



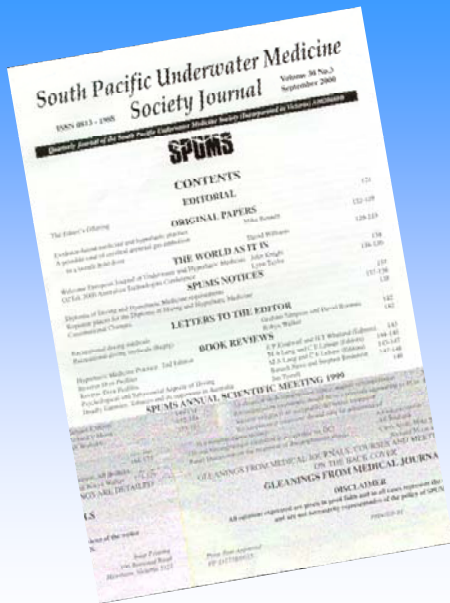
Diving Deaths *Downunder*

John Lippmann

Executive Director

Divers Alert Network Asia-Pacific



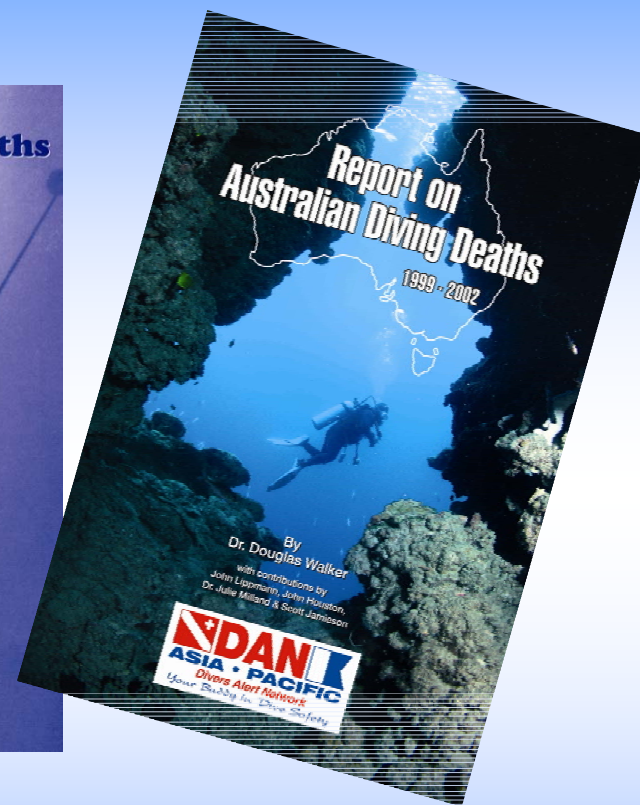
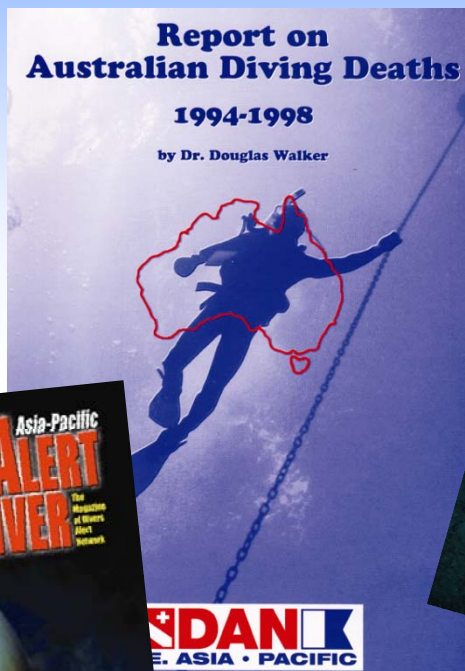


Project Stickybeak

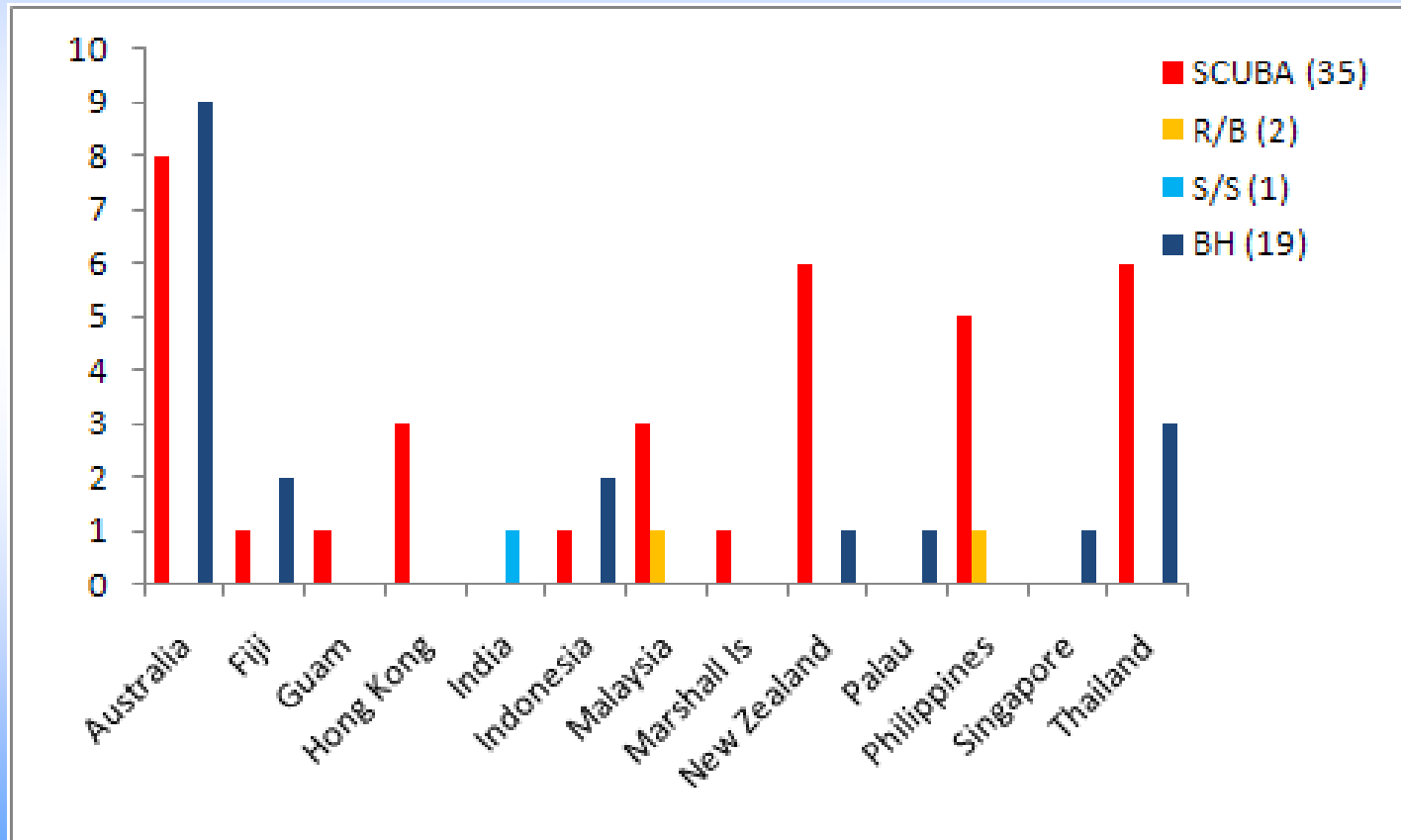


- Conducted by Dr Douglas Walker since 1968
- Solo and determined effort
- Incorporated in DAN AP Fatality Data Collection & reporting Project from 2003^{1, 2}

1. Walker D, Lippmann J, Lawrence C, Houston J, Fock A. Provisional report on diving-related fatalities in Australian waters 2004. *Diving and Hyperbaric Medicine*. 2009;39(3):138-61.
2. Walker D, Lippmann J. Provisional report on diving-related fatalities in Australian waters 2003. *Diving and Hyperbaric Medicine*. 2009;39:4-19.



Asia-Pacific Dive-related Deaths 2009 (Provisional)



Data Collection

- Good data from Australia
- Reasonable data from NZ & Singapore
- Poor data collection elsewhere in Region due to:
 - remoteness
 - cultural issues
 - attempts to hide accidents
(perceived threat to tourism?)

Data Collection

- Early information from witnesses
- Coroner's report
- Autopsy report
- Police report
- Witness statements

Autopsy

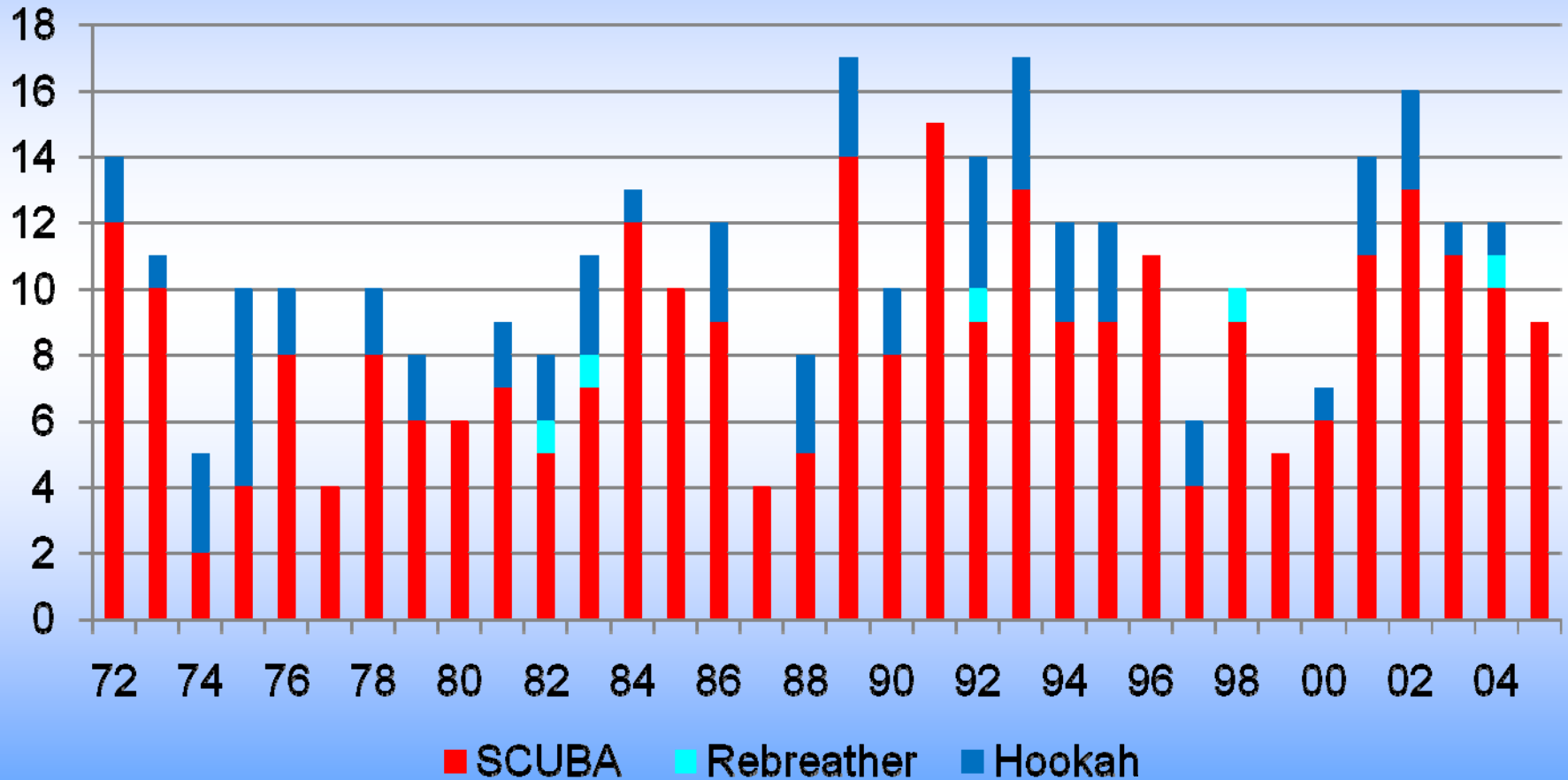
- In many places pathologists have no idea of diving autopsies
- In Australia, situation is improving, partly as a result of better dissemination of information to pathologists



Fact File – Autopsy and the investigation of scuba diving deaths. Surry Hills: The Royal College of Pathologists of Australasia; 2008.

