Logging is Perilous Work

Despite the risks involved in logging, timber is a multi-billion dollar industry in the United States. Products and structures made from trees are so prevalent that their origin is scarcely noticed. Yet, in 1997, logging was the most dangerous occupation in the country.

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Logging was the second most dangerous occupation (behind fishing) during 1992-96, according to data from the Bureau of Labor Statistics' Census of Fatal Occupational Injuries (CFOI). With over 128 deaths per 100,000 workers, logging surpassed fishing as the most dangerous occupation in 1997.[1] (See charts 1 and 2.) Timber is a multi-billion dollar industry in the United States, and financial incentives have maintained levels of employment to meet consumer demand.

Products and structures made from trees are so prevalent that their origin is often scarcely noticed. Homes and furniture, paper and pencils, some cloth fibers, even many medicinal extracts are derived from wood. According to one report, "an average American uses wood and paper products equivalent to what can be produced from one 100-foot, 18-inch tree every year."[2] Trees provide the convenience of the Sunday paper just as readily as they provided previous generations with fuel in the winter. In fact, it takes a cord of wood (a stack 8 feet by 4 feet by 4 feet) to produce 250 copies of a typical Sunday edition of *The New York Times*.[3]

Timber resources come at a price, however: Each year, between 100 and 150 loggers lose their lives according to the CFOI, and many more suffer non-fatal injuries. Loggers face a risk of fatal work injury approximately 27 times greater than the average for all occupations. During 1992-97, loggers suffered, on average, 128 fatalities per 100,000 workers compared to 5 per 100,000 for all occupations. (See table 1.) Over the 6-year period, 1 out of every 780 loggers lost his life to a work injury, which translates into 57 fatal injuries per 1,000 workers over a 45-year lifetime of timber cutting.[4]

Working conditions

Logging occupations are physically demanding, involving lifting, climbing, and other strenuous activities in remote locations, frequently isolated

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Occupations with large numbers of fatalities are not always those with the highest risk.

Chart 1. **Occupations with large numbers of worker fatalities and the leading event, 1997**

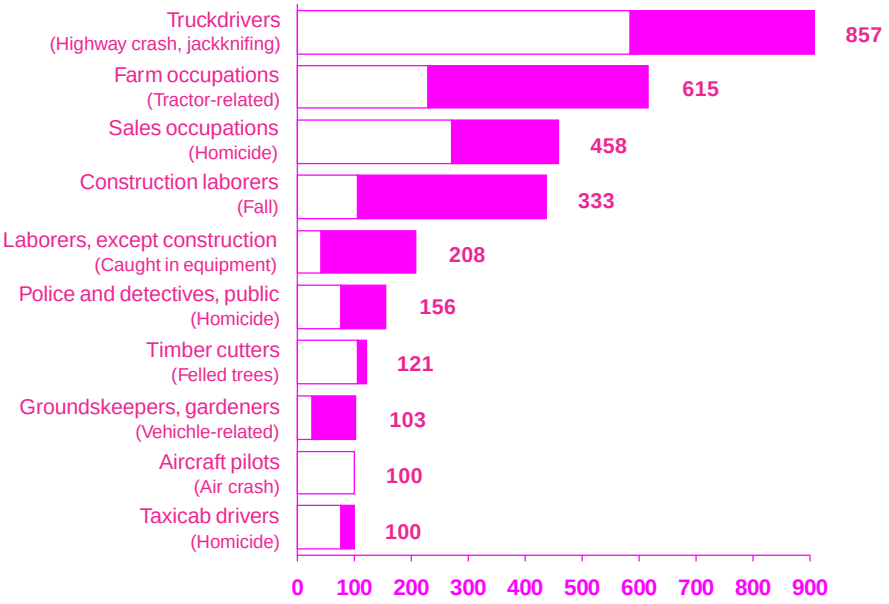
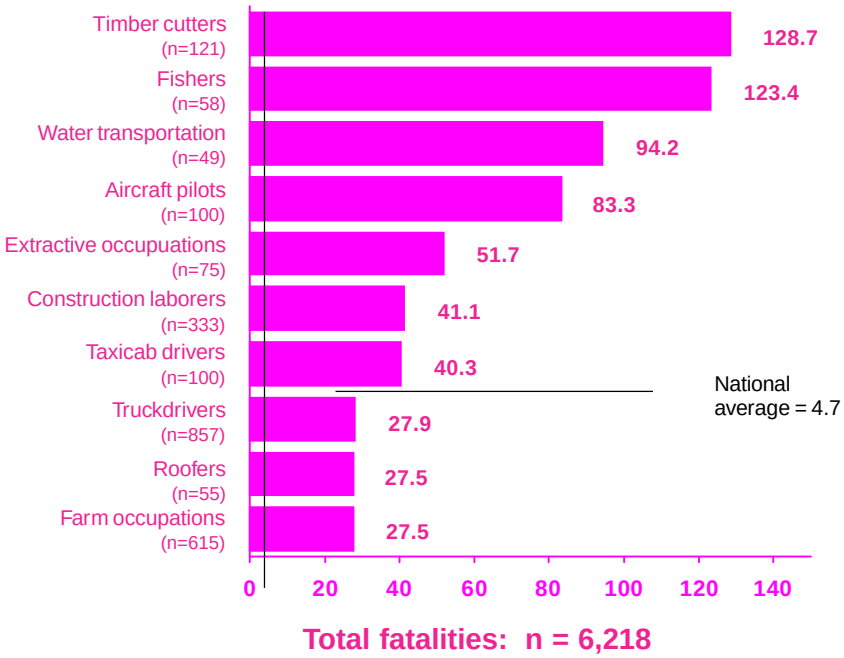


