

## BIRKIE BY THE NUMBERS

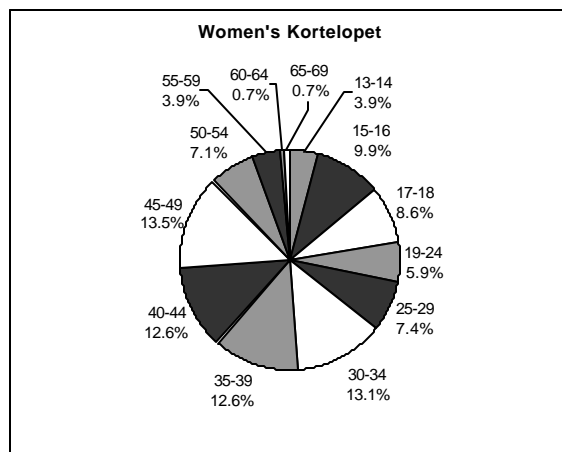
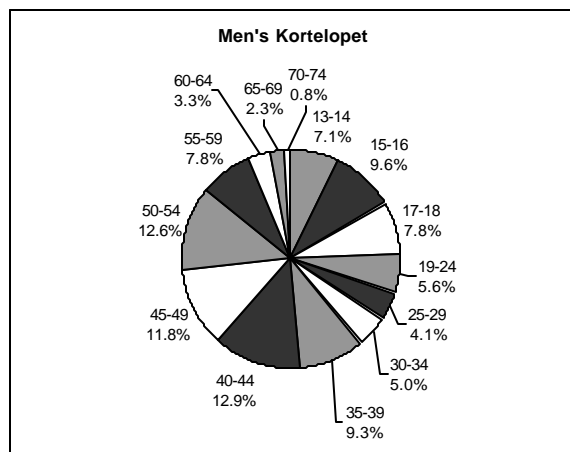
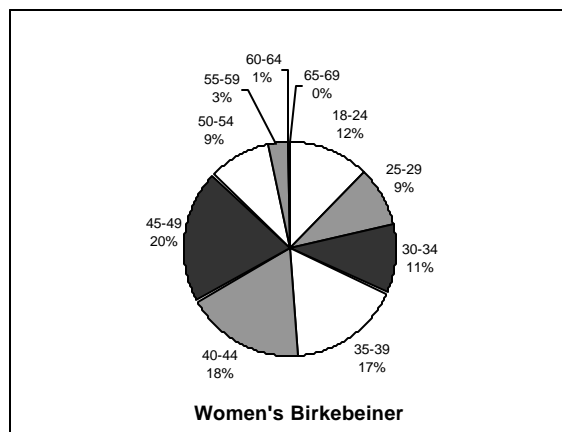
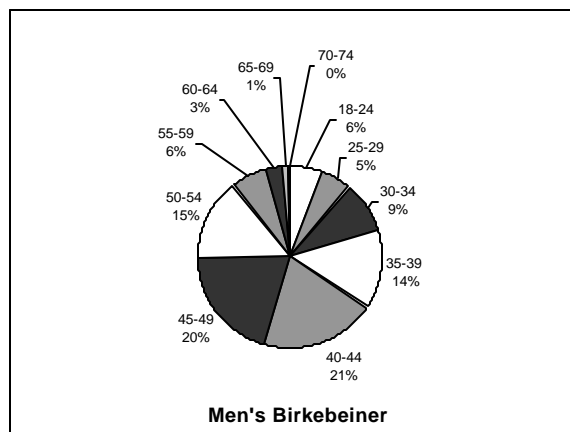
O.K. I like playing with numbers. The guys at White River Sports Timing may have thought I was crazy when I e-mailed them and asked for a computer file of the 2002 Birkie results so I could “play” around with the numbers but they were kind enough to provide it.

What did I do with the numbers? I determined who showed up and who didn't. I looked at how many and what type of skiers were in each starting wave. I sorted the results by age, by wave, by class. I then calculated how people would be placed in waves for the 2003 race according to 2002 results.

The wave placement part is the most interesting. For years I've suspected that the current %-back system of placing skiers in waves does not work very well. At the end of this report I will suggest a system that I think is a better way to place skiers in waves than the current fixed %-back system. Along the way I'll point out areas where I think the current system has problems.

### WHO'S IN THE BIRKIE?

It's an event for the 40 something crowd. These charts show age group breakdown for the *freestyle* events. The classic events had 10 year age groupings so the classical skiers were not included in these charts.

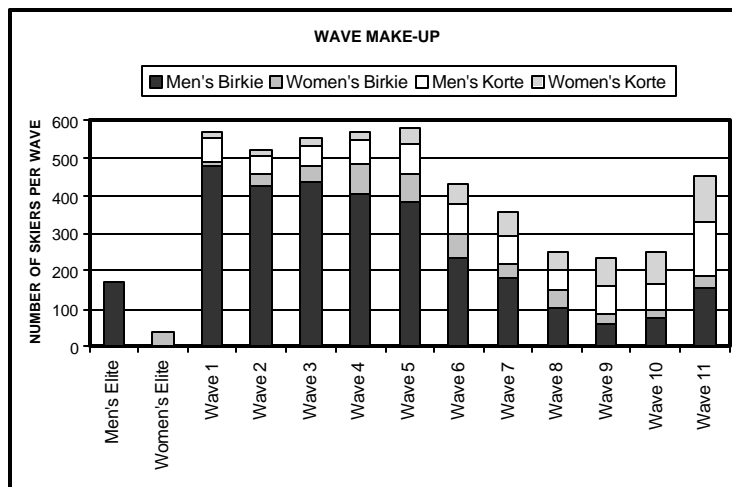


## WAVE MAKE-UP

The table and charts below show the number of finishers in each wave. This was easy to do just by sorting the results by bib numbers. I made one assumption; that the men's elite wave consisted of bib numbers 1-200. All skiers, freestyle and classical are included.

