

# Unrecognized decompression sickness among breath-holding pearl divers in the Arabian Gulf



Milton Bergson, MD  
Resident Physician, PGY-3  
Boston University Medical Center  
Department of Anesthesiology  
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Under the direction of Drs. Christopher Connor, MD. Ph.D &  
Massimo Ferrigno, MD.

# Pearling: The Predominant Industry in the Arabian Gulf during the early 20<sup>th</sup> Century

## THE HISTORY AND PREHISTORY OF PEARLING IN THE PERSIAN GULF

BY

ROBERT CARTER\*

“Pearl fishing (was) the premiere industry of the Persian Gulf: it is, besides being the occupation most peculiar to that region, the principal or only source of wealth among the residents of the Arabian side.”

Journal of the Economic and  
Social History, Vol. 48, No. 2,  
2005



- At least 50% or more of the populations of Ajman, Dubai, Abu Dhabi and Qatar were involved in the pearl industry.
- Almost all males in those populations in the first decade of the 20<sup>th</sup> century were engaged in pearling.
- During the Early 20<sup>th</sup> century 25% of the total population on the Arabian side of the Persian Gulf were engaged in pearling activities
  - 1 out of every 2 males involved.

## Some Background:

**Taravana:** *Tara* – to fall, *vana* crazily

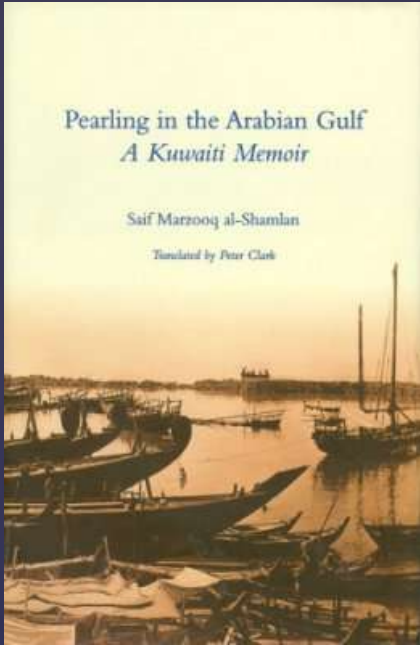
- a rare condition with symptoms of DCI Type 1 & 2 (ranging from visual disturbances to death) attributed to repeat breath-hold diving.
- First described by E.R. Cross in 1958 while observing natives in the Tuamotu Island of the South Pacific doing breath-holding dives for fish...
  - 60 dives/day
  - depths of 100+ feet
  - 2 minute dive times
  - 3-4 minute surface intervals
- Danish medical naval officer, Paulev, described his own personal experiences with DCI from breath-hold diving in 1965.
- In a 1967 paper Dr. Paulev showed that breath-hold diving could achieve tissue N<sub>2</sub> tensions high enough result in bubble formation and DCI.
- More recently, Dr. Robert Wong, in an article from the Journal of the South Pacific Underwater Medical Society, (September 1999): two more Australian cases in which one person died.

# Understanding Arab pearlers diving patterns

## Pearling in the Arabian Gulf *A Kuwaiti Memoir*

Saif Marzooq al-Shamlan

*Translated by Peter Clark*



A typical dive pattern:

- 14 Fathoms or 25.5 meters (though sometimes 35+ meters).
- They dove all day, sunrise to sunset with a 30 minute break in between for prayer & lunch.
- Bottom-times from 1-4 minutes depending on their depth.
- Surface intervals of 1-4 minutes.
- As many as 80 dives per day.
- Their season was from early June to late September (warmest water).



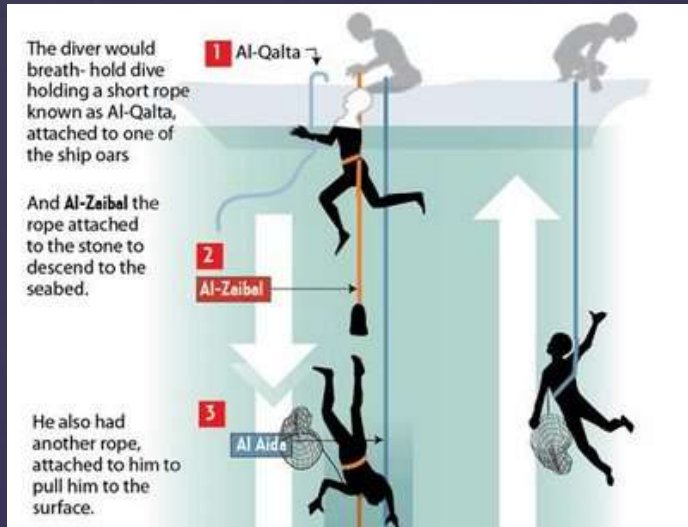
Mr. Dhali – one of the last pearlers in the region who worked on these boats in his youth.

