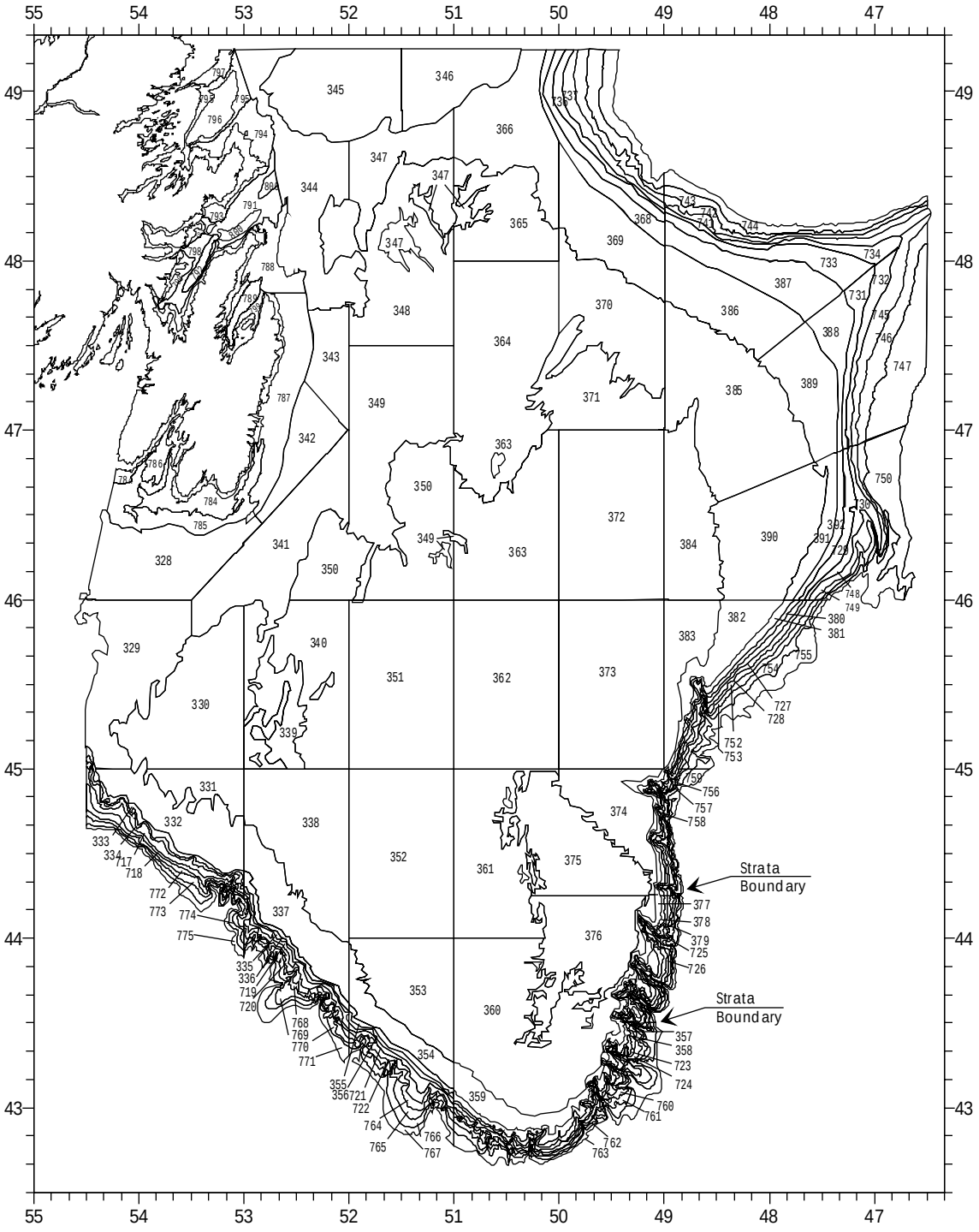

Fig. 1. Stratification chart for Div. 3LNO surveys.

