Ascents from 100 ft (30.5m) Dives on 32% Nitrox

Comparison of V-Planner VPM-B to NOAA Tables, and GAP RGBM + GF Tables

- **This compilation demonstrates that at 100 ft, VPM-B TATs are comparable to NOAA times –but more aggressive than GAP RGBM and GF.**

- **RGBM and GF tables are increasingly more conservative compared to VPM-B, with increasing dive times.**

- **VPM Equivalent Air Depth (EAD)-based decompression is much more conservative than VPM Nitrox decompression tables. For example, V-planner tables for Nx 32 dives at 100 ft are more aggressive than air tables for the corresponding EAD of 81.5 ft. This is for two reasons:**
  1) **Nitrox deco is more efficient than air deco.**
  2) **The VPM calculates more aggressive gradients for dives to larger ambient pressures. For further discussion see:**
     http://www.decompression.org/maiken/VPM/RDPW/VPMech3/VPMech3.htm

Organization

Notations and Conventions

•ALL CONLUSIONS and GENERALIZATIONS PERTAIN ONLY to the SPECIFIC DEPTHS, GAS MIXTURES, and PROGRAM SETTINGS CONSIDERED in this DOCUMENT

Profiles

•12 profiles of 100 ft on Nitrox 32% back gas, with bottom time ranging from 10-120 min are modeled, with deco using Nitrox 32% and O_2.
•Total of 72 VPM-B models = 12-profiles x 3-conservatisms x 2 deco gas combinations (Nitrox 32%, Nitrox 32%+ O_2).
•Correlations of RGBM and GF to 72 VPM-B models = 12-profiles x 3 different conservatism settings x 2 deco gas combinations.
•All ascents at 33 ft/min. No breaks included from O_2 Exposure. All descents on back gas at 100 ft/min.

Plots

•Gas mixtures denoted as percents in braces: {%O_2, %He, %N_2}
    •Nitrox 32 is then: {32,0,68}
•Three types of plots are shown that correlate VPM-B to RGBM and GF:
    •RGBM and GF vs. VPM Total Ascent Times (pages: 12, 13, 21, 22, 30, 31)
    •Overlaid stair-step profiles (pages: 8, 10, 17, 19, 26, 28)
    •RGBM, and GF Stop-times vs. VPM-B stop-times (pages: 9, 11, 18, 20, 27, 29)
•Diagonal lines in plots are *NOT* fitted correlations –they are just indications of 1:1 correlation to guide your eyes.
    •Points that lie above the lines denote longer GF and RGBM times, while points below the lines indicate longer VPM-B times.
•I use Imperial American units and conventions. cf == cubic feet (volume).1 cf = 28.23 liters. In the USA, tank capacities are discussed in terms of the volume of gas that is contained at the maximum rated pressure. psi == pounds per square inch (pressure).

V-Planner and GAP Software Settings

•Ascents calculated by GAP RGBM v2.1.3 (Aug, 2003 Edition) and V-Planner (VPM-B) v3.22.
•VPM conservatisms are denoted: Nominal as VPM-B (N), Level 2 as VPM-B (2), and Level 4 as VPM-B (4).
•RGBM and GF run at nominal GAP conservatisms. VPM-B run at nominal (N), (2), and (4) conservatisms.

Discussion of Correlation Plots for VPM-B to RGBM and GF Total Ascent Times (TATs)

VPM-B TATs Are Comparable to NOAA, and Shorter than RGBM

General Notes

•VPM-B stop times on Nitrox 32 are very similar to stop times for comparable dives on Trimix 30/30. RGBM stop times for comparable dives are are longer on Trimix 30/30 compared to Nitrox 32.

•All data include time to 1st stop at ascent rate of 33 ft/min.

•TATs are closely related to comparative surfacing gradients for VPM-B, RGBM, and GF because all three ascent methods employ similar stage depths. Therefore, roughly speaking, a longer TAT implies a more conservative schedule.

NOAA vs. VPM-B (page 7)

•100 ft VPM-B(N) correlates nearly linearly to the NOAA tables, with VPM-B slightly more aggressive for dive times longer than 40 min.

RGBM vs. VPM-B (pages 12, 21, and 30)

•VPM-B(N) and (2) yield substantially shorter TATs than RGBM. VPM-B(4) is comparable to RGBM for bottom times up to 70 min, and then yields longer TATs for longer bottom times.

•As with 100ft air tables, RGBM nitrox tables are very conservative --they call for a 2-min stop on O_2 after 20 min at 100 ft. In comparison, the NOAA nitrox tables allow 30 min of no-deco on 32%. The aggressive US Navy *air* tables for 100 ft allow you to ascend directly for bottom times up to 25 min.

GF vs. VPM-B (pages 13, 22, and 31)

•VPM-B(N) and (2) yield substantially shorter TATs than GF. VPM-B(4) TATs closely comparable to GF.

Discussion of Correlation Plots of VPM-B to RGBM and GF Stop Times

General Notes

•The plots on pages 9, 11, 18, 20, 27, and 29 directly compare stop time vs. stop time for two different deco methods.They avoid the offsets that occur on the conventional stair-step depth vs. run-time plots of the same data, which are shown on pages 8, 10, 17, 19, 26, and 28.

•Data points are plots of the (x,y) pair: (VPM-B stop time, RGBM/GF stop time) for each decompression stop. Individual stop depths are not indicated, but generally, the longest stops correspond to the shallowest stops for each gas mixture. For O_2 deco, the 20 and 10 ft stops are shown as green-colored points. Stops on back gas are shown as black-colored points. For the deepest stops, more than one point will often plot on top of another point.

RGBM vs. VPM-B (pages 9, 18, and 27)

•VPM-B(N) and (2) stops are shorter than RGBM (pages 9, 18).

•VPM-B(4) is increasingly more conservative than RGBM with increasing bottom times (page 27).

GF vs. VPM-B (pages 11, 20, and 29)

•VPM-B(N) and (2) stop times are shorter than GF (pages 11, 20).

•VPM-B(4) is generally linearly correlated to GF for dives longer than 20 min (page 29).

Discussion of Plots of VPM-B Stop Times vs. Bottom Times

See pages 14, 15, 23, 24, 32, 33

•TATs and groups of stop times (e.g. times at 10+20 ft) are linearly correlated to dive times. This translates to simple rules that relate stop times to bottom times. We can use these relationships to specify analytically-based procedures for VPM-B deco-on-the-fly.

•CAUTION: remember that the rules derived from these slides are special cases that only relate to 100 ft dives on Nitrox 32.

SECTION 1

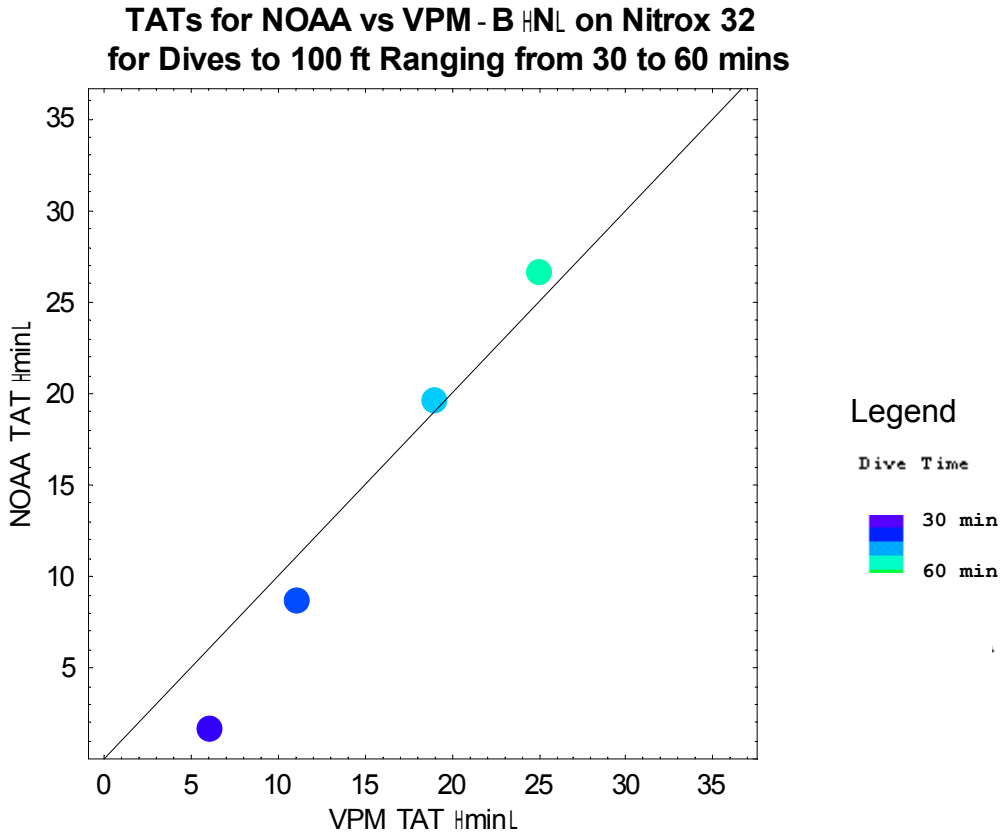
Ascents from Dives at 100 ft for 10 -120 min
12 on Nitrox 32 with Nitrox 32 Deco
12 on Nitrox 32 with Nitrox 32+O_2 Deco

VPM-B Conservatism Setting (N)

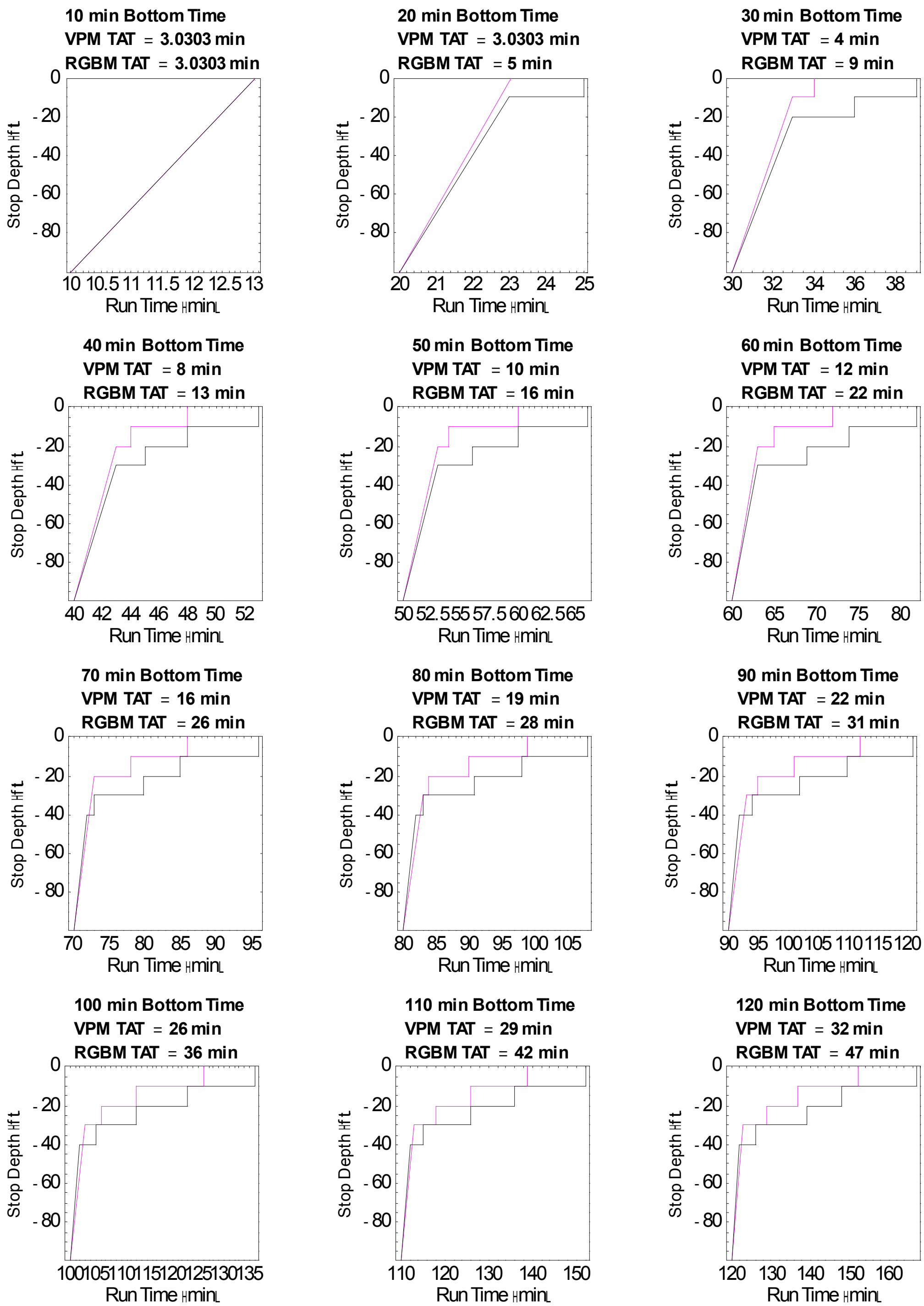
Benchmark:
Correlation of TATs for Nitrox 32% Decompression Dives

NOAA vs. VPM-B (N) 100 ft

Conclusion:
100 ft VPM-B(N) correlates nearly linearly to the NOAA Tables, with VPM-B slightly more aggressive for dive times longer than 40 min.



