

**All are not created equal:**  
operational variability in 49  
models of diving computer

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## *BACKGROUND*

- Dive Computers are permitted methods of decompression monitoring for some occupational diving sectors in some EU member states
- Sale of dive computers in all EU member states requires compliance with the relevant European Standard (CE mark)
- Use of dive computers for occupational diving in some EU member states requires compliance with the relevant European Standard (CE mark)

CE

**mares®**  
just add  
water

15 atm

battery CR 2430



stainless steel



# European Standard EN 13319:2000

*Diving accessories – Depth gauges and combined depth and time measuring devices – Functional and safety requirements, test methods*

Approved by CEN (European Committee for Standardisation) Jan 2000

# European Standard EN 13319:2000

*Depth gauges and combined depth and time measuring devices (doesn't mention "dive computers" in the text)*

*SCOPE: This standard is not applicable to any information displayed to the user besides **depth** and **time**.*

*SCOPE: Any information on **decompression obligations** displayed by equipment covered by this standard is explicitly excluded from its scope.*

UK “today”: 49 different models of downloadable diving computer marketed or remaining in mainstream use - 14 Manufacturers





# DIVE COMPUTERS:



# DIVE COMPUTERS:

## Size





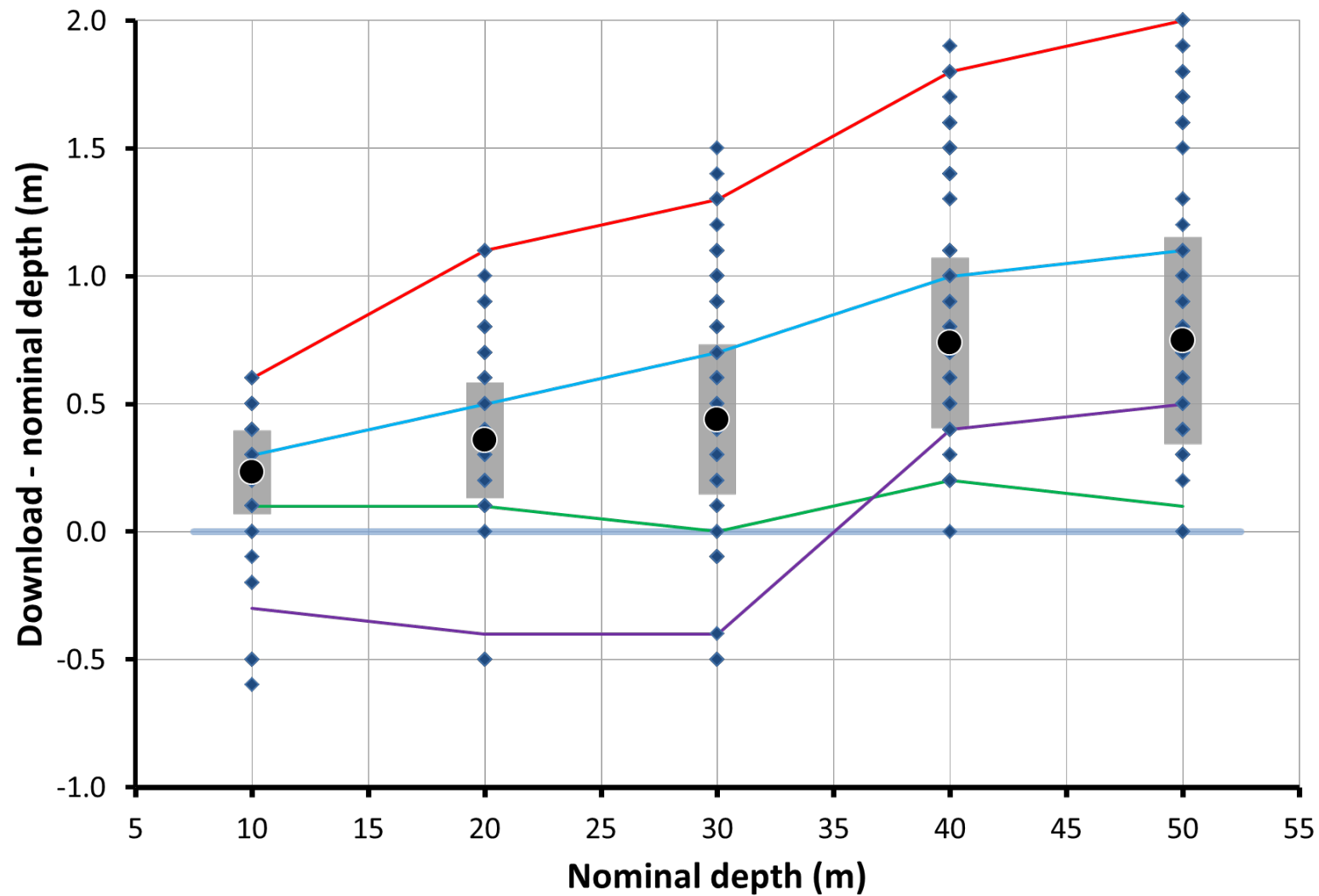
# DIVE COMPUTERS:



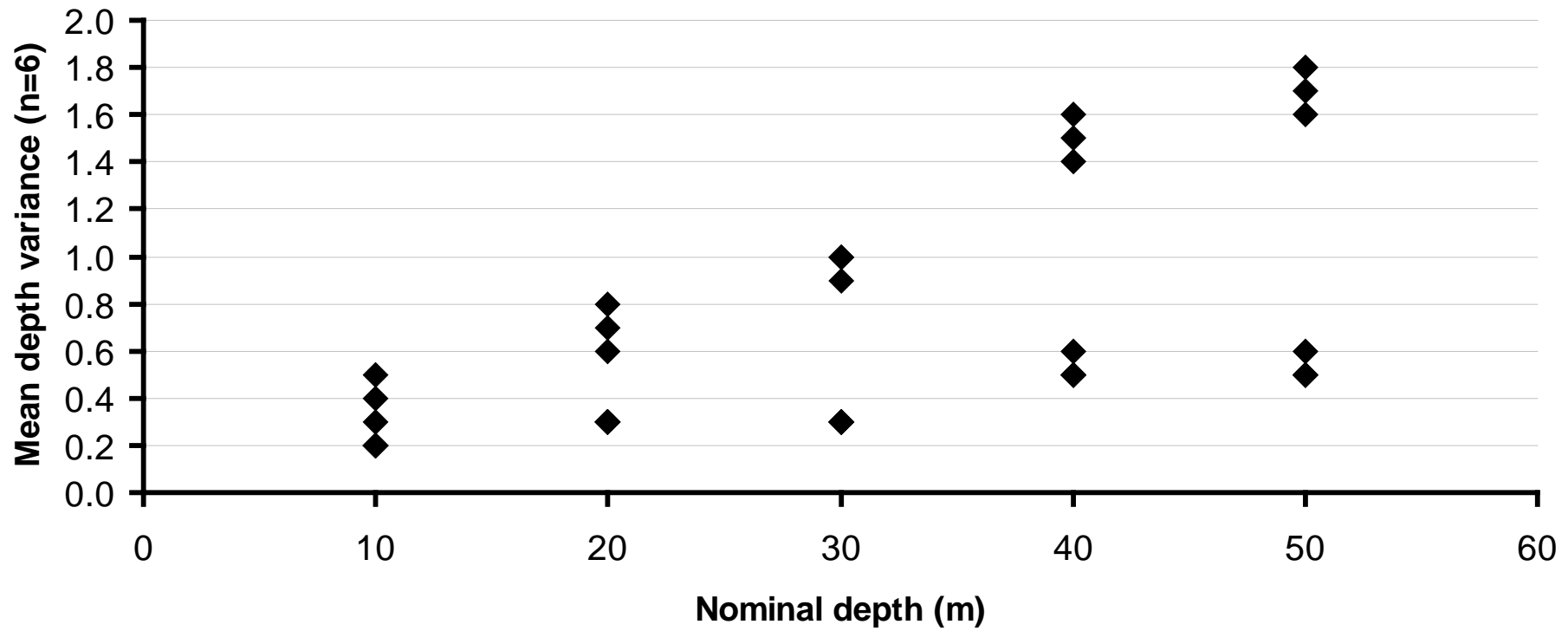
## Compromises for depth

- only measure pressure
- convert pressure to depth display assuming density standards (“salinity” not measured – may have FW/SW settings)
- EN 13319 assumes a water density of 1.0197 kg/l (27‰S)