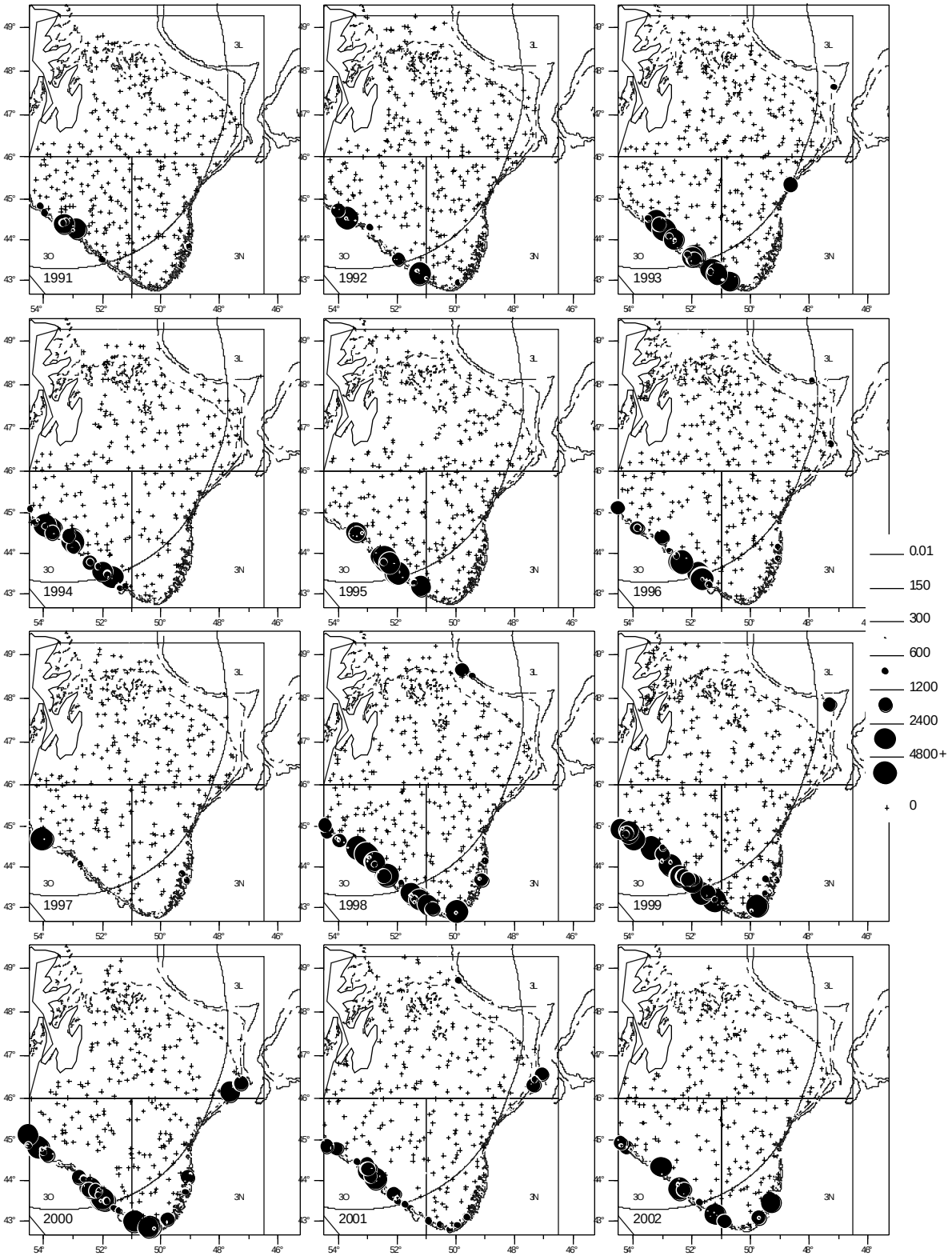

Fig. 2. Distribution of 3LNO Spring DFO RV Redfish catches.