Compressed Gas Deaths

1972 - 2005



Diving Activity

- **Certifications**

1988 – 50,550¹

1991 – 54,153²

2007 – 48,000³

- **Scuba dives conducted (Qld)**

1994 – 1.3 M⁴

2007 – 1.2 M⁵

1. Esguerra et al. Report on a study of the Aust diving industry. Lindfield:Diving Industry & Travel Assoc of Aust; 1989

2. Wilks J. Calculating diver numbers: Critical info for scuba safety & marketing programs. SPUMS J. 1993; 23:11-14

3. PADI, SSI, NAUI, SDI personal communications, 2008.

4. Windsor D. A study into the number of dives conducted on the GBR in 1994. SPUMS J. 1996; 26:72-4

5. Qld scuba diving & snorkelling report.- visitor characteristics. Qld Govt:2007 (internal report)

Average Fatalities per Year per Period 1972-2006

Years	All Modes (n = 566)	Scuba (n = 290)
1972-79	12.6	6.8
1980-89	12.8	7.9
1990-99	18.4	9.2
2000-06	23.0	9.1

- Scuba - slight trend but not significant ($p = 0.12$)

Lippmann J. Review of scuba diving fatalities and decompression illness in Australia. Diving and Hyper Med 2008; 38(2):71-78

Scuba Fatality Rate in Australia

- **Australian Residents:**

0.7 /100,000 dives (95% CI = 0.3, 1.5)

8.5 /100,000 divers (95% CI = 4.2, 17.5)

- **Overseas visitors:**

0.4 /100,000 dives (95% CI = 0.1, 1.2)

1.5 /100,000 divers (95% CI = 0.5, 4.3)

Lippmann J. Review of scuba diving fatalities and decompression illness in Australia. Diving and Hyper Med 2008; 38(2):71-78

Lippmann J. Australian scuba diving fatalities and decompression sickness. Erratum and further analysis. Diving and Hyper Med 2009;39(1):48

Global Risk Estimates for Scuba Deaths

Group	Deaths / 100,000 dives	95% CI	Deaths / 100,000 divers or visitors	95% CI
Australian residents	0.7	0.3, 1.5	8.5	4.2, 17.5
Australian visitors	0.4	0.1, 1.2	1.5	0.5, 4.3
DAN A members	-	-	11-18	-
UK divers	0.8	0.5, 1.3	-	-
Okinawa	1.3	0.3, 7.2	-	-
Stoney Cove visitors	-	-	2.9	1.4, 6.0

Sequential Analysis

- Trigger
- Disabling Agent
- Disabling Injury
- Cause of Death

Denoble PJ et al. Common causes of open-circuit recreational diving fatalities. UHM 2008. 35(6):393-406.

Sequential Analysis

- **Trigger**

Earliest identifiable event that appeared to precipitate an emergency

Sequential Analysis

- **Disabling agent**

Hazardous behaviour /circumstance associated with the trigger, perhaps causing the Event

Sequential Analysis

- **Disabling injury**

Directly responsible for death or incapacitation leading to death by drowning

Sequential Analysis

- **Cause of Death**

As specified by medical examiner.
Might be same as Disabling Injury (DI)
or might be drowning secondary to DI

Sequential Analysis

- **DI often provides a clearer picture than COD**

Sequential Analysis

Ex. Diver runs out of air, makes an emergency ascent to the surface, suffers a CAGE, becomes unconscious and subsequently drowns ...

- **Trigger** – Gas supply-related
- **Disabling agent** – Ascent-related
- **Disabling Injury** – GAGE
- **COD** – Drowning

Analysis of Australian Scuba Deaths 1972 – 2005

- 315 cases
 - 257 x Scuba (inc. 5 rebreather)
 - 58 x SSBA

Trigger

EQUIPMENT-RELATED

- BCD (e.g. sticky inflator)
- Hose entanglement
- Broken fin/mask strap
- Dry suit blow-up
- Weight belt detachment
- Tank slippage

Trigger

GAS SUPPLY-RELATED

- Out of gas
- Inappropriate gas
- Gas contamination
- Gas supply interruption

Trigger

ROUGH WATER

- Surface conditions
- Current
- Surge
- Suction

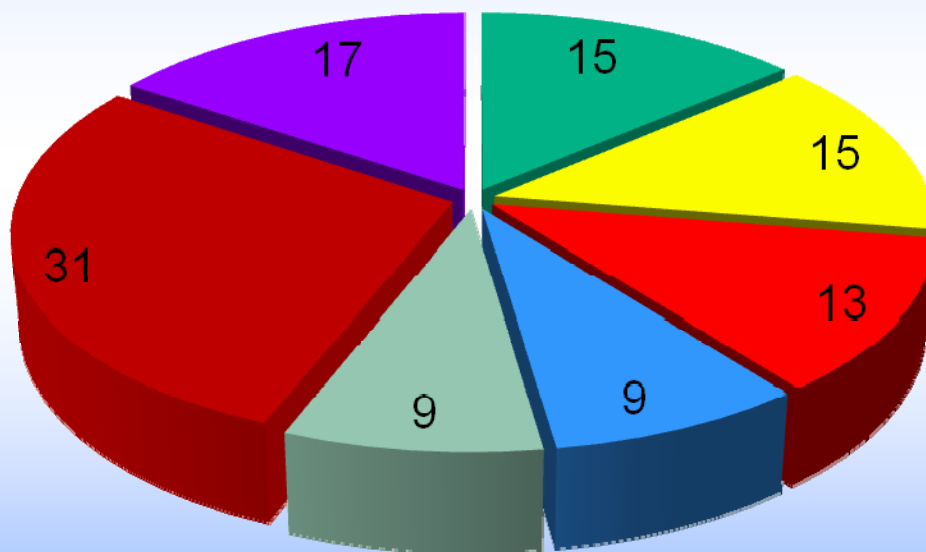
Trigger

OTHER

- Hit by boat
- Silting
- Spearfishing / fish collecting
- Vomiting
- Water in snorkel
- Suicidal intentions

Trigger

(n = 351) (%)



- Equipment-related
- Gas supply-related
- Rough water
- Anxiety / Stress
- Exertion
- Other
- Unknown

Disabling Agent

GAS SUPPLY-RELATED

- Out of gas
- Inappropriate gas
- Gas contamination
- Gas supply interruption

Disabling Agent

CARDIOVASCULAR DISEASE

- Older recruits to diving
- Ageing divers
- Unfit divers

Disabling Agent

ASCENT RELATED

- Rapid ascent
- Breath-holding on ascent
- Gas-sharing on ascent

Disabling Agent

BUOYANCY RELATED

- Lack / loss of buoyancy on surface
- Inadequate buoyancy control underwater (negative or positive)

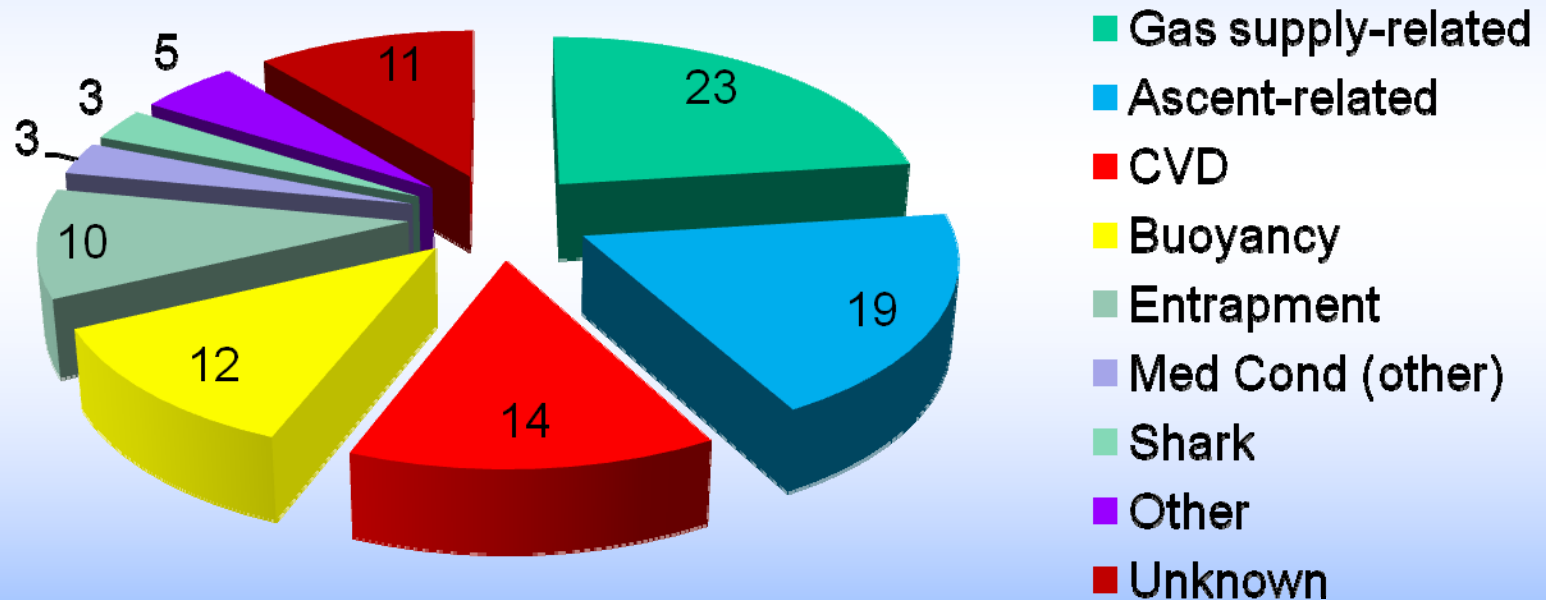
Disabling Agent

OTHER

- Blow to head
- Boat propeller
- Vomiting underwater
- Hypothermia
- Crocodile attack
- Inadequate decompression
- Laryngospasm
- Narcosis / CO₂

Disabling Agent

(n = 351) (%)



