



PACIFIC REGION TECHNICAL NOTES

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POP Verification for March and April 1983

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INTRODUCTION

Verification results have been compiled for a number of locations in British Columbia since the inception of the POP program last July 1982. These results have been presented over the year in several Pacific Region Technical Notes. The results for March and April 1983 are being examined in this report.

Unlike the previous Notes on this subject, the structure has been presented in a different fashion. The Figures which accompany this Note, highlight the performance of both the Pacific Weather Centre POP forecasts and those of the objective POPA guidance from CMC, and have been organized according to the climatic/forecast areas. For the sake of brevity, only the Today and Tomorrow forecasts abstracted from the 5 a.m. forecast and the 00Z guidance forecast will be considered. However, some additional comments will be given about the performance of the other forecast issues.

VERIFICATION METHOD

Probability forecasts are categorized according to whether a precipitation event was observed or not observed and the results are compiled into a simplified Brier Score (or mean square error). This score serves as the focus for comparison, and is used to compute a skill score (using climatological score as a standard). Special emphasis is given to the two separate components of the Brier score: Reliability and Resolution which sum to equal the Brier Score. The former evaluates the forecast accuracy, while the latter evaluates the forecasters' ability to discriminate between precipitation and non-precipitation events. The reliability (abbreviated REL in the figures) error ranges from 0 to 1, while the resolution (RES) error ranges from 0 to .25. In both cases, the best is zero. The method has been well documented in previous Notes on this subject, and the reader is invited to peruse these if more detailed information is required.

RESULTS

The results are portrayed in Figures 1 through 4 (a - Today, b - Tomorrow) with each figure corresponding to one of the larger geographic forecast regions in British Columbia. The circle diagrams in each figure represents the relative POP forecast frequency for 5 forecast groupings: 0%, 10-30%, 40-60%, 70-90%, and 100%. The shading at the beginning of each pie section indicates the proportion of the forecasts in that category which were inaccurate (e.g. shading in the 10-30% category indicates that the observed frequency was greater or less than 20%). The magnitude of the shading

indicates the measure of inaccuracy in that category. RELiability and RESolution errors, and the skill score are printed to the left of each circle. The figure given in brackets represents the maximum achievable Brier Score if all the forecasts were perfectly reliable.

Several trends became apparent upon reviewing all 4 figures. The forecasters demonstrated skill in predicting probabilities for Today and Tomorrow (also for Tonight) for all verification sites, and they generally improve on the guidance's performance in most cases. The forecasters also showed their ability to discriminate between the precipitation and non-precipitation events much better than the guidance with generally lower resolution errors. At least 25% of the PWC forecasts for each location were 0 or 100%, with generally very good reliability, while the guidance did so no more than 8% of the time. This also suggests that forecasters do recognize developing weather patterns that yield precipitation or no precipitation, even in the Tomorrow period with some confidence.

Forecast skill levels were generally greater for the coastal locations than for interior stations. This results primarily because precipitation is observed with about half the frequency in the interior than along the coast. However, for the most part, the Brier Scores were very similar between the coastal and interior locations. The reliability errors were generally less than .05, while the Resolution errors varied between .10 and .18. If the PWC forecasts were perfectly reliable the Brier scores for the coastal locations would be better than the others (the numbers shown in brackets in the figures). This is also consistent with the forecasters' tendency to be nearly twice as confident about whether it will precipitate or not (0 or 100% forecasts) for the coast than they are for interior points.

This latter observation is not inconsistent when one considers the variability in the precipitation regimes between the coast and the interior. Precipitation observed along the coast is generally associated with organized dynamic cloud systems and synoptic scale disturbances. The uncertainty does not generally arise over what locations along the coast will rain, since if it does, it occurs generally over a large area. The uncertainty generally arises because of the uncertainty in the track and timing of synoptic disturbances, or because of a transition in the upper air circulation pattern over the eastern Pacific.

