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# Results of groundfish surveys to Grand Bank and St. Pierre Bank, 1971-73

by

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## Introduction

Research vessel surveys to Grand Bank and St. Pierre Bank have been conducted on a regular basis by the St. John's laboratory for many years. Up to 1971 these surveys have used the standard line method of surveying as described by Pinhorn (1971). However, the stratified-random method of surveying referred to in Grosslein and Pinhorn (1971) was used in the 1971-73 surveys. The present paper compares the results of these surveys in the three years and also with the results of the USSR surveys in 1971-73 reported in Chekhova (1974). Figures 1 and 2 show the strata fished on Grand Bank and St. Pierre Bank.

## Results

Figures 3, 5 and 7 show the comparison of numbers per standard set for the three years in groups of strata selected to coincide with particular depth zones. Figures 4, 6 and 8 compare the stratified mean numbers per standard set from Canada (N) surveys and the number per hour from USSR surveys reported in Chekhova (1974).

### Subdivision 3Ps

The most obvious change in 1973 versus 1972 in Subdivision 3Ps (Fig. 3) is the increase in abundance of cod in stratum 307 (Burgeo Bank) and the deeper strata of 313, 316 and 318 on St. Pierre Bank and redfish in stratum 307 and strata 309 and 310 (Burgeo Channel). There was a corresponding decrease in abundance of cod in strata 309 and 310 and strata 311, 317 and 319 (51-100 Fath on the slopes of St. Pierre Bank) and redfish in strata 311, 317 and 319 and strata 313, 316 and 318. This may have been a migration to deeper water on St. Pierre Bank and westward to Burgeo Bank in 1973 because of the colder water temperature in the shallower areas of St. Pierre Bank (see Pinhorn and Wells, document this meeting). At the same time there was a decrease in abundance of American plaice in the 31-50 fath strata and an increase in the 51-100 and 101-200 fath strata on St. Pierre Bank.

In comparing the Canada (N) survey and the USSR surveys in 1972 and 1973 (Fig. 4), there is general agreement in the decrease in abundance of cod for 3Ps as a whole and an increase in abundance of American plaice, with the abundance of yellowtail remaining similar in both years. The abundance of redfish was similar in both years from Canada (N) surveys but increased slightly from USSR surveys. The only striking difference is in the abundance of haddock; the Canada (N) surveys indicated a decrease in abundance of haddock in Subdivision 3Ps in 1973 whereas the USSR surveys indicated a great increase in 1973. These fish were apparently 1-year-olds from their average size and it is interesting to note that about 60% of the haddock caught on the Canada (N) surveys were also 1-year-olds but not nearly in the quantity caught on the USSR survey. This difference might be explained by the difference in time of the survey (March compared to June) or in the larger net probably used on the USSR surveys.

ICNAF Division 3N

In ICNAF Division 3N cod abundance from Canada (N) surveys declined in the shallower strata (< 100 fath) in 1973 compared to 1972 and 1971 but increased in the deeper strata (100-200 fath) (Fig. 5). An exception to this is in 51-100 fath where the abundance was high in 1972 but low in the other two years. Haddock were almost completely absent in the surveys. Redfish abundance indices are probably not reliable since the survey only extended to 200 fath and redfish are distributed deeper than this. In any case redfish abundance declined between 1971 and 1972 in the 101-150 fath zone but increased markedly in 1973. In the 151-200 fath zone redfish abundance declined between 1971 and 1972 and remained low in 1973. No significant redfish catches were obtained in depths less than 100 fath. American plaice abundance was very similar between 1971 and 1972 in all strata groups but decreased in 1973 in the 31-50 fath strata and increased in the deeper strata. No significant catches of witch were obtained. Abundance of yellowtail increased progressively in 1971, 1972 and 1973 in the < 31 fath strata but increased in 1972 compared to 1971 in the 31-50 fath strata and decreased in 1973.

The agreement between the Canada (N) and USSR surveys for the entire area of 3N was good (Fig. 6). Cod abundance declined progressively from both sets of surveys. The decline in redfish abundance in 1972 and the increase in 1973 was evident from both surveys although the increase in 1973 was more pronounced in the Canada (N) surveys. The same remarks about interpretation of redfish results apply in this case also. The decline in yellowtail between 1971 and 1973 was broadly similar - both surveys.

ICNAF Division 3L

Cod abundance in strata less than 100 fath increased between 1971 and 1972 but decreased in the 101-150 fath strata (Fig. 7). The strata in depth range 151-200 fath were not fished in 1971 and 1972. However, cod abundance in strata less than 100 fath decreased drastically in 1973 (strata in one of the depth zones 51-100 fath on the northwestern part of the bank could not be fished in 1973 because of ice conditions). Cod abundance in the 101-150 fath strata increased slightly in 1973; cod abundance in the 151-200 fath strata was much higher than in any other strata in 1973 but since these strata were not surveyed in 1971 or 1972, it is not known whether this represents an increase in 1973 in the deeper zones as was the case in Division 3N. Except for the catches in stratum 388 (151-200 fath) in 1973 no significant catches of redfish were obtained in Division 3L but this is not surprising since only in 1973 were the strata deeper than 150 fath fished in Division 3L. Abundance of American plaice in strata in 31-50 fath and 101-150 fath was similar in all three years but showed a progressive decline between 1971 and 1973 in 51-100 fath on the northeastern part of Grand Bank. The 51-100 fath strata on the northwestern part of Grand Bank could not be fished in 1973 because of ice conditions but there was a decline between 1971 and 1972. This was unfortunate because this is the area of the greatest plaice abundance. Yellowtail were only caught in abundance in 31-50 fath strata and a drastic decrease occurred between 1971 and 1972 and 1973.

