

RISKS OF DECOMPRESSION SICKNESS (DCS) IN 125,091 AIR OR N₂/O₂ RECREATIONAL DIVES

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Background

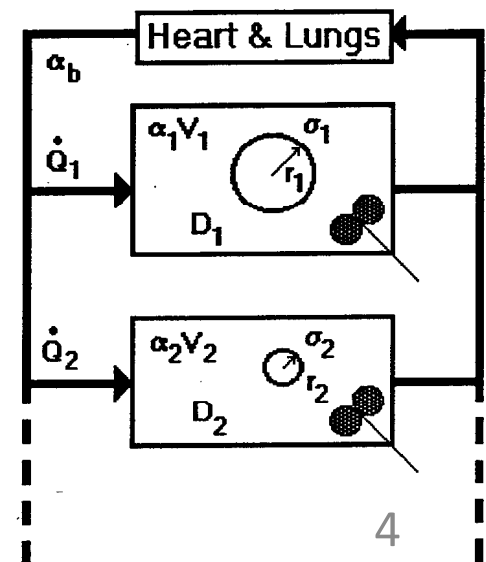
- ❖ Investigate DCS in recreational divers
- ❖ How is DCS incidence influenced by
 - Diving environment
 - Breathing gas
 - Depth-time profile
 - Diver characteristics

Methods

- ❖ IRB approved
- ❖ Volunteer divers provided
 - Demographic information
 - Depth-time profiles (checked for validity)
 - Dive outcome (-/+ report; if +, S/S)
 - Diving environment
- ❖ Operational DCS definition
 - Perceived Severity Index (PSI; Ozyigit. ASEM 2009;81:3-7)
 - Recompression

DiveStress

- ❖ Dive profiles varied widely in depth, time, repet dives, gas mix, and environment
- ❖ Hypothesis: dive profile affected DCS risk
- ❖ We computed $P(\text{DCS})$ according to Gerth's BVM(3) model (UHM 1997;24:275-92)
 - We called $P(\text{DCS})$ the *DiveStress*
 - Every dive had a unique *DiveStress* that accounted for differences between dive profiles



1995–2008 Results

- ❖ 125,091 dives (76.5% air)
 - 69 ± 29 fsw mean (\pm SD) max depth
 - 46 ± 15 min mean time
- ❖ 10,832 divers (71.2% male)
 - 17,605 dive series
 - Mean 14 dives per series
- ❖ 38 DCS incidents
 - Age, sex, BMI & experience were not associated with DCS

Perceived Severity Index (PSI)

- Ozyigit (2009)

<u>Percent</u>	<u>PSI</u>
37.1	3. Mild neurological (II)
31.4	4. Pain (I)
17.1	1. Serious neurological (II)
8.6	5. Skin/lymphatic (I)
5.7	6. Constitutional/non-specific (I)
0.0	2. Cardiopulmonary (II)