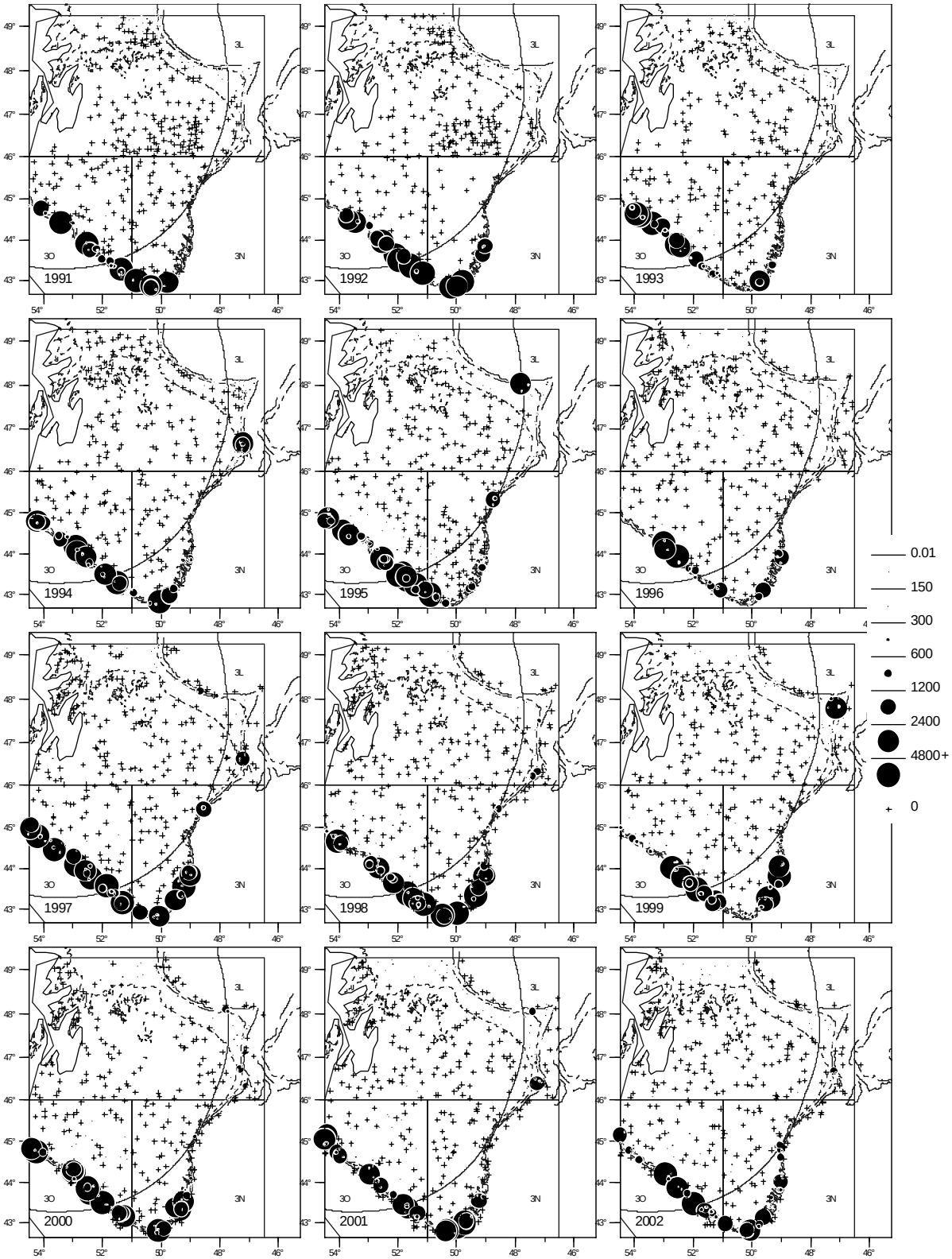

Fig. 3. Distribution of 3LNO Autumn DFO RV Redfish catches.