Disabling Injury

- Asphyxia
- CAGE / PBT
- Cardiac
- Trauma
- DCS

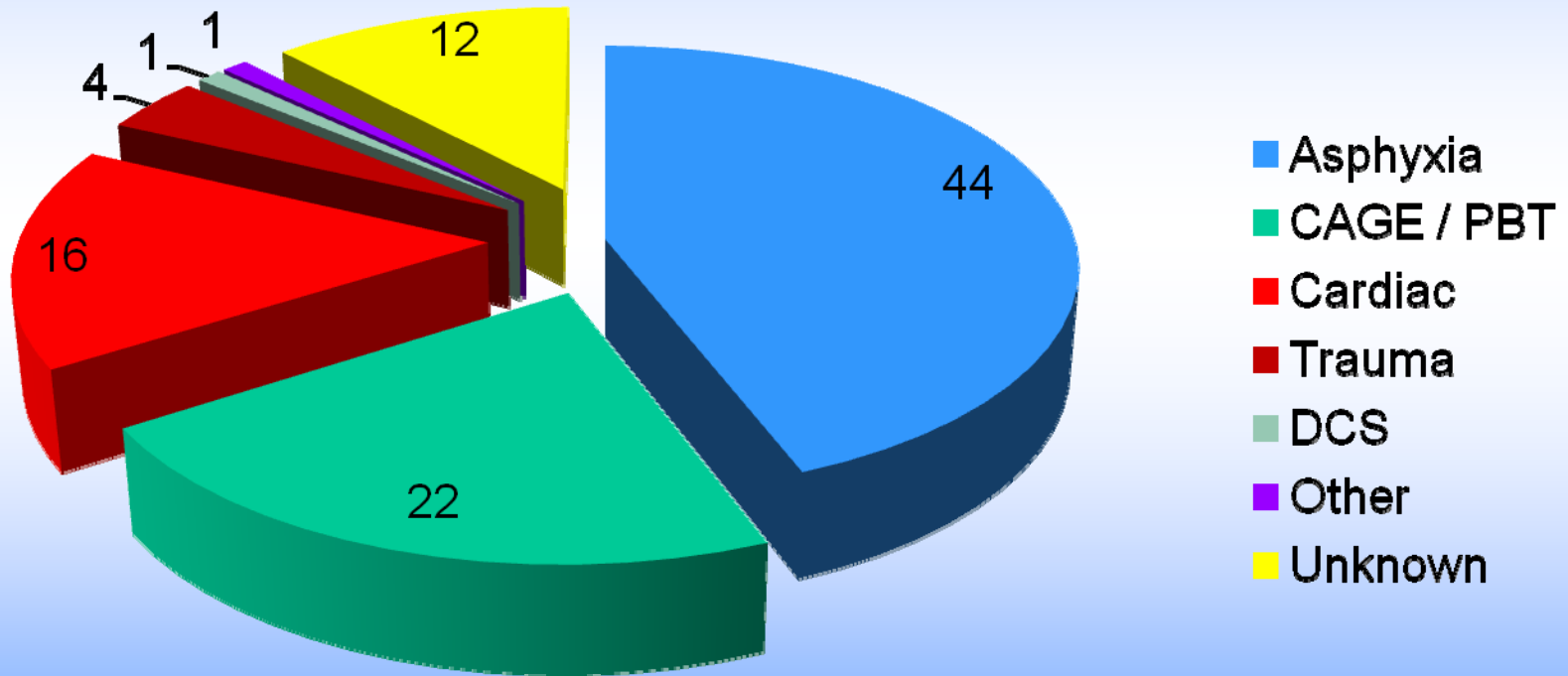
Disabling Injury

OTHER

- Stroke
- Gastrointestinal haemorrhage
- Head injury

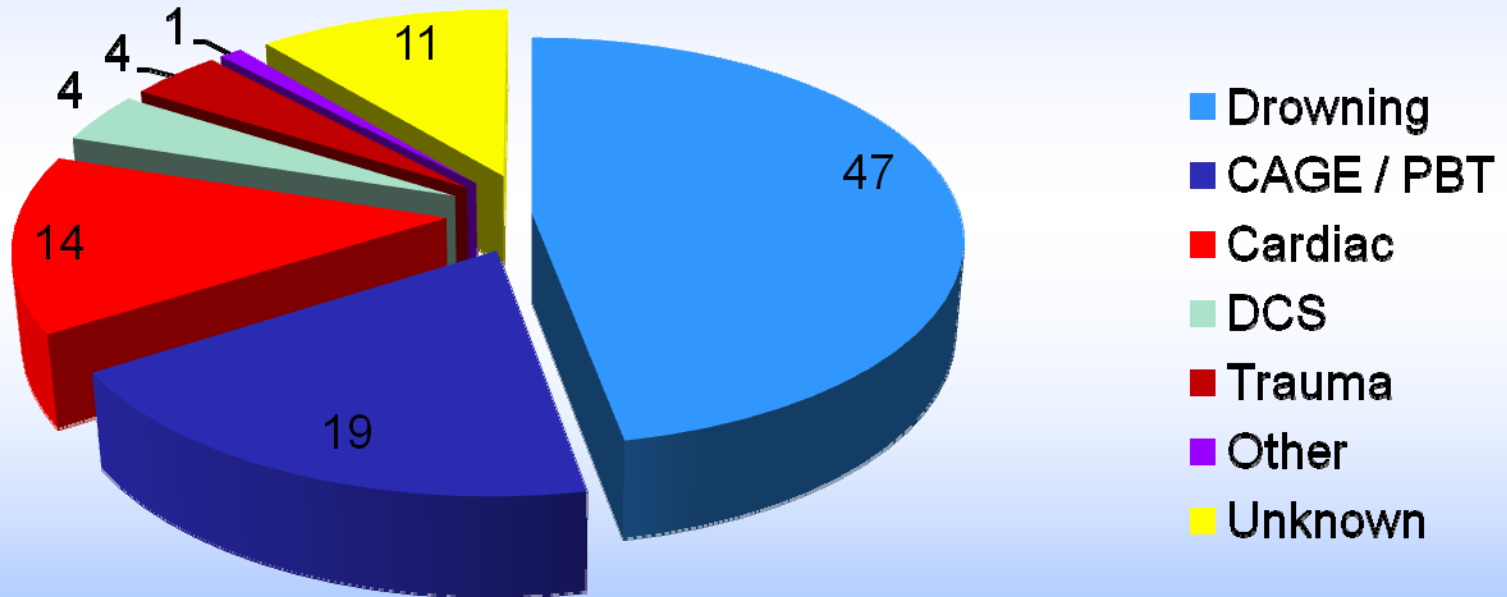
Disabling Injury

(n = 351) (%)

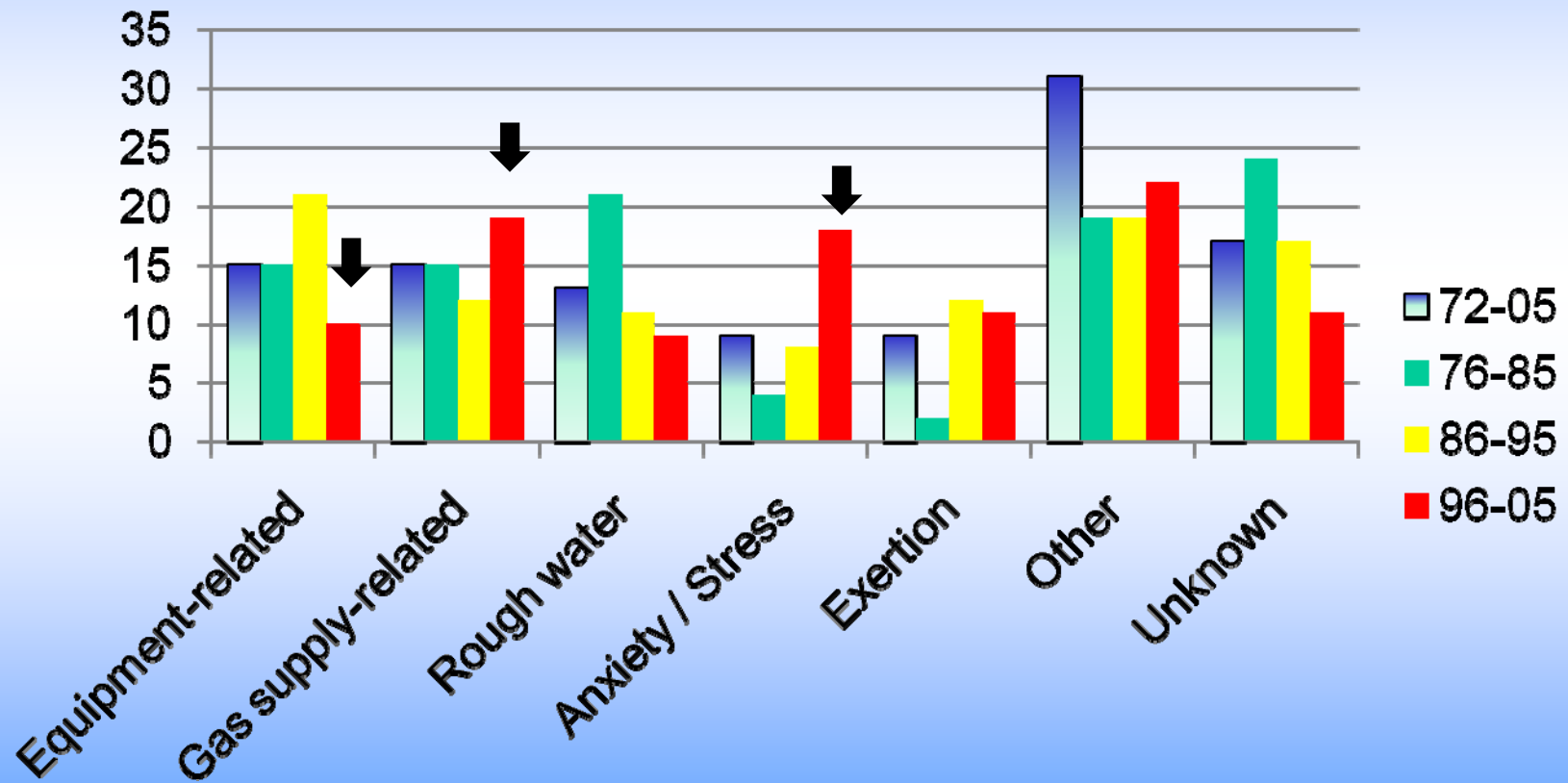


Cause of Death

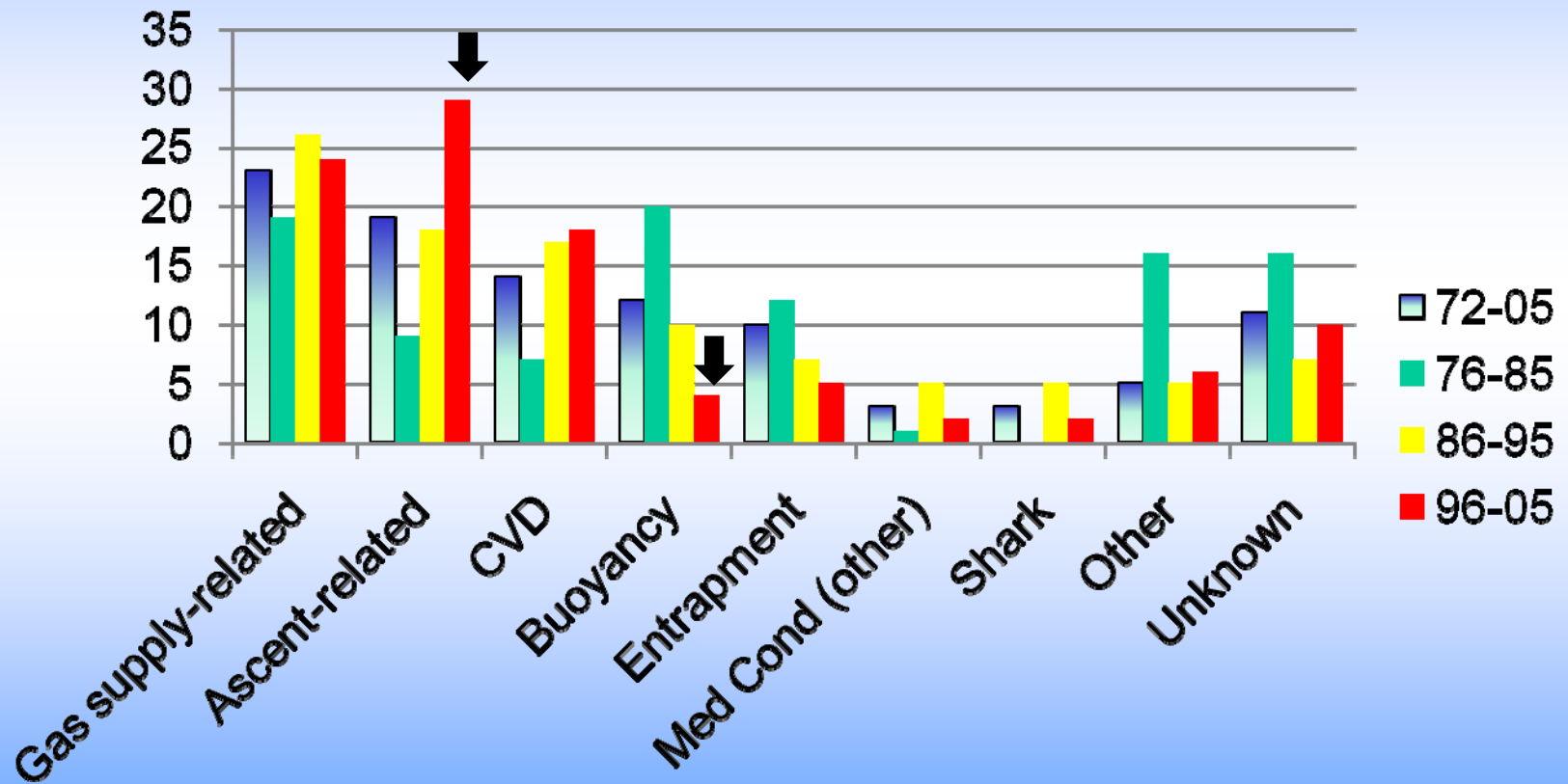
(n = 351) (%)