Comparison of RGBM and VPM-B (N) Ascents for Array of 100 ft Dives on Back Gas $\{O_2, He, N_2\} = \{32, 0, 68\}$ Deco on $\{32, 0, 68\}$, and $\{100, 0, 0\}$

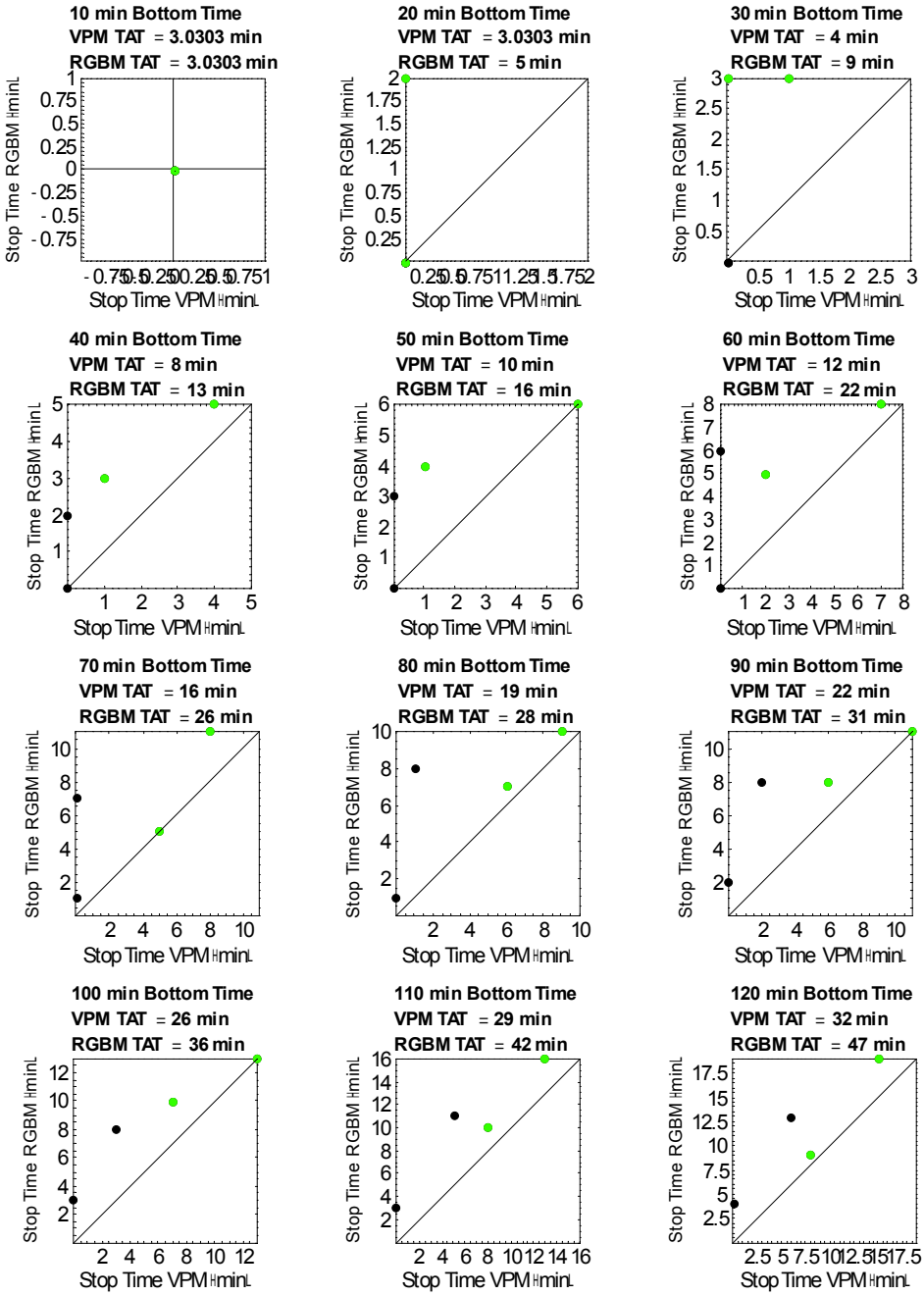


LEGEND
Dive Profiles

VPM-B
RGBM

Eric Maiken, 2003 Limited Distribution

Correlation of RGBM to VPM - B (N) Stop Times for Array of 100 ft Dives on Back Gas (O2, He, N2) = (32, 0, 68) Deco on (32, 0, 68), and (100, 0, 0)



LEGEND

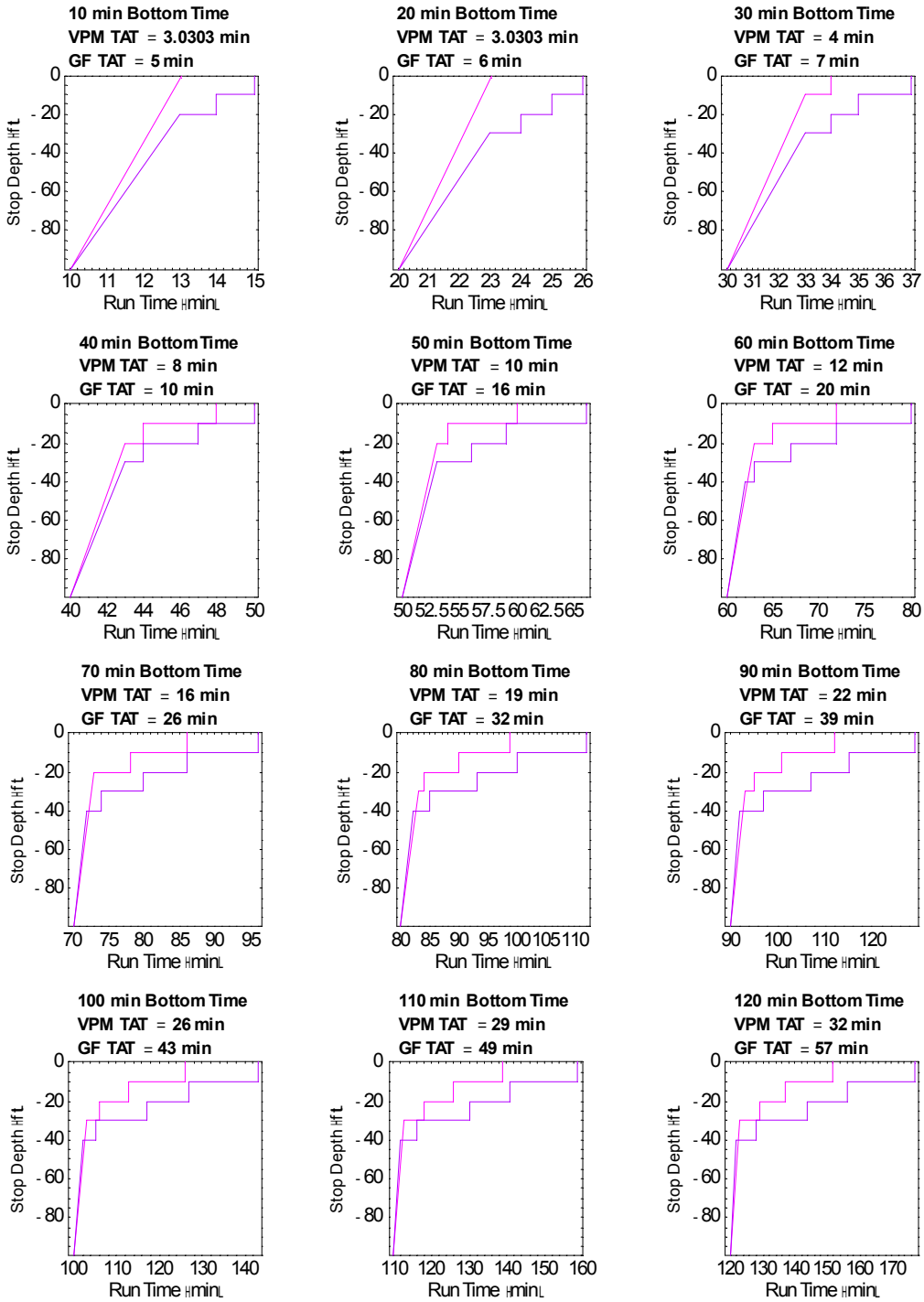
Deco Gases

O_2, He, N_2

100, 0, 0

21, 0, 79

Comparison of GF and VPM-B (NL) Ascents for Array of 100 ft Dives on Back Gas (O_2, He, N_2) = (32, 0, 68) Deco on (32, 0, 68), and (100, 0, 0)



