



Live coelacanth discovered off the KwaZulu-Natal South Coast, South Africa

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When a living coelacanth was trawled off East London, South Africa, at a depth between 72 m and 100 m on 22 December 1938, it caused an international sensation.¹⁻⁷ The specimen was saved for science by the young curator of the East London Museum, Marjorie Courtenay-Latimer⁸ and identified by JLB Smith of Rhodes University College^{5,6}. Smith named it *Latimeria chalumnae*, after Courtenay-Latimer and the river off which it was caught, and it is listed in the official Coelacanth Conservation Council (CCC) inventory as CCC 1. *L. chalumnae* is classified in the family Latimeriidae and the suborder Latimerioidea.

JLB Smith, who was a keen angler and had an excellent knowledge of fish anatomy, behaviour and habitat preferences, predicted that the East London fish was a stray from relatively shallow rocky reefs further north on the tropical east coast of Africa.⁷ Rumours of dead coelacanths being washed up on the seashore at Knysna and Gonubie near East London, or sighted by divers in Mozambique, have not been substantiated.⁹ In 1989, Bruton¹⁰ predicted that coelacanths would be found off the Transkei and Zululand coasts but this suggestion was rejected at the time.

L. chalumnae has since been found in the Comoros (over 200 specimens)¹¹, Mozambique (one specimen, CCC 162)¹², Madagascar (over 13 specimens)¹³, Kenya (one specimen, CCC 178)¹⁴ and Tanzania (over 70 specimens)^{15,16}, and a colony was discovered in the isiMangaliso Wetland Park in northern Zululand, South Africa, in 2000¹⁷. Another species of living coelacanth, *L. menadoensis*, was found on the other side of the Indian Ocean off North Sulawesi Island in Indonesia in 1997 (CCC 174)^{18,19}; this species is smaller than *L. chalumnae* and its body, which is also covered with white spots, is brown rather than blue.

The first scientist to observe a living coelacanth was Jacques Millot of France who briefly examined a dying immature female fish (142 cm, 41 kg; CCC 8) in a flooded wooden boat at Mutsamudu on Anjouan Island in the Comoros in 1954.²⁰ The fish was captured at 20:00 on 12 November 1954 and was kept alive in the sunken boat from about 23:30 until 15:30 on 13 November 1954. The fish was stressed and exhibited only feeble movements.

Several coelacanths that were subsequently caught by traditional fishermen in the Comoros (mainly Grand Comoro), and brought to the attention of scientists, survived for periods of 1–42 h, usually 1–11 h, near the water surface where they could be observed by divers.⁹

Hans Fricke and his team from Germany were the first to study the living coelacanth in detail from their research submersible *Jago*. They compiled an extraordinary data series on the living coelacanth in the Comoros spanning 21 years and including 145 specimens that had been individually identified using the unique patterns of white spots on their bodies.²¹⁻²⁶

On 28 October 2000, mixed-gas divers Pieter Venter, Peter Timm and Etienne le Roux discovered coelacanths living at a depth of 104 m in Jesser Canyon at Sodwana Bay¹⁷ in the newly proclaimed iSimangaliso Wetland Park in Maputaland – the shallowest sighting of coelacanths at that time. On 27 November 2000 they filmed three coelacanths at a depth of 106 m in Jesser Canyon. These discoveries led to the establishment of the African Coelacanth Ecosystem Programme (ACEP) in April 2002 which aimed to initiate and promote a new phase of multidisciplinary research on the coelacanth and its habitats.

The South African Institute for Aquatic Biodiversity in Makhanda (previously Grahamstown) was appointed as the lead organisation for ACEP, which has been carried out in three phases: 2001–2006, 2007–2011 and 2012–2015. From 2002 to 2004, Professor Hans Fricke and his team returned to South Africa with the *Jago* submersible to study coelacanths in the iSimangaliso Wetland Park from the R/V *Algoa* as part of ACEP. They carried out 47 survey dives with a total bottom time of 166 h at depths ranging from 46 m to 359 m. Initially, 24 coelacanths were identified in three submarine canyons at depths from 96 m to 133 m along a 48-km stretch of coast in the iSimangaliso Wetland Park. This number was later increased to 32 individuals.^{27,28} Over time the ACEP programme extended its research programme further north into other countries in East Africa and the Western Indian Ocean Islands using the R/V *Algoa* and other motherships, the *Jago* submersible and a *Sea-Eye Falcon* underwater remotely operated vehicle.

On 15 February 2004, mixed-gas diver Christo van Jaarsveld observed a coelacanth at a depth of about 54 m in Diepgat Canyon south of Sodwana Bay in the iSimangaliso Wetland Park (2004, personal communication to Mike Fraser, February 16; confirmed 26 November 2019). This sighting is the shallowest on record for a healthy adult coelacanth and was the 19th specimen known from the iSimangaliso Wetland Park, but it has not been seen again. Van Jaarsveld has subsequently seen and filmed another specimen on 7 August 2018 in the iSimangaliso Wetland Park (2018, personal communication to Mike Fraser, August 7); this fish has also not been seen since.