Comparisons between Canada (N) and USSR surveys indicated that cod abundance from Canada (N) surveys were similar in 1971 and 1972 but declined severely in 1973 (Fig. 8). Results from USSR surveys indicated a decline between 1971 and 1972 as well as 1972 and 1973. American plaice abundance from Canada (N) surveys was similar in 1971 and 1972 but declined in 1973 whereas abundance from USSR surveys declined between 1971 and 1972 but was similar to 1972 in 1973.

Statistical characteristics of stratified means

Coefficient of variation was used to compare variances between areas, years and species (Tables 1-3). Coefficients varied between 20% and 46% for cod with most values ranging between 20 and 30%. The only significant haddock catches were in Subdivision 3Ps where coefficients were 45 and 47% in 1971 and 1972 respectively. Coefficients for redfish in Subdivision 3Ps were 28 and 39% in 1971 and 1972 respectively. In other divisions catches were much lower and coefficients higher. Coefficients for American plaice were 32-33% in Subdivision 3Ps, 11-22% in Division 3N and 12-39% in Division 3L. The only significant witch catches were in Subdivision 3Ps where coefficients were 24 and 29%. Coefficients for yellowtail in Division 3LN ranged from 15-23%.

## Discussion

The results from both Canada (N) and USSR surveys in this study indicated declines in a number of species between 1971, 1972 and 1973 and a tendency for some species to be distributed more deeply in 1972 and 1973 than in 1971. Temperatures in 1972 and 1973 were colder than in 1971, especially in the shallower areas of both Grand Bank and St. Pierre Bank (see Pinhorn and Wells (1974) this meeting) and it is believed that at least some of this decline if not all may be explained by temperature effects. It is impossible at this stage to determine how much of the decline in some of these species is in fact due to decreased temperatures and how much is actual decline in stock abundance. Decline in temperatures can have a two fold effect on survey results: fish can be distributed in deeper zones outside the range of the surveys and changes in behaviour of fish in relation to the gear can occur, e.g. fish might be distributed farther off the bottom above the range of the net.

Coefficients of variations were reasonably consistent between areas, species and years for species for which significant catches were obtained. When catches were small, coefficients were larger but when catches were significant, coefficients were low in the range of 20-30% annually. This consistency of variation is encouraging and indicates that the variances are probably being estimated correctly.

## References

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Grosslein, M. D., and A. T. Pinhorn. 1971. Progress in development of a coordinated survey program in the ICNAF Area. Annu. Meet. Intern. Comm. Northw. Atlant. Fish. Res. Doc. 71/128, Serial No. 2634 (mimeographed).

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Table 1. Stratified mean number per standard set and relevant statistics from Canada (N) stratified-random surveys, Subdivision 3Ps, 1972 and 1973. Only strata fished in both years were used.

| Year | Mean | Variance | Standard deviation | Coefficient of Variation | 95% limits Lower | 95% limits Upper |
|---|---|---|---|---|---|---|
| | | | COD | | | |
| 1972 | 22.0 | 34.9 | 5.9 | 0.27 | 10.1 | 33.8 |
| 1973 | 15.7 | 23.3 | 4.8 | 0.31 | 6.0 | 25.3 |
| | | | HADDOCK | | | |
| 1972 | 7.2 | 10.4 | 3.2 | 0.45 | 0.8 | 13.6 |
| 1973 | 3.7 | 3.1 | 1.8 | 0.47 | 0.2 | 7.3 |
| | | | REDFISH | | | |
| 1972 | 485.6 | 18522 | 136.1 | 0.28 | 213.4 | 757.8 |
| 1973 | 453.4 | 30801 | 175.5 | 0.39 | 11.1 | 859.7 |
| | | | AM. PLAICE | | | |
| 1972 | 51.5 | 270.0 | 16.4 | 0.32 | 18.6 | 84.4 |
| 1973 | 123.2 | 1616 | 40.2 | 0.33 | 42.8 | 203.6 |
| | | | WITCH | | | |
| 1972 | 9.8 | 5.8 | 2.4 | 0.24 | 5.0 | 14.7 |
| 1973 | 11.5 | 9.7 | 3.1 | 0.27 | 5.2 | 17.7 |
| | | | YELLOWTAIL | | | |
| 1972 | 3.3 | 4.1 | 2.0 | 0.61 | -1.9 | 8.6 |
| 1973 | 5.6 | 18.5 | 4.3 | 0.77 | -8.1 | 19.3 |

Strata used: 307, 309, 310, 311, 312, 313, 315, 316, 317, 318, 319, 321.

Table 2. Stratified mean number per standard set and relevant statistics for Canada (N) stratified-random surveys, Division 3N and Divisions 3LN (yellowtail), 1971, 1972 and 1973. Only strata fished in all three years were used.

| Year | Mean | Variance | Standard deviation | Coefficient of Variation | 95% limits Lower | 95% limits Upper |
|---|---|---|---|---|---|---|
| | | | COD | | | |
| 1971 | 44.2 | 420 | 20.5 | 0.46 | 3.2 | 85.2 |
| 1972 | 39.9 | 64.7 | 8.1 | 0.20 | 23.8 | 56.0 |
| 1973 | 10.5 | 7.4 | 2.7 | 0.26 | 5.1 | 16.0 |
| | | | HADDOCK | | | |
| 1971 | No catch | - | - | - | - | - |
| 1972 | 0.22 | 0.043 | 0.21 | 0.94 | -0.19 | 0.64 |
| 1973 | 0.02 | 0.0006 | 0.02 | 1.00 | -0.03 | 0.08 |
| | | | REDFISH | | | |
| 1971 | 16.9 | 58.3 | 7.6 | 0.45 | -2.7 | 36.5 |
| 1972 | 6.1 | 26.8 | 5.2 | 0.85 | -4.2 | 16.4 |
| 1973 | 37.1 | 705 | 26.6 | 0.72 | -16.1 | 90.2 |
| | | | AM. PLAICE | | | |
| 1971 | 54.6 | 147.1 | 12.1 | 0.22 | 30.4 | 78.9 |
| 1972 | 59.3 | 41.8 | 6.5 | 0.11 | 46.3 | 59.3 |
| 1973 | 50.9 | 70.5 | 8.4 | 0.16 | 34.1 | 67.7 |
| | | | WITCH | | | |
| 1971 | 0.4 | 0.03 | 0.2 | 0.50 | 0.0 | 0.73 |
| 1972 | 0.7 | 0.2 | 0.4 | 0.57 | -0.06 | 0.86 |
| 1973 | 1.1 | 0.6 | 0.8 | 0.73 | -0.7 | 2.9 |
| | | | YELLOWTAIL DIVISIONS 3LN | | | |
| 1971 | 111.4 | 266 | 16.3 | 0.15 | 78.8 | 144.0 |
| 1972 | 102.5 | 452 | 21.3 | 0.21 | 60.0 | 145.0 |
| 1973 | 63.1 | 207 | 14.4 | 0.23 | 34.3 | 91.9 |