# Depth records – pressure conversion

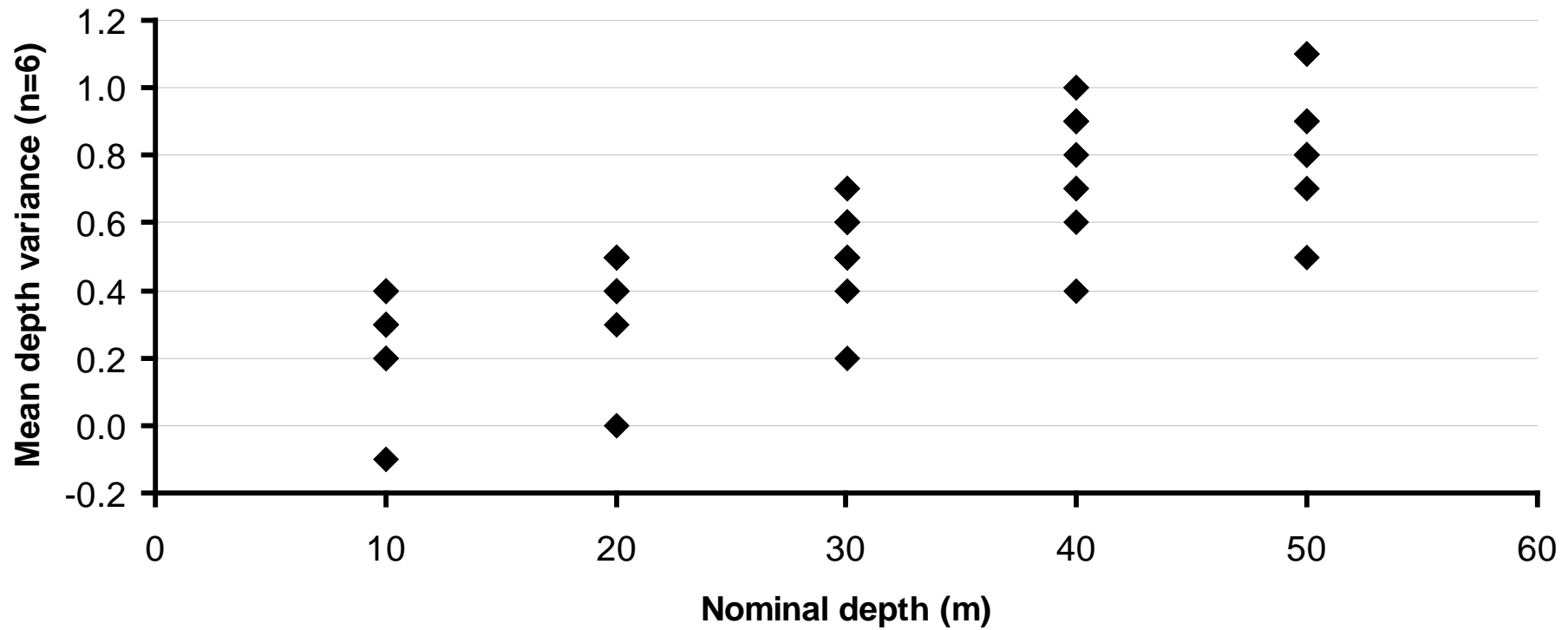


## UWATEC (n=8)





## SUUNTO (n=12)



# DIVE COMPUTERS:



## Compromises for temperature

- temperature not measured
- estimated from the pressure sensor temperature compensation (assumed)
- EN 13319 doesn't state that pressure sensors need to be temperature compensated
- EN 13319 doesn't deal with temperature display

