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WSFO MILWAUKEE NEARSHORE MARINE FORECAST VERIFICATION RESULTS
FOR THE 1989 SEASON

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1. Introduction

WSFO Milwaukee's area of nearshore marine forecast responsibility is the water within five miles of the west shore of Lake Michigan, from Sheboygan on the north to Kenosha on the south, covering an area of approximately 400 square miles. Ranges in wind speeds, wave heights, and weather are forecast for this corridor four times daily from April 1st to the end of October. This paper reports on a verification effort on the 1989 forecasts.

2. Sources of Wind Speed and Wave Height Observations

Four sources of wind and wave observations are available: Buoy 45007 located approximately 45 miles southeast of Milwaukee in south central Lake Michigan; and the three Coast Guard stations at Milwaukee, Sheboygan, and Kenosha. None of these sources alone can supply data that would be representative of average conditions in the five mile wide nearshore corridor.

Wave heights on the Great Lakes are directly related to wind speed and fetch. Fetch is the distance winds travel over the water. These, in turn, depend on wind direction. Hence, conditions at any particular point on the lake vary depending upon its geographical location and the prevailing wind direction. The buoy, in most cases, is not representative of conditions relatively close to shore, and the Coast Guard stations located along the shoreline do not generally supply wind/wave data representative of the deeper waters at the outer extent of the forecast area. Also, the Kenosha station is not located within sight of the lake, but is tucked in a protected harbor.

The frequency of the Coast Guard observations must also be considered. Therefore, no wave height information is available. All of the Coast Guard stations take observations every other hour, but only the Milwaukee station takes observations 24 hours a day. Wave height data, in most cases, was reported only during daylight hours. The loss of Coast Guard observations due to circuit problems, or search and rescue operations also cut back significantly the amount of data available for the verification program. Of 549 forecasts

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available for verification purposes from May 1st to October 30th, 1989, 38 percent were not included due to a lack of corresponding Coast Guard and/or buoy data at the critical verification time.

3. The Verification Program

The main difficulty in developing a verification program for the nearshore forecast is the shortage of representative wind and wave information within the nearshore corridor. To develop the nearshore verification program, an average of conditions between the buoy (45007) and the Coast Guard station at Milwaukee was used. The Milwaukee station was selected because it is a midpoint between Kenosha and Sheboygan, and they took observations every two hours 24 hours a day. An average of buoy and Coast Guard conditions was used because this would more accurately reflect average conditions in the five mile corridor.

The forecasted range of wind speeds and wave heights was compared with the average of existing winds and waves reported by the buoy and Coast Guard at specific times. These times were approximately nine hours into each of three forecast periods. For example, wind/wave conditions forecast at the 3:30 a.m. LST scheduled nearshore forecast would be compared with an average of conditions between the buoy and Milwaukee Coast Guard station reported at 18Z. Similarly, the 9:30 a.m. forecast would be compared with conditions at 00Z, and the 3:30 p.m. forecast at 06Z.

The verification program included 342 forecasts made between May 1st and October 30th, 1989. Statistics for the month of April were not included, since during this month the verification program was still in the developmental stage.

4. Results

Results of the verification program showed a consistent tendency toward overforecasting wind speeds by around five knots (Figure 1). Wave heights were overforecast by around one foot. One reason for this overforecasting may be a heavy reliance on the NGM (Nested Grid Model) boundary layer wind forecast (L2M-L8M). These winds are valid at the mid-point of the lowest NGM layer which is typically some 500 feet aloft. They seldom reach the surface except in times of good cold air advection, hence, the higher surface wind forecast. This would also account for the overforecasting of the wave heights since a higher wind forecast would normally mean higher waves.

For the entire season, observed wind speeds were within the forecasted range 54 percent of the time (Figure 2). Reported wave heights were within the forecasted range 86 percent of the time (Figure 3). Winds were underforecast only eight times during the six month verification period, but were overforecast 151 times, or 44 percent of the time. Wave heights were a little closer, being underforecast 19 times and overforecast 29 times. Statistics showed little variation from month to month.