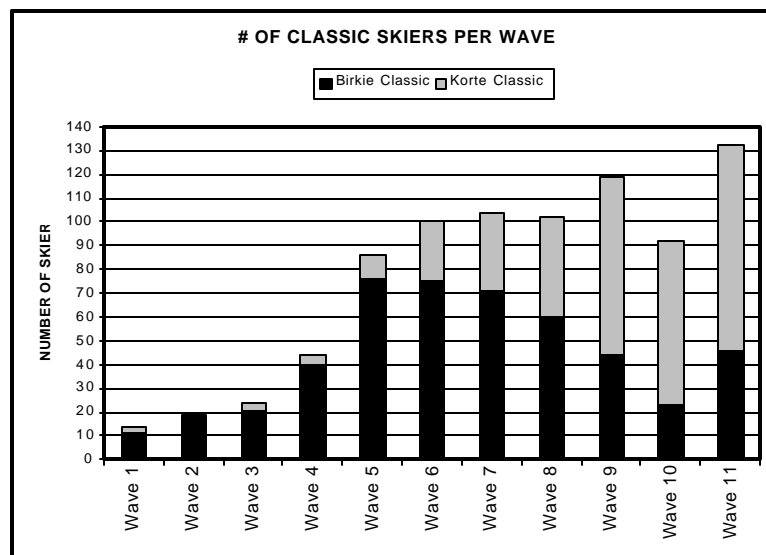
The Korte skiers are pretty well evenly distributed between the 11 waves but the Birkie skiers are very heavily loaded in the first 5 waves (no wonder my wave 2 starts always seem so crowded). Crowded trail conditions at the start of the race is the main problem I

	WAVE NUMBER											Total		
	Men's Elite	Women's Elite	1	2	3	4	5	6	7	8	9		10	11
Men's Birkie	171		480	427	436	405	381	233	181	102	61	78	156	3111
Women's Birkie		42	9	33	45	81	76	67	38	48	27	19	30	515
Men's Korte			64	43	50	63	79	79	71	52	75	73	144	793
Women's Korte			14	17	22	20	45	56	67	49	71	84	122	567
Total			567	520	553	569	581	435	357	251	234	254	452	4986



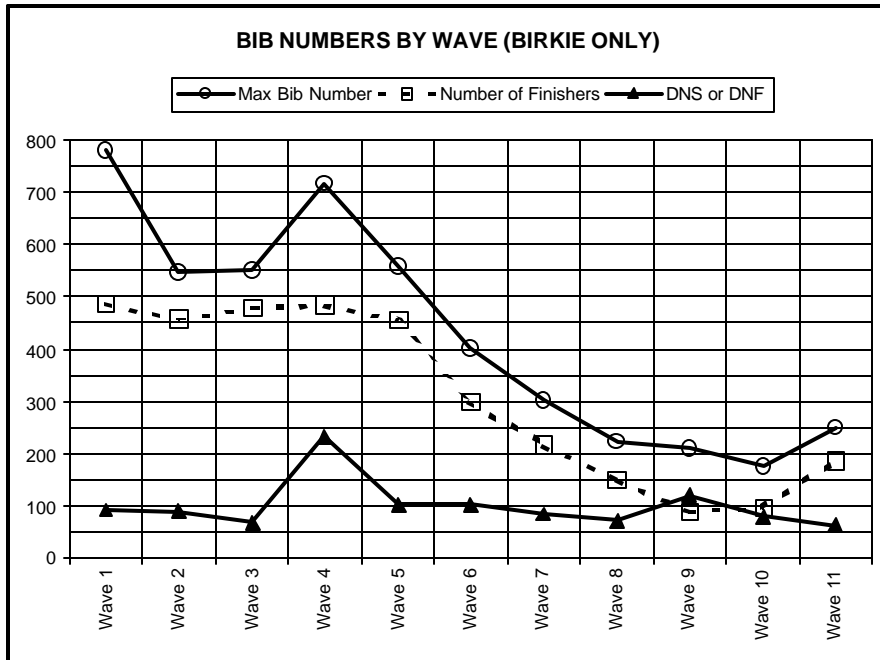
see with the current wave placement system. The policy of allowing skiers to use their best result over the last 4 years contributes to this overcrowding in the first waves and the frustration of having to pass skiers who could be 3 or 4 years out of shape.

This next chart shows the number of classical skiers in each wave. The classical technique is favored by the skiers in the later waves and especially by Korte skiers.



## WHO DIDN'T COME?

The number of finishers in 2002 was down about 1000 from previous years. This next chart shows my attempt at figuring out what waves the no shows were registered for. I looked for the highest bib number in each wave, counted the total number of finishers in each wave and calculated the difference. The difference should be the number of skiers who Did Not Start or Did Not Finish. The assumption here is that there was a registered skier for each bib number between 1 and the highest number in each wave. This chart



counts Birkie skiers only.

Like the wave make-up chart, this chart shows the significantly larger number of Birkie skiers placed in the first 5 waves. Even so, the number of DNS/DNF is about equal in each wave. But on a percentage basis, the later waves had a much higher rate of DNS/DNF, up to about 50% in waves 9 and 10.

## HOW FAST DID THEY SKI?

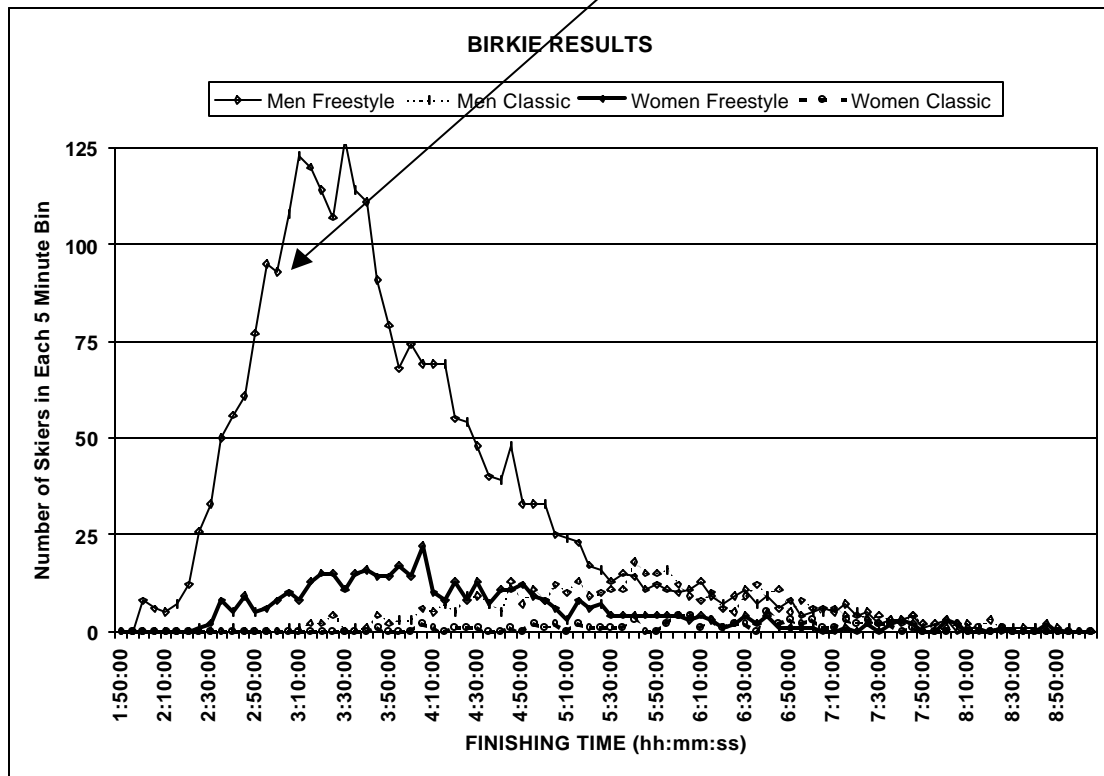
I tried to show these results with histograms. Histograms may be unfamiliar to some people but they show a very large amount of information on a single chart.