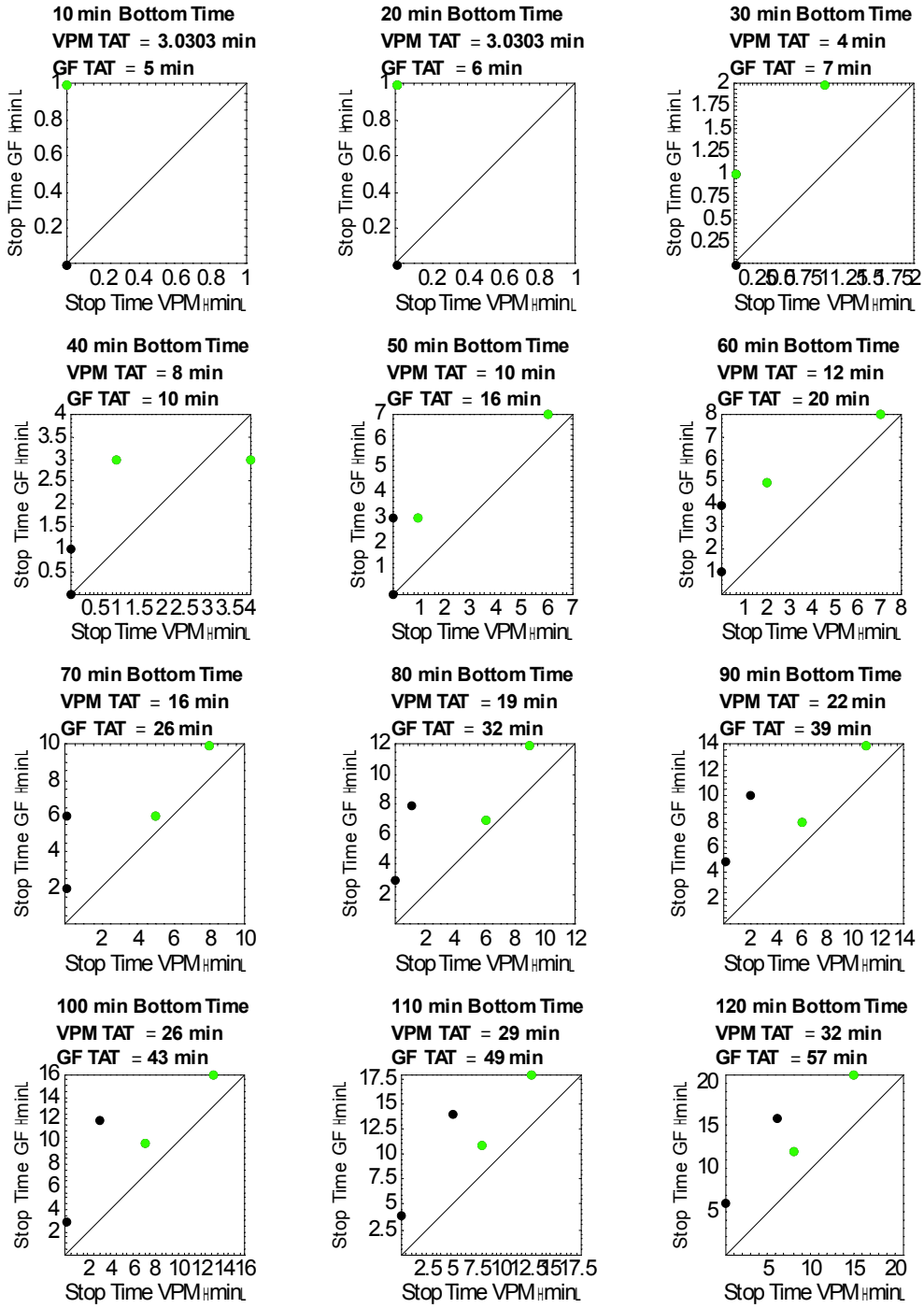
LEGEND
Dive Profiles

VPM-B
GF

Eric Maiken, 2003

Limited Distribution

Correlation of GF to VPM-B (NL) Stop Times for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



LEGEND

Deco Gases

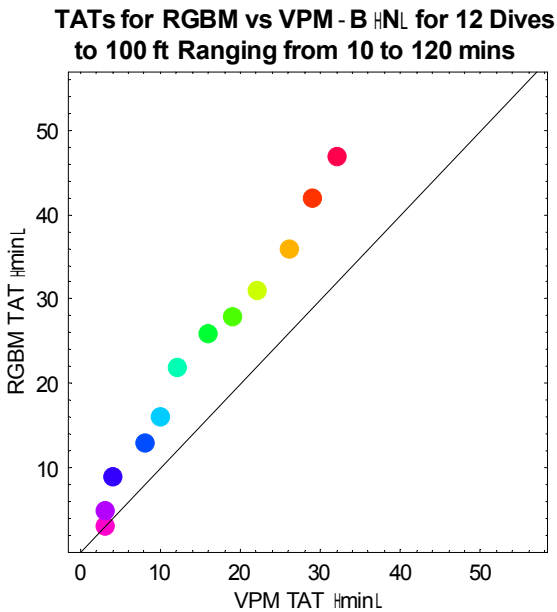
O_2, He, N_2

100, 0, 0

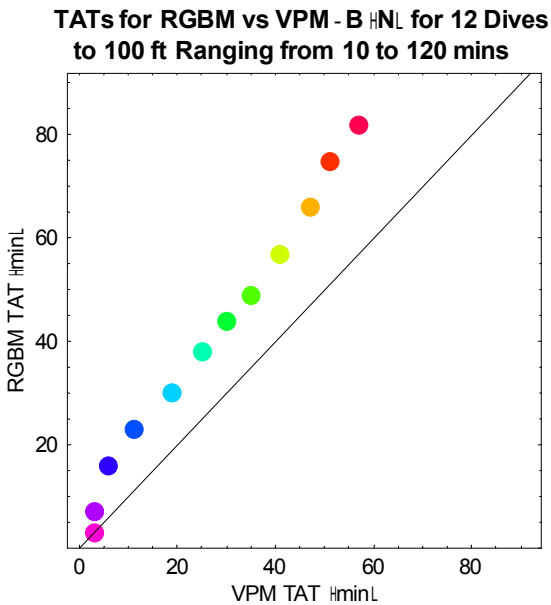
21, 0, 79

Correlation of RGBM and VPM-B(N) TATs for 100ft Dives on Nx 32%

Nx32+O_2 Deco



Nx 32 Deco



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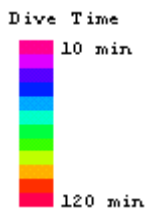

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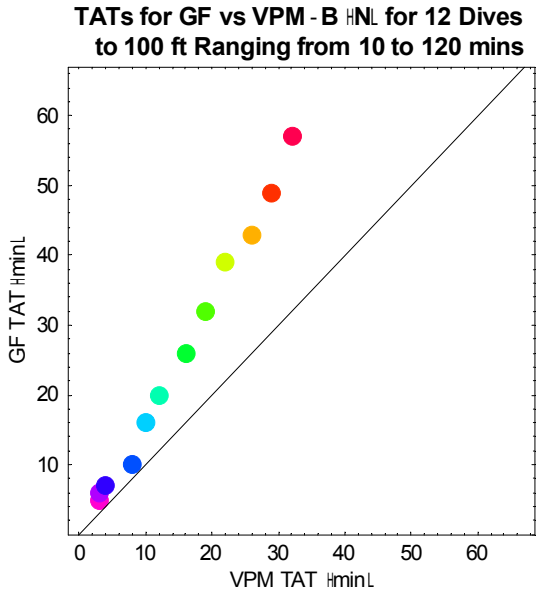
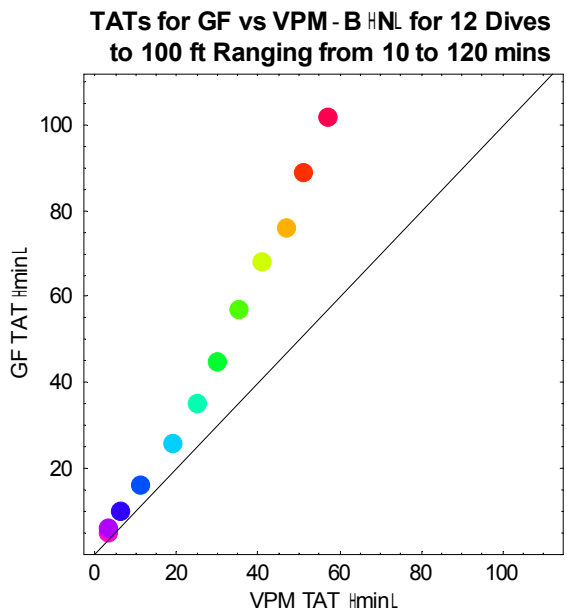
Limited Distribution

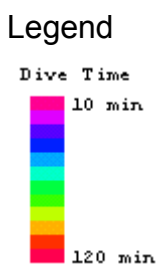
Correlation of GF and VPM-B(N) TATs for 100ft Dives on Nx 32%

Nx32+O_2 Deco



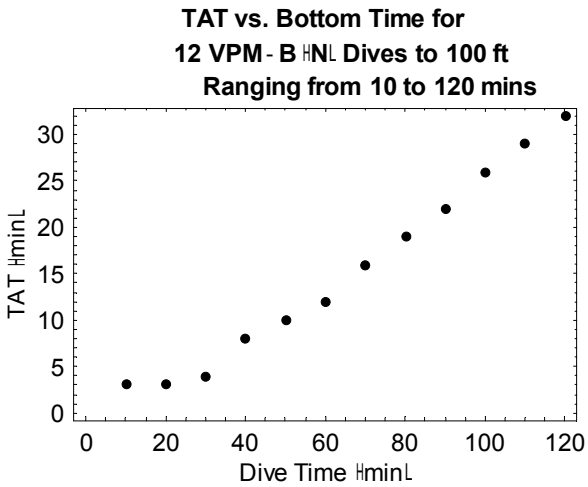
Nx 32 Deco

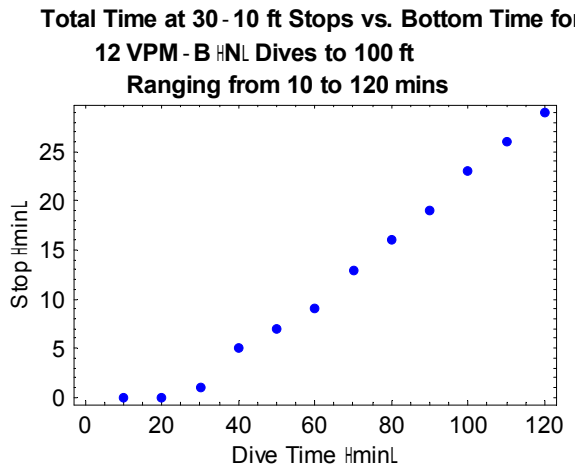


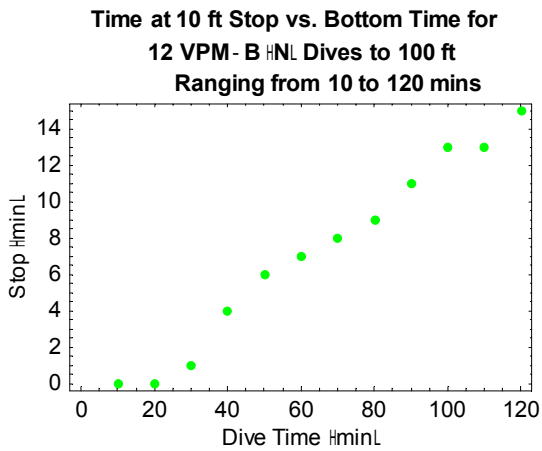


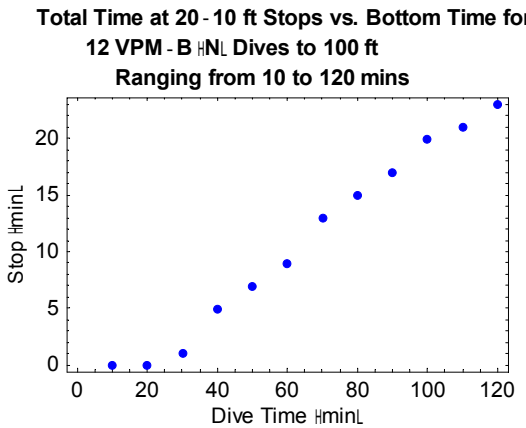
Stop Times vs. Bottom Times VPM-B Conservatism (N)