Strata used: Division 3N - 358, 359, 361, 362, 373, 374, 375, 376, 377, 378, 380, 381, 382, 383.
Yellowtail: Divisions 3LN - 350, 358, 359, 361, 362, 363, 370, 371, 372, 373, 374, 375, 376, 377, 378, 380, 381, 382, 383, 384, 385, 389, 390, 391.

Table 3. Stratified mean number per standard set and relevant statistics from Canada (N) stratified-random surveys, Division 3L, 1971, 1972 and 1973. Only strata fished in all three years were used.

| Year | Mean | Variance | Standard deviation | Coefficient of Variation | 95% limits Lower | 95% limits Upper |
|---|---|---|---|---|---|---|
| | | | COD | | | |
| 1971 | 27.3 | 45.5 | 6.7 | 0.25 | 13.8 | 40.7 |
| 1972 | 29.2 | 40.0 | 6.3 | 0.22 | 16.5 | 41.8 |
| 1973 | 12.5 | 25.6 | 5.1 | 0.40 | -0.8 | 25.9 |
| | | | REDFISH | | | |
| 1971 | 4.3 | 17.8 | 4.2 | 0.98 | -13.9 | 22.5 |
| 1972 | 0.18 | 0.016 | 0.13 | 0.70 | -0.21 | 0.58 |
| 1973 | 0.0 | 0.0 | - | - | - | - |
| | | | AM. PLAICE | | | |
| 1971 | 159.2 | 1170 | 34.2 | 0.21 | 90.8 | 227.7 |
| 1972 | 163.9 | 391 | 19.8 | 0.12 | 124.4 | 203.5 |
| 1973 | 99.8 | 1480 | 38.5 | 0.39 | 4.8 | 194.9 |
| | | | WITCH | | | |
| 1971 | 0.15 | 0.005 | 0.07 | 0.47 | 0.01 | 0.29 |
| 1972 | 0.49 | 0.034 | 0.18 | 0.38 | 0.12 | 0.86 |
| 1973 | 0.07 | 0.0048 | 0.07 | 1.00 | -0.15 | 0.29 |

Strata used: 350, 363, 370, 371, 372, 384, 385, 389, 390, 391.

Table 4. Periods of Canada (N) and USSR surveys in Subdivision 3Ps and Divisions 3N and 3L, 1971-73

| Year | 3Ps Canada(N) | 3Ps USSR | 3N Canada(N) | 3N USSR | 3L Canada(N) | 3L USSR |
|---|---|---|---|---|---|---|
| 1971 | No survey | May | June | June-July | June | July |
| 1972 | March | May | May | April | May | June |
| 1973 | March | June | April | June-July | April | July |