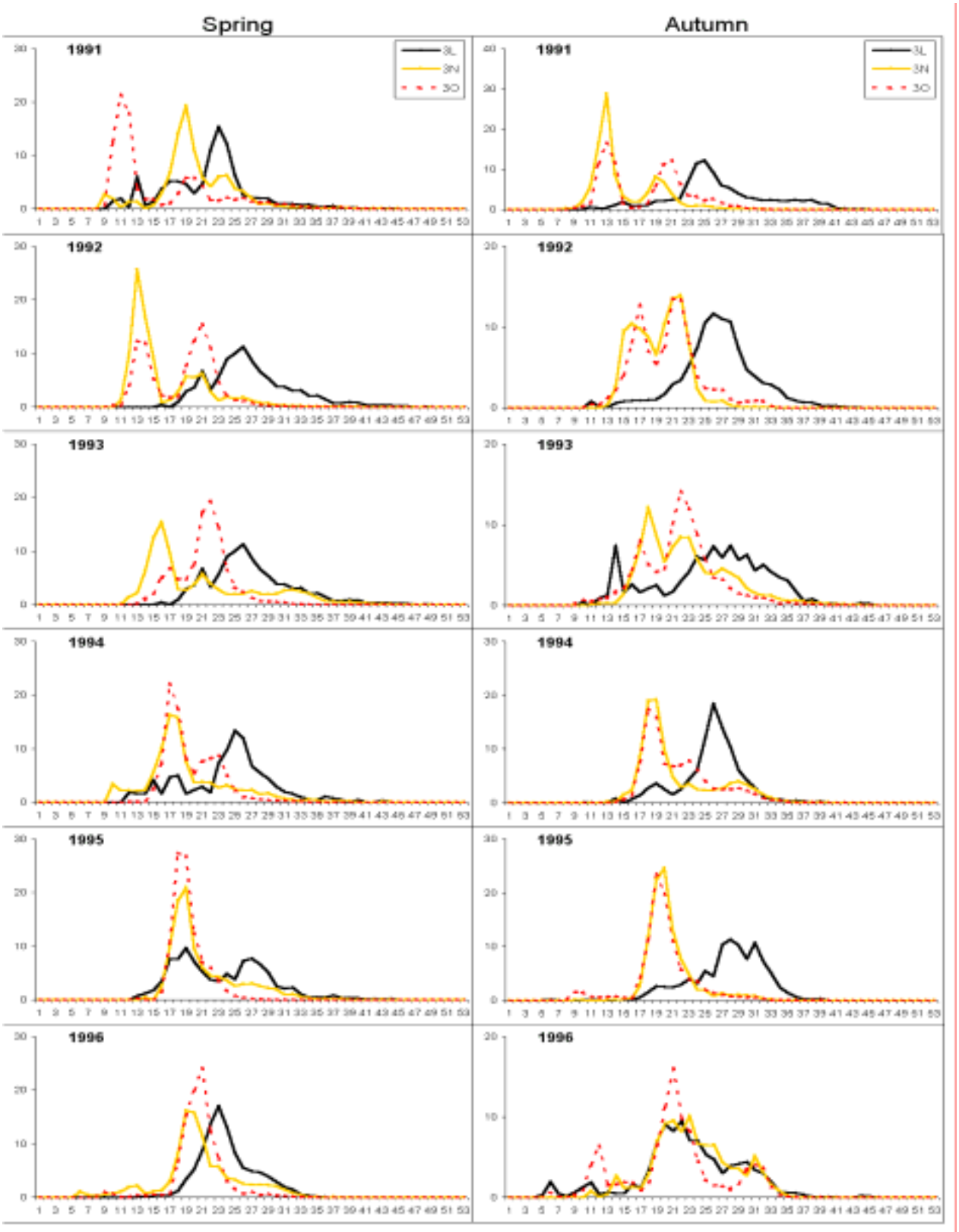

Fig. 4. Comparative length frequency distribution from stratified-random research surveys to Div. 3LNO from 1991-1996. Plotted are percent at length from stratified mean per standard tow.