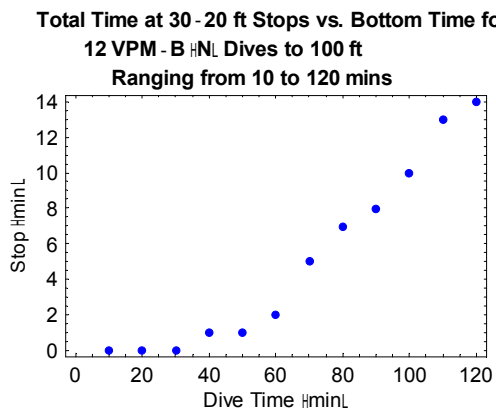
Nx32+O_2 Deco





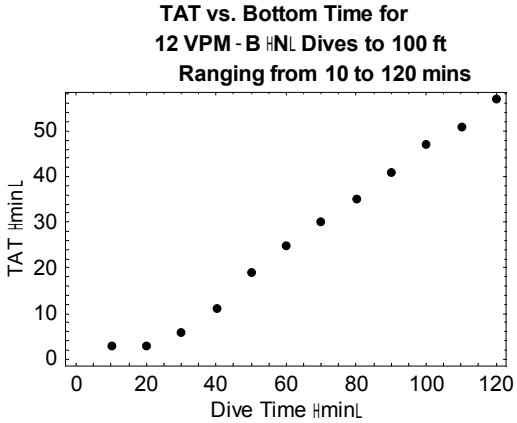


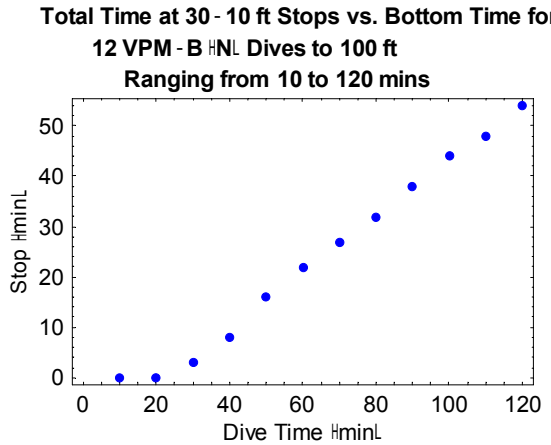


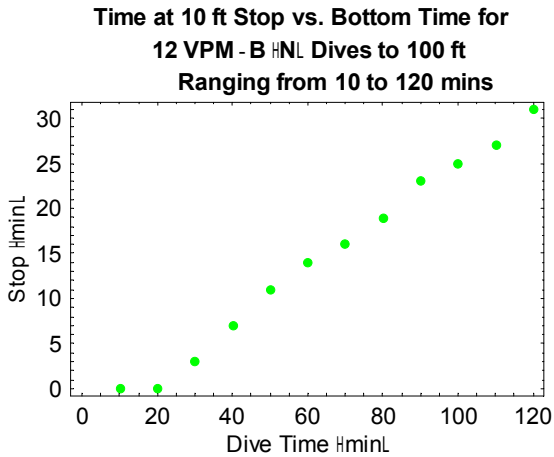


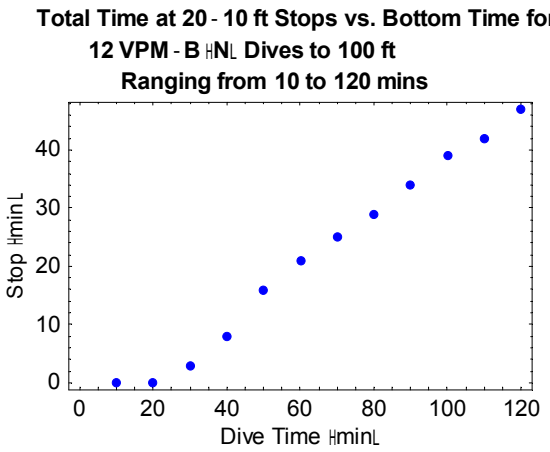
Stop Times vs. Bottom Times VPM-B Conservatism (N)

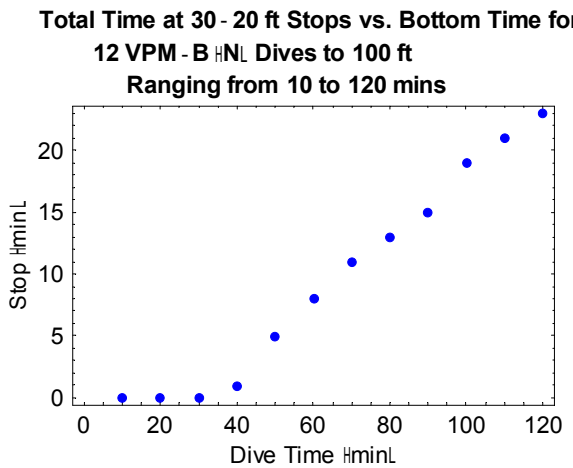
Nx32 Deco











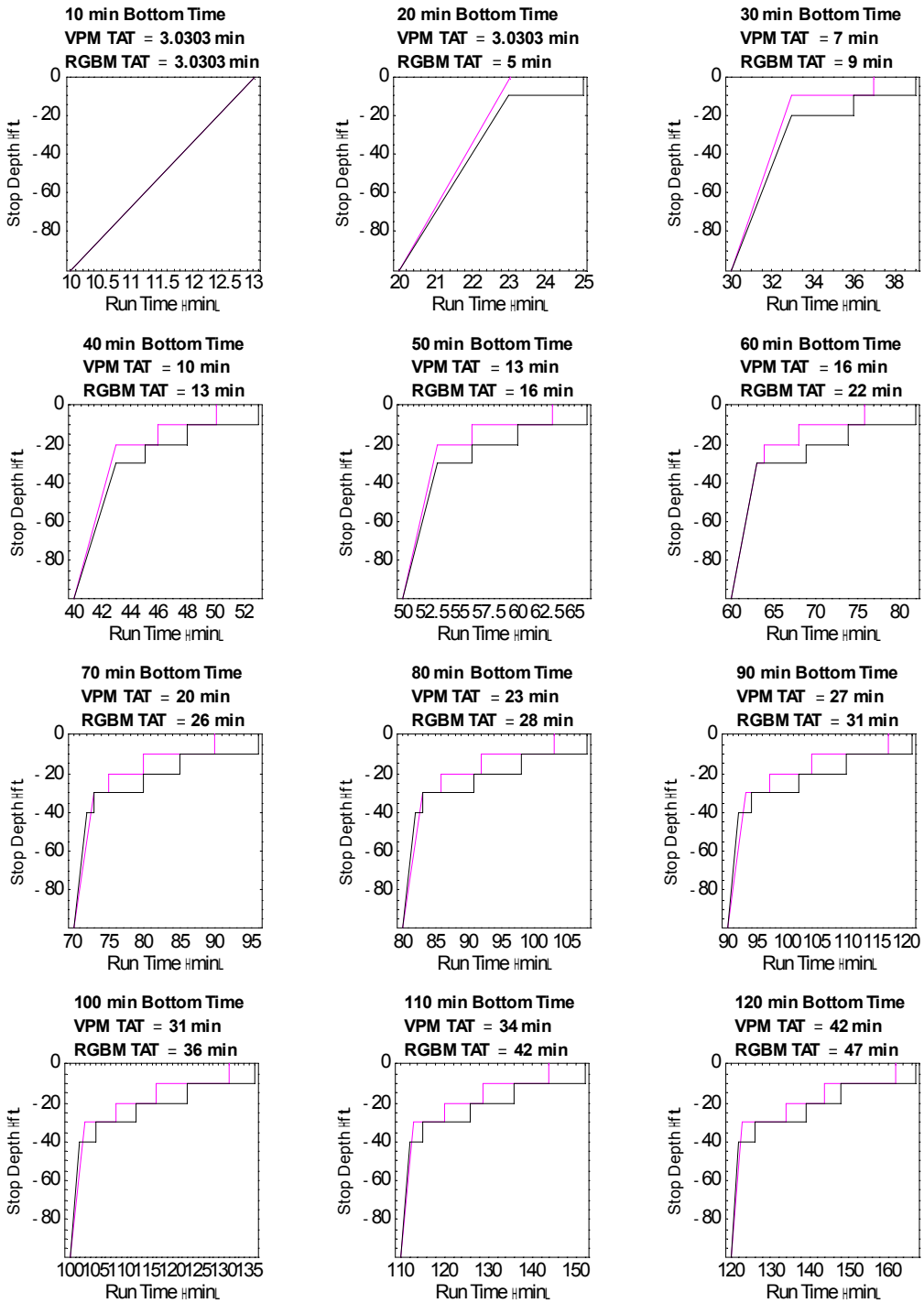
SECTION 2

Ascents from Dives at 100 ft for 10 -120 min
12 on Nitrox 32 with Nitrox 32 Deco
12 on Nitrox 32 with Nitrox 32+O_2 Deco

VPM-B Conservatism Setting (2)

24 VPM-B profiles compared to RGBM and GF (pages 17-22)
24 VPM-B ascents on Nitrox and Nitrox+O_2 deco summarized (pages 22-23)

Comparison of RGBM and VPM-B (2) Ascents for Array of 100 ft Dives on Back Gas (32, 0, 68), Deco on (32, 0, 68), and (100, 0, 0)



LEGEND
Dive Profiles

VPM-B
RGBM

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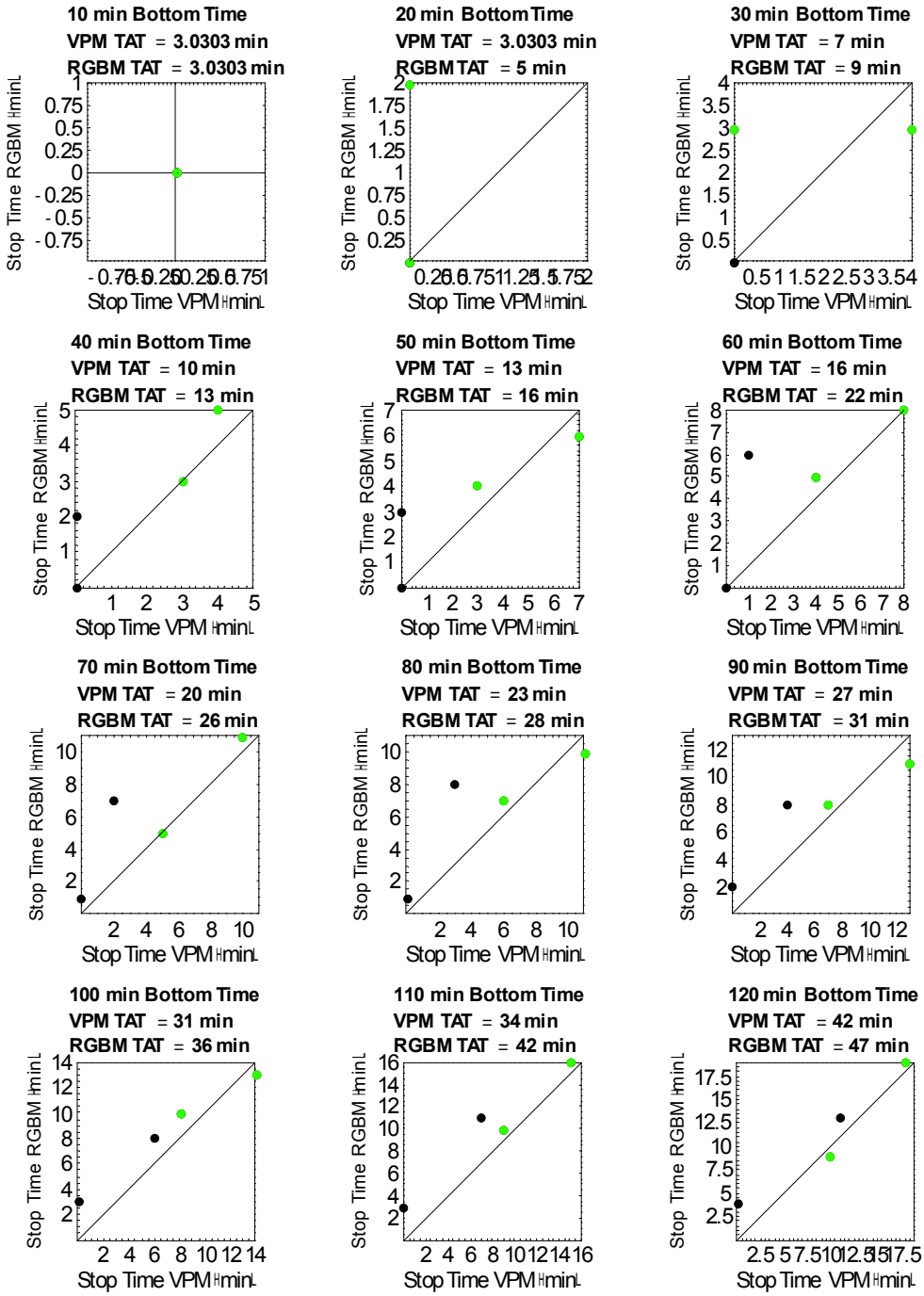
Limited Distribution