Information you can get from a histogram includes;

- Number of skiers.
- How fast they were.
- How spread out they were.
- How certain groups of them compare to other groups.

Each dot on the histogram below shows the number of finishers within 5 minute blocks of time.

For example, the number of Men Freestyle skiers who finished with a time between 3:00:00 and 3:04:59 is 93 and is show by this data point.

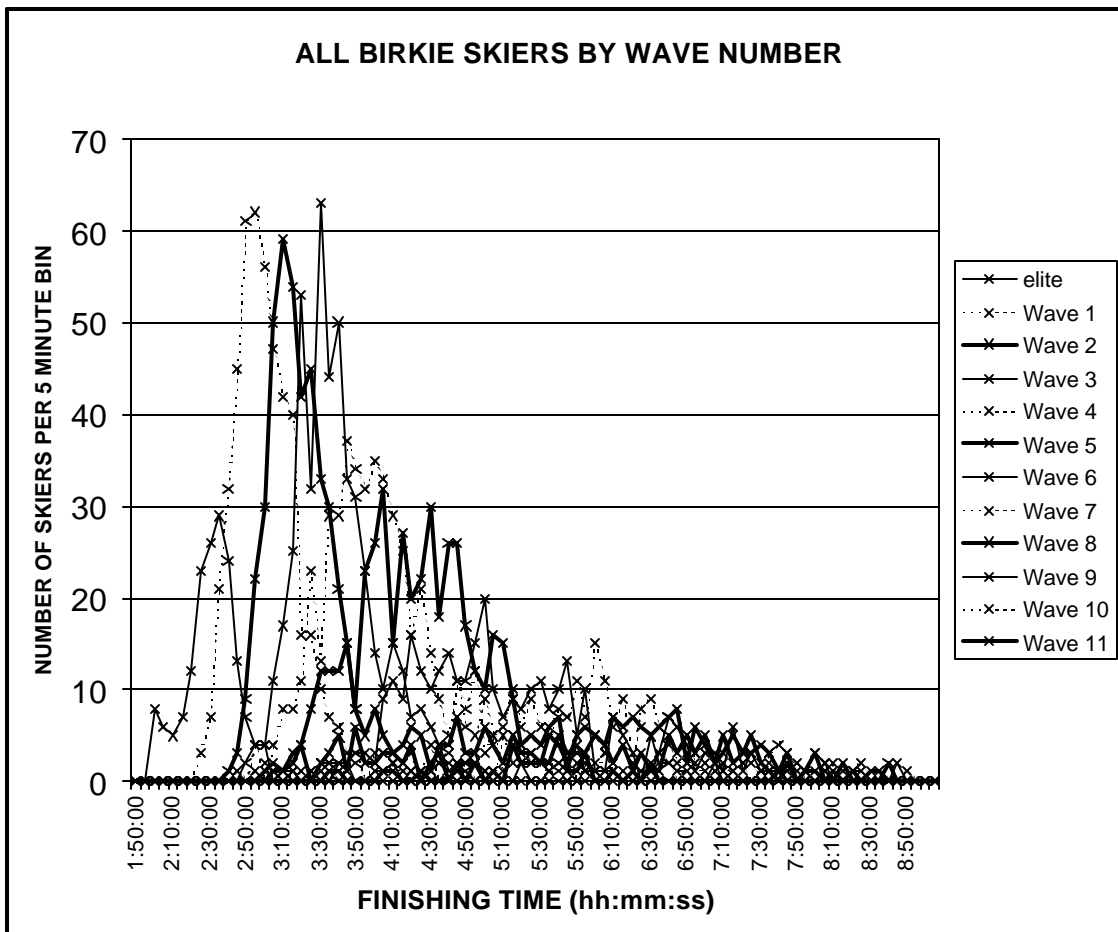


The chart above shows the results of the Birkie race with the skiers grouped by gender and style. It's immediately clear that men freestylers are the largest and fastest group of skiers. The other groups are considerably smaller and much more spread out.

The core group of the women freestylers is just a little slower than the core group of the men (3 hours 20 minutes for men, about 3 hours 50 minutes for women).

The next chart is quite busy but deserves spending a couple of minutes trying to understand it because it serves a useful purpose. A couple of points I'd like to make from this graph are;

1. This chart again shows the significant crowding in the first few waves (represented by the height of the first few curves compared to the last few). Up to about wave 5 there were huge numbers of skiers finishing within a few minutes of each other. The later waves were very spread out and had very few skiers in them.
2. The first few waves look like the classic bell shape curve distribution. Past wave 5 however the shape of the curve is not at all a normal distribution and just become one big jumbled mess.
3. The skiers in the last several waves could easily be grouped together into fewer waves without any harm to their Birkie experience. The skiers in the first several waves should be spread out into more waves with fewer skiers in each wave. This would dramatically improve the Birkie experience for the skiers in the early waves.
4. We've got 10 waves. Let's even things out and fill them up equally.