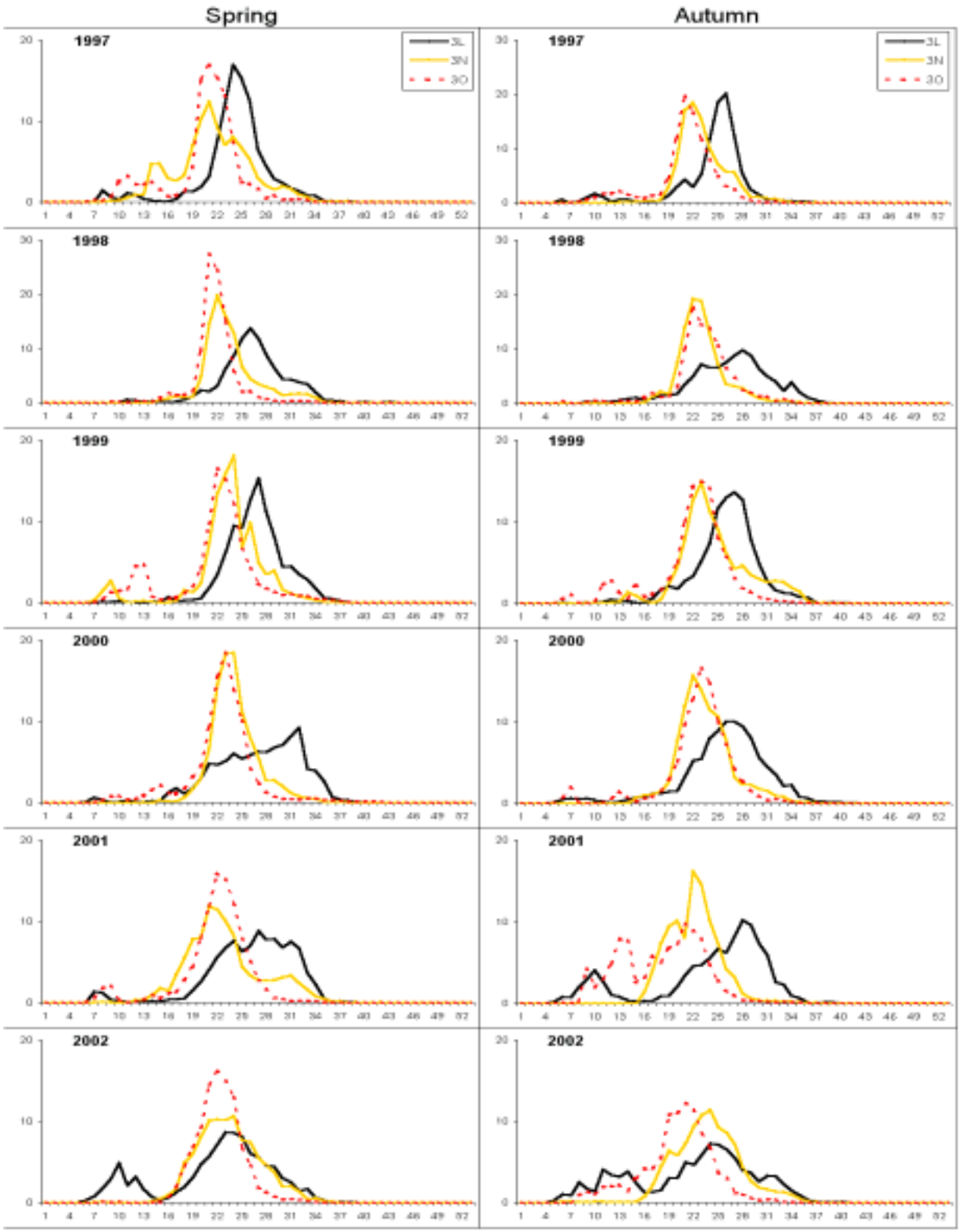

Fig. 5. Comparative length frequency distribution from stratified-random research surveys to Div. 3LNO from 1997-2002. Plotted are percent at length from stratified mean per standard tow.