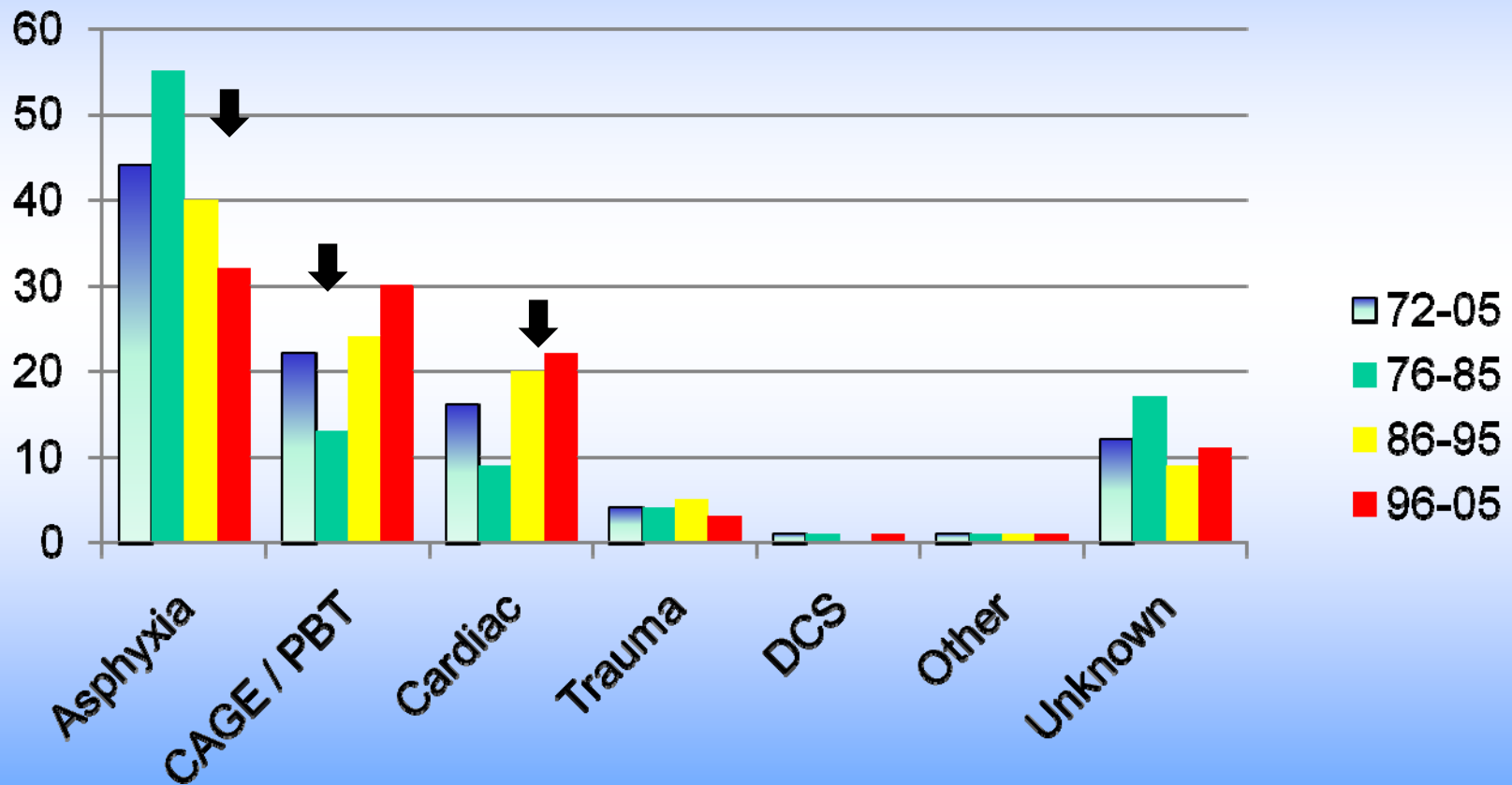
Trigger



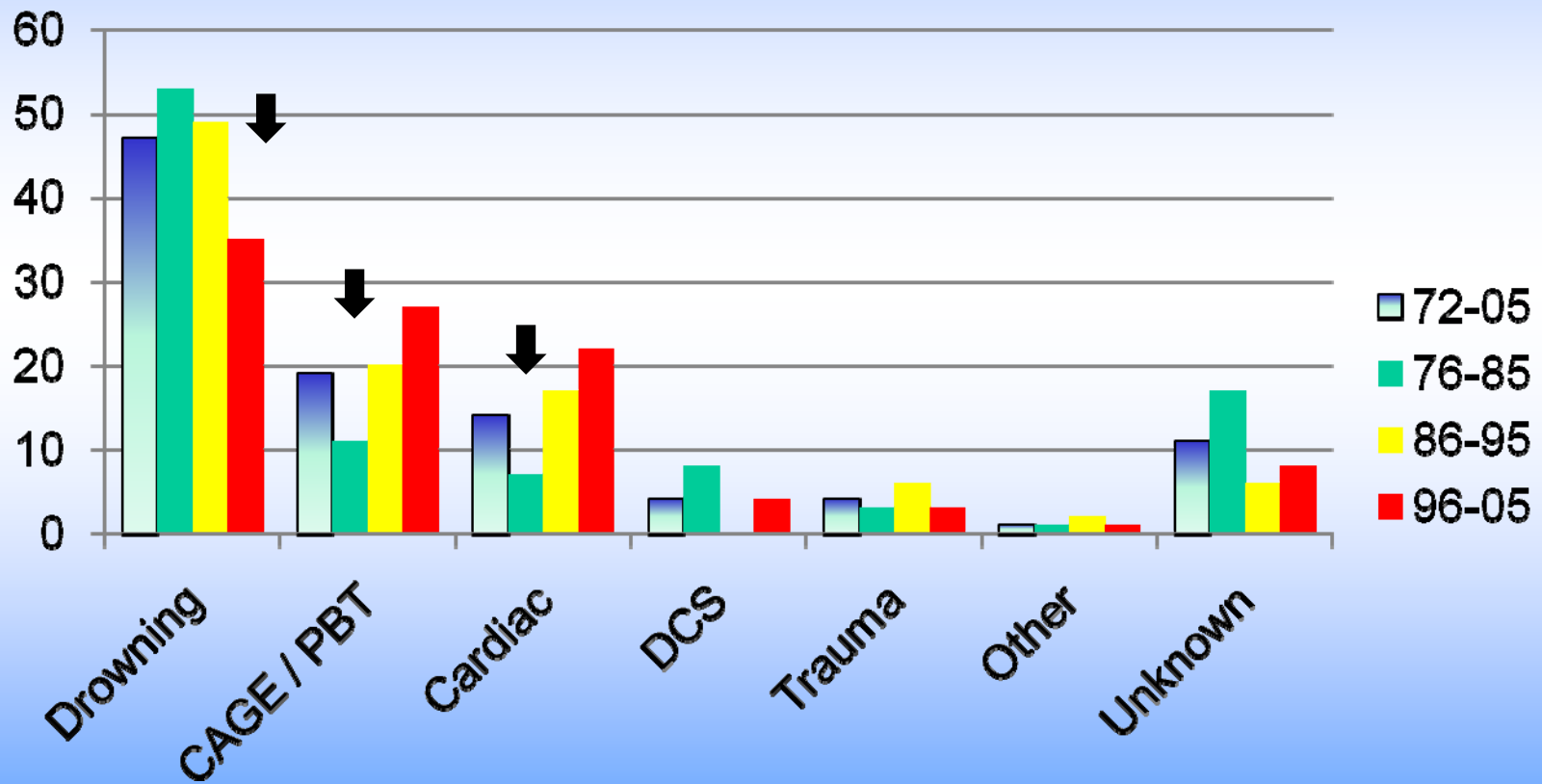
Disabling Agent



Disabling Injury



Cause of Death



Cause of Death (Cardiac)

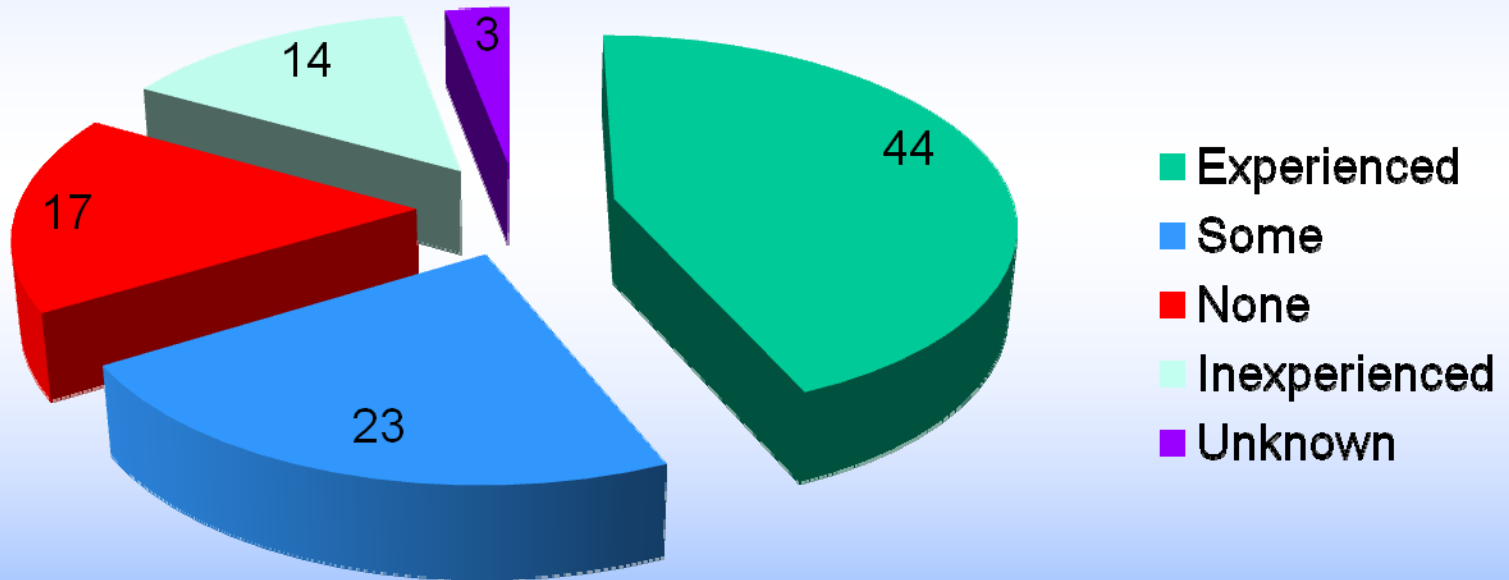
(2003-2005; compressed gas divers, n = 32)