## STATISTICAL SUMMARY BY WAVE NUMBER

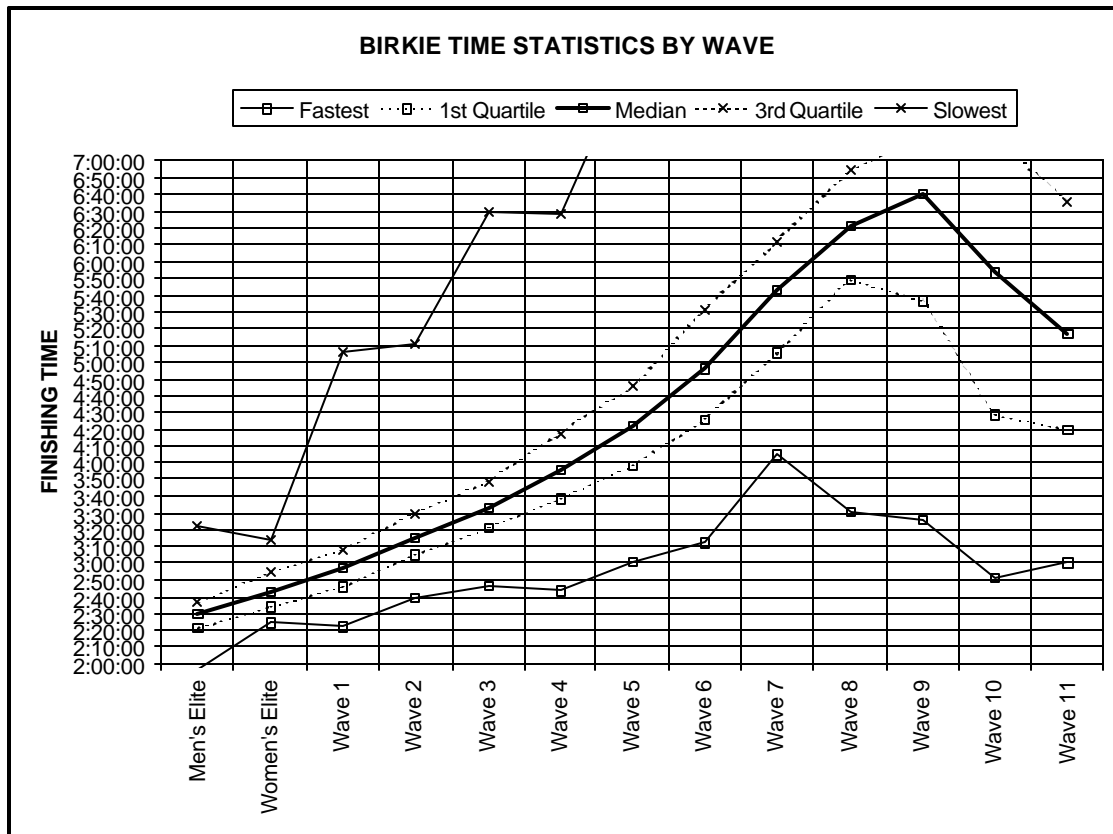
The next chart is a statistical summary of Birkie skiers by wave number. All skiers, classic and freestyle, men and women are grouped together in this summary.

The chart has 5 lines.

- The bottom line shows the fastest skier in each wave.
- The next line up is the first quartile finishing time. The first quartile is the finishing time at which 25% of the skiers in that wave were faster and 75% of the skiers were slower than that time.
- The median line is next and is the time at which exactly ½ the skiers in that wave were faster and ½ were slower (it's close to but different than the average time).
- Then the 3<sup>rd</sup> quartile is the time at which 75% are faster, 25% slower.
- The upper most line is for the slowest finishing time in each wave.

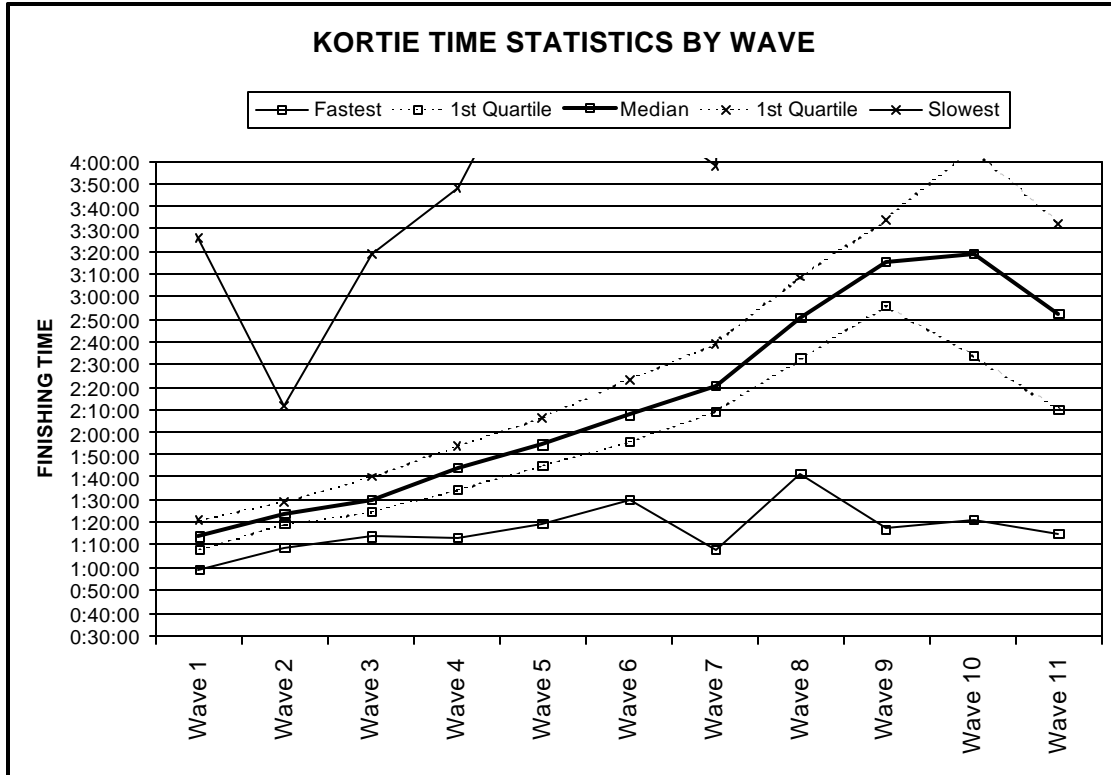
The area between the 1<sup>st</sup> and 3<sup>rd</sup> quartiles (50% of all the skiers in that wave) is pretty small and those times gradually increase with each wave numbers. This is good to see and means that the “typical” skiers each wave are properly placed relative to the other waves.

On the negative side; note that the 1<sup>st</sup> quartile time of any particular wave is about the same as the median time of the wave before it. This means that the fastest 25% of the skiers in any wave are faster than slowest 50% of the skiers in the wave before it.



Note also the gradually increasing spread between the 1<sup>st</sup> and 3<sup>rd</sup> quartiles as the wave numbers increase. This was also seen on the histogram charts with the flattening and widening of the distribution curves for the later waves.

Here is the same chart for the Korteloppet race.