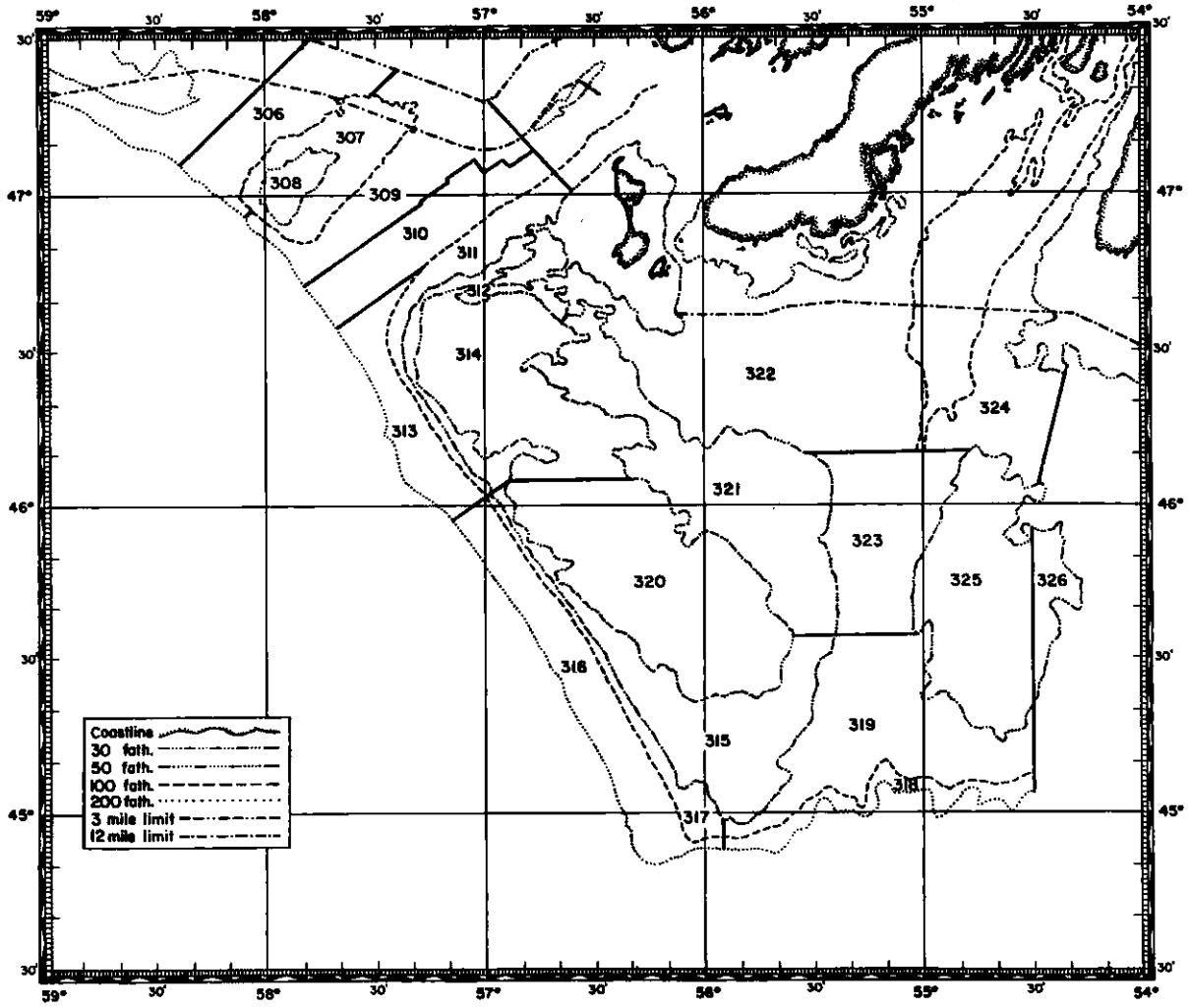


Fig. 1. Map showing strata fished on Canada (N) stratified-random cruises to Subdivision 3Ps, 1972 and 1973.

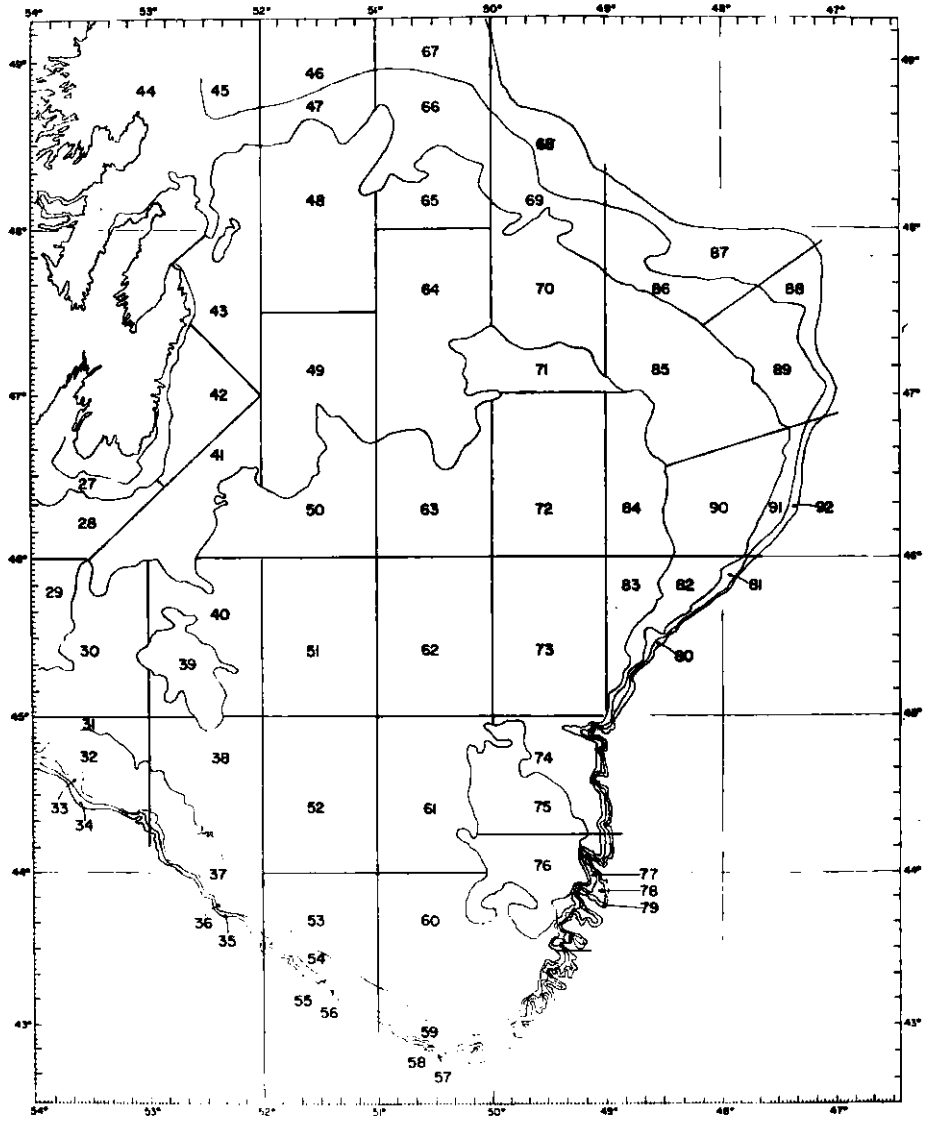


Fig. 2. Map showing strata fished on Canada (N) stratified-random surveys to Division 3L and 3N.