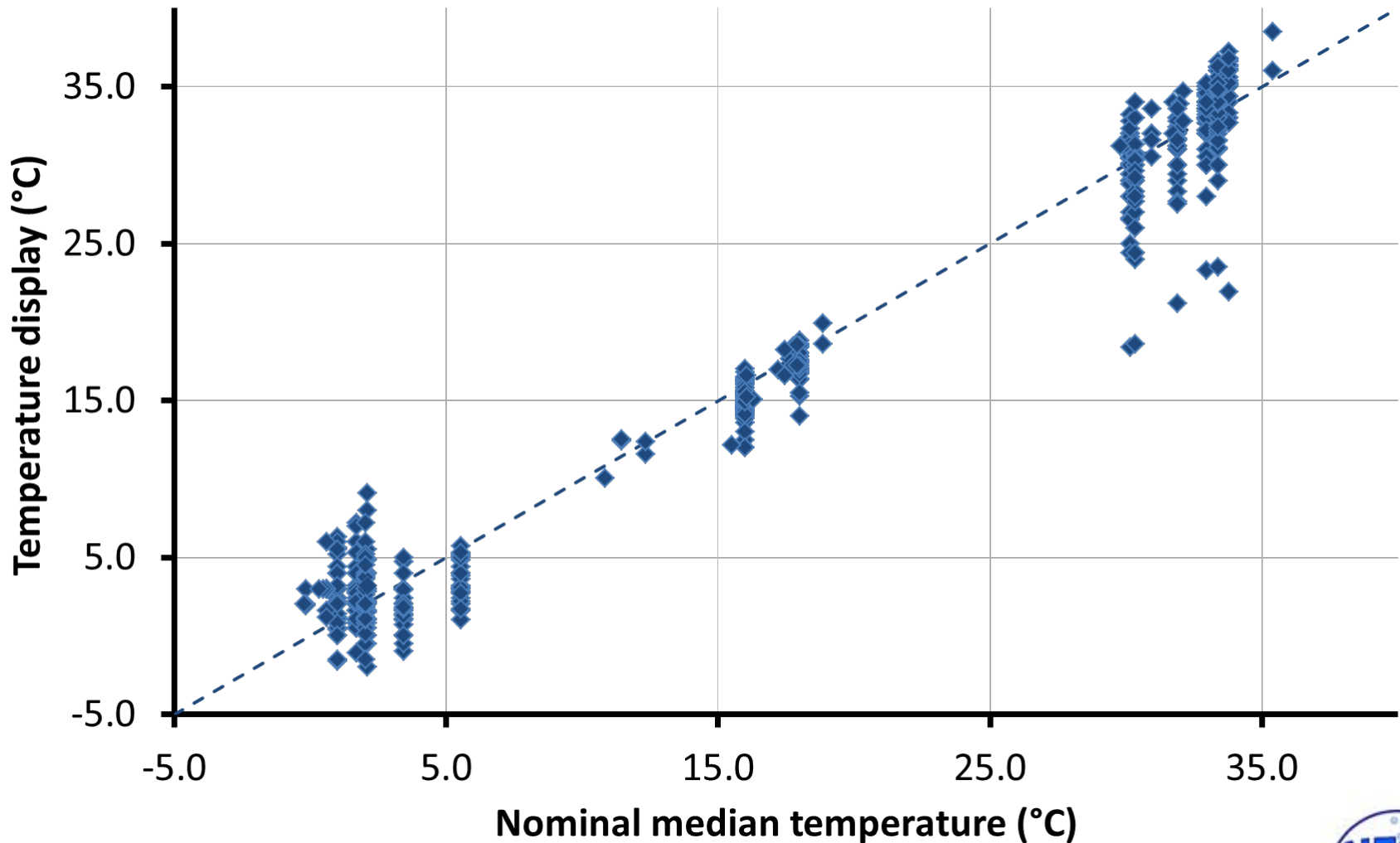
# Temperature

- Cold water (polar):  
-0.8 to 7°C
- Temperate (summer UK):  
14 to 19°C
- Warm water (tropical):  
25 to 33°C





# Computer temperature “display/record”



# No-stop decompression

## “No-stops”

The time a table or computer permits a diver to dive at a particular depth or profile whereby no decompression “stops” are required