The forecaster is presented with a different forecast problem for producing a POP for interior sites. The Coast Range Mountains act as a natural barrier to impede the penetration of moisture and to deflect the wind circulation from the Pacific. The natural diffluence which results often dictates the demise of synoptic scale disturbances advancing into the interior. In this situation the forecaster is confronted with making two decisions under uncertainty firstly, whether it will rain or snow a measurable amount; and secondly, where will it occur. The most frequent precipitation event observed over the interior arises as a consequence of a destabilizing airmass (invasion of cool air aloft or day heating) which sets off isolated or widely scattered showers the majority of the time. This forces the forecaster to be more conservative in his predictions avoiding

the usage of 100% most of the time, and generally confining his forecasts between 0 and 60%. If the forecaster uses 0% sparingly, the resultant Brier Scores will be higher than those achieved on the coast, where he has experienced much better reliability in making more confident predictions.

Keeping this last point in mind, one should review the forecasters' performance in comparison to some minimum level of error. If the forecasters are aiming for perfect reliability, then this standard is determined by the forecast resolution, given the forecast distributions in Figures 1 through 4, the numbers contained in brackets represent the maximum achievable score if the forecasts were perfectly reliable. Over the past months, these values have been remarkably consistent, and one could conclude that a forecast score of near .10 over the South Coast and .13 elsewhere shows excellent skill. Recalculating skill scores using these new minimum values as perfect scores (instead of zero), portray a more realistic view of the forecasters' performance. For the coastal locations, the skill ranges between 60 and 85%, while in interior locations the skill levels vary from nil to 60%.

The guidance's minimum achievable error given the forecast distribution and perfect reliability, has also been consistent over the past months. For most cases in Figures 1 to 4, the actual resolution error would have increased (sometimes significantly) if the forecasts were reliable. This results because there are a few of the forecast categories (10, 20, 30,...90, 100%) where precipitation was observed everytime a particular category was forecast or precipitation was not observed everytime a particular category was forecast. In both cases, it would result in a 0 contribution to the resolution error (error was due entirely to unreliability). Therefore the guidance performs better because it is unreliable, but it makes the product more difficult to use. The higher minimum score when compared to the subjective minimum results because the objective guidance distribution is clustered towards the central values and away from the extremes.

Figures 1 through 4 illustrate the performance of the forecasters and the guidance on a region by region basis. The reader is invited to evaluate these diagrams and little further will be said. However, the reader's attention needs to be directed to two of these figures. Figure 3 illustrates the very poor performance of the guidance for Prince George and Revelstoke. This certainly suggests the guidance in this period was more of a hinderance than benefit, but the forecasters still manage to demonstrate some skill none-the-less. Figure 4 presents the verification results for Prince Rupert and Terrace. In this case, both places are located in the same public forecast region; the Northern Mainland. Although their forecast distributions are nearly identical, it appears that their precipitation regimes are not. These results suggest that precipitation events are more frequent at Prince Rupert than at Terrace.

SUMMARY

The POP program continues to be successful at least from a production viewpoint. The forecasters demonstrate skillful abilities at predicting probabilities even when the POPA (Probability fo Precipitation Amounts) guidance does poorly.