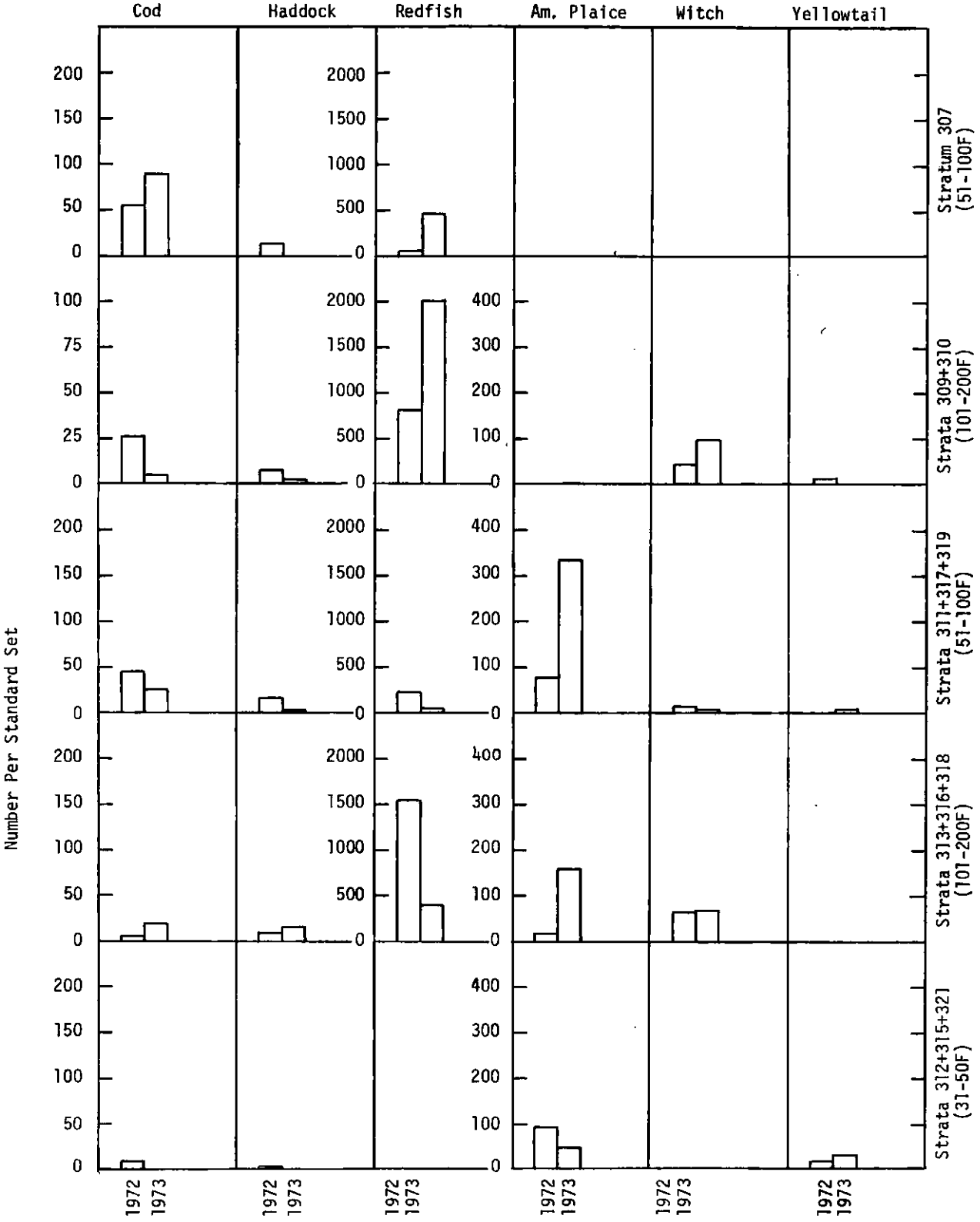


Fig. 3. Comparisons of numbers per standard set for major species caught during Canada (N) stratified-random cruises to Subdivision 3Ps, 1972 and 1973.