Chart 2. **The rate of fatal injuries per 100,000 workers in "high risk" occupations, 1997**



NOTE: Rate = (Fatal work injuries/Employment) x 100,000 workers. Employment data extracted from the 1997 Current Population Survey.

SOURCE: US Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries, 1998

TABLE 1. **Number and rate[1] of fatal occupational injuries to loggers by year, 1992-97**

Year	Logging occupations[2]					
	Total		Supervisors, forestry and logging		Timber cutting and logging	
	Number	Rate	Number	Rate	Number	Rate
1992-1997	772	128.3	76	81.7	696	136.8
1992	146	162.2	13	108.3	133	170.5
1993	135	121.8	11	64.7	124	133.3
1994	131	123.6	19	95.0	112	130.2
1995	110	100.0	12	92.3	98	101.0
1996	129	139.2	10	62.5	119	157.3
1997	121	128.7	11	73.3	110	140.7

[1] The rate represents the number of fatal occupational injuries per 100,000 employed workers and was calculated as follows: (N/W) x 100,000, where

N = the number of fatal work injuries to workers 16 years of age and older.

W = the number of employed workers 16 years of age and older.

100,000 = number of workers.

Employment figures are annual average estimates of employed civilians 16 years of age and older from the Current Population Survey (CPS), 1992-97.

See "Explanatory Notes and Estimates of Error" in the January 1998 *Employment and Earnings* for an explanation of CPS sampling and estimation methodology, and standard error computations. The relative standard error of the CPS employment estimates can be used to approximate confidence ranges for the fatality rates.

[2] Based on the 1990 Occupational Classification System developed by the Bureau of the Census.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, in cooperation with State and Federal agencies, Census of Fatal Occupational Injuries, 1992-97

from readily available medical services.[5] In addition, because the work is performed outdoors, loggers must often face adverse weather conditions, irregular terrain, and contend with swarms of mosquitoes, black flies, and deer flies. Long hours and 6-day workweeks are also common.[6] None of these conditions, however, is as menacing to the well-being of a logger as the trees themselves; of the 772 fatal injuries to loggers in 1992-97, 70 percent resulted directly from contact with trees and logs. The magnitude of this number is significant, as skidders[7] and tractors, the next most common sources of injury, together only accounted for 6 percent of total fatalities. The remaining 24 percent were from a variety of sources (such as dump trucks, the ground, and pickup trucks), none of which individually accounted for more than 2 percent of the logging fatalities.