REFERENCES

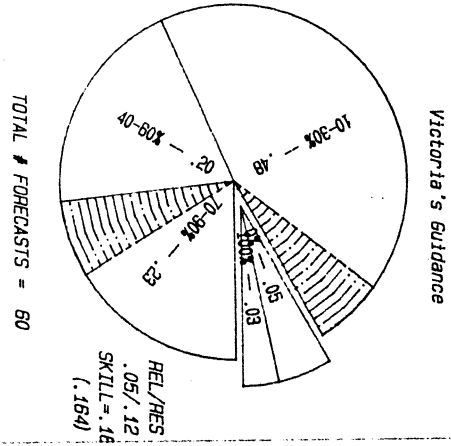
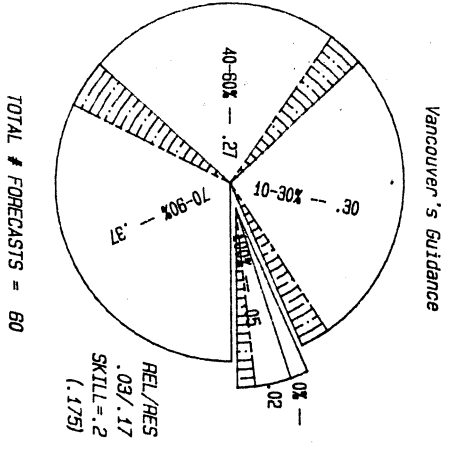
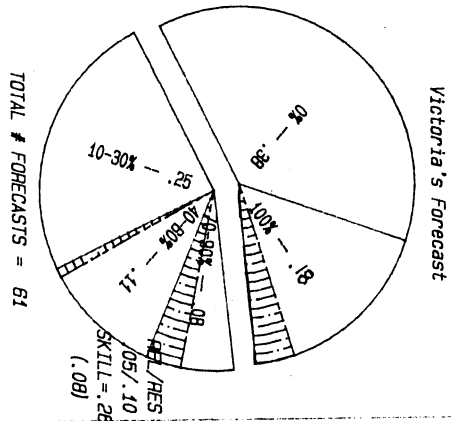
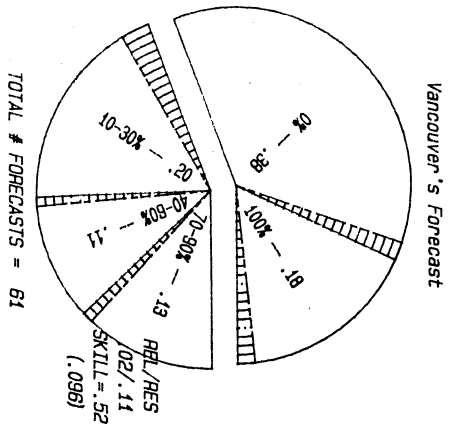
D. Grimes, 1983, Verification of POP over the South Coast of B.C.,
PRTN 83-019

D. Grimes, 1983, Verification of POP over the Southern Interior of B.C.,
PRTN 83-020

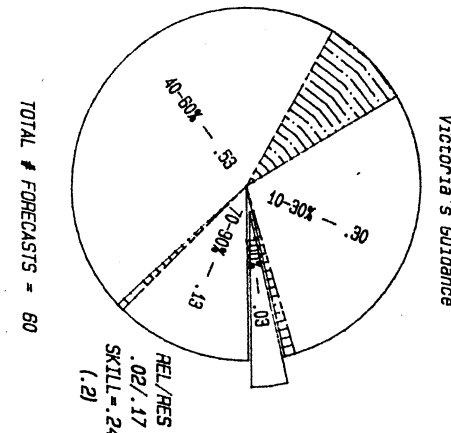
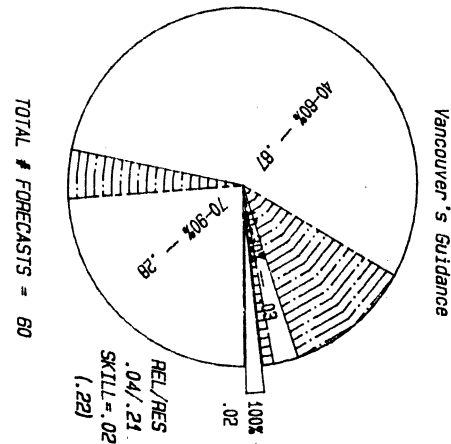
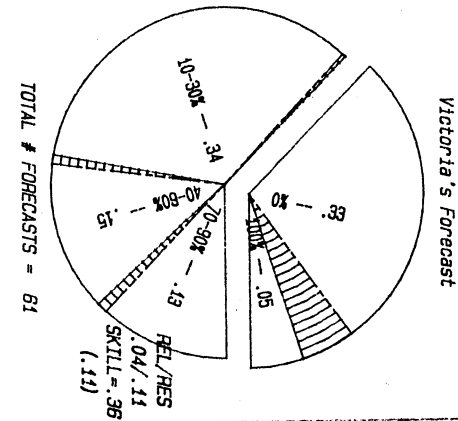
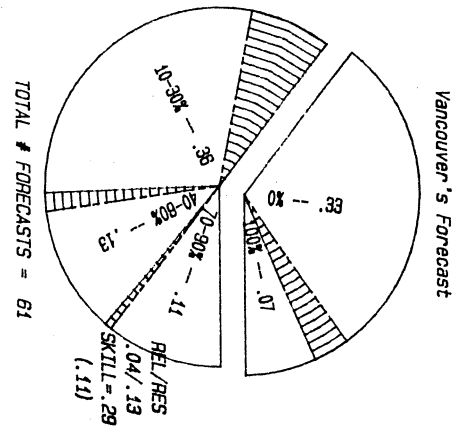
D. Grimes, 1983, Verification of POP over the North Coast of B.C.,
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Columbia Mountain Regions of B.C., PRTN 83-022