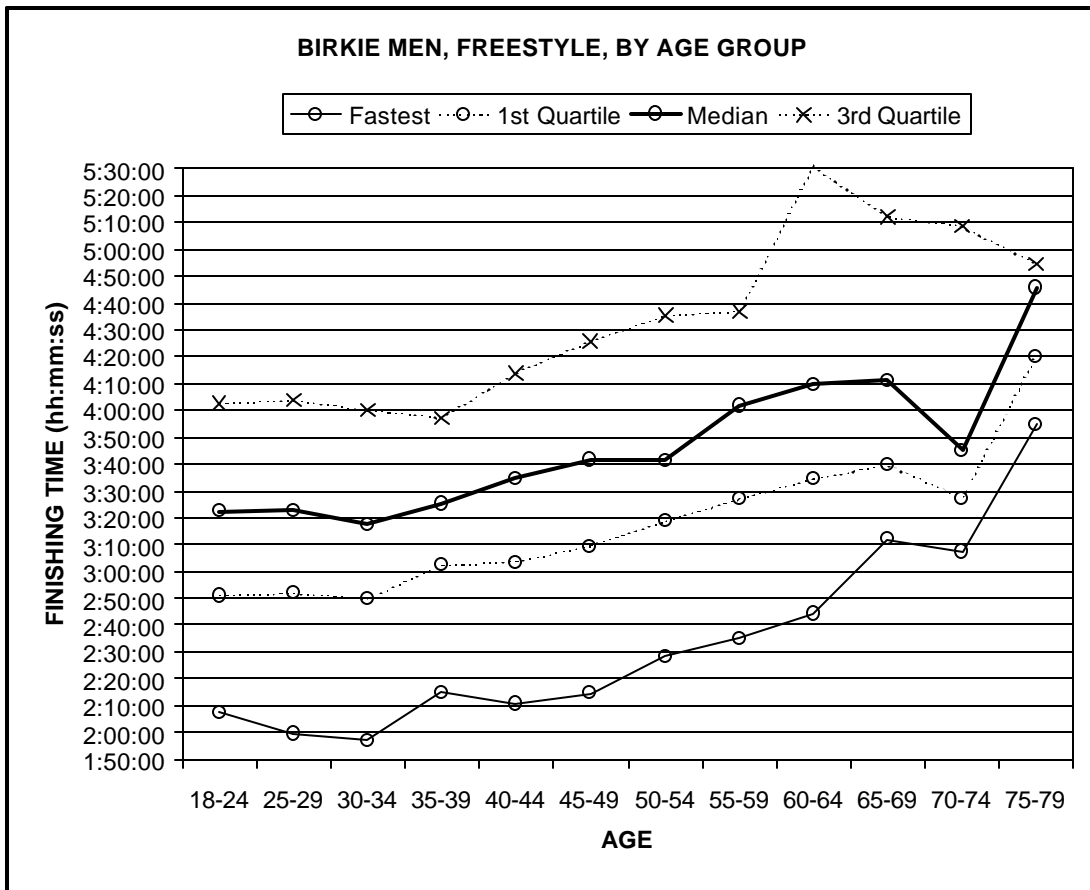


## STATISTICAL SUMMARY BY GENDER AND AGE GROUP

The next chart shows the male Birkie skiers sorted by age group (freestyle only, classic skiers had 10 year age groups). The slowest times were not plotted on the chart because they are just too slow and the graph would get scaled such that it would be hard to see any detail.

From the 30-34 age group to the 60-64 age group the median time increases an average of about 9 minutes per age group. The 70-74 age group median takes a big decrease due to the presence of the legendary Bjorn Lasserud.

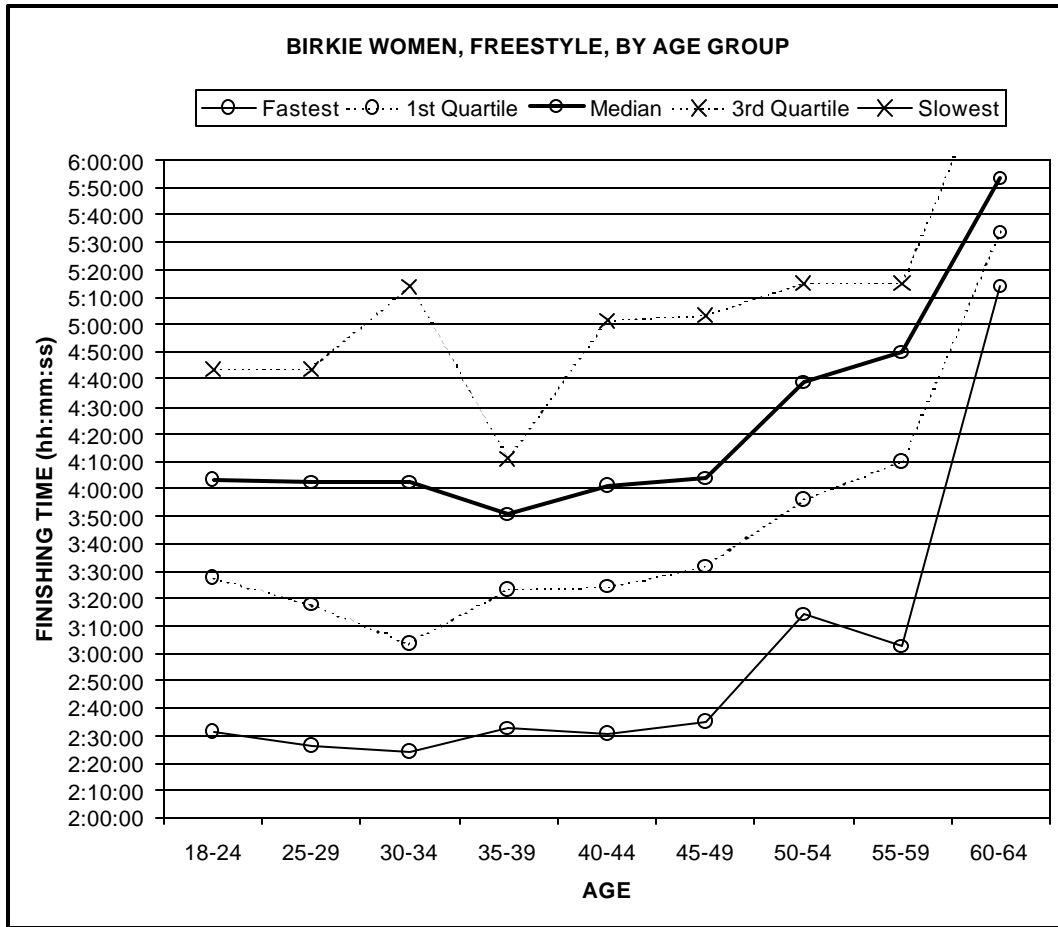
Men, by age, free style only												
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79
Fastest	2:07:37	1:59:30	1:57:09	2:15:00	2:10:47	2:14:42	2:28:31	2:35:19	2:44:11	3:12:10	3:07:12	3:54:27
1st Quartile	2:50:53	2:51:47	2:49:42	3:02:18	3:03:36	3:09:39	3:18:44	3:27:01	3:34:31	3:39:26	3:27:35	4:20:07
Median	3:22:31	3:22:59	3:17:37	3:25:28	3:34:23	3:41:41	3:41:16	4:01:51	4:09:49	4:11:10	3:44:51	4:45:47
3rd Quartile	4:02:25	4:04:00	3:59:54	3:57:06	4:13:55	4:25:41	4:35:03	4:37:04	5:30:56	5:11:56	5:08:35	4:54:20
Slowest	7:38:06	7:09:10	8:45:08	7:41:12	8:20:15	8:31:28	8:14:37	8:05:21	7:54:50	8:35:08	6:45:48	5:02:52