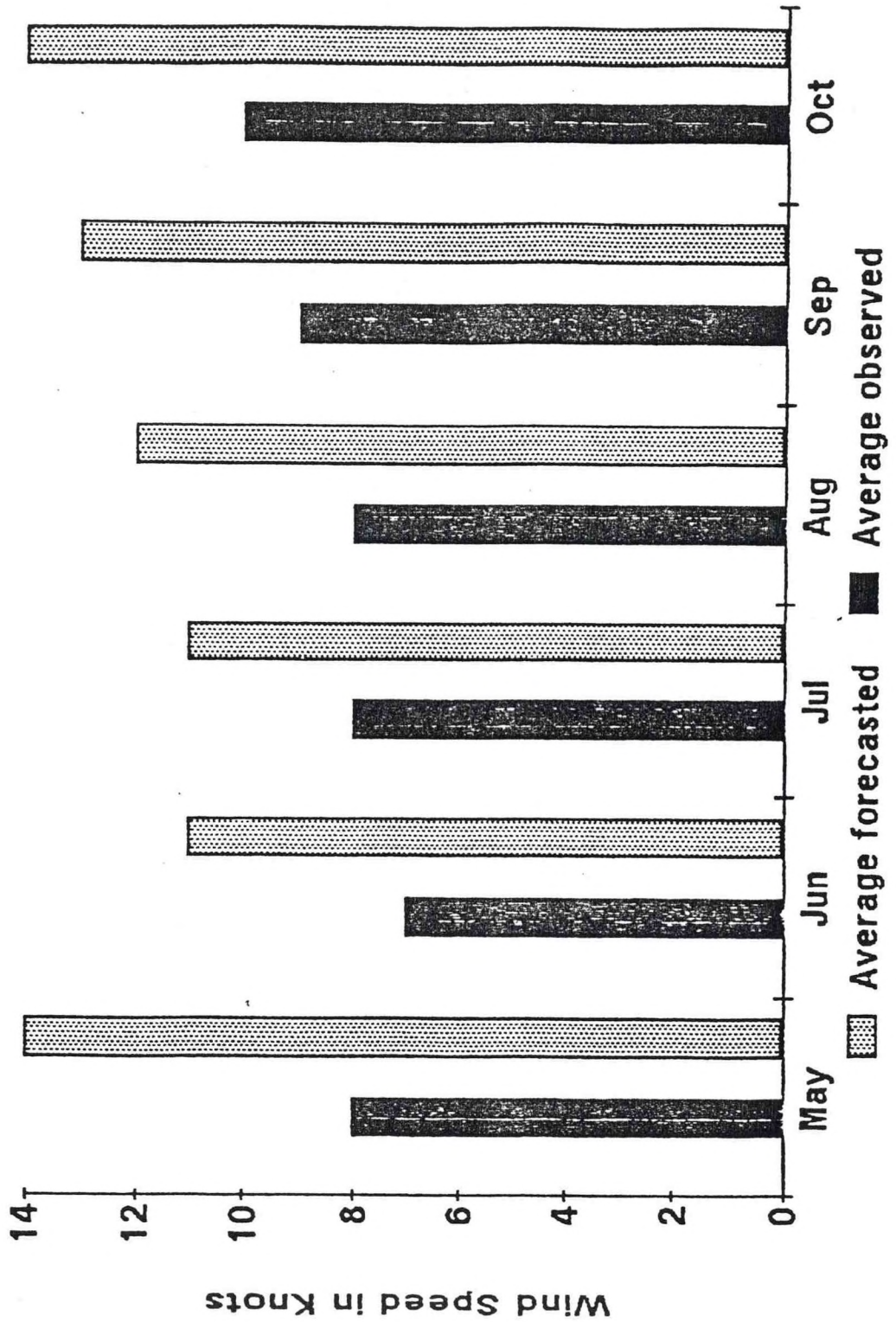


FIGURE 1 AVERAGE OBSERVED WIND SPEEDS AND AVERAGE FORECASTED WIND SPEEDS

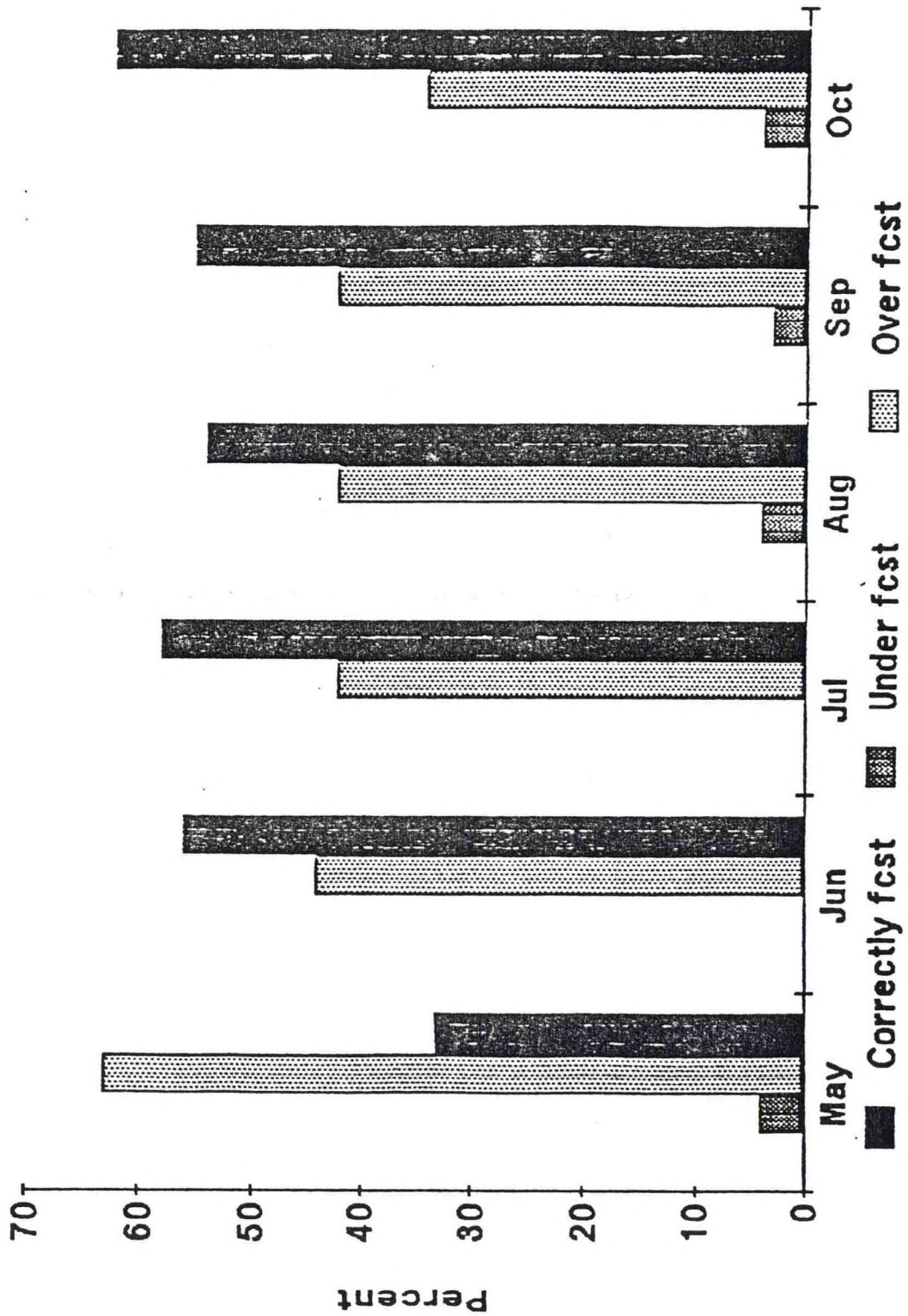


FIGURE 2 PERCENT TIMES WINDS WERE UNDER/OVER/CORRECTLY FORECASTED