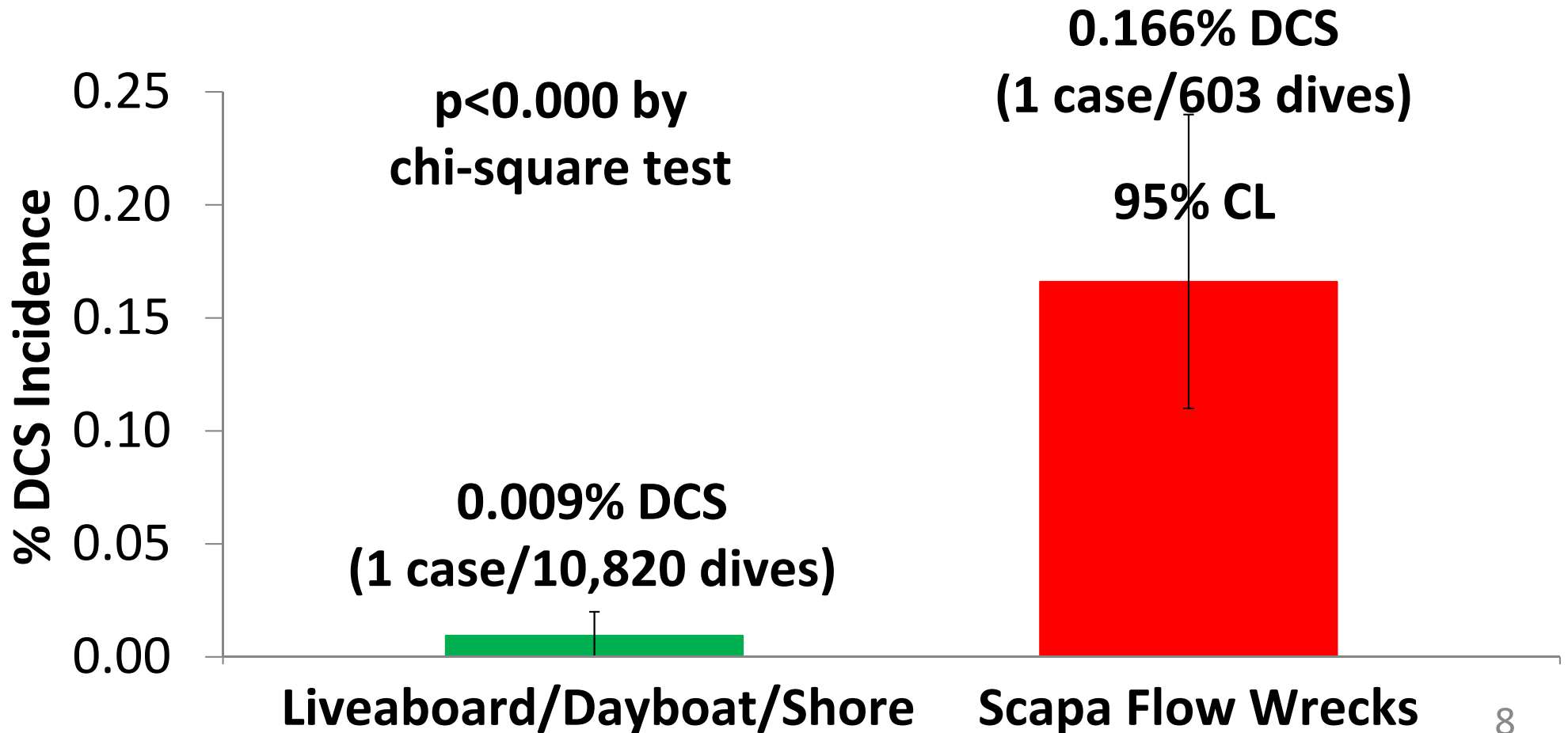
Breathing Gas: Air vs. N₂/O₂

	<u>Air</u>	<u>N₂/O₂</u>	<u>p-value</u>
Depth (fsw)	67	82	<0.0000
SD	28	32	(t-test)
% DCS	0.03	0.05	0.067
95% CI	0.02-0.04	0.05-0.09	(chi-square)