Trees pose a number of hazards to loggers. Wind, structural irregularities in the tree, wet or sloped terrain, and structural failures within the tree such as heart rot, splits, breaks and cracks may cause the tree to fall at unexpected times in unexpected directions. Felled trees can become entangled in other trees or, less obviously and more commonly, broken tree limbs can be caught in nearby trees where they dangle capriciously, often falling onto unsuspecting loggers. The latter scenario is so common that hanging limbs are often referred to as "widow makers." Falling trees can also hit overhead power lines and telephone poles, or vines and other dense vegetation, resulting in erratic falls, fires, or entanglement. "Fish-tailing" trees sweep a large surface area as they swing sideways, and "mousetraps" sometimes occur when a felled tree strikes another, perhaps concealed log, which in turn strikes the logger. Even when the tree is settled it poses dangers when limbs become locked or bent. Loggers who cut these limbs must guard against slingshot effects, which can throw large limbs up to 50 feet.[8]

Some 65 percent of logging fatalities occurred as a result of being struck by falling objects, almost all of which were trees and logs. Various types of non-roadway vehicular accidents, including those caused by tractors and skidders, accounted for 7 percent of fatalities; loggers crushed or struck by rolling logs accounted for 5 percent; and falls from trees, 2 percent. In 95 percent of the cases where the time of the incident was reported, they occurred between the hours of 7 a.m. and 5 p.m.[9]

Economic and demographic characteristics

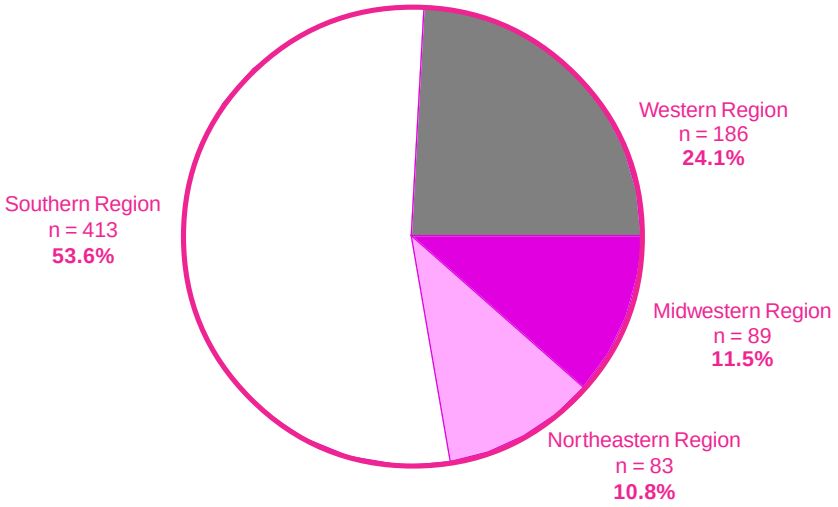
Many regions of the United States boast a rich sylvan heritage—the huge douglas firs and redwoods of the Pacific Northwest, the hearty maples of the upper Midwest, the white pine of the Northeast, and the southern pines (long leaf, short leaf, slash, and loblolly) of the South are some of the most well-known. Logging of these trees is a multi-billion dollar industry practiced in all States. Some regions (those characterized by the types of trees they harvest, the levels of mechanization used, and other economic factors) have natural advantages over others.

Weather and climate, and the percent of logging employment are important factors to consider when comparing regional fatality numbers. (See charts 3 and 4.)

The Southern region, as defined by Census,[10] had 413 logging fatalities, about 54 percent of the total between 1992-97. In this region, North Carolina, with 55 deaths, had the most fatalities of any State; this represents 7.1 percent of all logging fatalities, although North Carolina only accounts for 2.9 percent of all loggers. (See table 2.) Logging is a flourishing industry in the South " … [where] tim-