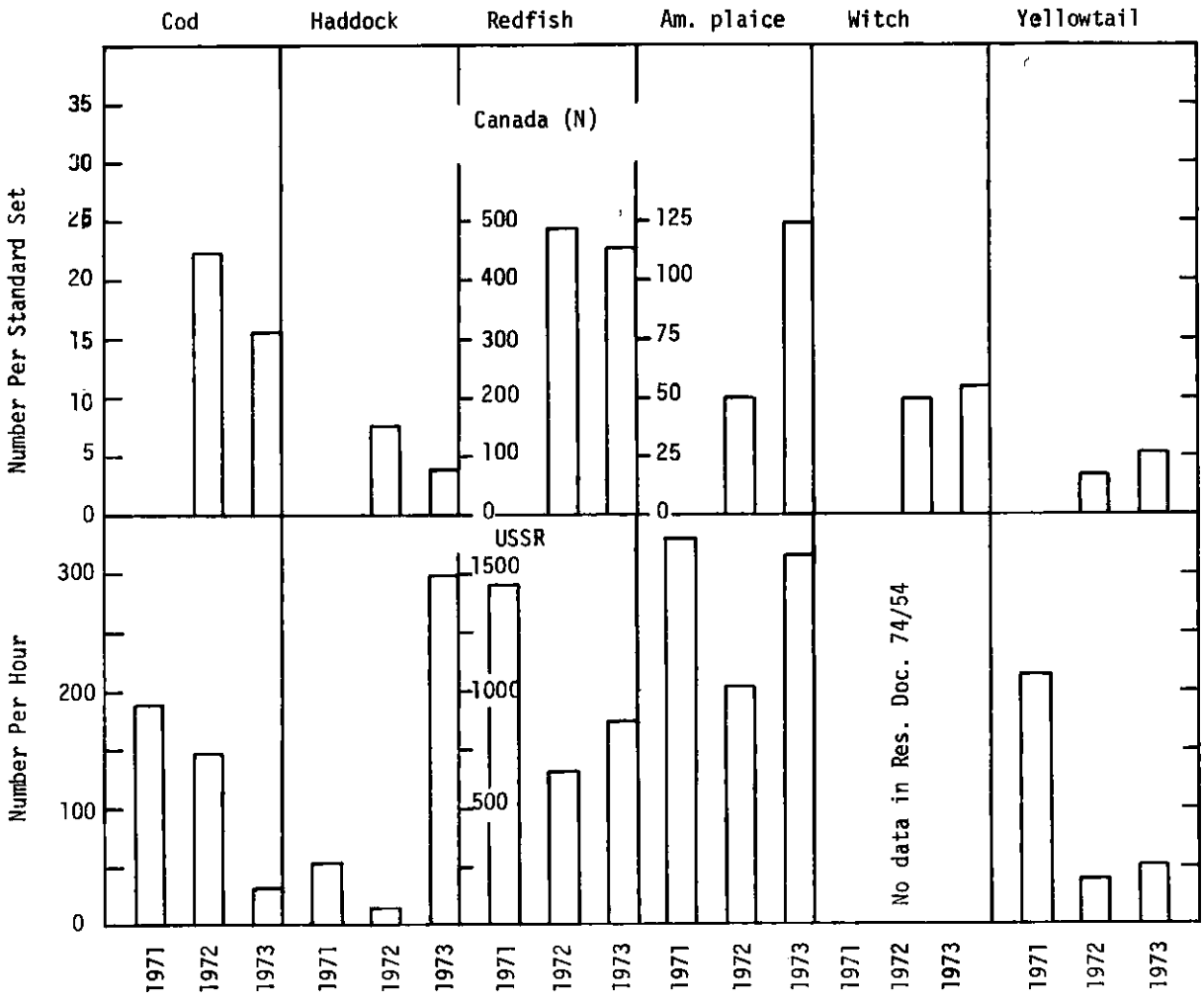


Fig. 4. Comparisons of stratified mean number per standard set from Canada (N) surveys and numbers per hour from USSR surveys for major species in Subdivision 3Ps, 1971, 1972 and 1973. Only these strata fished in both years were used for Canada (N) surveys.

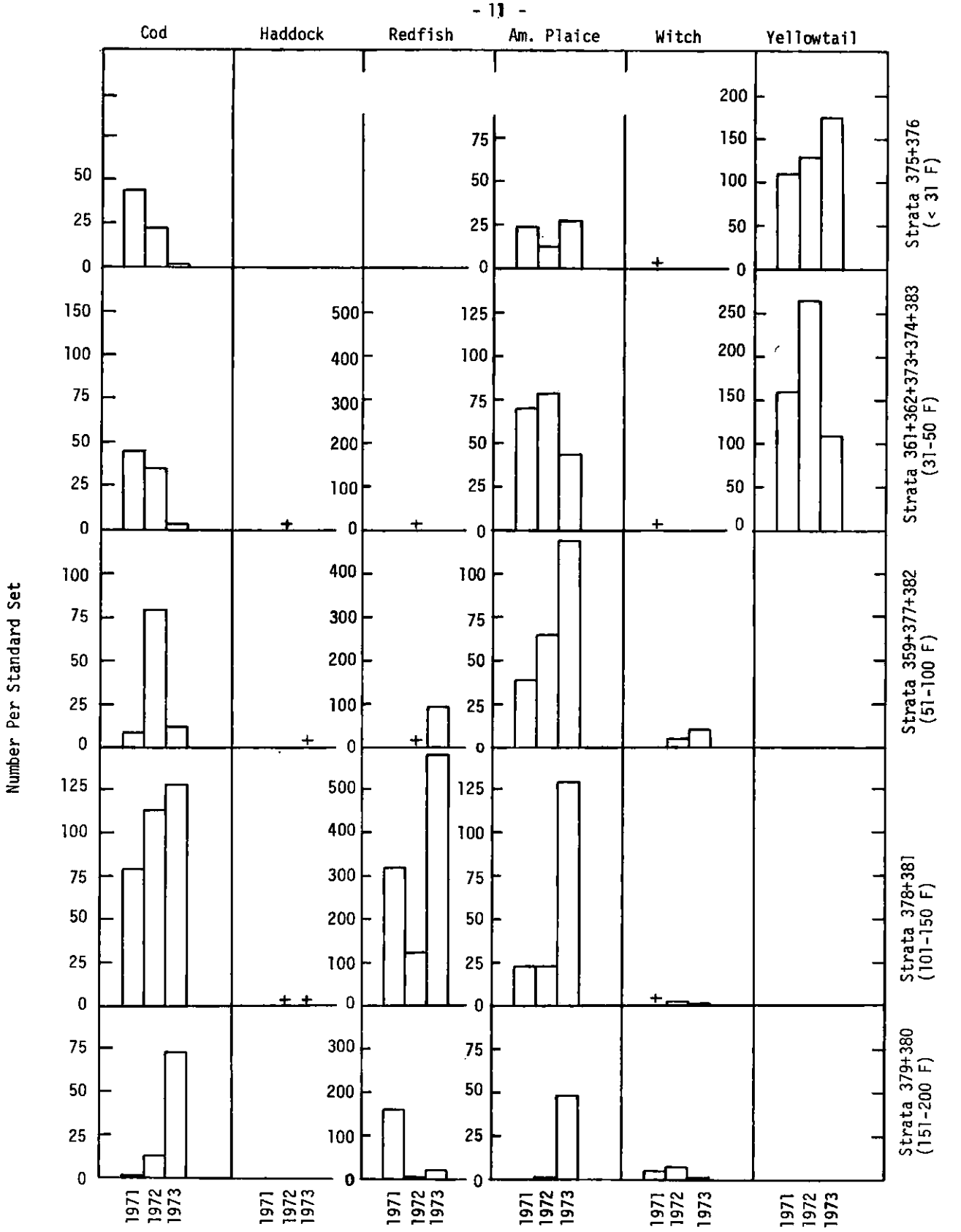


Fig. 5. Comparisons of numbers per standard set for major species caught during Canada (N) stratified-random cruises to Division 3N, 1971, 1972 and 1973.