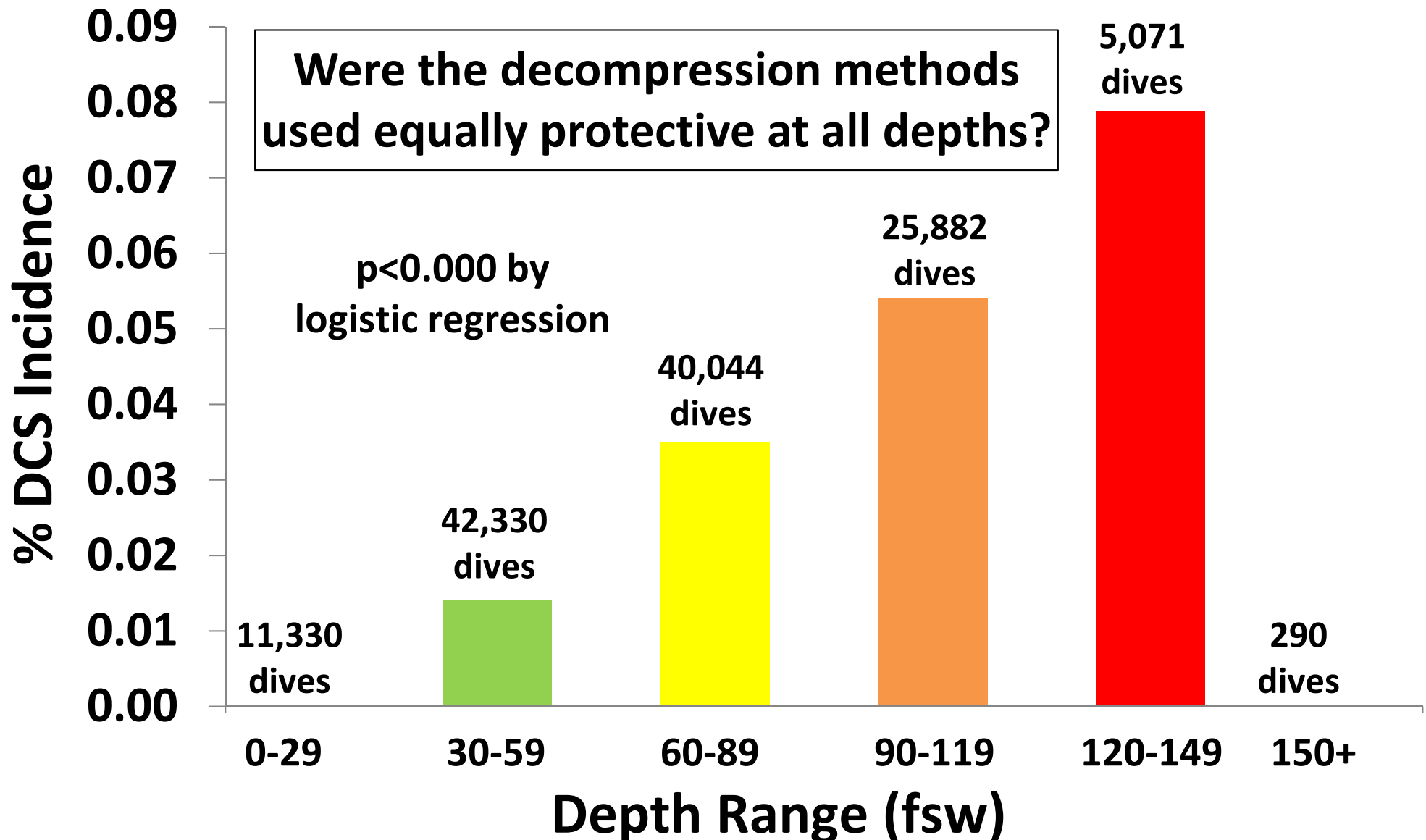
❖ N₂/O₂ seemed to be similar in DCS incidence to air although dived to greater depths