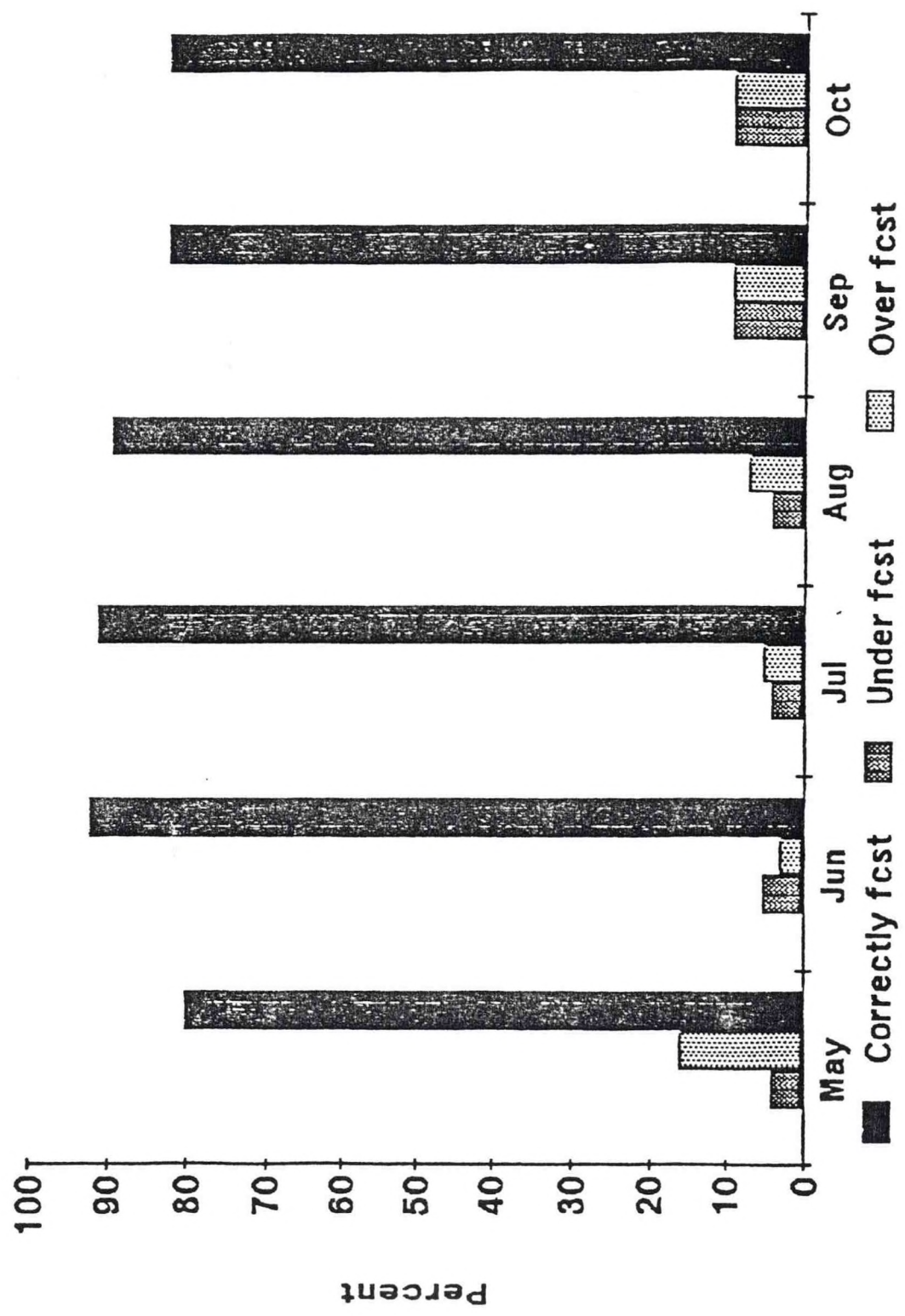


FIGURE 3 PERCENT TIMES WAVES WERE UNDER/OVER/CORRECTLY FORECASTED

5. Summary

The results of the program indicate that Milwaukee's nearshore forecasts generally match the buoy and Coast Guard averages, but with a trend toward overforecasting wind and wave conditions. This is not necessarily an undesirable tendency since it's better for the boating community to expect conditions a little higher than what actually occurs than to be caught unaware.