For Birkie women freestylers the median time does not increase like it does for the men until the 50-54 age group when there is a sharp rise in the median times.

Women, by age, free style only									
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Fastest	2:31:38	2:26:22	2:24:14	2:32:32	2:30:30	2:35:07	3:14:25	3:02:25	5:13:56
1st Quartile	3:27:50	3:17:46	3:03:35	3:23:23	3:24:10	3:31:19	3:56:09	4:10:02	5:33:32
Median	4:03:25	4:02:09	4:02:18	3:50:37	4:01:24	4:03:56	4:39:02	4:49:44	5:53:08
3rd Quartile	4:43:43	4:43:41	5:13:41	4:11:16	5:01:15	5:03:23	5:15:08	5:14:58	6:41:41
Slowest	8:23:21	6:38:43	8:04:14	6:19:42	7:38:38	8:42:19	7:59:17	7:30:14	7:30:14

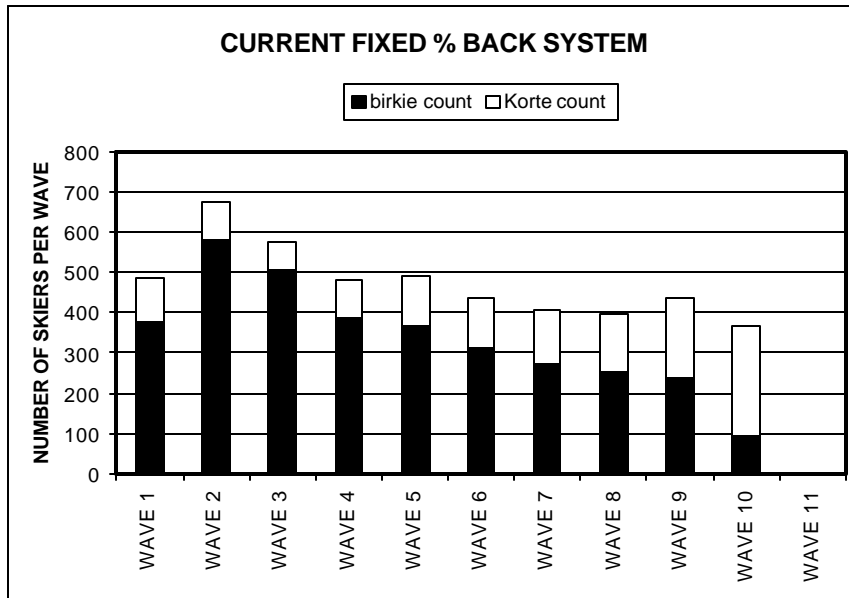


## WAVE PLACEMENT FOR 2003 BASED ON 2002 RESULTS

The time basis for calculating the %-back value this year is 2:09:31. This is between the finishing times of the 18<sup>th</sup> and 19<sup>th</sup> male skiers. The table below shows the %-back values and cut-off times for each wave.

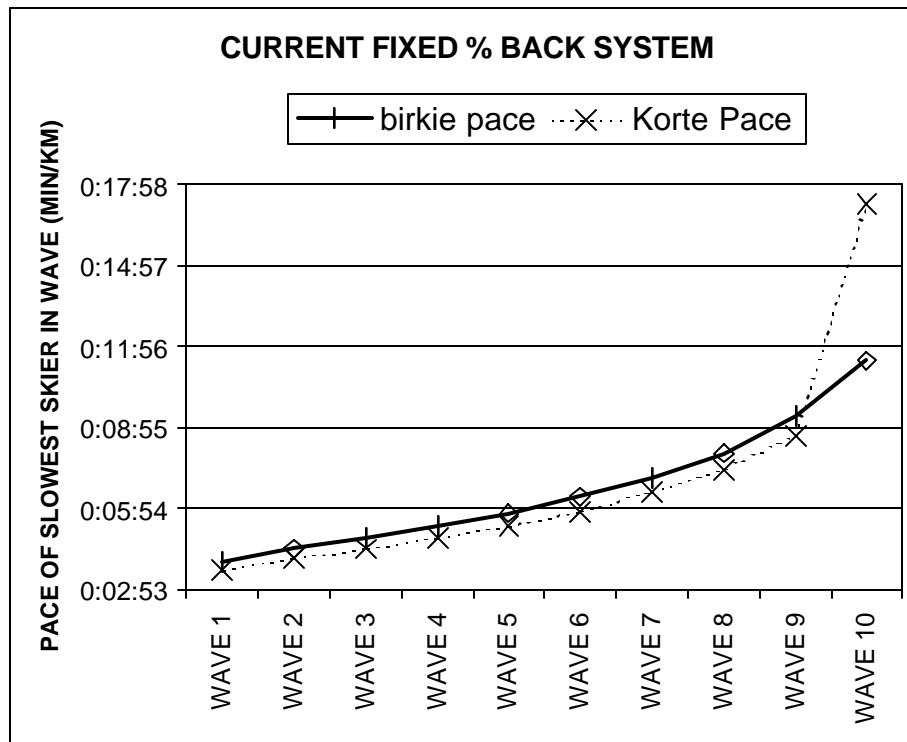
	WAVE 1	WAVE 2	WAVE 3	WAVE 4	WAVE 5	WAVE 6	WAVE 7	WAVE 8	WAVE 9	WAVE 10
Birke % Back	<41%	<58%	<73%	<89%	<107%	<128%	<155%	<187%	<238%	>238%
Birke time Cut-off	<03:02:37	<03:24:38	<03:44:04	<04:04:47	<04:28:06	<04:55:18	<05:30:16	<06:11:43	<07:17:46	>07:17:46
Korte % Back	<34%	<50%	<64%	<79%	<96%	<116%	<142%	<172%	<221%	>221%
Korte Time Cut-off	<01:22:14	<01:32:03	<01:40:38	<01:49:51	<02:00:17	<02:12:33	<02:28:30	<02:46:55	<03:16:59	>03:16:59

If the 2002 results had to be used for next year's wave placement, the number of Birkie and Korte skiers (after subtracting the elite wave qualifiers) per wave would be:



Wave 2 would be extremely crowded next year but wave 10 would be nearly empty of Birkie skiers. But, under the current system people can use their best result from the previous 4 years! So the number of skiers per wave will not be as shown in the chart above. Most likely, the early waves will be even more because of the policy of being able to use the best result over the last 4 years.