## Arab Taravana

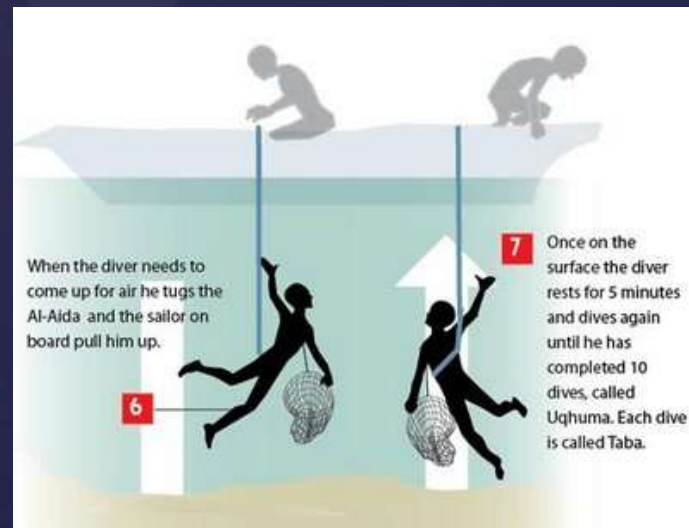
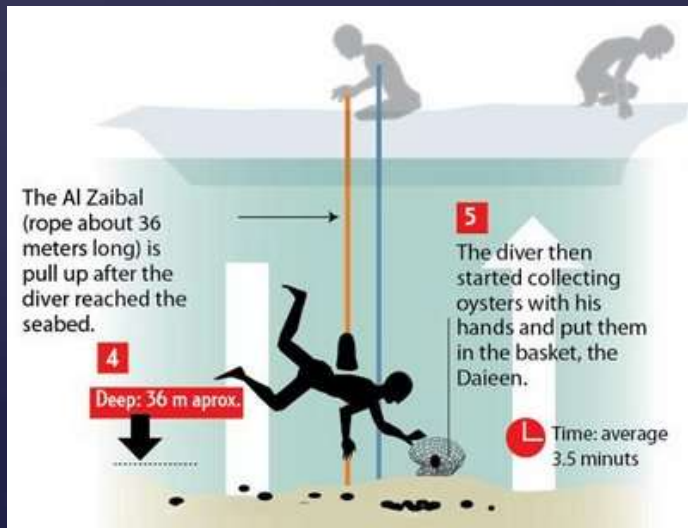
- Al-Shamlan discusses the “fits” some divers experienced after witnessing “wild and frightening sights, especially in deep water.”
- He goes on to describe how these pearlers were treated with Quaranic readings.

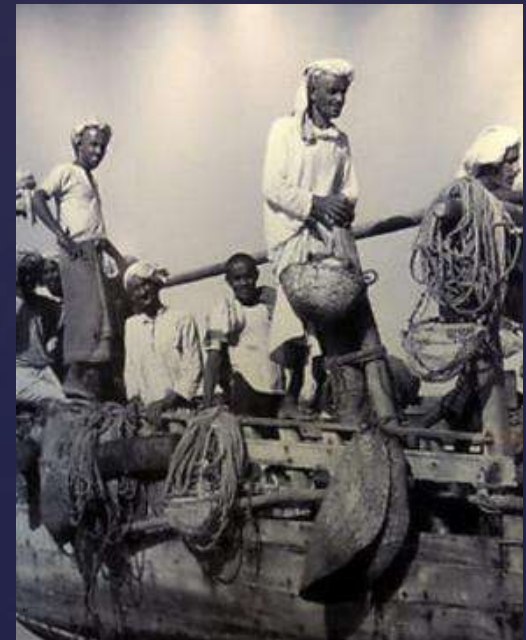


# How did they do this?



Weights tied to rope at regular intervals and dropped by the crew to gauge the depth of the water.





# Has this been studied in the past?



## Decompression sickness following repeated breath-hold dives

P. PAULEV

*Institute of Physiology, University of Aarhus, Aarhus, and  
The Diving School of the Royal Danish Navy,  
Holmen, Copenhagen, Denmark*

While serving as a medical officer Dr. Paulev incidentally underwent a dive pattern nearly identical to Pearlers in the Gulf while submarine-escape training with the Norwegian Navy...