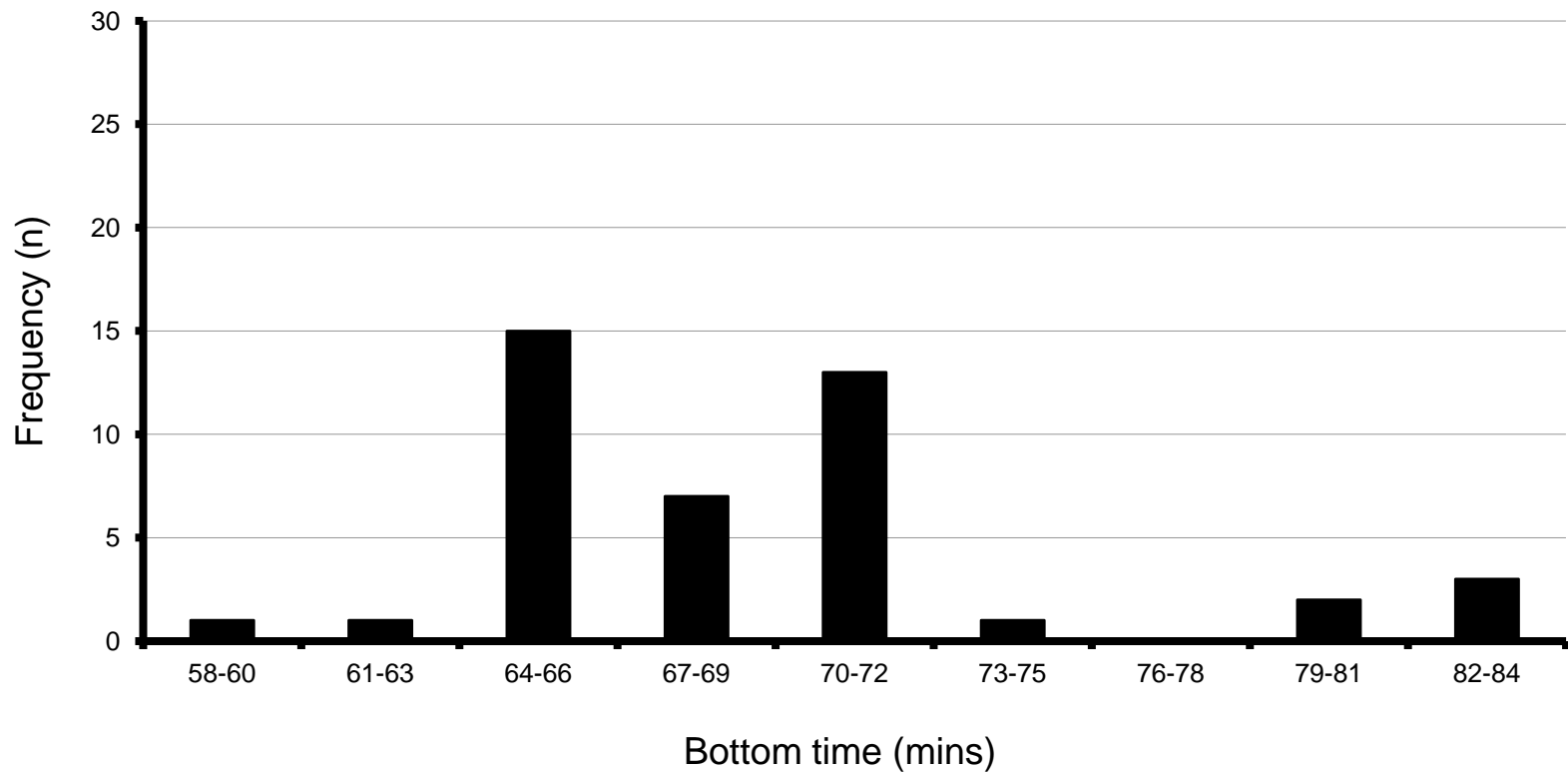
That is, the diver can come straight to the surface