Today's POP for S. Coast ... Mar-Apr '83
Figure 1a

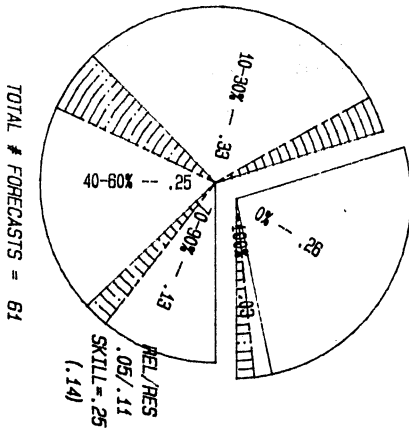


TOMORROW'S POP for S. Coast ... Mar-Apr '83
Figure 1b

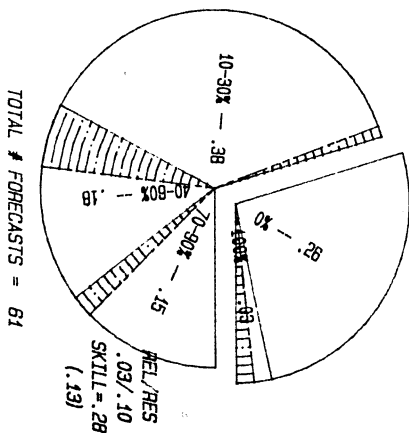


Today's Pop for Srn Interior... Mar-Apr '83
Figure 2a

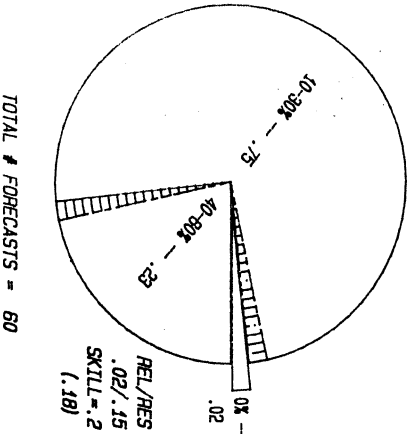
Pentiction's Forecast



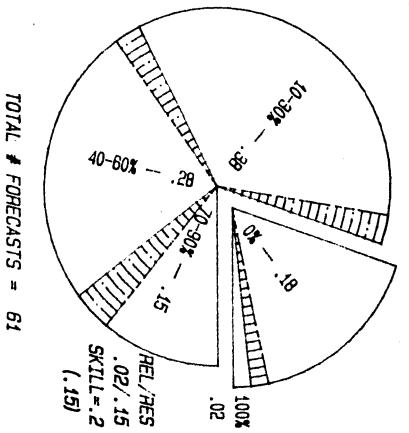
KamLoop's Forecast



Pentiction's Guidance

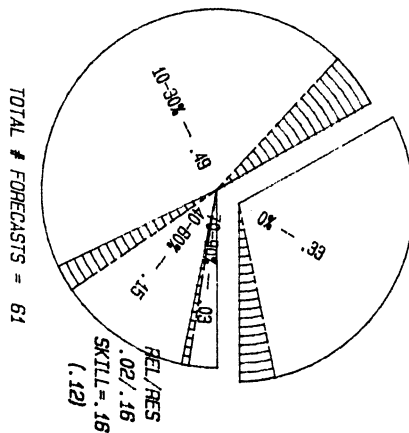


Cranbrook's Forecast

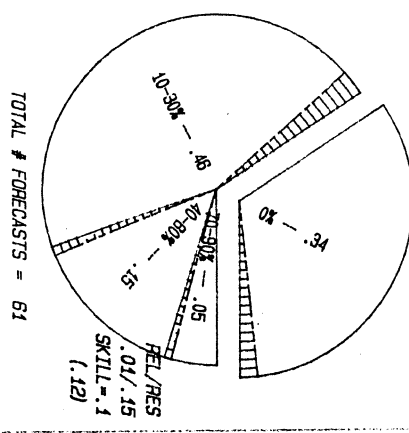


Tomorrow's Pop for Srn Interior... Mar-Apr '83