"The diving pattern in nearly all dives was as follows: it took about 20-25 sec to reach the bottom where I sat or walked slowly about until the urge to breath became imperative. This usually occurred in about 2 minutes, my maximum breath-holding time during a non-working dive to that depth. A few powerful pulls on a rope attached above the tank then caused me to ascend rapidly, reaching the surface within 10-15 sec. The periods spend on the surface between dives varied from a few seconds to 1 or 2 min. The total number of dives was about 60, of which 9 were to the bottom and the others to depth between 50 and 66 ft (15 and 20 m). The water temperature was comfortable."

## His Symptoms:

- "increasing nausea, dizziness, and eructation"
- "slight pain in the left hip"
- "right knee also became painful"
- "severe chest pains began...inspiratory distress and a sense of imminent collapse."
- "paresthesia of the right hand"
- "markedly pale and weak, as in impending shock"
- "visual disturbances"



# Predicting the risk...

## Nitrogen tissue tensions following repeated breath-hold dives

POUL-ERIK PAULEV

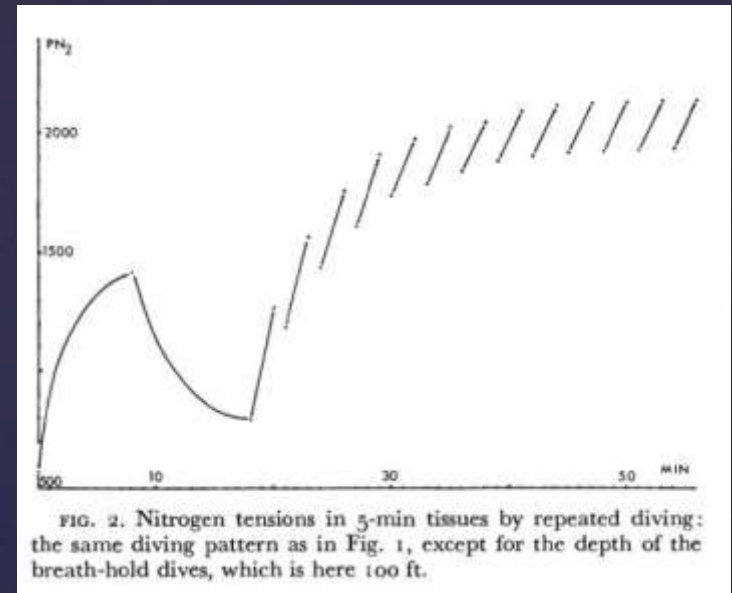
*Institute of Physiology, University of Aarhus, Aarhus, and Institute of Medical Physiology B, University of Copenhagen, Copenhagen, Denmark*

Computer-based systemic calculations of tissue-nitrogen tensions of various tissues with different half-lives for on-gassing of N<sub>2</sub>.

Tissue half-time	5	10	20	40	80	120
Max tens, mm Hg	2,395	2,027	1,658	1,336	1,198	1,175
Depth m						
18.5				41		
30			15	16	24	34
35			7	3	8	17

Number of breath-hold dives necessary to exceed the maximum allowable tissue N<sub>2</sub> tension – assuming 1 minute intervals and 2-minute bottom-times.

- Note: these maximum allowable N<sub>2</sub> tensions computed assume a slow (0.3m/sec) ascent.
- Breath hold dives ~1.8m/sec ascents.