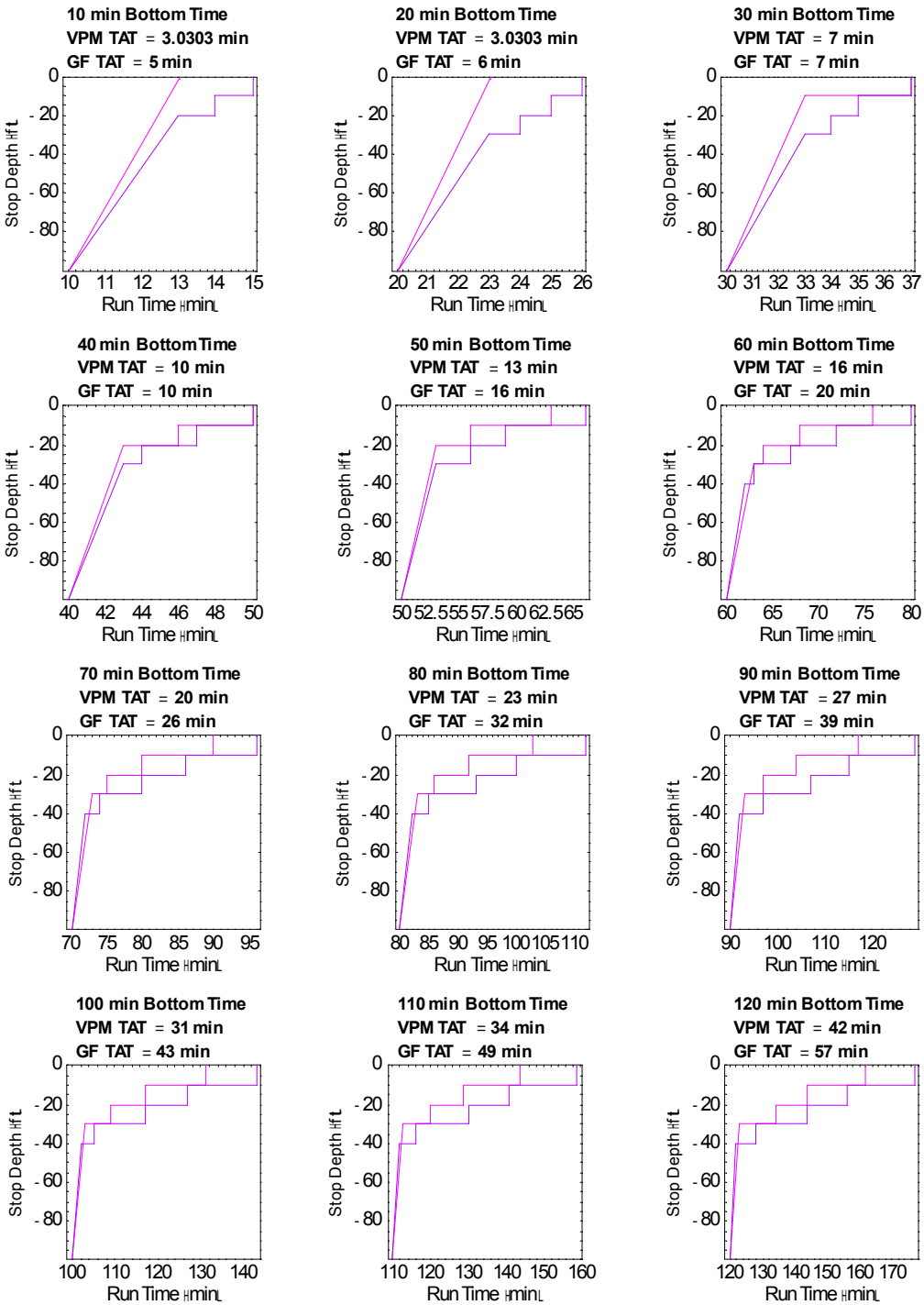
Correlation of RGBM to VPM-B (2) Stop Times for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



LEGEND
Deco Gases
O_2, He, N_2
100, 0, 0

21, 0, 79

Comparison of GF and VPM-B (2) Ascents for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



LEGEND
Dive Profiles

VPM-B
GF

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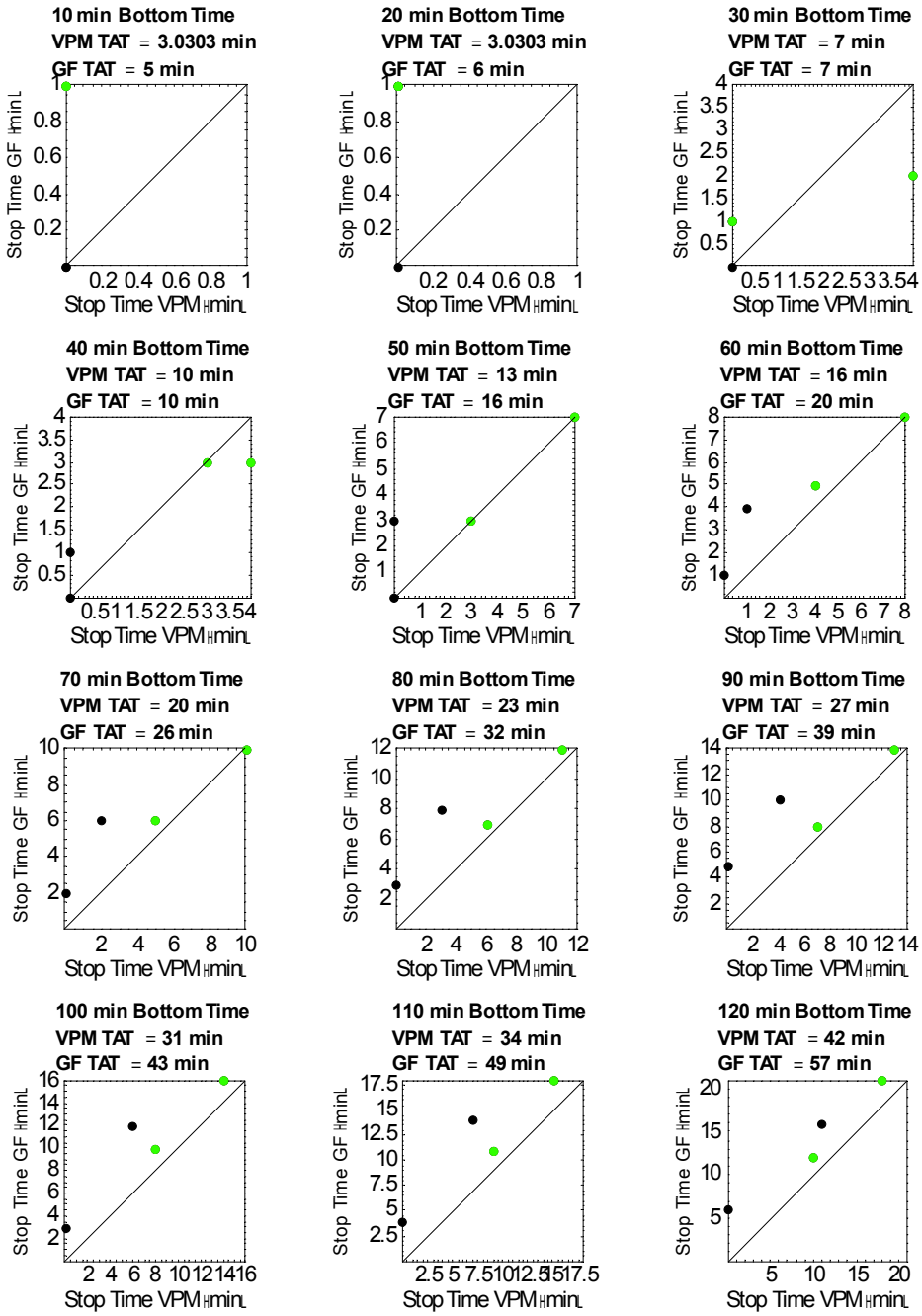
Limited Distribution

Correlation of GF to VPM-B (2) Stop Times for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



LEGEND
Deco Gases
O_2, He, N_2
100, 0, 0
21, 0, 79

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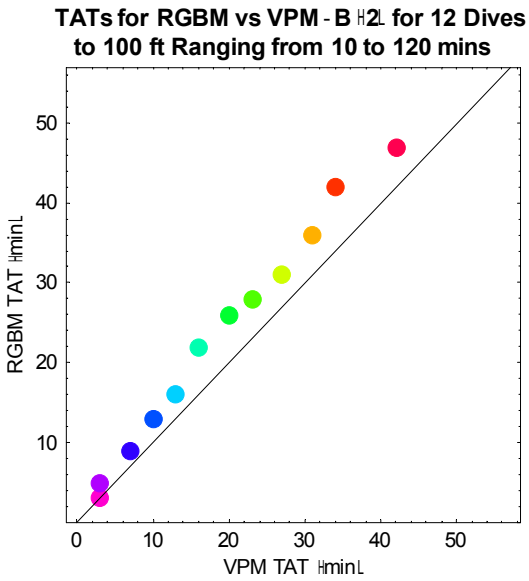
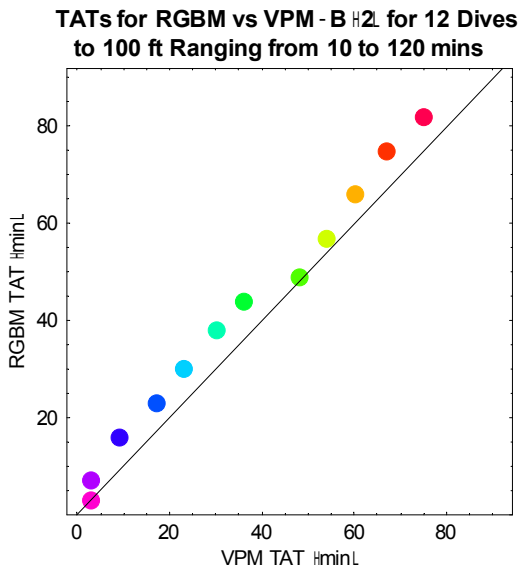
Limited Distribution

Correlation of RGBM and VPM-B(2) TATs for 100ft Dives on Nx 32%

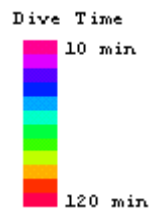
Nx32+O_2 Deco



Nx 32 Deco

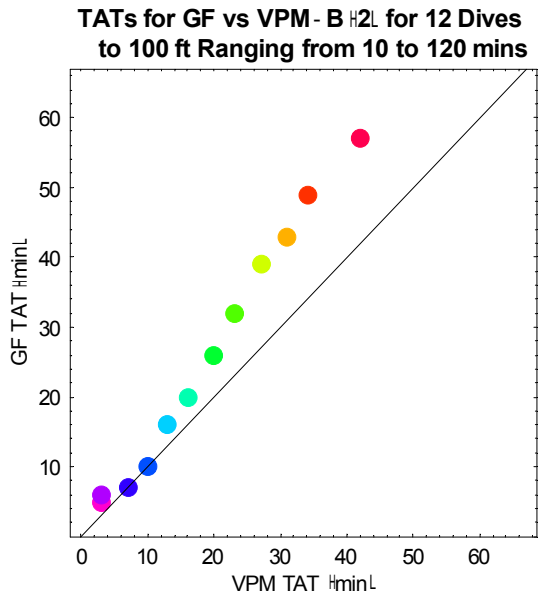


Legend

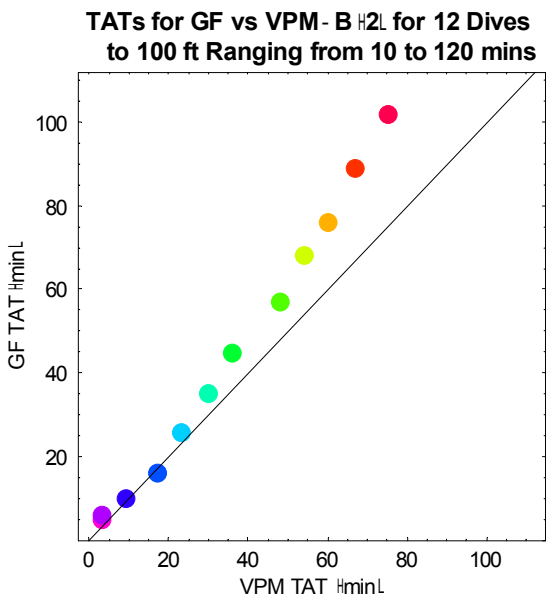


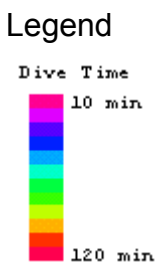
Correlation of GF and VPM-B(2) TATs for 100ft Dives on Nx 32%