Diving Environment & %DCS

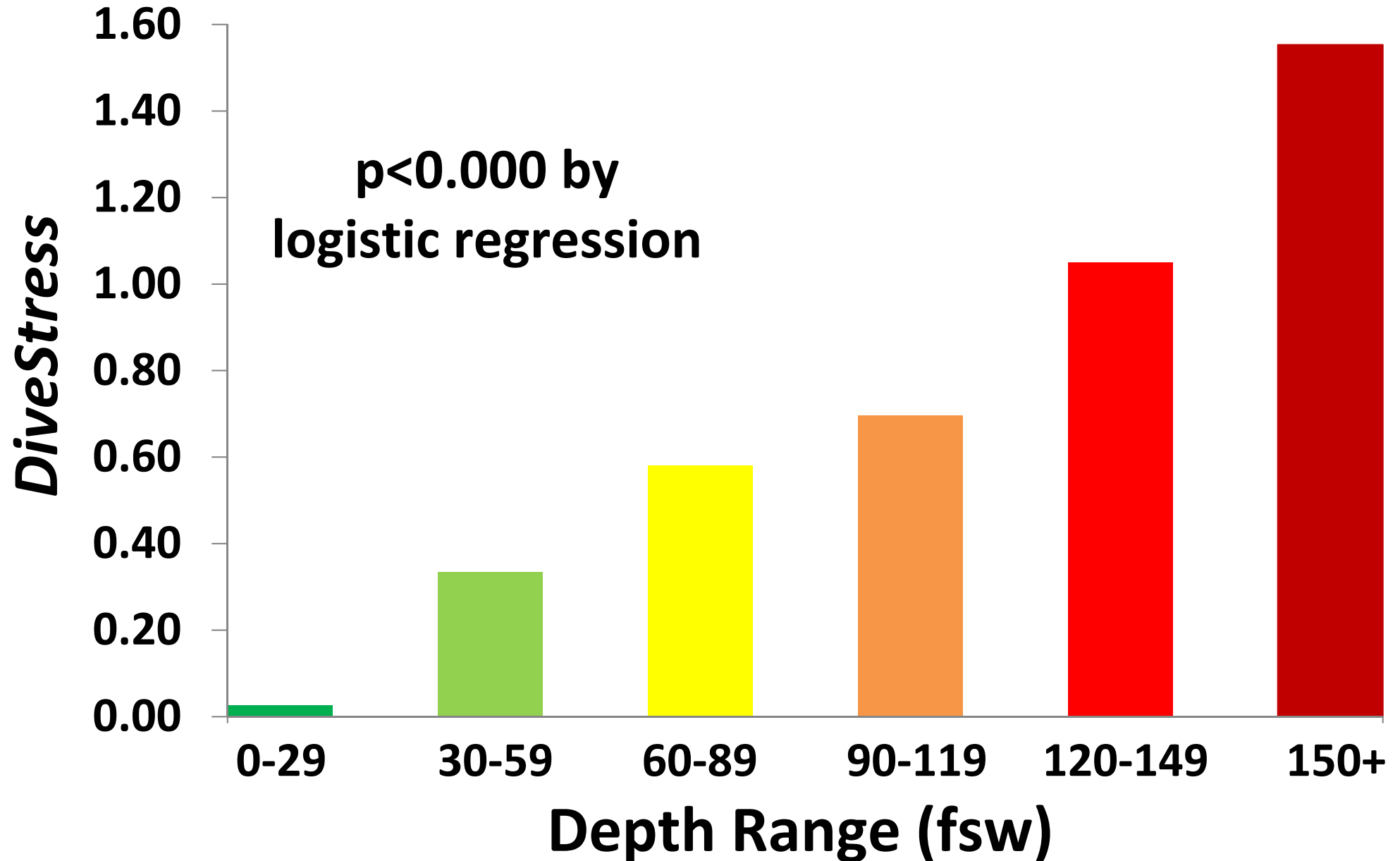
<u>Diving Environment</u>	<u># DCS</u>	<u># Dives</u>
Liveaboard, Dayboat, Shore	10	108,195
Scapa Flow Wrecks	28	16,887