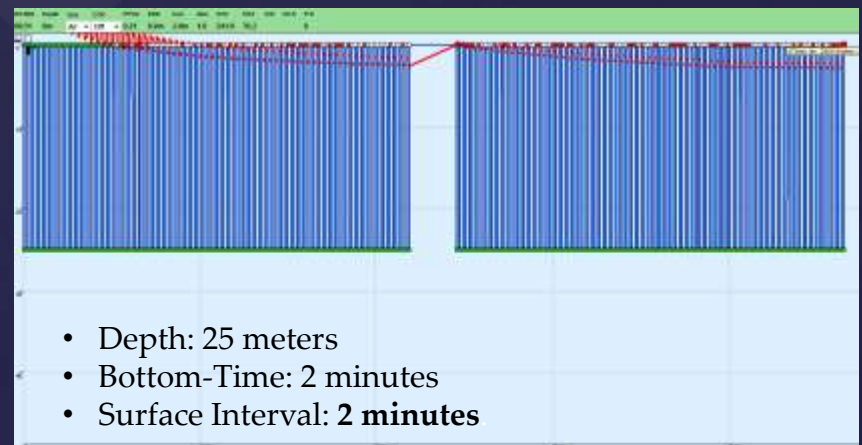
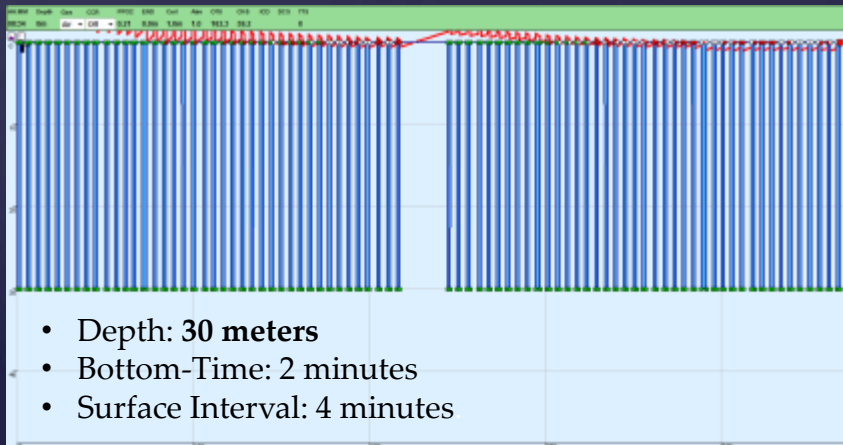
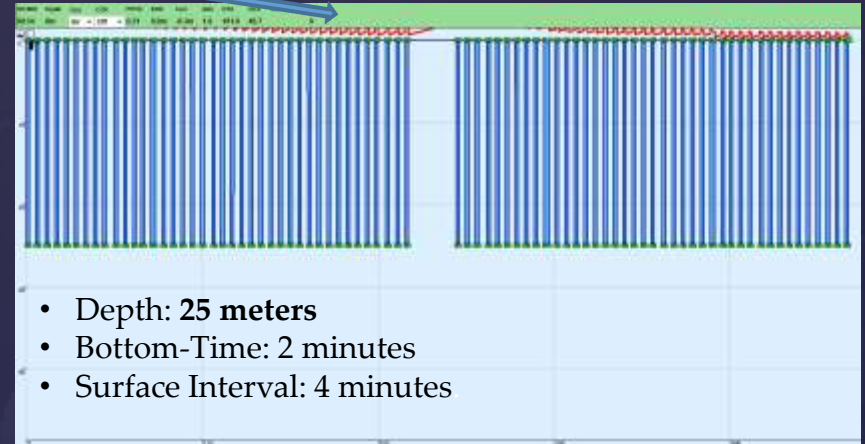
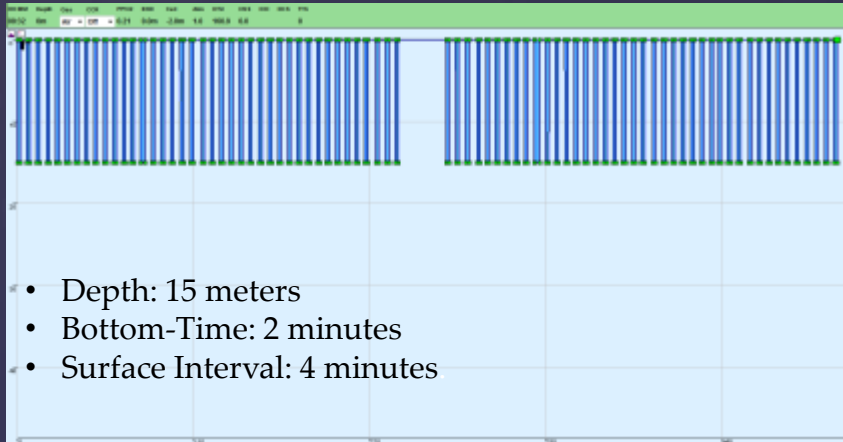
8 minutes in a pressure chamber to 3 atm, 10-min surface interval followed by 13 breath-hold dives to 100 feet.

- PN<sub>2</sub> of 1,705 mmHg reached in 20-min tissue.
- PN<sub>2</sub> of 1,353 mmHg reached in 40-min tissue.



# Simulated dive patterns

- Open Source software incorporating Arterial-Blood Model Version 2  
-DecoChek Dive Analyzer, version 2.04
- Red ceiling appears at the point when the maximum allowable tissue  $N_2$  tension is accumulated.



## Other possible causes of “Taravana” other than the $N_2$ tension:

- Toxic levels hypercapnia: Progressive  $CO_2$  retention occurring during repeated dives.
- Increased  $CO_2$  tension in the tissue favoring bubble formation itself.

## Conclusion:

Pearl divers in the Arabian Gulf were likely to be unwittingly and routinely subjected to decompression sickness as an occupational hazard.