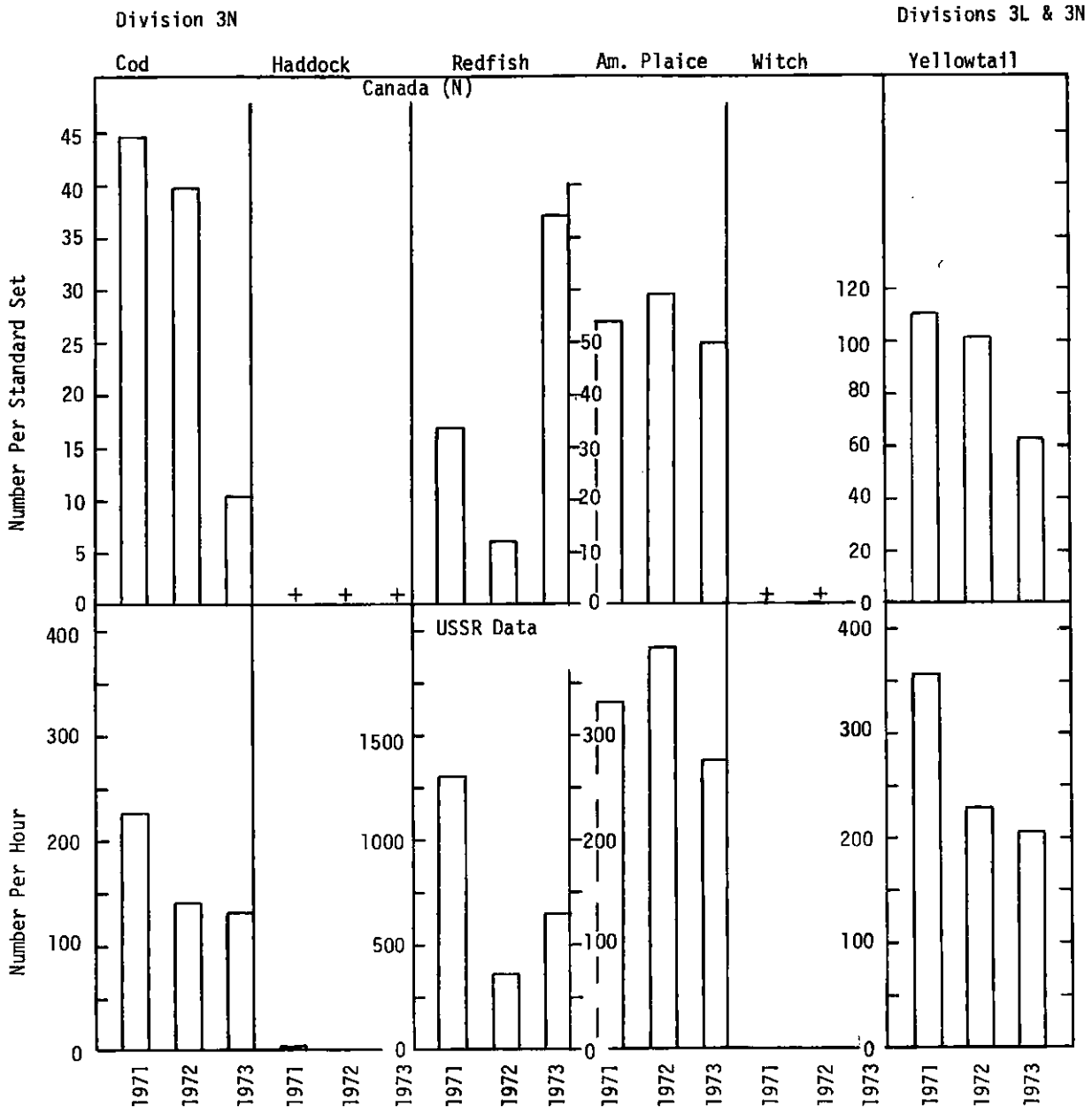


Fig. 6. Comparisons of stratified mean number per standard set from Canada (N) surveys and numbers per hour from USSR surveys for major species in Division 3N and yellowtail in Divisions 3L and 3N, 1971, 1972, 1973. Only those strata fished in all three years were used for Canada (N) surveys.