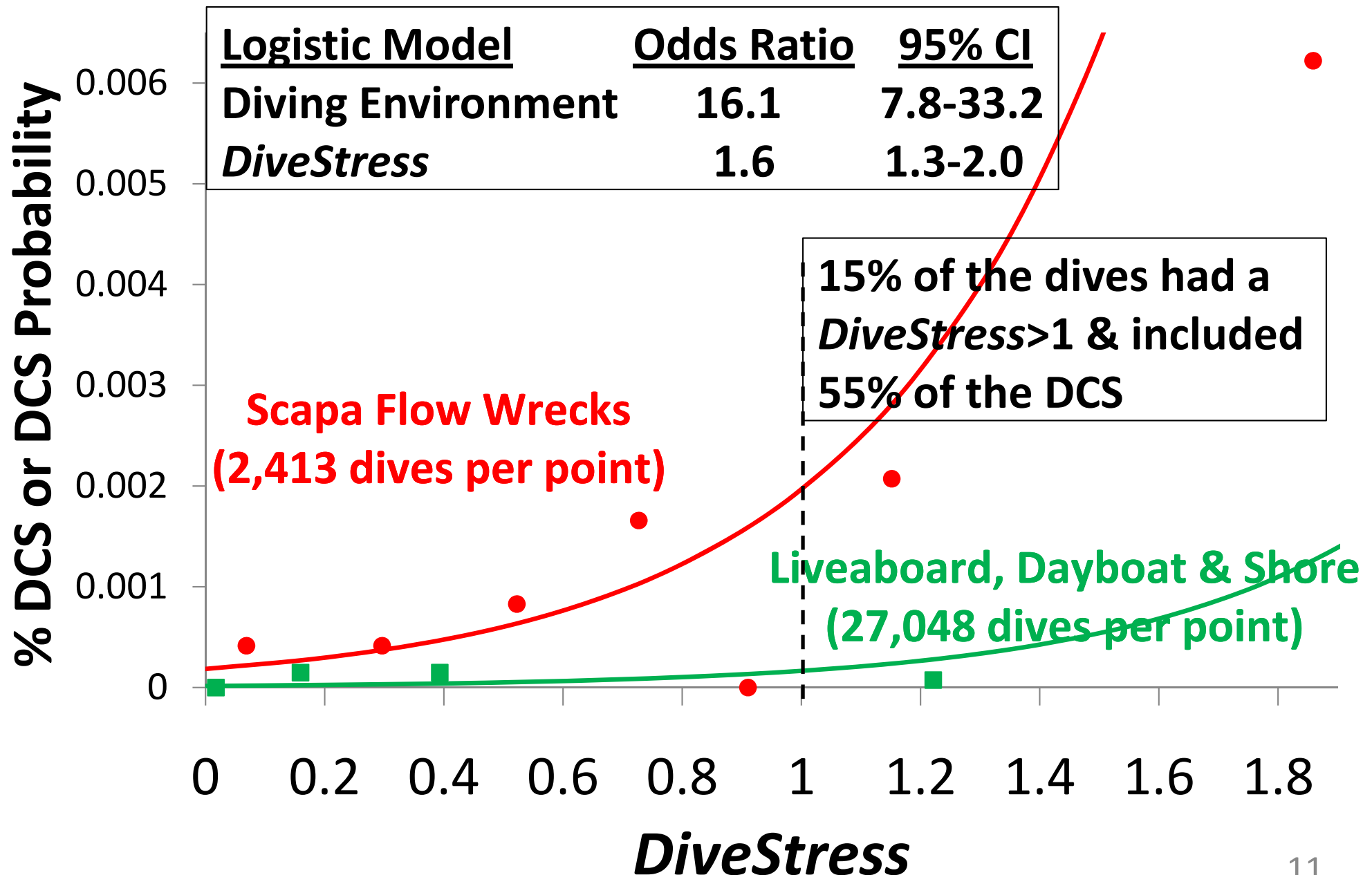
Depth & %DCS



DiveStress & Depth



P(DCS), Environment & *DiveStress*



Conclusions

- ❖ Deeper dives were possible with N₂/O₂ than with air at similar DCS incidences
- ❖ Diving environment may influence DCS risk
- ❖ Decompression methods used did not seem equally safe for all depths
- ❖ Probabilistic decompression models such as represented by *DiveStress* may improve DCS safety of dive computers