- 2003 – 4/9 (44%)
- 2004 – 4/13 (31%)
- 2005 – 2/10 (20%)

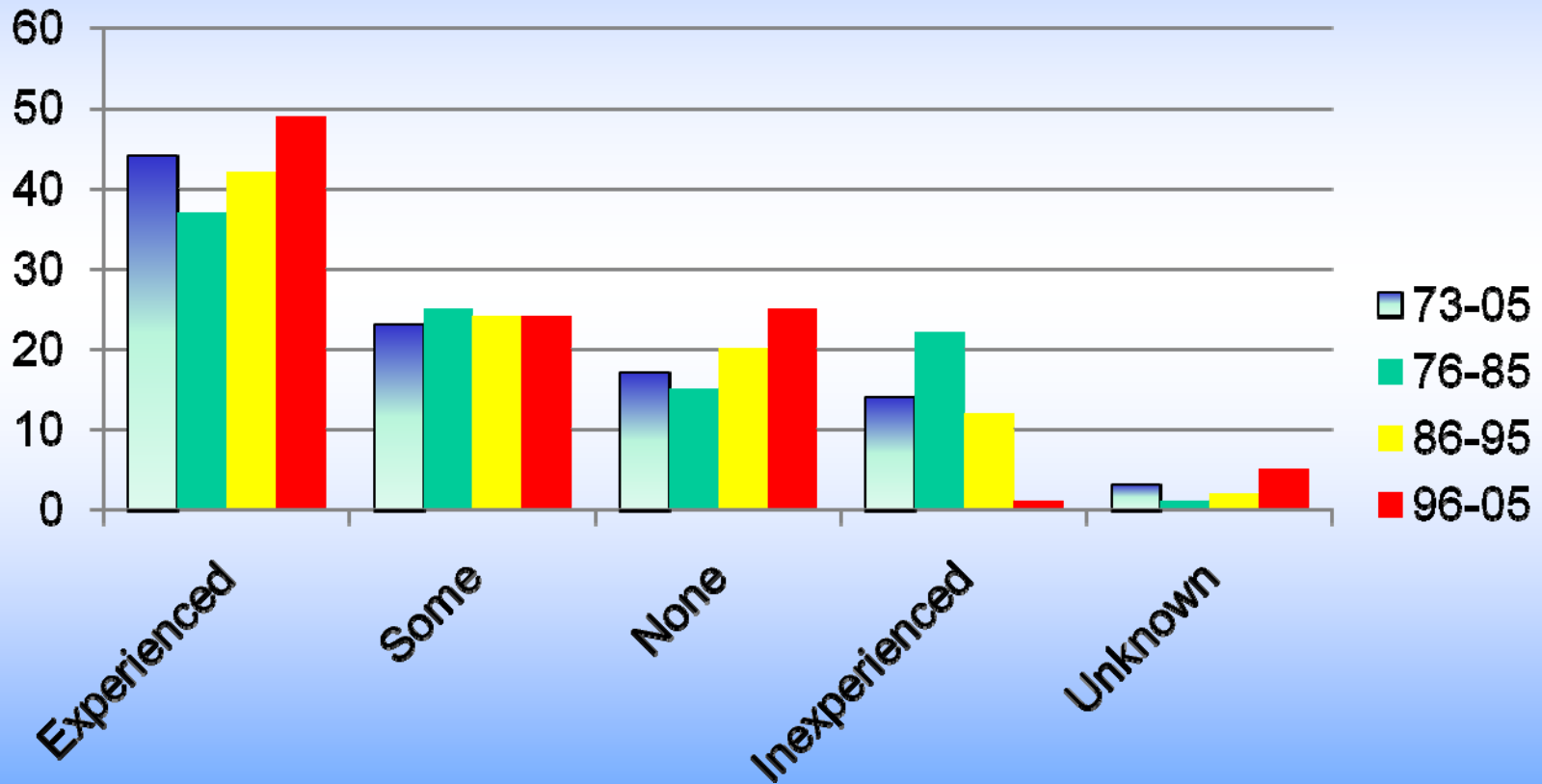
= 32% *cardiac-related*

Experience

(n = 351)

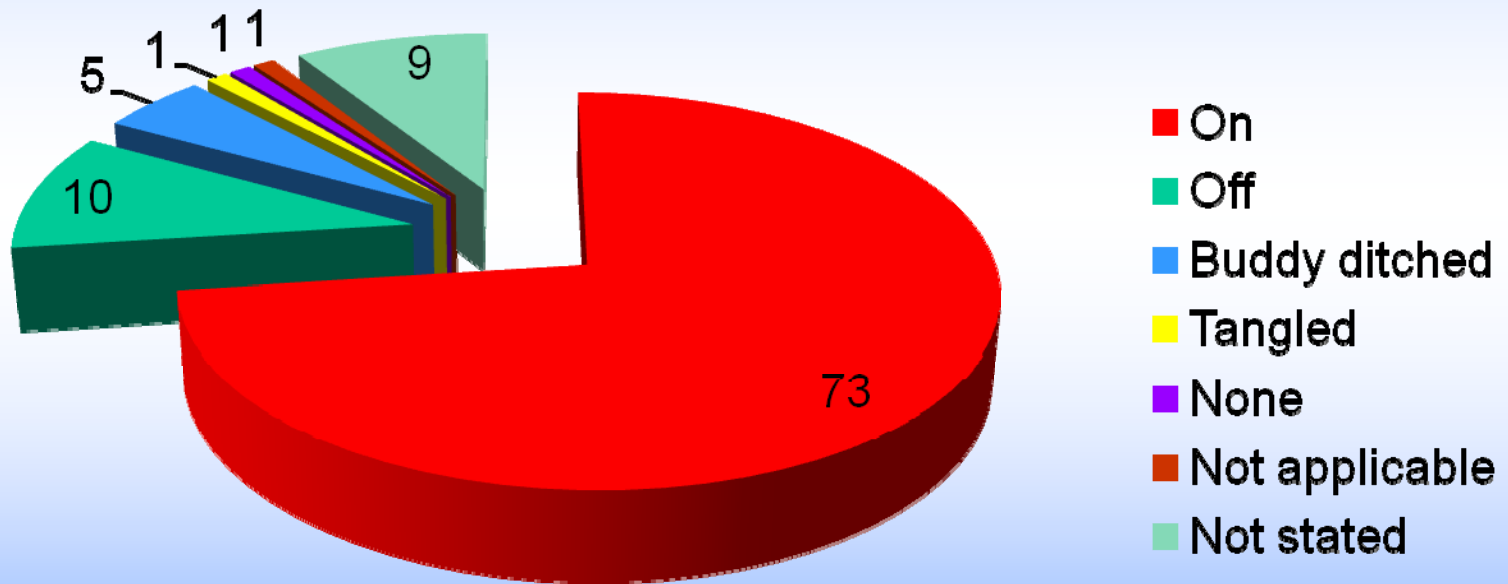


Experience



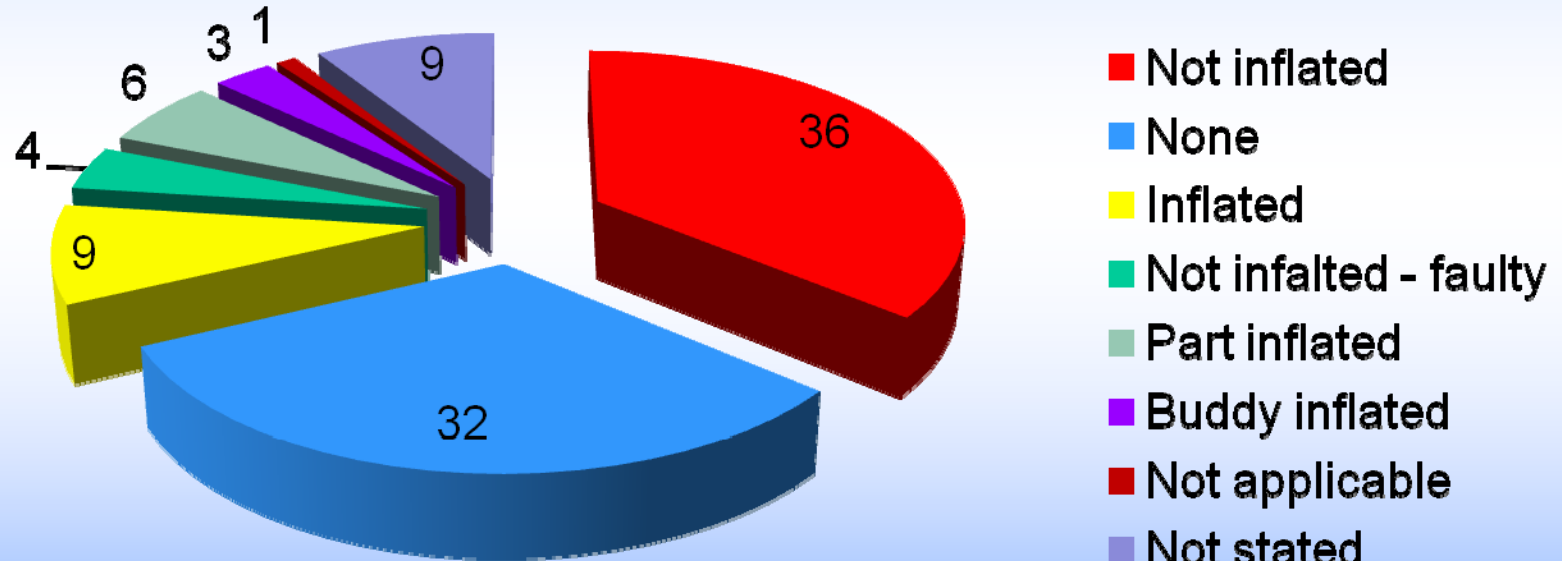
Weights management

(n = 351)

