

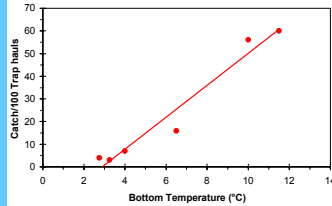
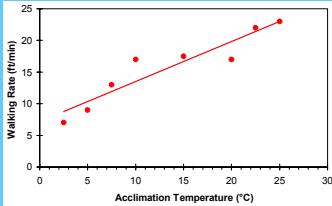
# The influence of wind and temperature on the catch rate of the American lobster (*Homarus americanus*) during spring fisheries off eastern Canada



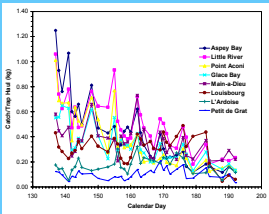
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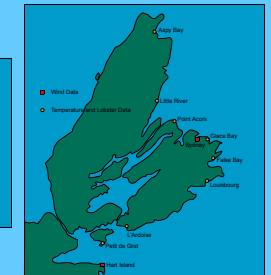
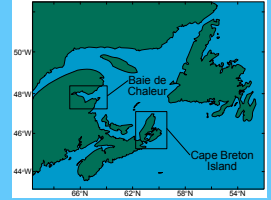
- 1. Motivation:** Fishermen's observations that lobster catches vary with wind direction.
- 2. Hypotheses Tested:** Believing that wind affects the catch through wind-induced temperature variability, we tested the following hypotheses:
  - (i) Temperature variability affects commercial catch-per-trap-haul (CPH)
  - (ii) Wind affects temperature variability.



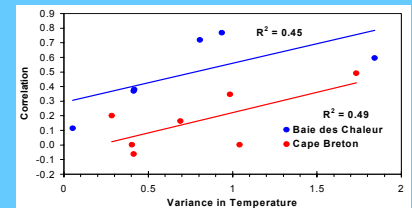
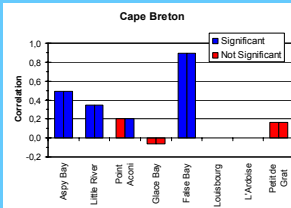
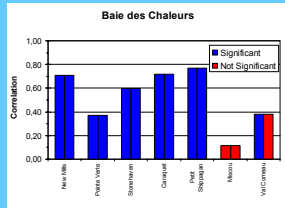
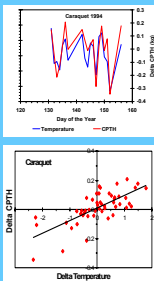
**3. Background:** Laboratory studies showed lobster activity is temperature dependent and experimental fishing suggested a temperature effect on catch per unit effort (McLeese and Wilder, 1958). This has never been tested on commercial data, however.



- 4. Data and Study Areas:** Lobster landing and trap haul data were from voluntary logbook programs in Baie des Chaleur (1994-1996) and off Cape Breton (1996-1998) in eastern Canada. Temperature data were obtained at fixed stations near lobster traps and wind data from nearby airport stations.
- 5. Data Treatment:**
  - (a) Catch per trap haul (CPH) was estimated from 1-day soak times and temperatures and winds averaged over previous 24 hours.
  - (b) First-differenced the data to remove linear trends.
  - (c) Restricted analysis to first 4 (BdC) or 5 (CB) weeks of the lobster season to avoid period of low catchability during moulting.

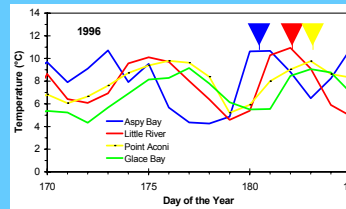
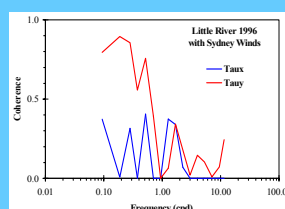
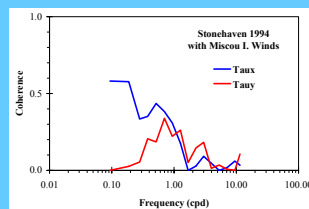


**6. Analyses:** Investigated standard correlations and binomial distributions of daily changes in CPTH and temperature. The latter examines the ratio of the number of points in the upper right and lower left quadrants to the total number of data points.



**7a. Results of Lobster-Temperature Analyses:** There were significant correlations between changes in landings and temperature at 6 of 7 sites in Baie des Chaleurs and 4 of 5 sites along eastern Cape Breton but none along south coast of Cape Breton. The height of the bar indicates the standard correlation coefficient between landings and temperatures; the colour on the left hand side of the bar indicates if it is significant based on standard tests and the right hand if it is significant based upon the binomial distribution.

**7b. Results Continued:** The strength of the correlations increase with the temperature variance in both study areas. The lower correlations in Cape Breton are believed to be due to lower lobster densities and colder absolute temperatures.



**8a. Wind-Temperature Results:** There was high coherence of the temperature with the wind at most sites. The maximum coherence occurred with the alongshore component of wind stress. This and the phase information were consistent with Ekman drift, i.e. winds with the shore to the right (left) looking downwind produced downwelling (upwelling) and subsequently warmer (colder) temperatures near bottom.

**8b. Results Continued:** There was also evidence of propagating temperature signals along the coast in both study areas. Further analysis indicated that these were a result of wind-induced Internal Kelvin waves.

**9. Multiple Regressions:** To determine if the winds had an effect on catchability unrelated to temperature (perhaps due to changes in currents, turbidity, etc.), we ran multiple regressions of catch rate as a function of both temperature and wind together. Results showed most of the catch rate variance was accounted for by temperature. At no site was wind significantly related to catch rate once temperature was accounted for. This indicates the primary effect of wind on lobster catch is through its effect on temperature.

- 9. Conclusions:**
- (a) Temperature variability affects lobster catchability with higher catches associated with increasing temperatures.
  - (b) The strength of the relationship between the daily changes in temperature and lobster landings depends upon the degree of temperature variability with higher correlations with increasing temperature variance.
  - (c) Much of the temperature variability in both study areas is directly wind-forced and is consistent with wind-induced Ekman drift.
  - (d) There is also evidence of alongshore propagation of wind-induced temperature variability by internal Kelvin waves.
  - (e) The fishermen's observations that lobster catches vary with wind direction was confirmed.

**References:** McLeese, D.W. and Wilder, D.G. (1958) The activity and catchability of the lobster (*Homarus americanus*) in relation to temperature. *J. Fish. Res. Board Can.* 15: 1345-1354.

**This poster is based upon:** Drinkwater, K.F., J. Tremblay and M. Comeau. 2004. The influence of wind and temperature on the catch rate of the American lobster (*Homarus americanus*) during spring fisheries off eastern Canada. *Fish. Oceanogr.* (submitted to Fisheries Oceanography)