Further Work

❖ Additional data

- DAN America: 2009-2010
- DAN Europe: ~50,000 dive profiles

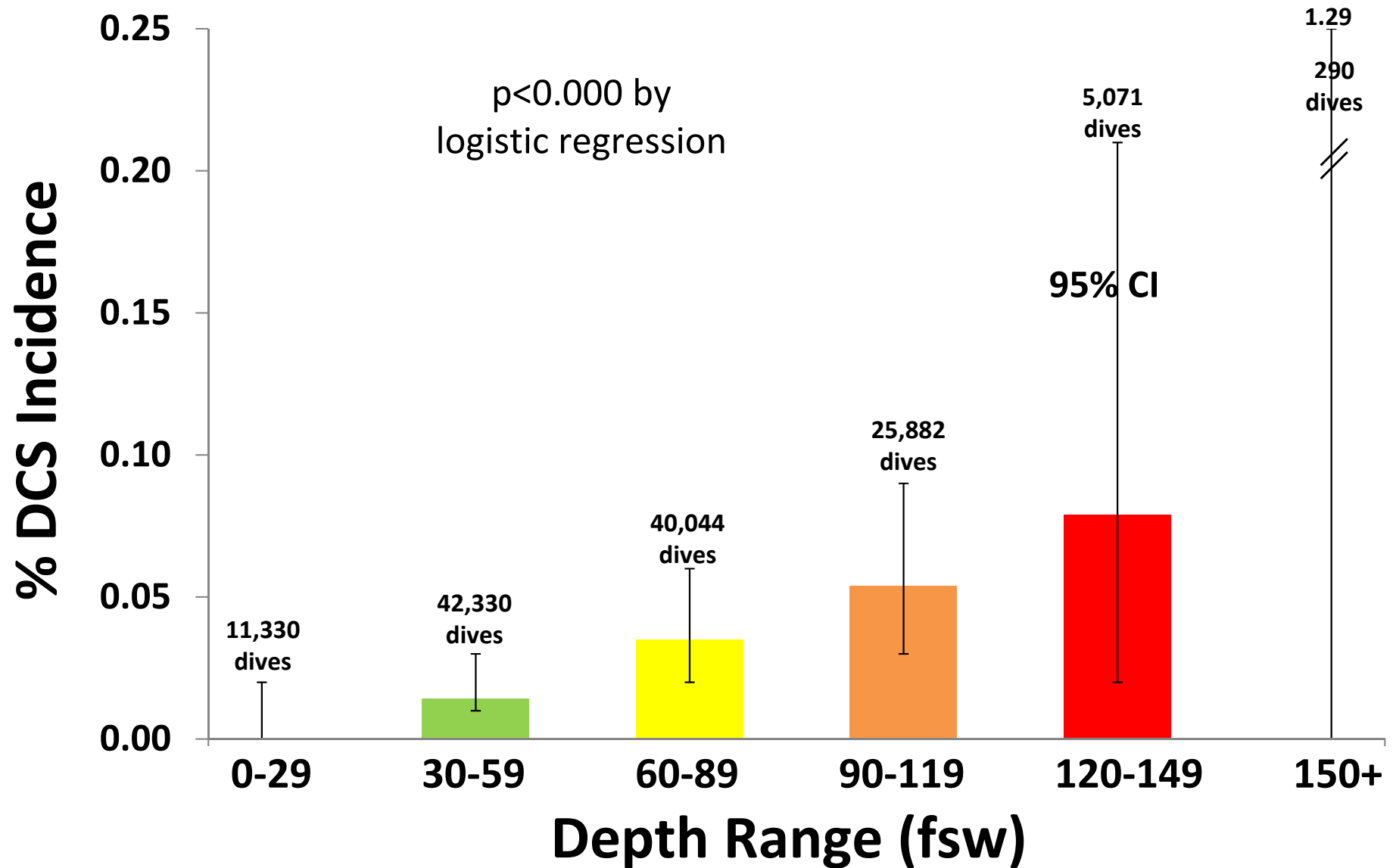
❖ Other probabilistic decompression models (robustness test)

- ✓ BVM(3)
- Exponential-Exponential (EE)
- Exponential-Linear (LE)
- Pharmacokinetic (Goldman 2007)

Limitations

- ❖ Clinical examination of DCS cases
- ❖ Loss of dive profiles
- ❖ Knowledge of diving environment

Depth & %DCS



Depth & *DiveStress*