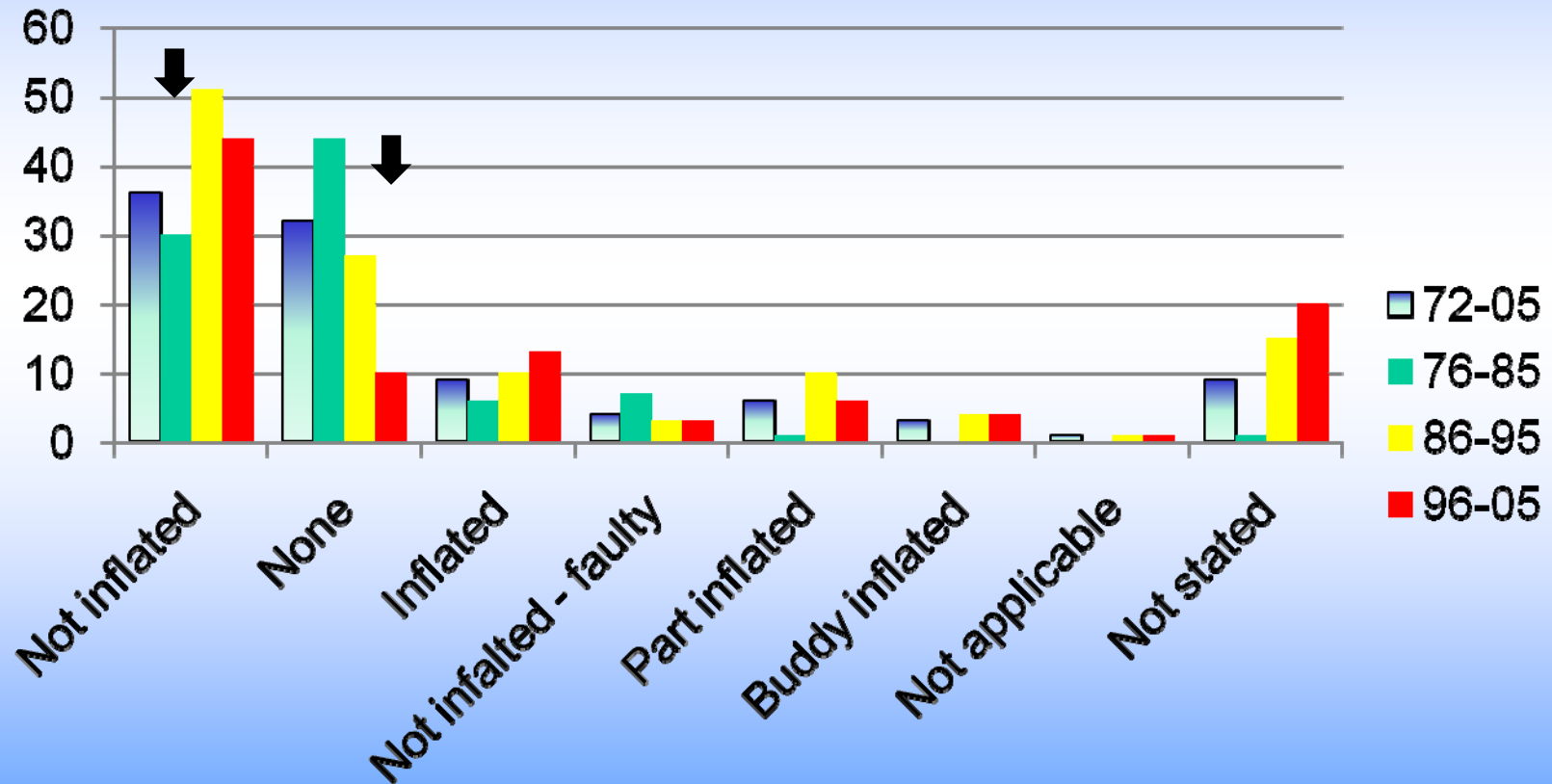


BCD Management

(n = 351)

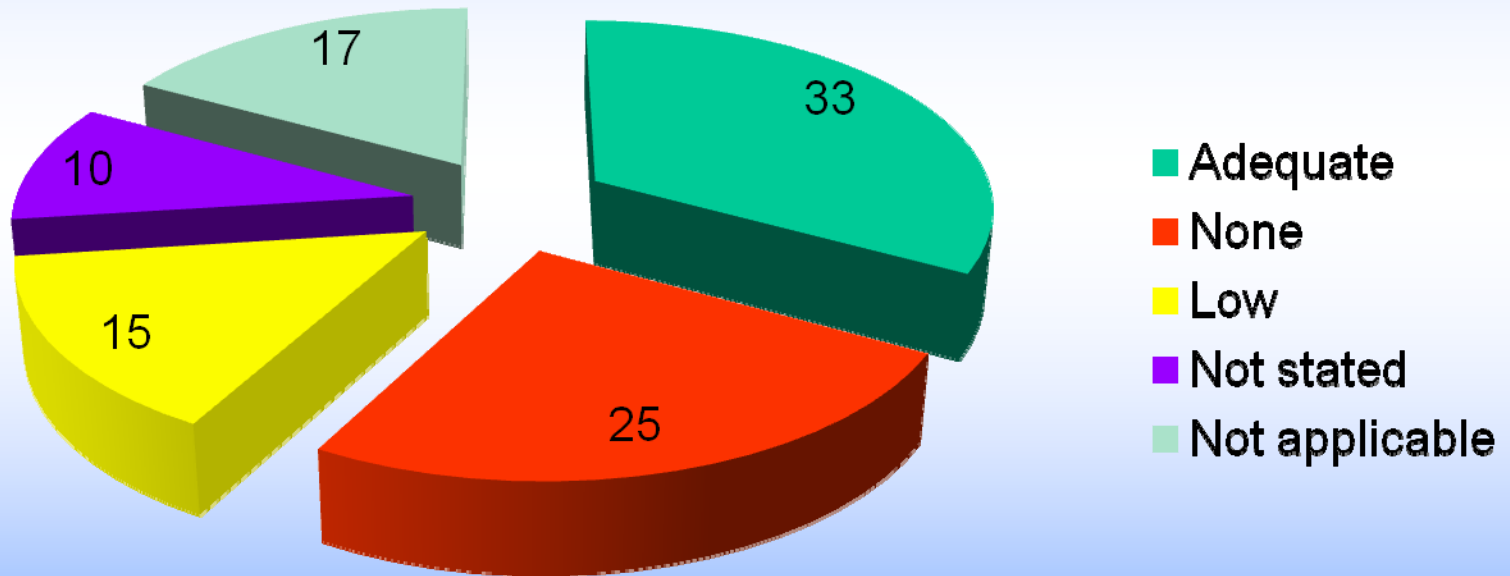


BCD Management

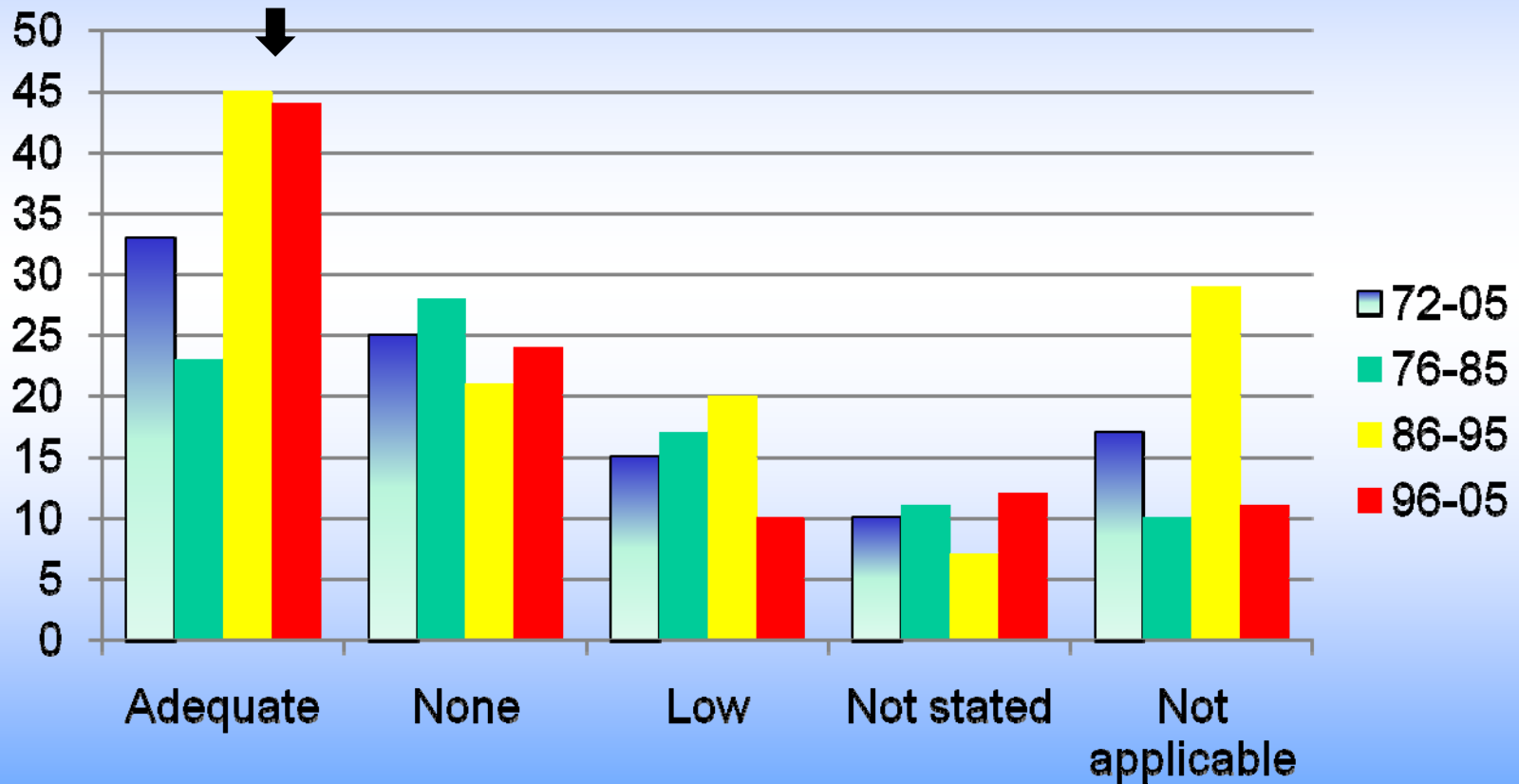


Remaining Gas

(n = 351)