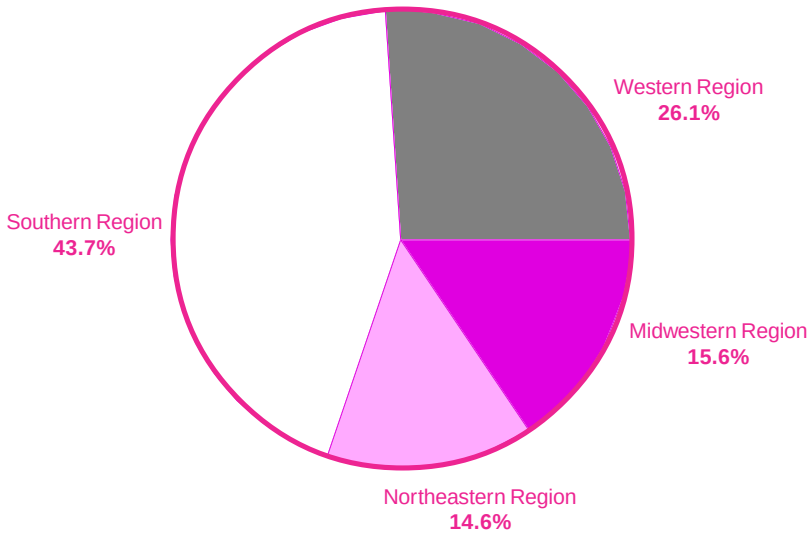
Fatal occupational injuries occurring in logging and timber cutting occupations by region and employment share.

Chart 3. **Logging fatalities and percentages by region, 1992-97**



Total fatalities: n = 772

Chart 4. **Logging employment percentages by region, 1992-97**



NOTE: Data includes supervisors. Regions are based on the Bureau of Census' regional designations. See technical note for additional information.

SOURCE: US Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries, 1998

TABLE 2. **States with the largest number of logging fatalities, 1992-97**

State	Fatalities[1]		Percent of logging workforce[2]
	Number	Percent	
All States[3]	772	100	100
North Carolina	55	7.1	2.9
Mississippi	51	6.6	3.3
Kentucky	45	5.8	3.7
Virginia	42	5.4	2.8
Washington	41	5.3	9.7
Alabama	37	4.8	6.0
Pennsylvania	33	4.3	3.3
Oregon	32	4.2	7.0
West Virginia	31	4.0	2.0
Montana	29	3.8	2.0
Texas	29	3.8	4.5
Tennessee	27	3.5	5.3
Georgia	25	3.2	5.0
California	24	3.1	2.4
South Carolina	23	3.0	1.3

[1] Includes supervisors.
[2] See Technical note.
[3] Not all States had logging fatalities between 1992-97.

ber harvesting costs … are among the lowest in the world, and perhaps the lowest."[11] New mechanization procedures in the South for wholetree (longwood) harvesting have decreased average costs and increased efficiency, shifting the production output dramatically over the 1979-87 period. The number of less efficient pulpwood (shortwood) firms decreased by half over the 8-year period and average pulpwood harvesting costs declined significantly in real terms.[12]

The rich soils, ample rain, and mild climate of the West Coast make it an ideal location to practice silviculture (the care and tending of forest vegetation).[13] In 1991, California's timber harvest value exceeded $900 million, and California, Oregon, and Washington combined produce nearly 14 million board feet of lumber per year.[14] These 3 States accounted for 97 deaths, or 13 percent of the total, for the 1992-97 period. The Western region had 186 deaths, or 24 percent of all logging fatalities from 1992-97.

The remaining 2 regions, the Northeast and Midwest, accounted for 83 and 89 deaths, or 11 and 12 percent, respectively. In these two regions, only Pennsylvania ranked among the top 15 States in fatalities with 33, or 4.3 percent of the total. Fifteen States experienced 70 percent of all logging fatalities, and the top 5 States, 30 percent. (See table 2.)

During the 1992-97 period, less than 1 percent of the logging fatalities involved women, who comprised about 3 percent of the logging industry workforce. Blacks made up between 7 and 12 percent of the workforce, but were slightly over-represented in fatalities, with between 11 and 17 percent. Whites, who made up 83 percent of the workforce, also constituted 83 percent of the fatalities. The remaining races, who comprise only a small fraction of those employed, incurred very few fatalities.