To see how well the Korte skiers would match the Birkie skiers, I plotted the pace of the Birkie skiers in each wave with the pace of the Korte skiers in each wave.



The pace of the Korte skiers in a given wave is a little slower than the pace of the Birkie skiers in that wave. It would be more desirable to have the paces matched better.

I think the current fixed %-back system has some problems.

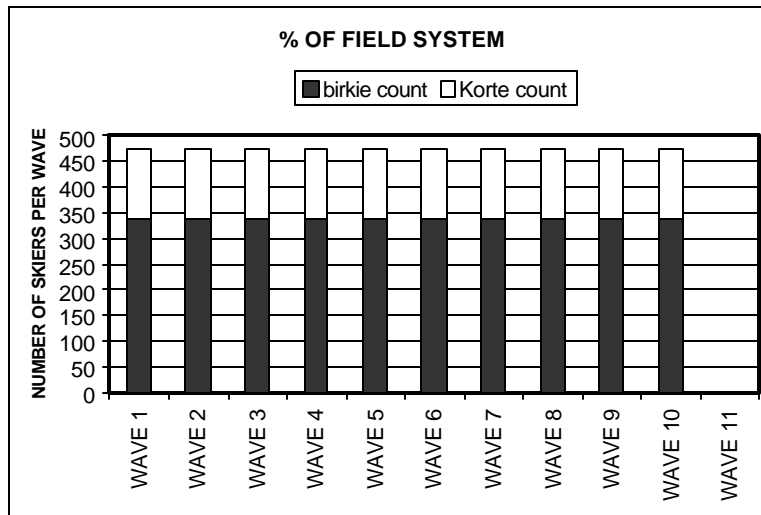
- The first is that by fixing the %-back criteria for each wave skiers will not be evenly distributed throughout the ten waves. Based on the 2002 results, wave 2 would have almost 600 skiers while wave ten would have less than 100. We have ten waves, let's us them all equally and spread the skiers out to reduce crowding!
- The second problem is the policy of being able to use your best result over the last 4 years. This leads to significant crowding in the first few waves and the inclusion of some significantly out of shape skiers in the faster waves.
- Lastly, finishing time is not a good wave placement tool. It's overall placement, not time, that should determine the wave placement criteria. Finishing times are too dependent on snow conditions to be used as a good wave placement tool. The Birkie office adjusts for finishing time somewhat by changing the basis time for calculating the %-back value. But this just shifts all the waves equally, it does nothing to even out the number of skiers in each wave.

## IS THERE A BETTER SYSTEM?

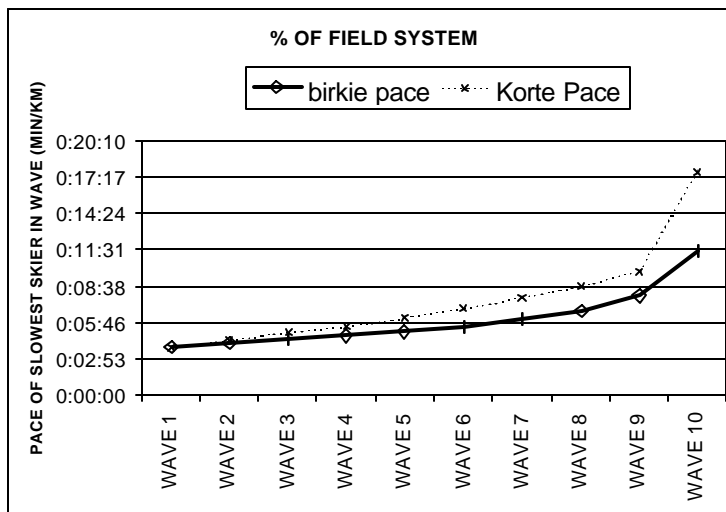
I think there is and I'll show two systems that I think are better than the current system. The goal of both proposed systems is to have an equal number of skiers in each wave. This year some waves had close to 600 skiers while others had about 200. What's the point in having 10 waves if most of the skiers are bunched up in the first few?

### % OF THE FIELD SYSTEM

The first proposed system is what I call the “% of the field” system. For this system, I took off the top 200 men and top 50 women for placement in the elite waves. I counted up all the remaining Birkie skiers and divided them equally into the 10 waves based on their PLACEMENT, NOT TIME, in the 2002 Birkie. I did the same with the Korte skiers. Wave 11 would still be reserved for new skiers. If the same skiers participate next year there would be 474 skiers in each wave.



The disadvantage with this system is that it does not do a very good job of matching the skiing pace of the Korte skiers to the pace of the Birkie skiers. In all the waves, the Korte skiers would be skiing a slower pace and this could create problems for the faster Birkie skiers coming up behind them.



Obviously, the same skiers won't all be in next year's race. If somebody didn't ski this year but had in previous years, the placement system could still be used. For example, if they were between 30% and 40% of the field in the year they raced, they would be placed in wave 4. To alleviate the over crowding in the first wave, I suggest that skiers MUST use their most previous result for wave placement. There should be a 1 wave penalty for every year back the placement results were taken from.

### FLOATING %-BACK SYSTEM

The other system I propose is what I've called the "floating %-back system". The goals of this system are to achieve pace matching of the Korte and Birkie skiers and to have an equal number of skiers in each wave. The %-back number applies only to Birkie skiers and is based on the average time of the first 5 Birkie skiers. I adjusted the %-back criteria for each wave to achieve balanced waves, hence the term "floating %-back system".

Specifically, this is how the system works.