3L

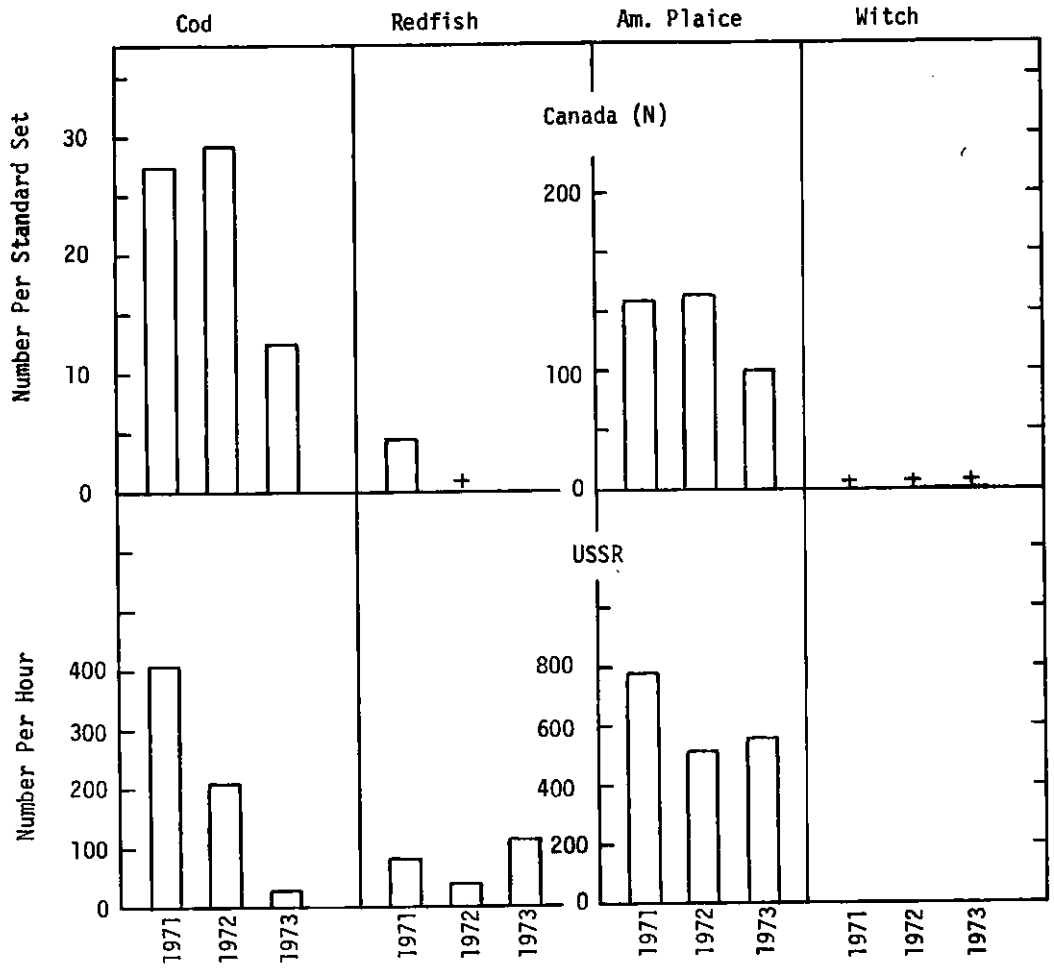


Fig. 8. Comparisons of stratified mean number per standard set from Canada (N) surveys and numbers per hour from USSR surveys for major species in Division 3L, 1971, 1972 and 1973. Only those strata fished in both years were used for Canada (N) surveys.

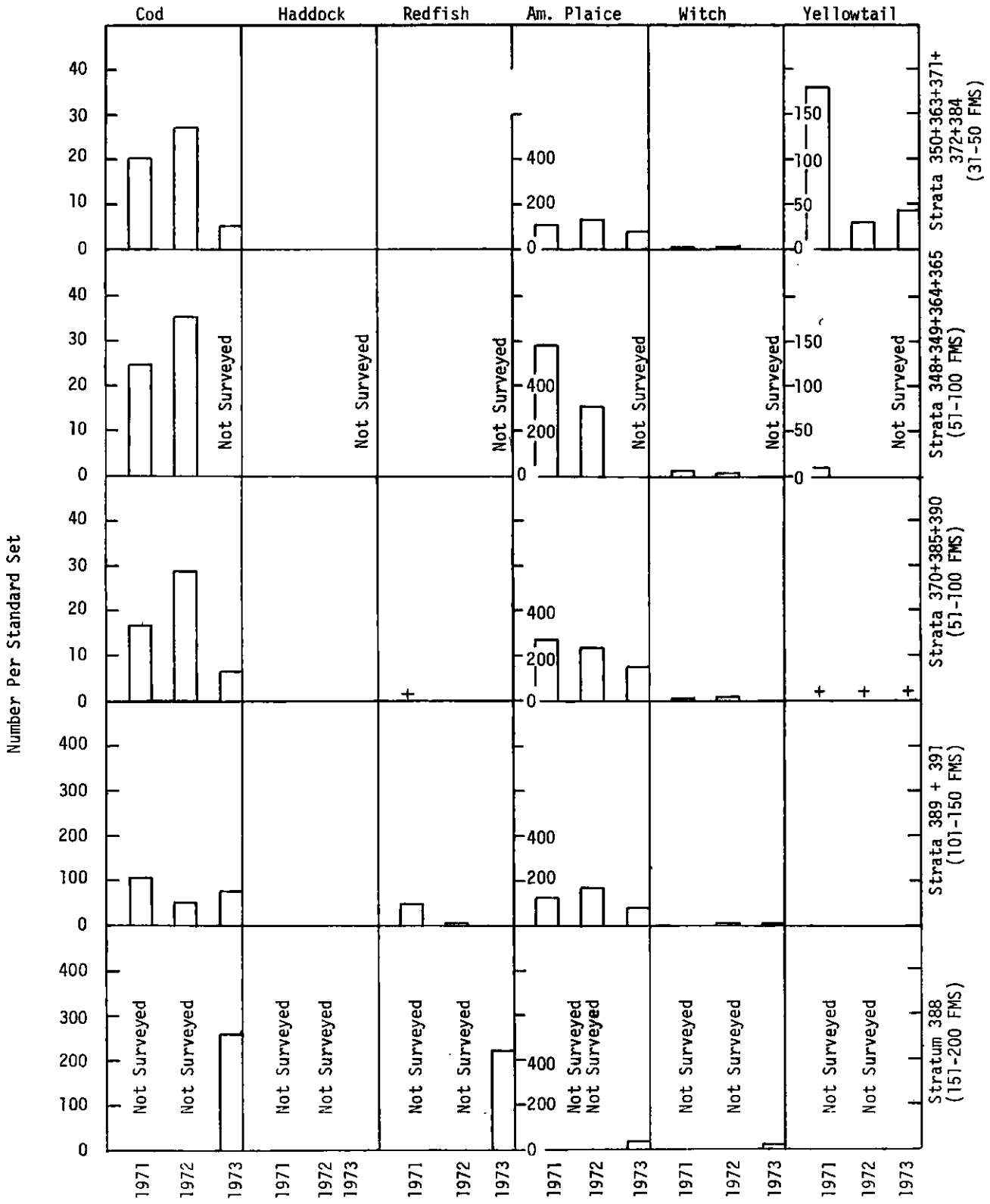


Fig. 7. Comparisons of numbers per standard set for major species caught during Canada (N) stratified-random cruises to Division 3L, 1971, 1972 and 1973.