About one-third of logging workers are self-employed, a much higher proportion than in most occupations.[15] These workers incurred about one-third of the logging fatalities between 1992-97.[16] Employees working for compensation or pay constitute the overwhelming majority of remaining fatalities, with very few fatalities among those working in family businesses or volunteering their efforts. In the competitive logging industry, the median weekly earnings for full-time wage and salary earners in the forestry and logging occupations was $443, compared to $490 for all occupations.[17]

Data for non-fatal injuries

Logging injuries that do not result in a fatality but require time away from work to recuperate most often occur to the trunk of the body and the lower extremities. In 1996, the most recent year for which data are available, there were an estimated 2,136 cases involving time away from work. However, this statistic does not account for the self-employed, government workers, or workers in agricultural establishments with fewer than 11 employees.[18] As the following tabulation shows, the injuries most often reported in 1996 for timber cutters, including supervisors, were sprains and strains, followed by fractures and bruises.

Nature of injury	*Number of cases*	*Percent of total cases*
Total, 1996	2,136	100
Sprains, strains	713	33
Fractures	359	17
Bruises	305	14
Cuts, punctures	209	10
Bodily pain	87	4
All other [19]	463	22

About half of the non-fatal injuries in 1996 were caused by events such as being struck or crushed, followed by falls, which accounted for about one-quarter.

Between 1992-96, over 30 percent of the logging injury cases resulted in 31 or more lost workdays and almost 17 percent resulted in 3-5 days away from work. The median number of days away from work for the 5-year period was 11. As the following tabulation shows, an important trend seems to have developed, as the number of non-fatal injury cases involving lost workdays has steadily dropped from over 4,500 in 1992 to 2,136 in 1996.

Year	*Number of injuries*
1992	4,537
1993	4,522
1994	3,479
1995	2,779
1996	2,136

Conclusion

Loggers comprise one-half of 1 per-

cent of the total workforce in America, yet they account for nearly 2 percent of all fatalities. This astounding ratio is an indication of the unpredictable dangers involved in logging.

Employment levels and the demand for wood have been relatively stable over the past 6 years, and any future increases in the demand for wood products is expected to be offset by improvements in technology rather than increases in employment.[20] Recent history reveals a disturbing pattern of regularity to logging fatalities that does not appear to be changing. Perhaps developments in logging techniques, training, and equipment will provide a boost in safety. Significant decreases in the number of non-fatal injuries requiring time away from work is encouraging, certainly, but logging still has the highest fatality rate among all occupations.

Technical note

The lifetime risk for a specific industry or occupation was calculated using an equation proposed by the Occupational Safety and Health Administration in 1995:

$$WLTR = [1 - (1 - R)^{y}] \times 1{,}000$$

where: WLTR = working lifetime risk.

R = probability of a worker having a work-related fatal injury in a given year.

1 – R = probability of a worker not having a work-related fatal injury in a given year.

y = years of exposure to work-related injury.

$(1\text{-}R)^{y}$ = probability of surviving y years without a work-related fatal injury

$1 - (1 - R)^{y}$ = probability of having a work-related fatal injury over y years of employment.

For this article, y was set at 45 years. This assumes workers are exposed to work-related injury hazards for approximately 45 years, starting at age 20.

The number of fatal occupational injuries per 1,000 workers is derived as follows:

R = 0.00128 = 128 fatalities per 100,000 workers which is equal to a .128-percent probability of a worker having a work-related fatal injury in a given year.

1 – R = 1 – 0.00128 = 0.99872 which is equal to a 99.87-percent probability of a worker not having a fatal occupational injury in a given year.

$(1 - R)^{45} = 0.9987^{45} = 0.9431$ which is equal to a 94.31-percent probability of surviving 45 years without having a work-related fatal injury.

$1 - (1 - R)^{45} = 1 - 0.9431 = 0.0569$ which is equal to a 5.69-percent probability of having a work-related fatal injury over 45 years of employment.

Although it is tempting to view the inverse of 0.0569 (1:18) as the probability a worker faces of suffering a fatal occupational injury over a theoretical 45-year logging career, risk should be expressed on a per 1,000 worker basis to account for such factors as turnover, as follows:

$[1 - (1 - R)^{45}] \times 1{,}000 = 0.0569 \times 1{,}000$ which is equal to 57 fatalities per 1,000 workers over a 45-year period comprising a working lifetime.

