

Diving accidents related to sea-cucumber fishing at Nosy Be, Madagascar¹

by Dr C. Maillaud

Summary

On the north-east coast of Madagascar, certain varieties of sea cucumber (*dingha-dingha* in Malagasy) are collected by scuba-diving or skin-diving and then marketed as *trepang* in Asian countries. Diving accidents are frequent even though no statistics are available locally. We describe decompression accidents, cases of drowning of skin-divers and shark attacks, and highlight the circumstances surrounding these types of accident. With regard to decompression accidents, no safety rules were followed by divers, whose equipment was generally poorly maintained. The amount of money they could earn from their work seemed to be their only concern. No specialised treatment was available locally. Efforts should be made to provide those concerned with information about safety rules, but would be hindered by their complete lack of interest in the subject.

Introduction

Our study covered accidents which affected divers specialising in the collection of certain edible varieties of sea cucumber (also known as holothurians, or *beche-de-mer*) in the Nosy Be region of Madagascar. Our main focus was on decompression accidents, but we also included skin-diving accidents and shark attacks.

Material and methods

The data we used were collected from sea-cucumber fishermen from Ambatoloka and Dar-Es-Salam at Nosy Be with the assistance of an interpreter, who was also a fisherman. However, our work did not always offer the scientific precision that we would have liked it to have. This was because we could not always meet accident victims personally, due to logistical difficulties inherent in local communication methods, and because it was not possible to cross-check the information collected from local medical facilities. More specifically, we were unable to find any hospital records of the accidents described.

For all these reasons, our methods did not allow us to collect information that could be used statistically, as no record of diving accidents was kept, an apparently impossible task in any event. In addition to this, a large number of unexplained disappearances at sea also complicated the data collection.

Consequently, we concentrated mainly on describing in detail the exact nature of the accidents brought to our attention and the circumstances surrounding them.

Background

Madagascar is characterised by one of the lowest per capita incomes in the region. The two principal industries in coastal regions are tourism and artisanal fisheries.

Certain local varieties of sea cucumber, known as *dingha-dingha*, are marketed in Asia under the name of *trepang*. This mainly involves the following species: *Thekenota ananas* (in Malagasy: *Zanga borozy*) and *Holothuria nobilis* (in Malagasy: *benono*). They are eaten dried, mainly in soups.

Sea cucumbers are first boiled over open fires in large pots set up on beaches near the place where they are collected. They are then buried in the sand for one night, before being put on racks to dry in the sun.

Each *dingha-dingha* can earn a fisherman between FMG 20,000 and FMG 25,000 (about US\$ 3.5–5.0). Given the fact that one fisherman can collect up to 50 *dingha-dingha* a week, his monthly income could be as much as FMG 500,000. By comparison, the average monthly income for a salaried employee in Madagascar is between FMG 180,000 and FMG 250,000. However, these large sums of money are rarely converted into capital, as they are usually spent locally during the fishing expedition. Marketing sea cucumber requires divemasters (who provide the equipment but do not dive) and collectors. A kilogram of dried sea cucumber, i.e. two to four *dingha-dingha* depending on the size of the specimens, is then sold locally for as much as FMG 120,000 (about US\$ 23.00), with, of course, the added value being pocketed by the middlemen.

Divers, diving circumstances and factors in accidents

Divers are young (between 18 and 35 years old), usually illiterate and do not receive any kind of preparatory training. Only a small minority has had any previous experience, usually empirical, with scuba-diving. Infrequent attempts to provide

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training seem to have encountered difficulties in understanding and met a complete lack of motivation on the part of the concerned parties.

Nosy Be has 80 to 100 such divers, a good number of whom are currently fishing in the Mahajanga region, or even in Les Glorieuses due to the increasing scarcity of the resource in their region.

Dives are commonly carried out in a state of intoxication, or under the best circumstances, the day after immoderate alcohol use, since most of the money earned from fishing is immediately converted into alcohol, which is consumed in the company of lady friends in a festive atmosphere.

The depth of dives carried out with scuba equipment varies: i.e. 15 to 40 m as a general rule, and less frequently, 50 m or even more.

The length of dives does not follow any rules. It is limited only by the amount of air in the tanks and is based on the need to fill a sack with sea cucumbers. The switch-over to the reserve tank is normally the signal to ascend. Divers then re-surface as quickly as possible, with no intermediate stages. The small portion of divers equipped with buoyancy control devices (5 to 10%) may use them to ascend to the surface more quickly. The amount of effort needed to re-surface is often increased by the need to heave up a sack containing sea cucumbers.