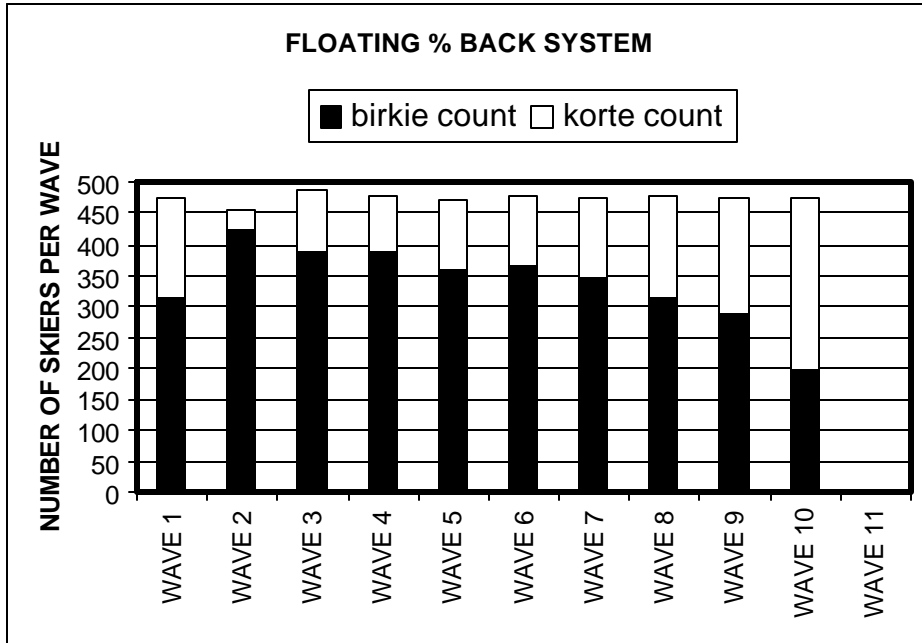
- I estimated a %-back range for each wave.
- I used the %-back number for the slowest Birkie skier in each wave.
- I then took all the Korte skiers that had a pace equal to or faster than that.
- I manually adjusted the %-back numbers in each wave until I achieved approximately an equal number of skiers in each wave.

It may sound difficult but it can be programmed easily in a computer spreadsheet so that it is not too difficult. The %-back numbers would be different every year because of varying snow conditions. I continued the use the %-back numbers like the current system because those numbers work well for fitting in people who did not ski the most recent race but need to be placed in the proper wave using the results from a previous year.

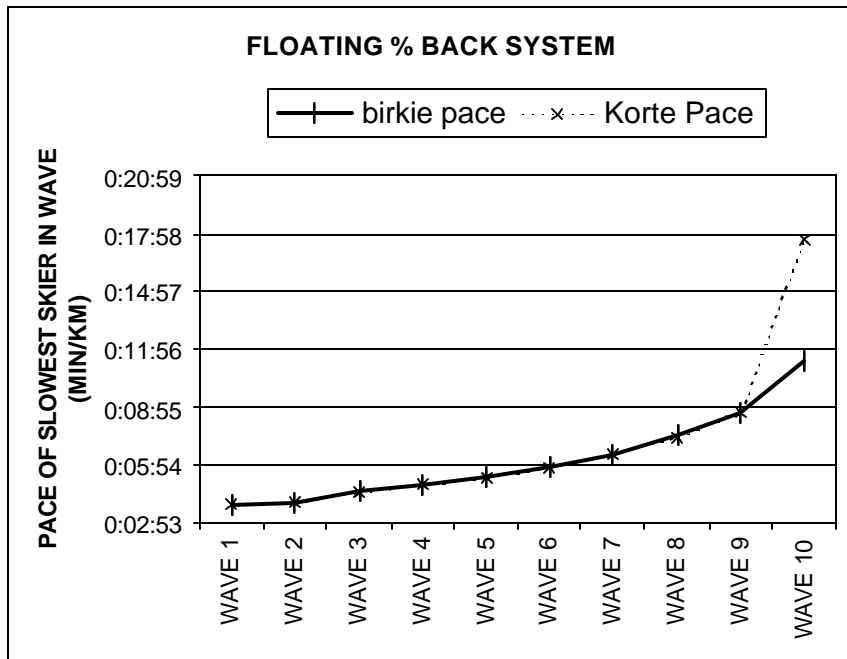
The table below shows what the %-back values and cut-off times would be for the 2003 race based on the 2002 results

	WAVE PLACEMENT BASED ON 2002 RESULTS									
	WAVE 1	WAVE 2	WAVE 3	WAVE 4	WAVE 5	WAVE 6	WAVE 7	WAVE 8	WAVE 9	WAVE 10
Birke % Back	<52%	52% - 66%	66% - 79%	79% - 93%	93% - 109%	109% - 129.5%	129.5% - 155.5%	155.5% - 192%	192% - 242%	>242%
Birkie time Cut-off	<02:59:07	<03:15:36	<03:30:50	<03:47:24	<04:06:12	<04:30:19	<05:01:03	<05:44:03	<06:42:32	<08:51:17
Korte % Back	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Korte Time Cut-off	<01:27:22	<01:29:51	<01:42:23	<01:50:52	<02:00:01	<02:11:39	<02:26:37	<02:47:52	<03:16:11	<06:43:05

The chart below shows the number of Birkie and Korte skiers in each wave using this system.



Note that the number of Korte vs. Birkie skiers is different in each wave but the total number of skiers is the same in every wave. Also, their paces match as the next chart shows.



## **WAVE PLACEMENT SYSTEM SUMMARY:**

### **CURRENT FIXED %-BACK SYSTEM:**

Advantages: I can't think of any.

Disadvantages: Very unbalanced waves. The early waves have large numbers of skiers, the later waves have very few.

### **%-OF FIELD SYSTEM:**

Advantages: Balanced waves and simplicity. A skier will know what wave they are in as soon as they know how they placed and how many people were in the race (remember to subtract 200 men and 50 women from the Birkie for the elite waves). Ten waves makes it simple, if you are between the 20<sup>th</sup> and 30<sup>th</sup> percentile you're in wave 3.

Disadvantages: It doesn't guarantee that the pace of the Korte skiers will match the pace of the Birkie skiers.

### **FLOATING %-BACK SYSTEM:**

Advantages: Balanced waves and Korte/Birkie pace matching.

Disadvantages: A little more complicated. It takes some manipulation of the numbers every year but it can be programmed fairly easily. A skier won't know what wave they are in until all the numbers have been crunched.

All systems would benefit by eliminating the policy of being able to use the best result from the last 4 years. I think a skier must use the result from the previous year's race but could use a result from prior years but with a 1 wave penalty for each year back.