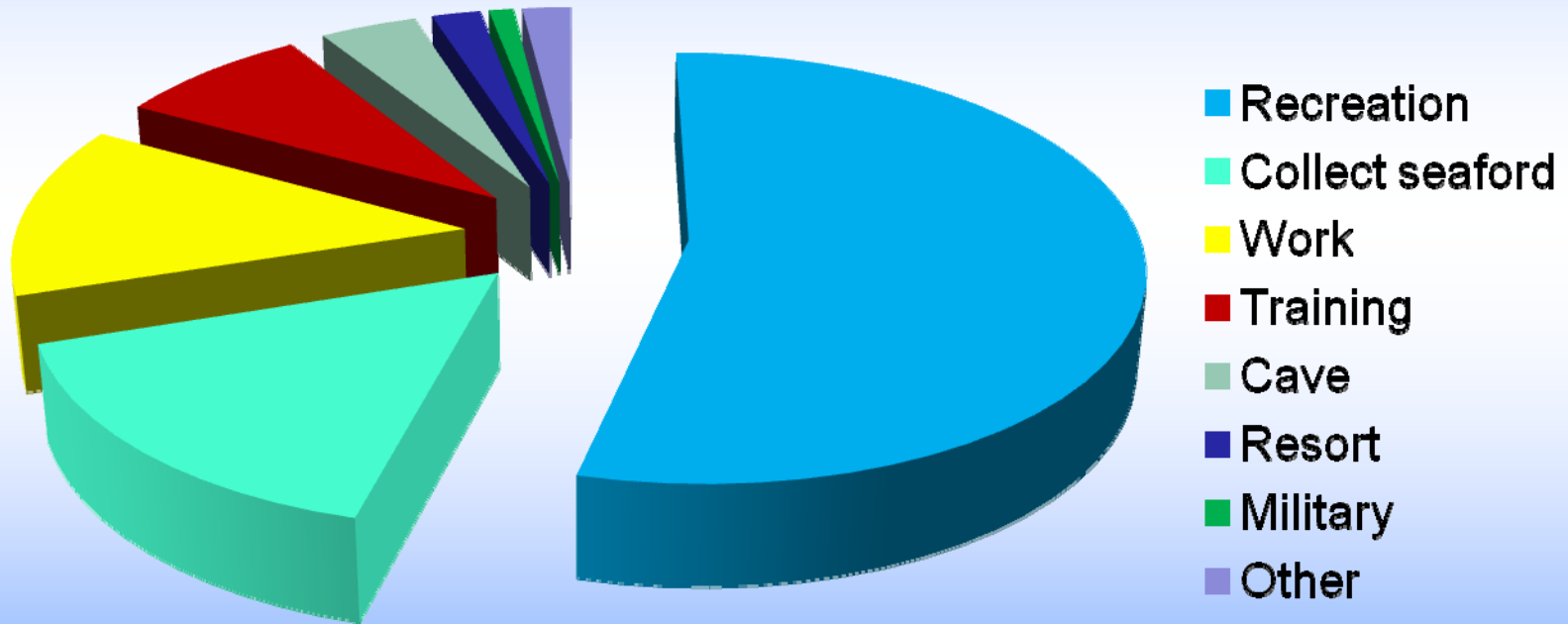


Remaining Gas



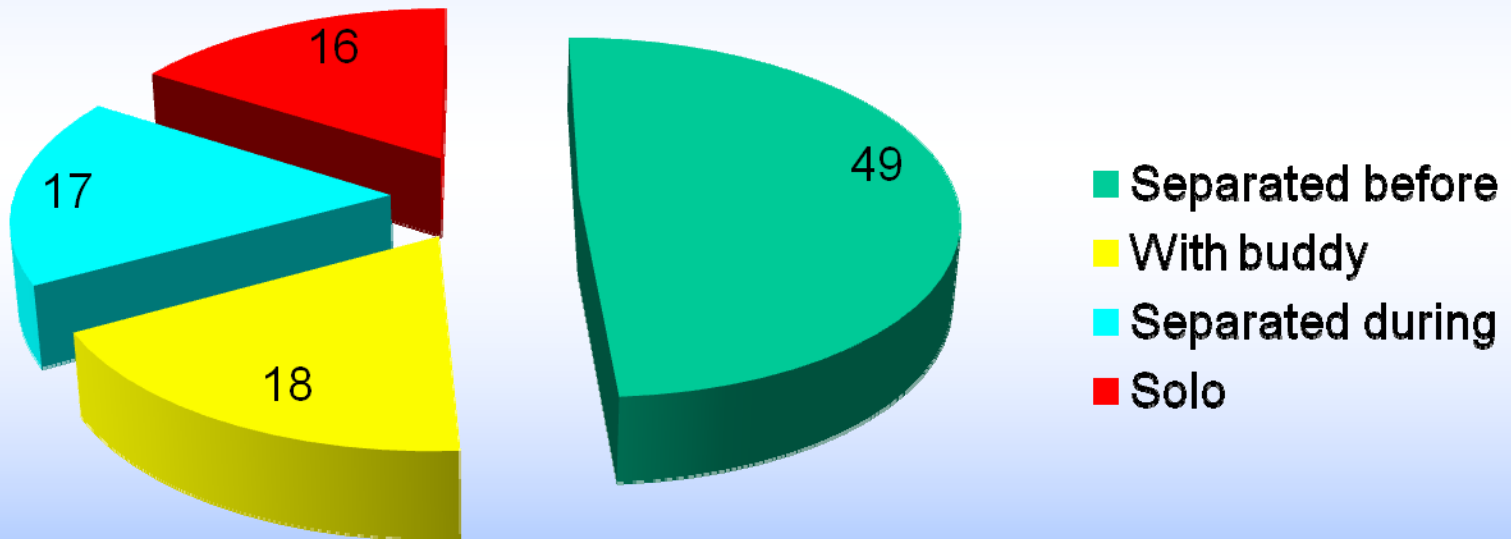
Purpose of Dive

(n = 351)

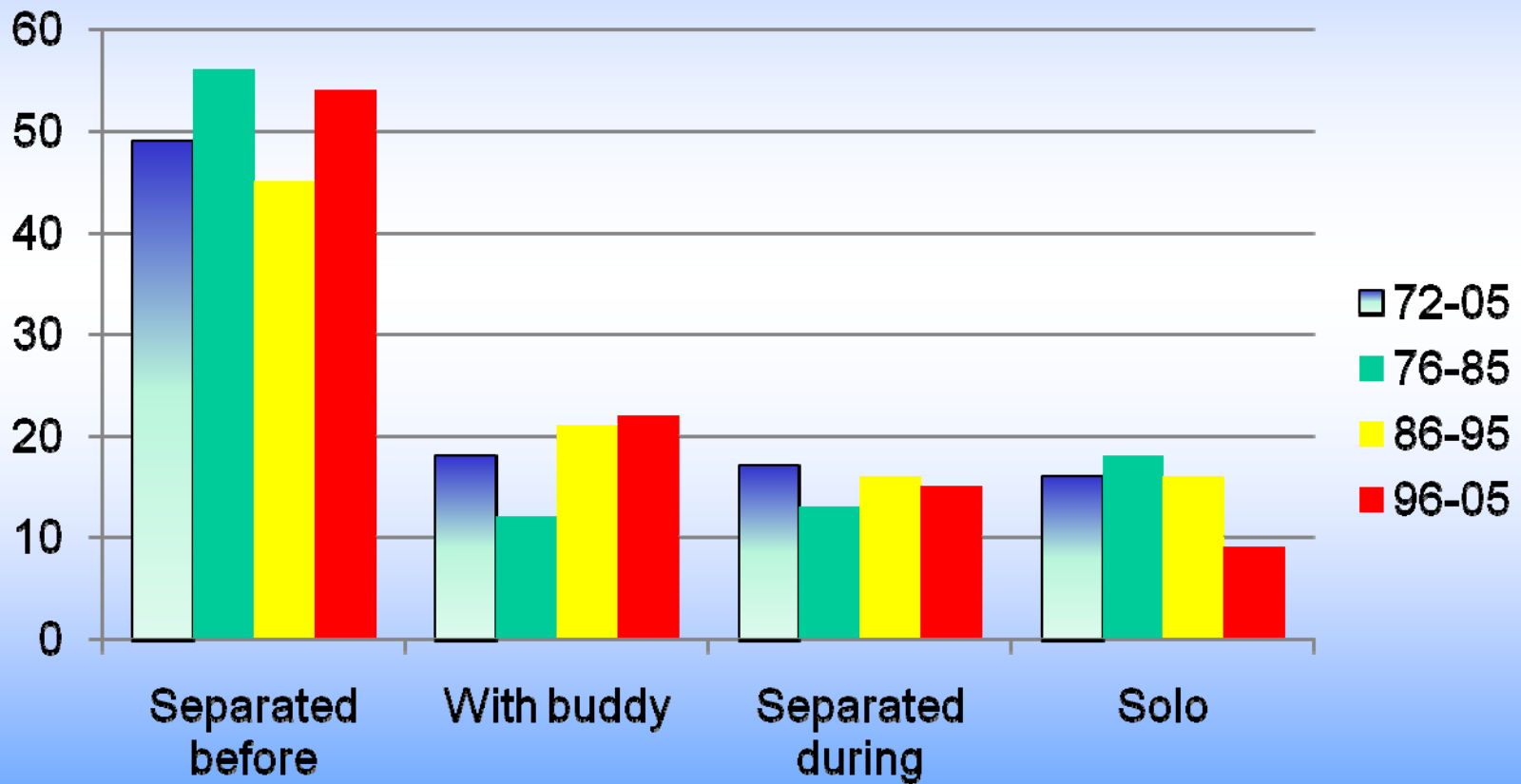


Buddy

(n = 351)