Nx32+O_2 Deco



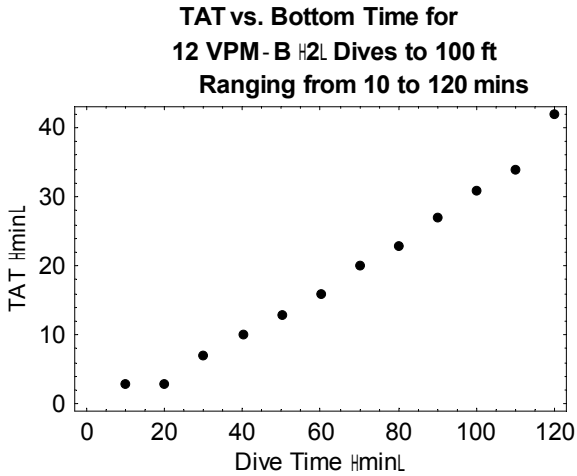
Nx 32 Deco

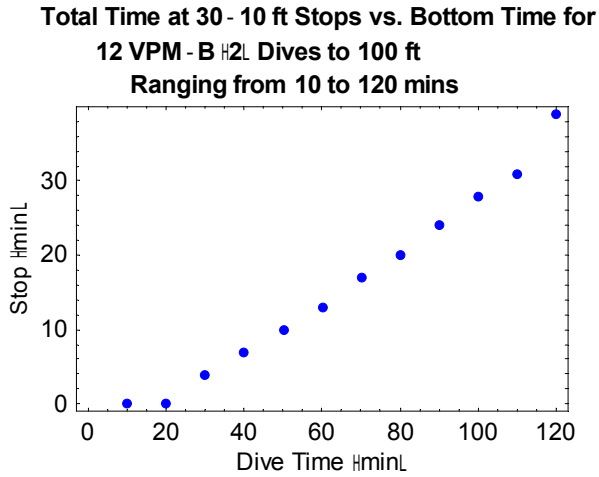


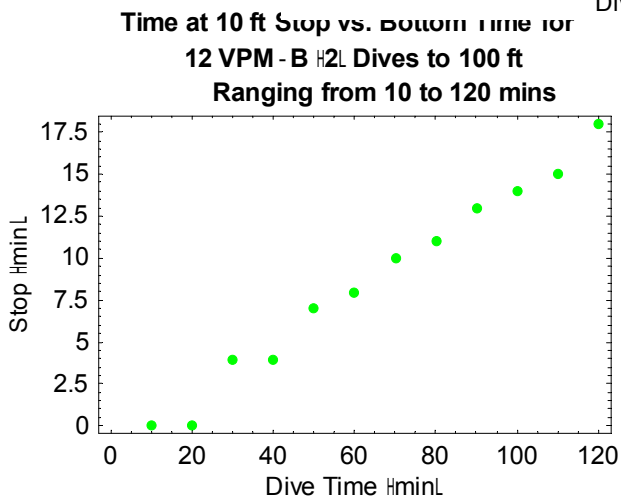


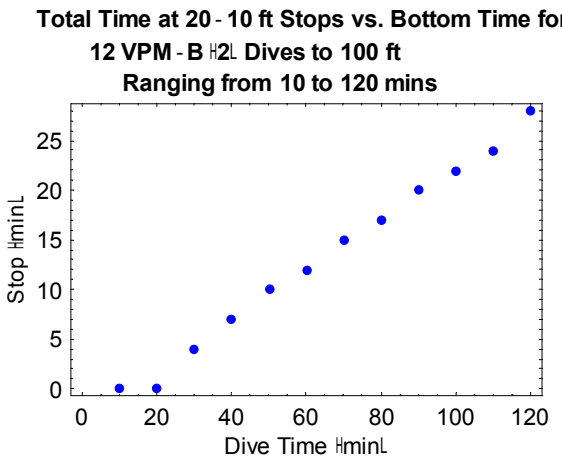
Stop Times vs. Bottom Times VPM-B Conservatism (2)

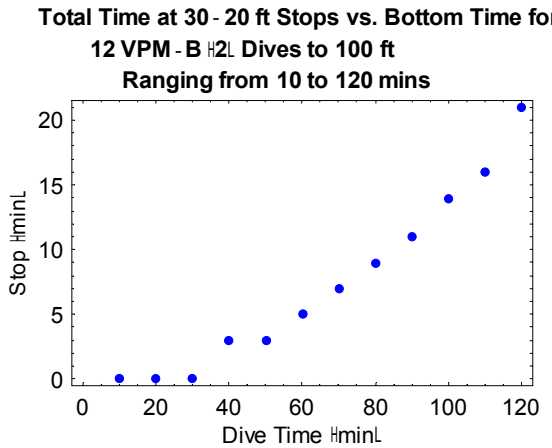
Nx32+O_2 Deco











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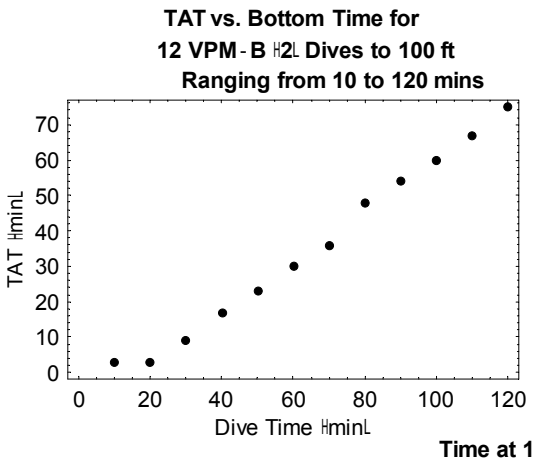
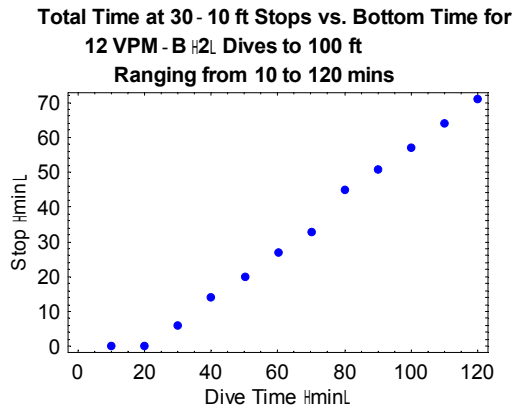
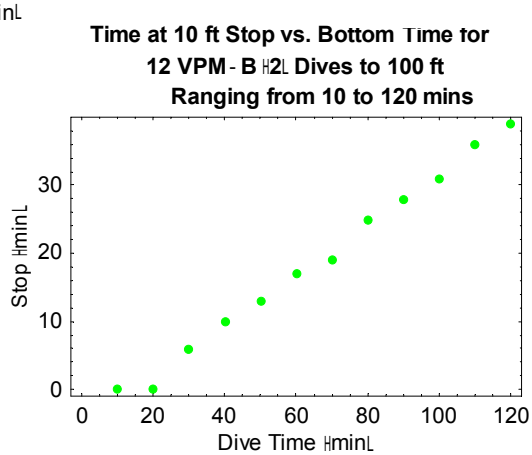
Limited Distribution

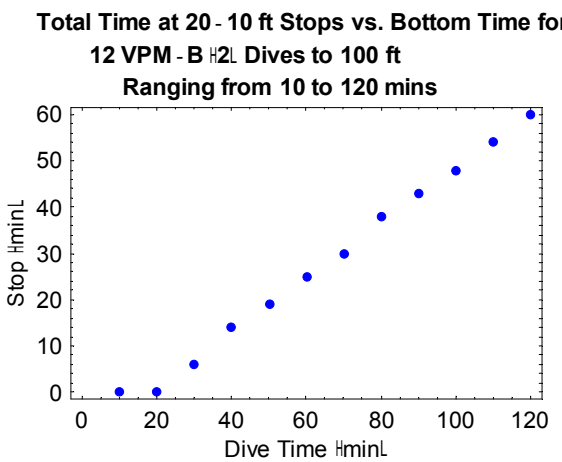
Stop Times vs. Bottom Times VPM-B Conservatism (2)