Figure 2b

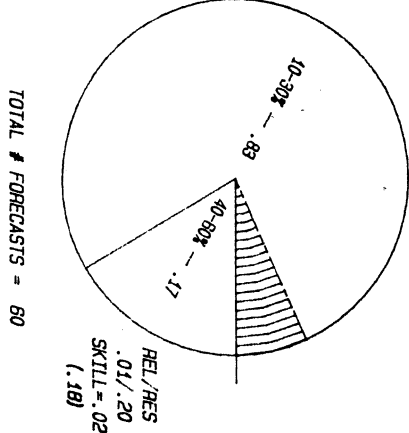
Pentiction's Forecast



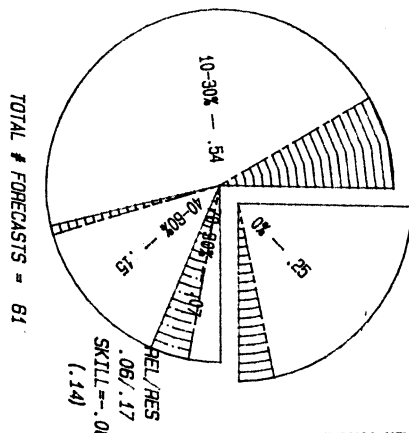
KamLoop's Forecast



Pentiction's Guidance

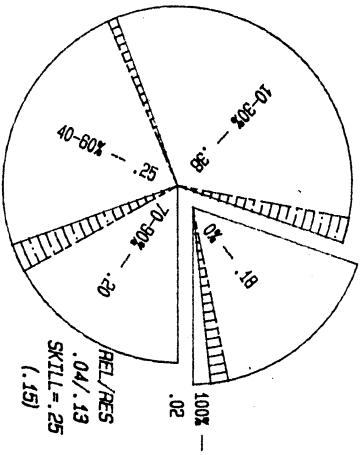


Cranbrook's Forecast



Today's POP for C. Interior... Mar-Apr '83
Figure 3a

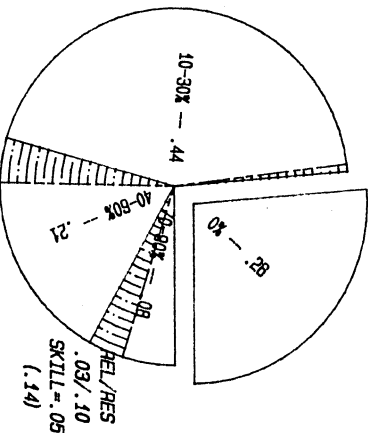
Revelstoke's Forecast



TOTAL # FORECASTS = 61

REL/RES
.04/.13
SKILL = .25
(.15)

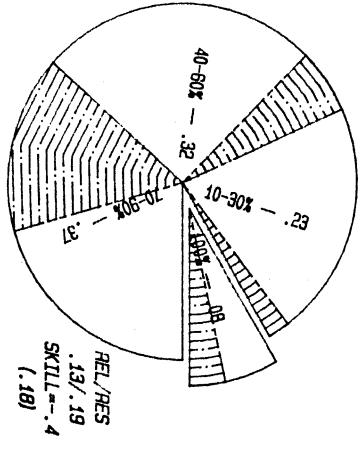
Prince George's Forecast



TOTAL # FORECASTS = 61

REL/RES
.03/.10
SKILL = .05
(.14)