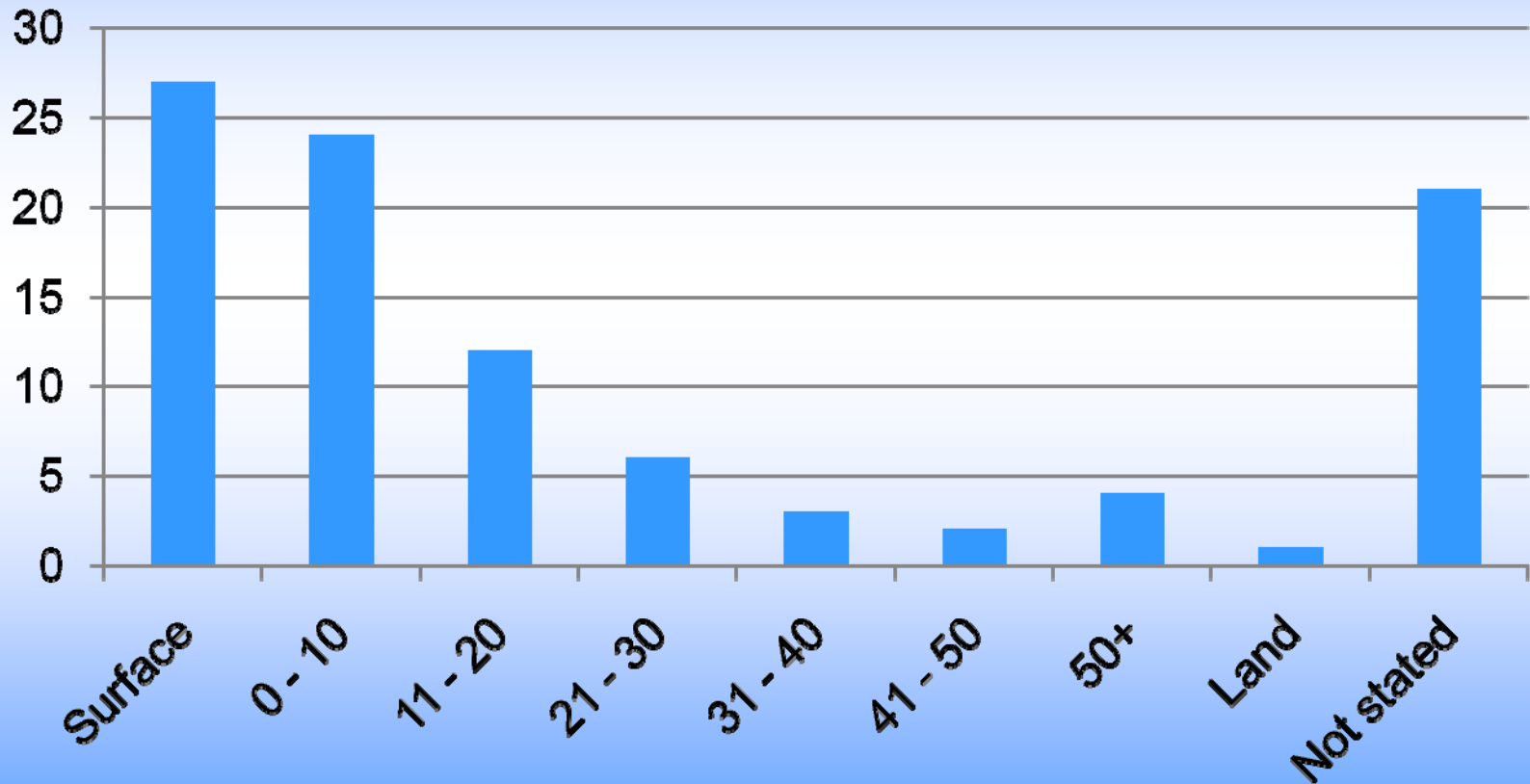


Buddy

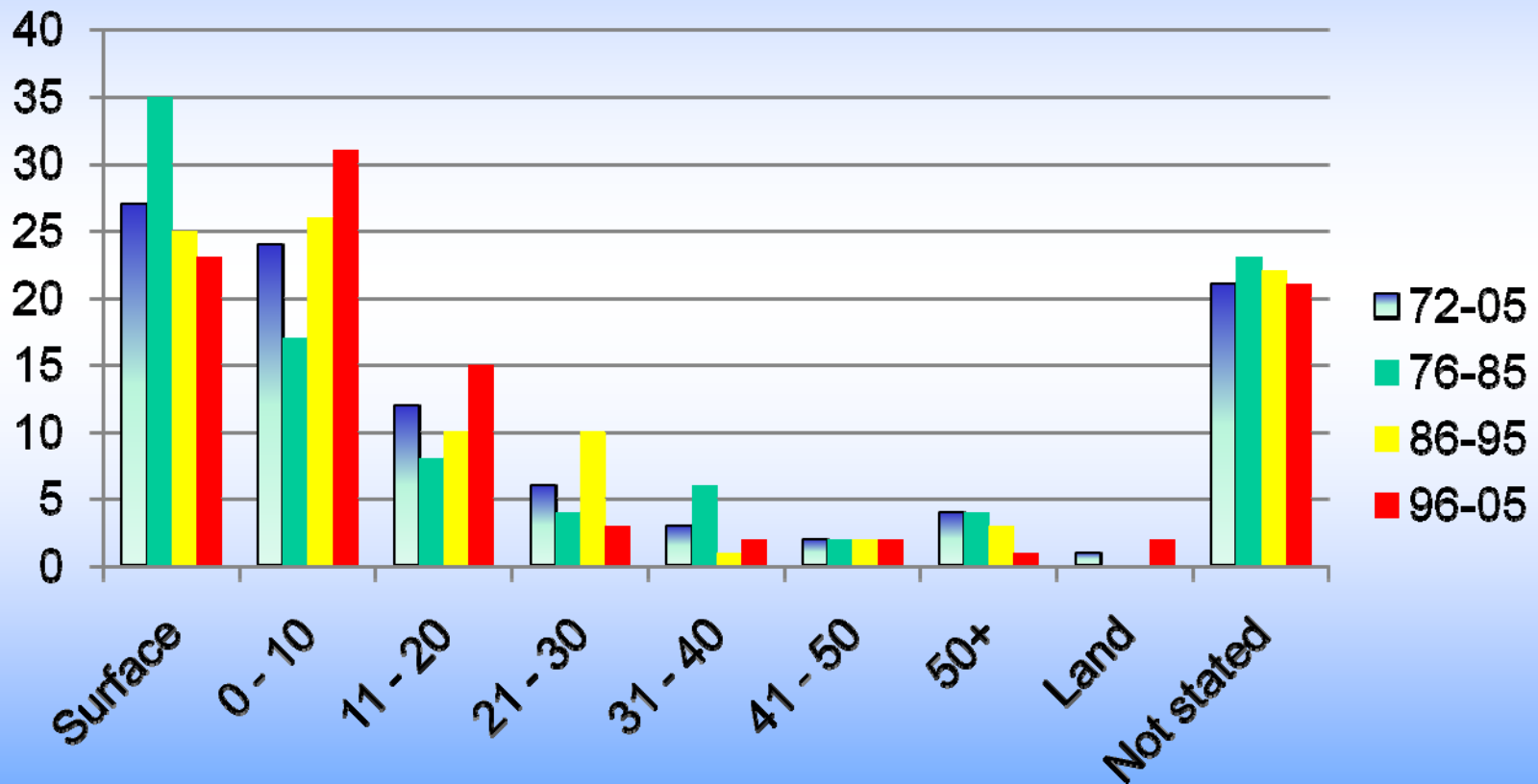


Depth

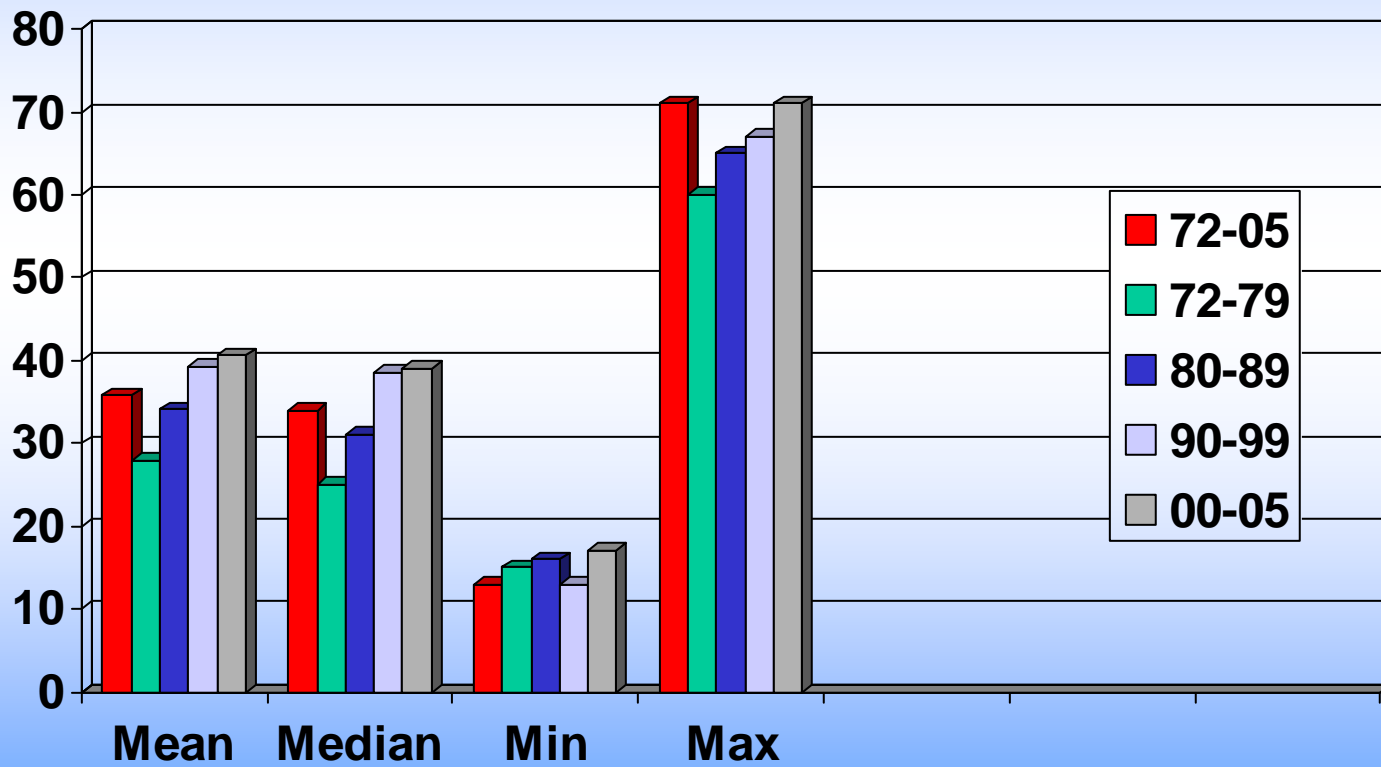
(n = 351)



Depth



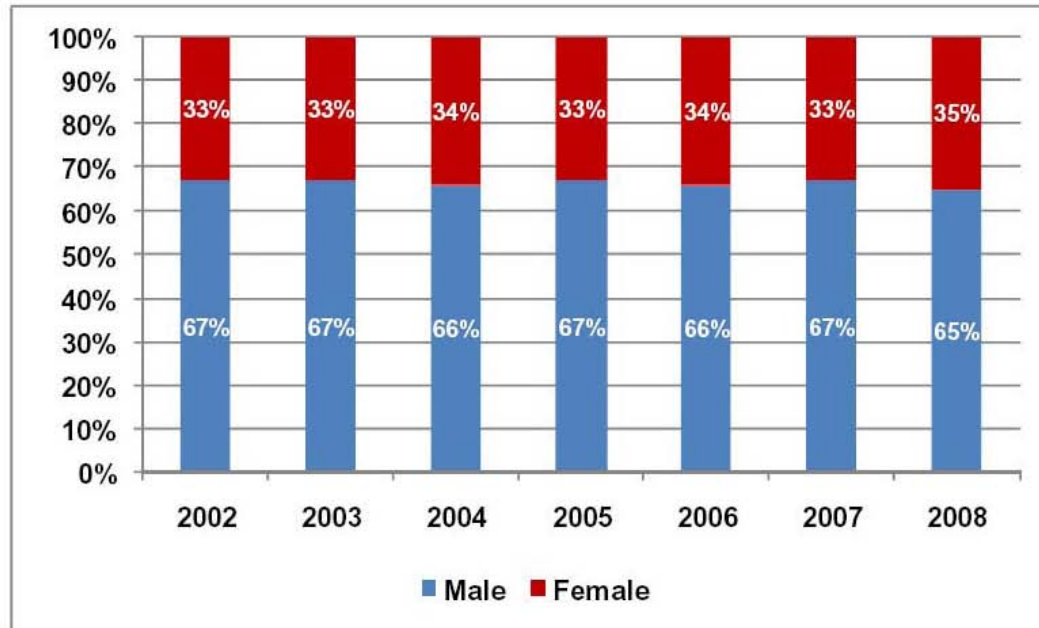
Age



Gender

PADI Worldwide Certifications & Experiences

Worldwide by Gender



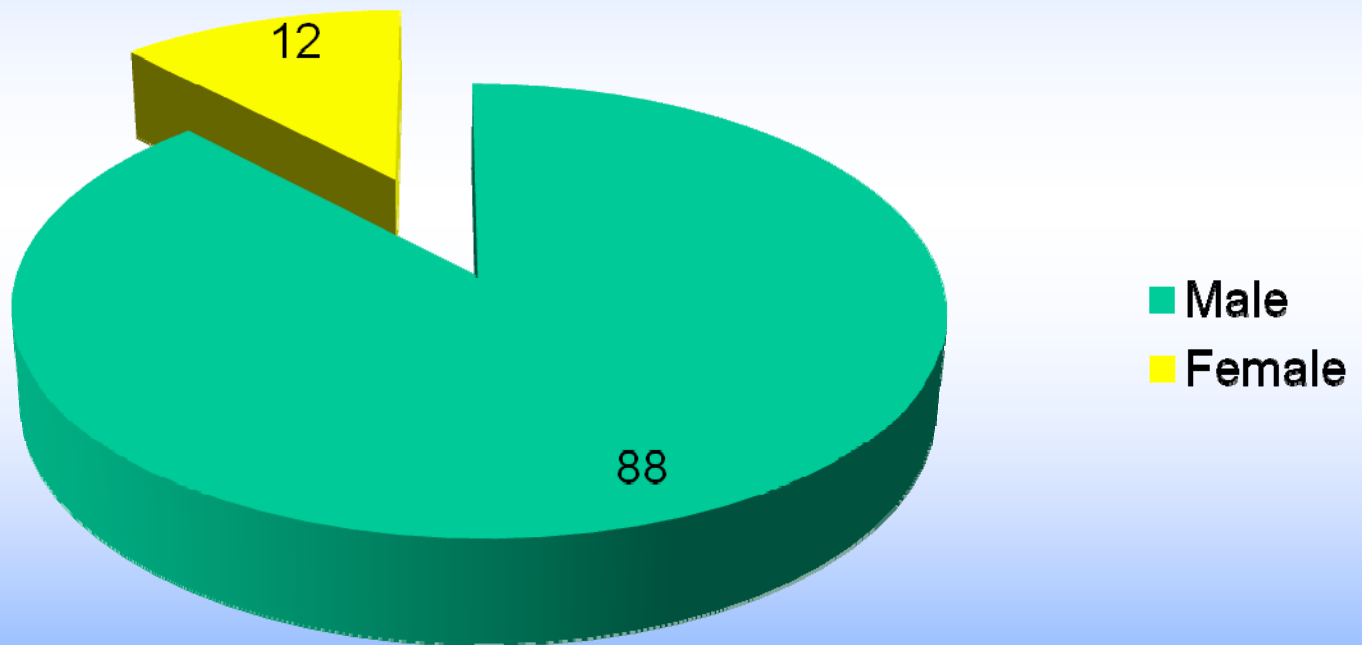
Represents total diving certifications, non-diving certifications and experiences for all PADI Offices combined with the exception of PADI Japan. Divers and participants may have multiple certifications or experiences.

Source: PRJ8327 report

8 - PADI Confidential

Gender

(n = 351)



Gender