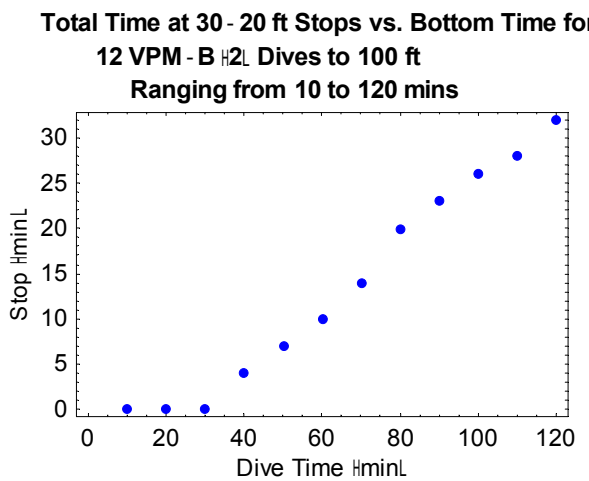
Nx 32 Deco











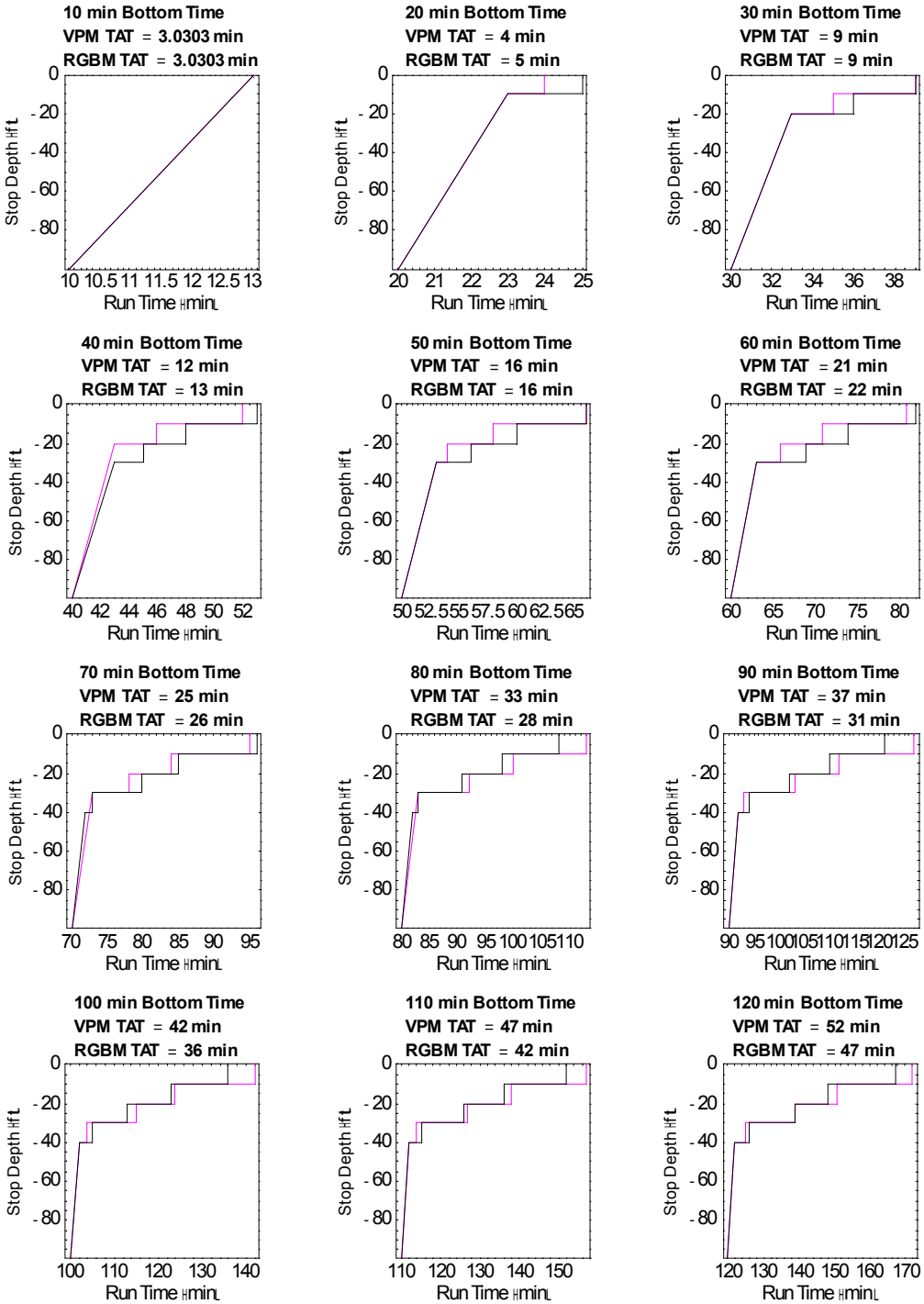
SECTION 3

Ascents from Dives at 100 ft for 10 -120 min
12 on Nitrox 32 with Nitrox 32 Deco
12 on Nitrox 32 with Nitrox 32+O_2 Deco

VPM-B Conservatism Setting (4)

24 VPM-B profiles compared to RGBM and GF (pages 26-31)
24 VPM-B ascents on Nitrox and Nitrox+O_2 deco summarized (pages 32-33)

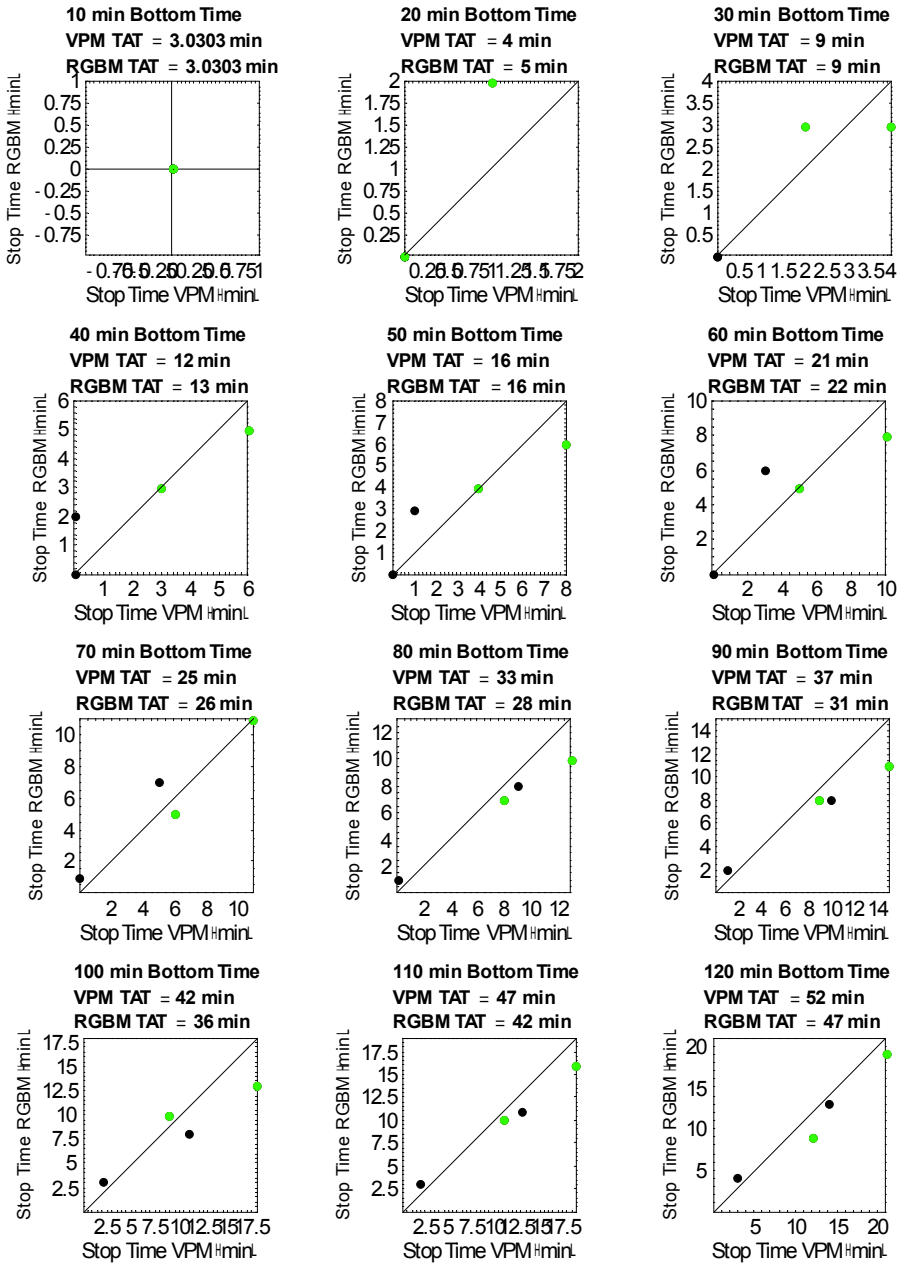
Comparison of RGBM and VPM-B (4) Ascents for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



LEGEND
Dive Profiles

VPM-B
RGBM

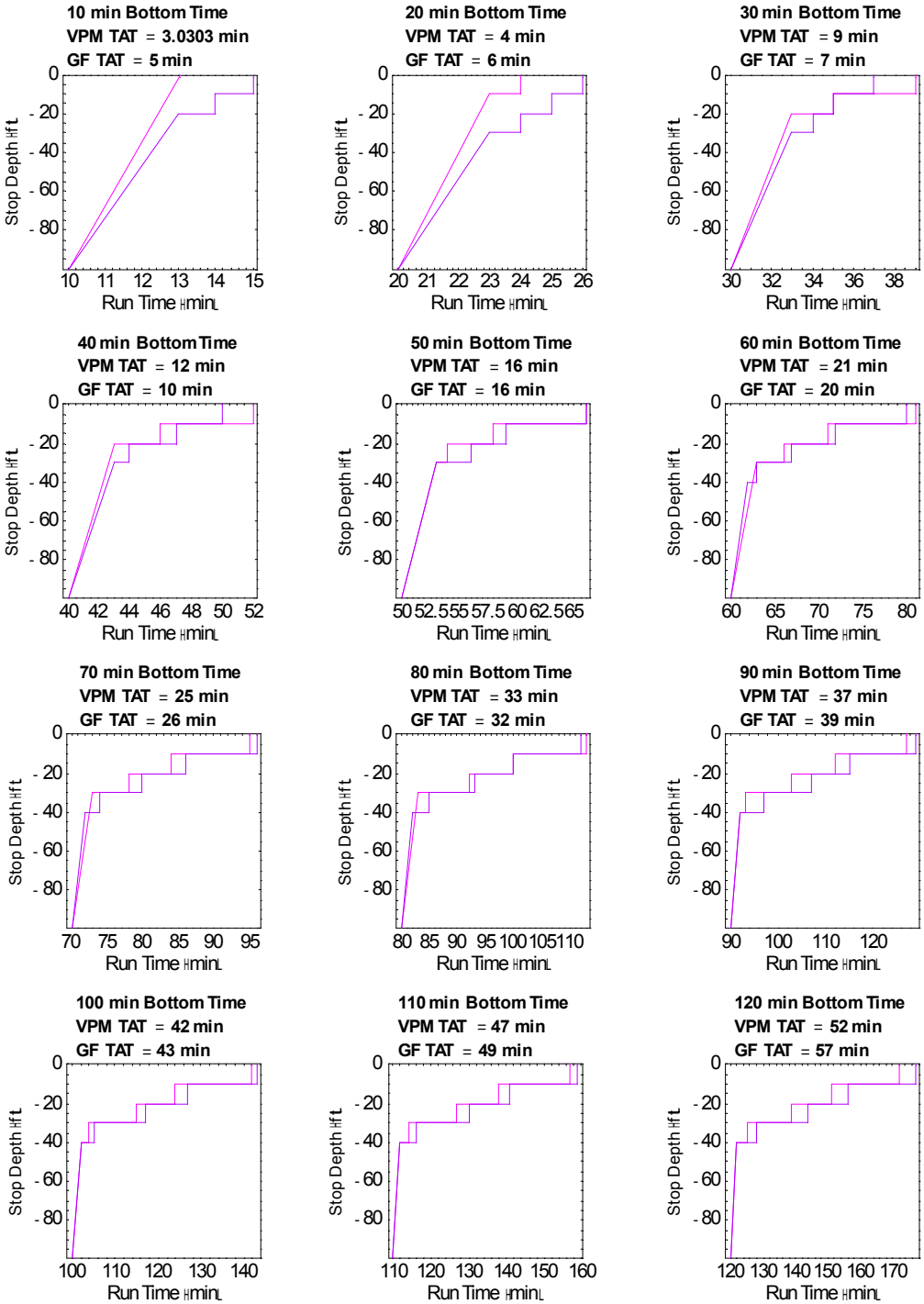
Correlation of RGBM to VPM - B (4) Stop Times for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



LEGEND
Deco Gases
O_2, He, N_2
100, 0, 0

21, 0, 79

Comparison of GF and VPM-B (4) Ascents for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