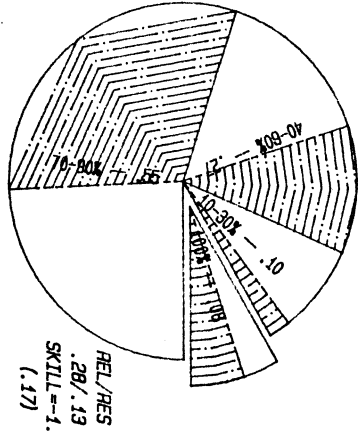
Revelstoke's Guidance



TOTAL # FORECASTS = 60

REL/RES
.13/.19
SKILL = -.4
(.18)

Prince George's Guidance

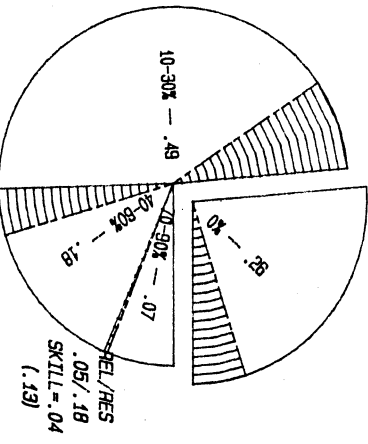


TOTAL # FORECASTS = 60

REL/RES
.28/.13
SKILL = -1.8
(.17)

Tomorrow's POP for C. Interior... Mar-Apr '83
Figure 3b

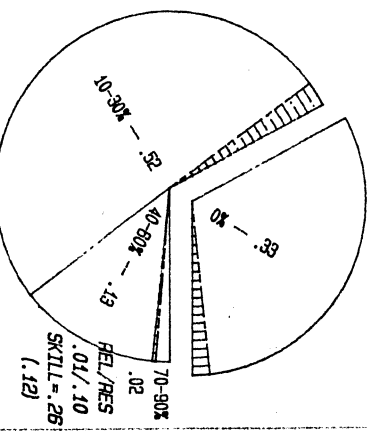
Revelstoke's Forecast



TOTAL # FORECASTS = 61

REL/RES
.05/.18
SKILL = .04
(.13)

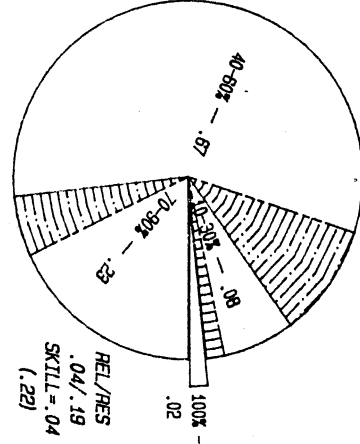
Prince George's Forecast



TOTAL # FORECASTS = 61

REL/RES
.01/.10
SKILL = .26
(.12)

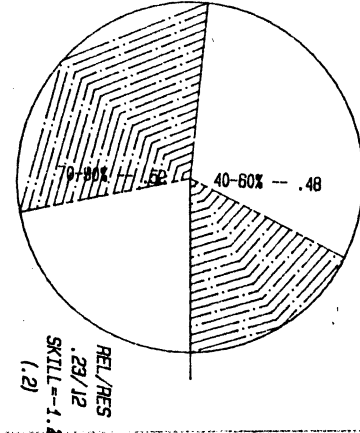
Revelstoke's Guidance



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REL/RES
.04/.19
SKILL = .04
(.22)