Computers were compressed to a range of depths

Downloaded, and the no-stop value determined for each computer for every depth

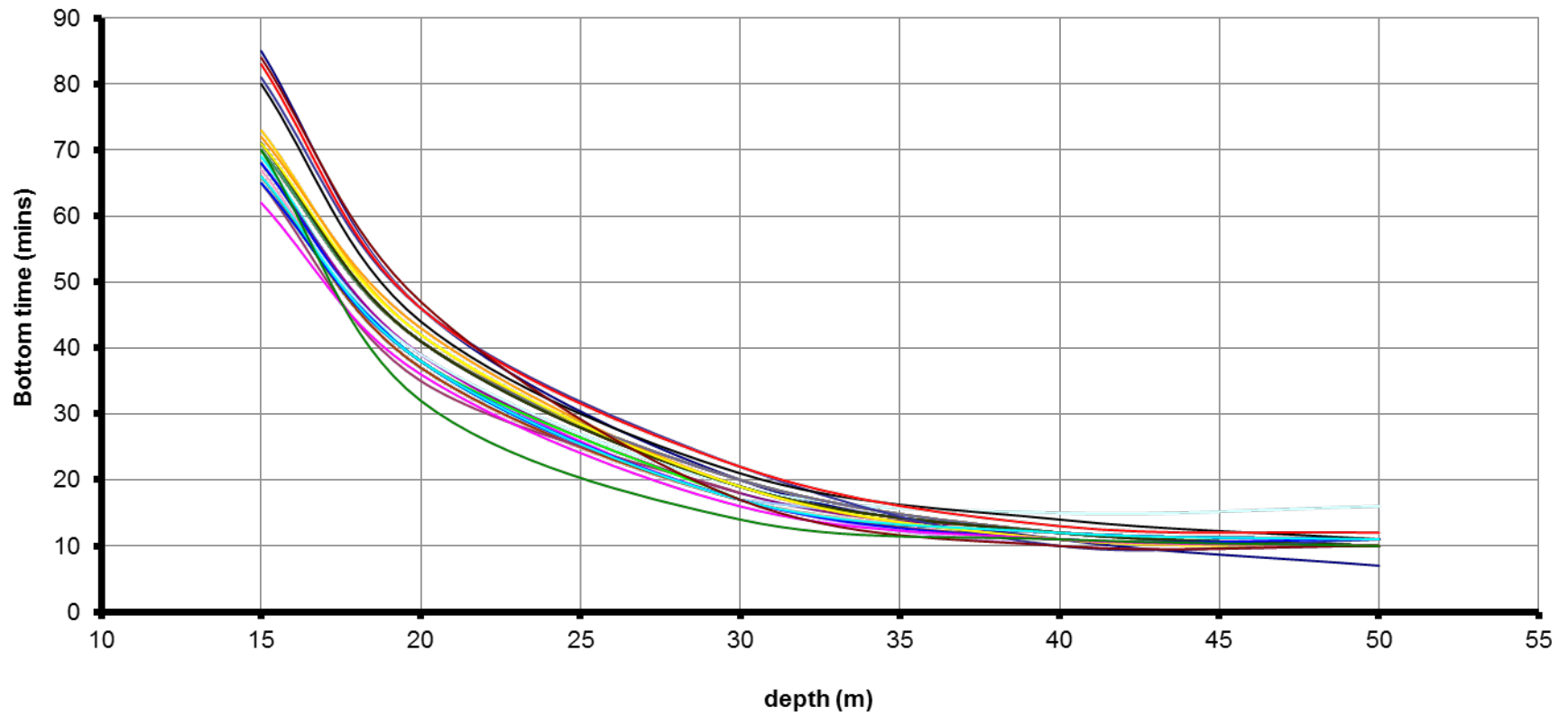


## No-stop limits - 15m

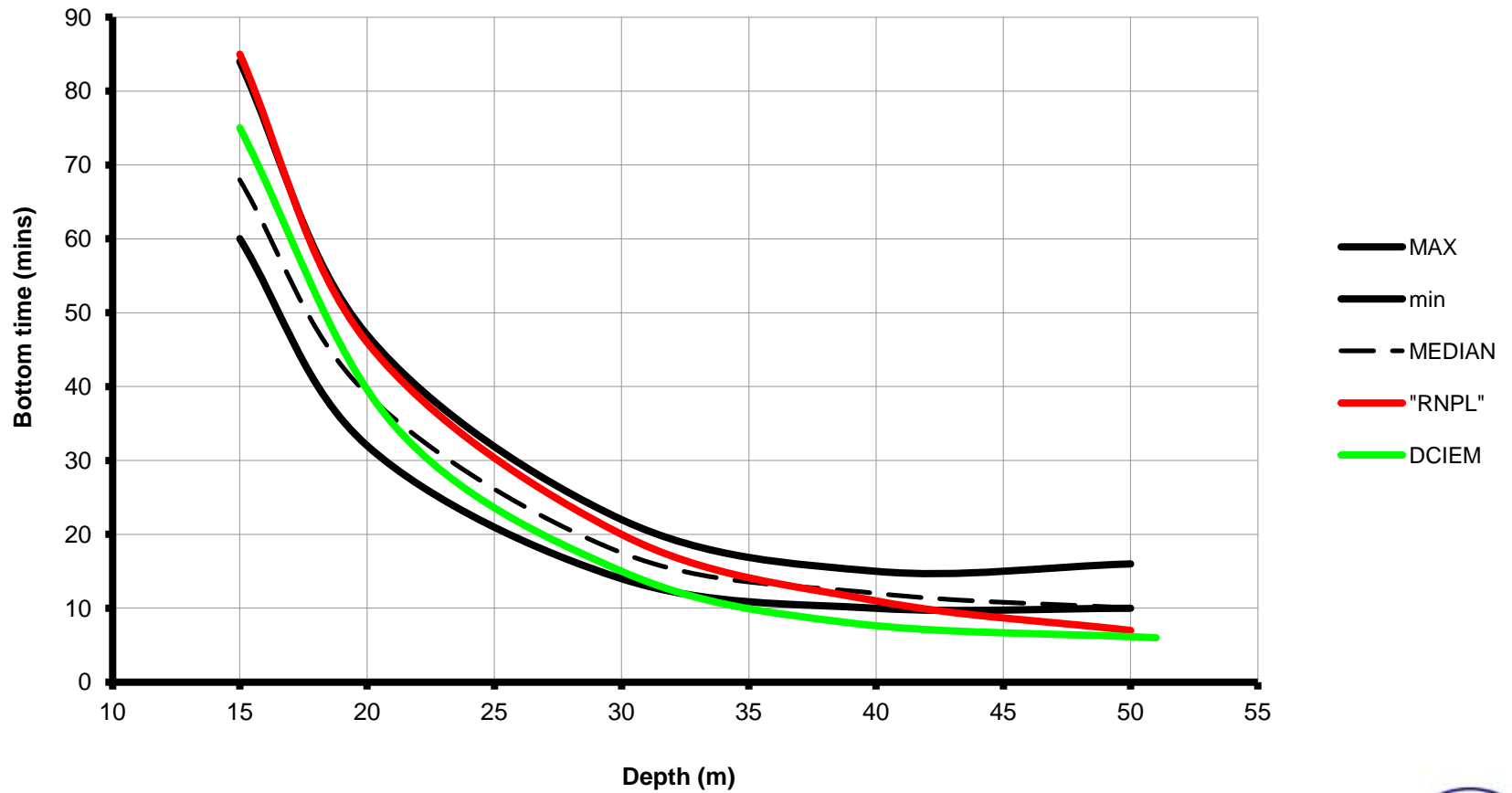




## No-stop times



## No-stop times



# Faults

	#	dive #	dive time (h)	1 per dives	1 per time/h
Battery replacements	41	2401	2008	58.6	49
Developed faults	8	2401	2008	300.1	251
Flood	1	2401	2008	2401	2008



# Conclusions:

- No CE Mark for decompression
- Decompression modelling employs pressure / time profiles (i.e. “depth” not used)
- “Depth” only an issue if:
  - using computer information for computing decompression using tables or
  - for forensic examinations / scientific measurement
- Nearly all depth estimates are “deep”
- Temperature measurement highly unreliable
- Always carry TWO computers?



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