Divers do not use diving tables, watches, or depth gauges, as these are not included in their equipment. Depth is estimated by using a rope hanging from the boat. The equipment is not maintained, diving tanks are never serviced and regulators are often defective. When equipment fails, divers make panic ascents. Each diver does at least two dives a day, and sometimes three or even four. Diving in pairs is unknown.

Skin-diving is carried out at maximum depths of between 17 and 20 m, under the same physical conditions as scuba diving and without any mutual surveillance.

We should note that the shark attacks reported only involved skin-divers working on banks in the open ocean. Known factors that favour shark attacks, such as time of day, water clarity or the feeding instinct, did not appear to be determining factors in these accidents.

Types of accident

We found three categories of accident:

- Diving accidents in the strictest sense, i.e. Type 2 decompression accidents, mainly with neuro-

logical symptoms and at least one embolism. Fatalities did not seem to be unusual with this type of accident.

- Drowning during skin diving, probably following a black-out.
- Shark attacks.

The total number of accidents is difficult to determine: between 10 to 20 according to estimates whose reliability, however, is subject to caution.

Another factor which should be noted is frequent disappearances at sea (4 to 5 a year), probably due to one of the categories of accidents identified.

Reported cases

We decided to present four cases, illustrating two of the three categories identified:

- *Case no. 1:* Subject: 22 years old. 18 m dive at Mahajanga, on an empty stomach after a night of intoxication. Became ill after ascending to the boat, with difficulty in breathing and coughing blood. Died after 24 hours in hospital. Probable embolism.
- *Case no.2:* Subject: 31 years old. 40 m (?) dive on the 5 m bank at Nosy Sakatia (not far from Nosy Be). Paraplegia appeared shortly after ascension. Patient currently bedridden with severe complications (bedsores).
- *Case no.3:* Subject: 24 years old. 40 m dive (location not indicated). Hemiplegia and aphasia after return to boat. Re-immersed by diving companions to 25 m, slow re-ascension: complete recovery.
- *Case no.4:* Subject: 19 years old. 14 m skin-dive off Nosy Be (exact location not indicated). Poor visibility between surface and 10 m, but very acceptable on sea floor. The diver accidentally bumped into a sawfish lying in the sand. The animal reacted in defence and injured the fisherman with its bill: deep cuts on the right thigh and left arm. Favourable outcome.

Treatment of accidents

Treatment is purely symptomatic (except for surgical treatment of shark-related accidents). No means of therapeutic recompression are currently available locally.

Acquisition of a de-compression chamber does not appear to be a public health priority in Madagascar.

Conclusion

After the data had been collected, our modest efforts involved arranging an information session, at the request of some of the concerned parties, on:

- ENT physiology of diving;
- preventing black-outs during skin diving;
- the usefulness and principles of diving tables. A set of tables was given to the president of the Fokontany (village assembly), who was supposed to give copies to those concerned.

We do not, however, have any illusions about the impact, even short-term, of our work.

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About the Latin name of the Japanese sea cucumber

by Pr.V.S.Levin

Eight genera are specified in the family Stichopodidae: *Stichopus* Brandt, 1835; *Thelenotia* Brandt, 1835; *Astichopus* Clark, 1922; *Parastichopus* Clark, 1922; *Neostichopus* Deichmann, 1958; *Eostichopus* Deichmann, 1958; *Isostichopus* Deichmann, 1958; *Apostichopus* Liao, 1980.

Identification of the taxonomic status of a very common and commercially important species—the Japanese sea cucumber *Stichopus japonicus*—has been one of the obscure questions in the family's taxonomy. Liao (1980) included this species in the newly established genus *Apostichopus*. However, he provided only a comparison between *S. japonicus* and the type species of genera *S. chloronotus* without considering the status of other 'problematic' representatives of the family, primarily *Parastichopus californicus* and *P. parvimensis* that inhabit the Pacific coast of the USA. Deichmann (1937) had attributed those species to the genus *Parastichopus* established by H. Clark in 1922 for *S. tremulus* (north Atlantic) and *S. nigripunctatus* (Japan).

Established by us, a very pronounced morphological and chemical similarity between *S. japonicus* and *P. californicus* (Levin et al., 1985, 1986; Kalinin et al., 1994), and their wide difference from the type species, explain the need of separating these species from the genus *Stichopus*. Therefore, despite the limited data used by Liao in establishing the genus *Apostichopus* I consider it valid to place *Stichopus japonicus* within the monotypic genus *Apostichopus*.

Thus, the correct Latin name of the Japanese sea cucumber is *Apostichopus japonicus* (Selenka).

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