Prince George's Guidance

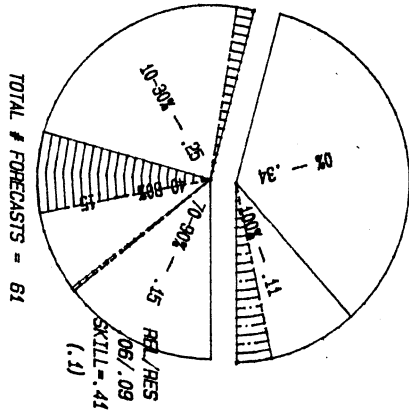


TOTAL # FORECASTS = 60

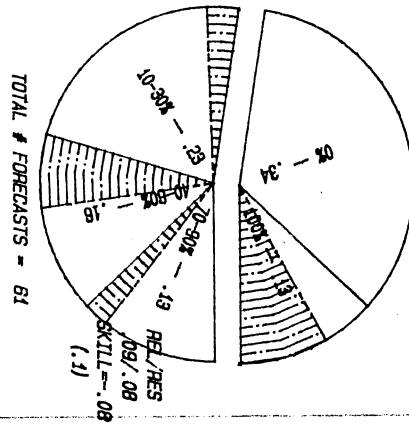
REL/RES
.23/.12
SKILL = -1.2
(.2)

Today's Pop for N. Coast... Mar-Apr '83
Figure 4a

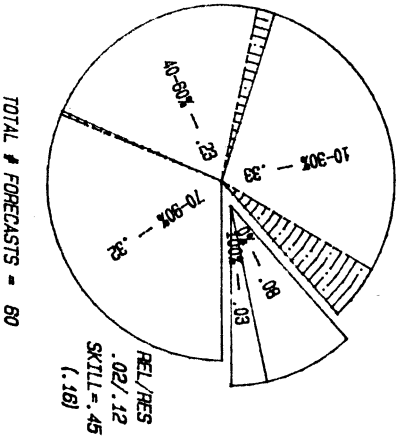
Prince Rupert's Forecast



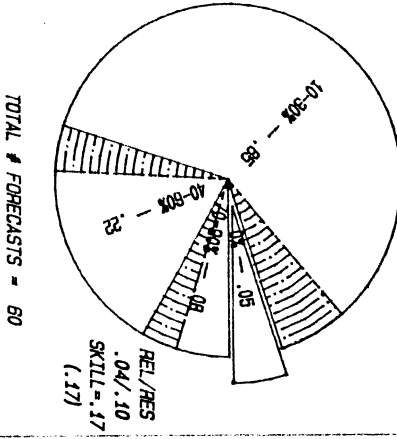
Terrace's Forecast



Prince Rupert's Guidance

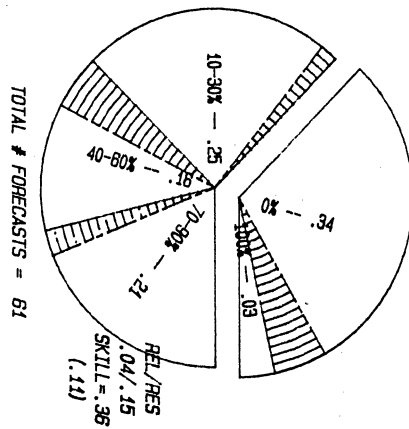


Terrace's Guidance

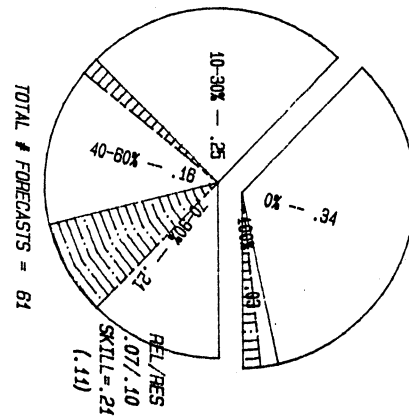


Tomorrow's Pop for N. Coast... Mar-Apr '83
Figure 4b

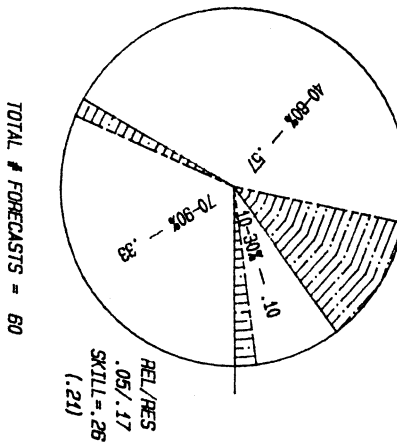
Prince Rupert's Forecast



Terrace's Forecast



Prince Rupert's Guidance



Terrace's Guidance