State and region-specific employment estimates were obtained using the Current Population Survey's Federal Electronic Research and Review Extraction Tool (FERRET) for the years 1994-97, corresponding with the earliest year for which FERRET micro data is available, and the latest year for which CFOI numbers are available. Given the stable employment numbers and markets for loggers between 1992-97, this average estimate for 67 percent of the period should prove reliable for employment composition by State over the whole 1992-97 period. Additional information on FERRET can be obtained from the Bureau of Labor Statistics Internet site at **http://ferret.bls.census.gov/cgi-bin/ferret**. See "Explanatory Notes and Estimates of Error" in the January, 1998 *Employment and Earnings* for an explanation of CPS sampling and estimation methodology, and standard error computations. The relative standard error of the CPS employment estimates can be used to approximate confidence ranges for the fatality rates.

[1] The Census of Fatal Occupational Injuries has collected occupational fatality data since 1992, using diverse data sources to identify, verify, and profile fatal work injuries. Information about each workplace fatality (occupation and other worker characteristics, equipment being used, and circumstances of the event) is obtained by cross-referencing source documents, such as death certificates, workers' compensation records, and reports to Federal and State agencies. This method assures counts are as complete and accurate as possible.

[2] Washington Contract Loggers Association, *Washington State Timber Facts, Figures and Issues for Concerned Citizens*, on the Internet at **http://www.loggers.com/timbfact.html** (visited Aug. 12, 1998).

[3] *Ibid.*

[4] For an explanation of the methodology used to derive this statistic, see David E. Fosbroke, Suzanne M. Kisner, and John R. Myers, "Working Lifetime Risk of Occupational Fatal Injury," *American Journal of Industrial Medicine*, Vol. 31, Wiley-Liss, Inc., 1997, pp. 460-61. Also see technical note at the end of this article.

[5] *Occupational Outlook Handbook, 1998-99 Edition*, Bulletin 2500, Bureau of Labor Statistics, 1998, p. 420.

[6] John Gagnon, *Hard Maple, Hard Work*, (Marquette, MI: Northern Michigan University Press), 1996, pp. 63-65.

[7] Skidders are tractor-like vehicles used to drag logs through forest terrain.

[8] Gerald F. Beranek, *The Fundamentals of General Tree Work*, (Fort Bragg, NC: Beranek Publications, 1996), pp. 362-383.

[9] Ninety-four percent of the cases reported the time of incident.

[10] Bureau of the Census regional designations:

Northeast: CT, ME, MA, NH, NJ, NY, PA, RI, and VT.

Midwest: IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, and WI.

South: AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, and WV.

West: AZ, AK, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, and WY.

[11] Douglas R. Carter, et. al., *Southern Pulpwood Harvesting Productivity and Cost Changes Between 1979 and 1987*, Research Paper NC-318, U.S. Department of Agriculture, North Central Forest Experiment Station, St. Paul, MN, 1994, pp. 31-32.

[12] Ibid.

[13] Earl Roberge, *Timber Country*, (Caldwell, ID: Caxton Printers, 1973), p. 1.

[14] Little Hoover Commission, *Timber Harvest Plans: A Flawed Effort to Balance Economic and Environmental Needs*, Sacramento, CA, 1994, pp. 10-12.

[15] *Occupational Outlook Handbook, 1998-99 Edition*, p. 420.

[16] Two-thirds of the fatality records in the 1992-97 period indicated the size of the establishment that employed the decedent. Eighty-two percent of those indicating employment size employed between 1 and 10 workers.

[17] *Employment and Earnings*, Bureau of Labor Statistics, January, 1997, table 39, pp. 206-210.

[18] The Survey of Occupational Injuries and Illnesses (SOII) collects information from a random sample of about 200,000 establishments representing most of private industry, with the exception of the self-employed. Worker characteristics are collected only for those workers sustaining injuries and illnesses that require days away from work (with or without restricted work activity) to recuperate.

Because the scope and methodology of CFOI and SOII are slightly different, comparison of the fatal and nonfatal data is problematic.

Additional information on either CFOI or SOII can be obtained from the Bureau of Labor Statistics Internet site at **http://stats.bls.gov/oshhome.htm** or via email at cfoistaff@bls.gov.

[19] Includes non-classifiable responses and response numbers too small to publish according to the confidentiality standards established by the Bureau of Labor Statistics, Office of Safety, Health and Working Conditions.

[20] *Occupational Outlook Handbook, 1998-99 Edition*, p. 421.