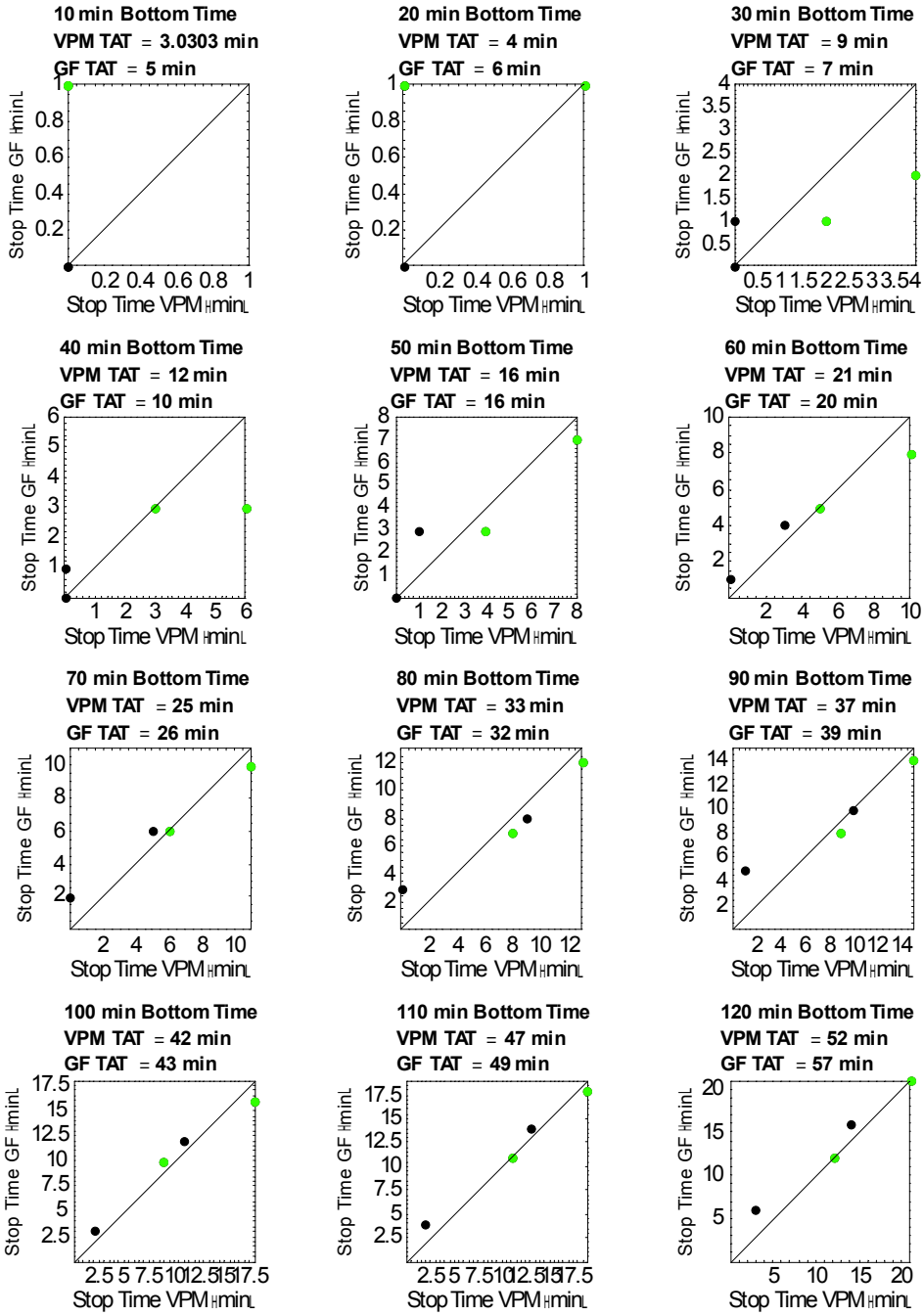
LEGEND
Dive Profiles

VPM-B
GF

Eric Maiken, 2003

Limited Distribution

Correlation of GF to VPM-B (4) Stop Times for Array of 100 ft Dives on Back Gas {O_2, He, N_2} = {32, 0, 68} Deco on {32, 0, 68}, and {100, 0, 0}



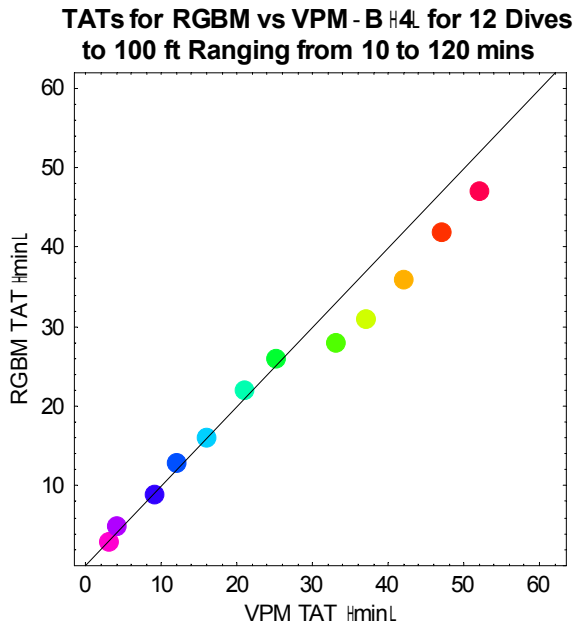
LEGEND
Deco Gases
O_2, He, N_2
100, 0, 0
21, 0, 79

Eric Maiken, 2003

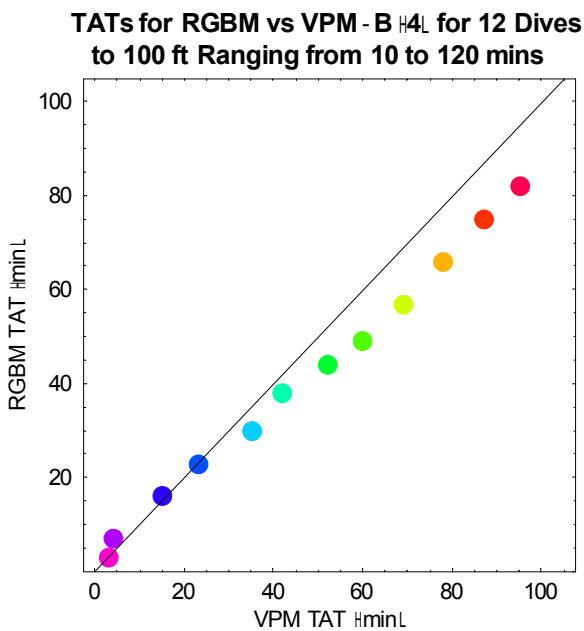
Limited Distribution

Correlation of RGBM and VPM-B(4) TATs for 100ft Dives on Nx 32%

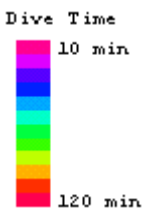
Nx32+O_2 Deco



Nx 32 Deco

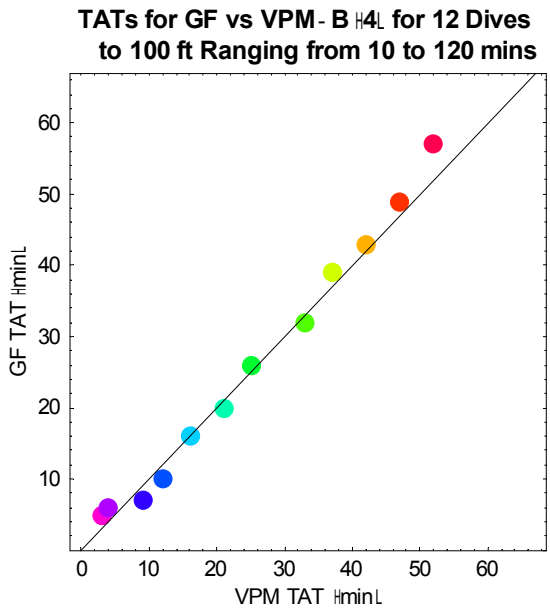


Legend

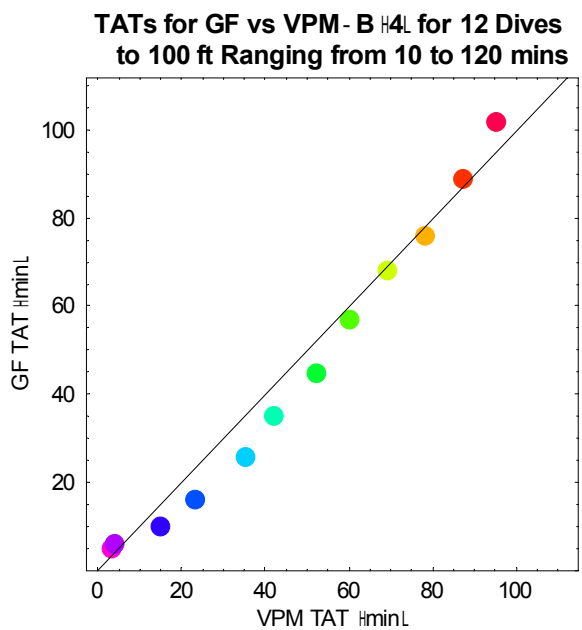


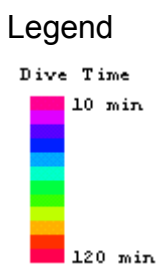
Correlation of GF and VPM-B(4) TATs for 100ft Dives on Nx 32%

Nx32+O_2 Deco



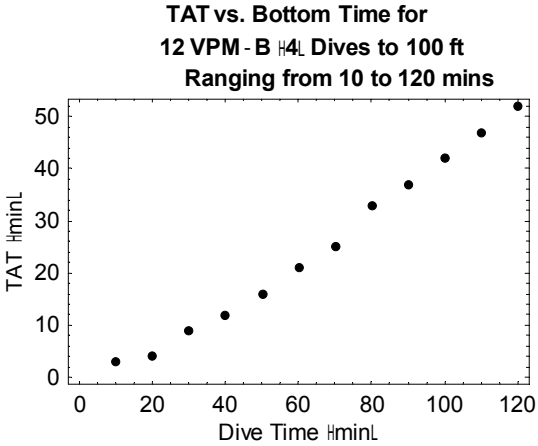
Nx 32 Deco

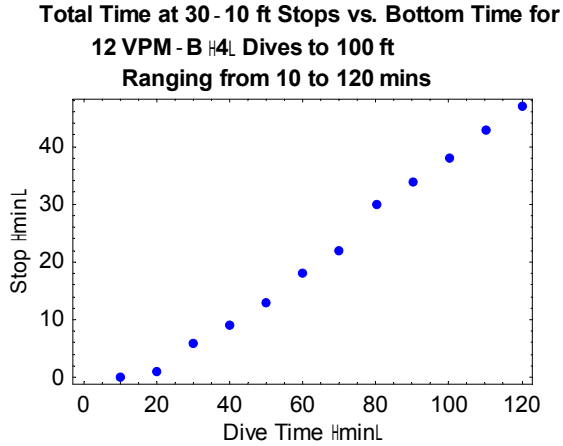


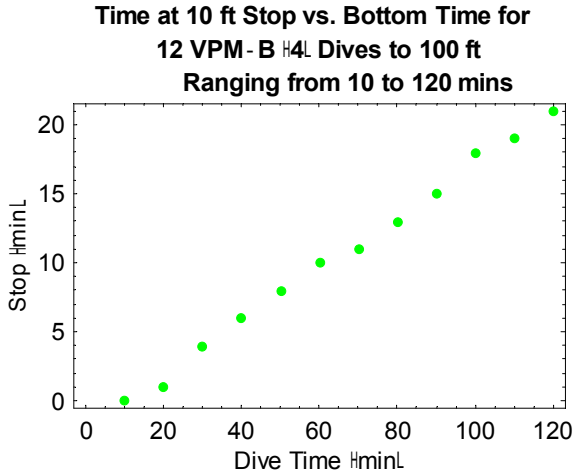


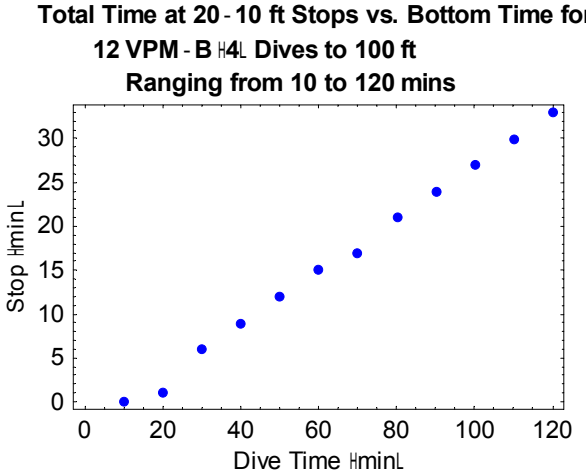
Stop Times vs. Bottom Times VPM-B Conservatism (4)

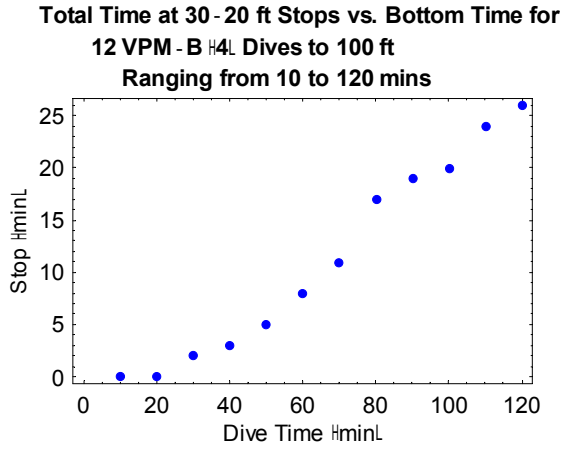
Nx32+O_2 Deco











Stop Times vs. Bottom Times VPM-B Conservatism (4)

Nx 32 Deco