At about 09:00 on 22 November 2019, a team of divers observed and filmed a single coelacanth (ACEP no. 34) at a depth of 69 m off the village of Umzumbe (between Hibberdene and Pumula) on the South Coast of KwaZulu-Natal (Figure 1). This site is about 325 km south of the iSimangaliso Wetland Park. The divers, Mike Fraser and Alan Fraser from Pumula and Bruce Henderson and Pieter Carstens from Somerset West, launched from the Injambili launch site at Pumula, with Benjamin Henderson and Marc Dukes acting as surface support in the boat. Henderson and Carstens used open circuit trimix and Mike and Alan Fraser used rebreathers with trimix diluent.

Mike and Alan Fraser are keen anglers and have fished the reef on which the coelacanth was found for many years. They are also avid scuba divers who have been using AP diving rebreathers for the past 9 years and are familiar with the underwater terrain on this coast. Mike and Alan Fraser had previously speculated that the Umzumbe River

Canyon would be an ideal place to spot a coelacanth, because the caves and cracks seen on the sonar would offer good shelter from predators.



Figure 1: Coelacanth off Pumula on the KwaZulu-Natal South Coast, South Africa, on 22 November 2019 (photo: Bruce Henderson).

The reef on which the dive took place (the longitude and latitude coordinates for the discovery site are known but are being kept confidential in order to safeguard the coelacanth) is about 1 km from the continental shelf edge and is washed by strong currents. The coelacanth was first found by Alan Fraser who was swimming ahead of the other divers. On the video recorded during the dive (supplementary material) he can be heard shouting for Bruce Henderson, who had the GoPro 7 video camera with a 150 m underwater housing. The maximum depth of the dive was 72 m and the total bottom time 15 min, of which about half was spent with the coelacanth. Bruce Henderson filmed the coelacanth at a depth of 69 m.

The single coelacanth that was sighted remained relatively motionless under an overhang despite the attentions of the four divers and their strobe lights. It maintained a head-down position, slowly moving its paired fins. Although the epicaudal ridge along the middle of the tail was prominent, the fin rays on the epicaudal lobe of the tail fin did not extend beyond the curve of the rays on the dorsal and ventral portions of the fin, as in the second coelacanth, which Smith initially thought was a separate species.¹¹

The size of the coelacanth was estimated to be 180–200 cm and about 100 kg by comparing its dimensions with those of the divers, although it is difficult to estimate a fish's size accurately under water. It would almost certainly have been a female individual as male coelacanths rarely exceed 150 cm in length.^{9,26}

This estimated size is comparable to the largest coelacanths on record which include a 179-cm, 98-kg female caught off Pebane in Mozambique (CCC 162)¹⁴, a 183-cm female caught off Mutsamudu, Anjouan (CCC 126), a 187-cm, 85-kg individual caught off Toliara in Madagascar (CCC 284) and a 190-cm female caught off Chiconi, Anjouan (CCC 127), according to the official CCC inventory^{29,30}.

What is the significance of the Pumula coelacanth discovery? It indicates that coelacanths live along our coast further south than the iSimangaliso Wetland Park in Maputaland and raises the possibility that they may live elsewhere along the KwaZulu-Natal coast and even further south along the Transkei coast into the Eastern Cape. If this is the case, then the first coelacanth that was caught off East London over 80 years ago may not have been a stray but a member of a resident population. Instead of being washed southwards from the tropics by the south-flowing Mozambique current, as Smith⁷ had suggested, coelacanths may have moved purposefully over time into suitable habitats further south than their optimal range in the tropics.

Dives conducted using the research submersible *Jago* off the Eastern Cape coast near East London and Port Elizabeth in 1991 by Hans Fricke, Jurgen Schäuer, Mike Bruton and others revealed that underwater habitats there were suboptimal, with only small overhangs and no deep caves.⁹ On these dives large ambush predators, such as the wreckfish, *Polyprion americanus*, seemed to fill the coelacanth's niche.⁹ More suitable habitats for coelacanths along the Eastern Cape coast have

since been found in the Chalumna Canyon by Dr Kerry Sink of ACEP (2019, personal communication) using remotely operated vehicles near the capture site of the first specimen in December 1938.

The depth preferences of coelacanths throughout their range extends from about 54 m to over 800 m,^{21–31} shallow by marine standards as the average depth of the ocean is 3688 m. The Pumula coelacanth record is therefore the second shallowest yet recorded for a healthy, non-pregnant adult coelacanth. Coelacanth specimens, and the data associated with their capture, are well documented; the latest edition of the coelacanth inventory compiled by Rik Nulens for the CCC lists 323 specimens caught to date (Nulens R 2019, personal communication, December 29).

Dead or dying coelacanths, some with their guts full of plastic, one with a *Tetradon* blaasop stuck in its mouth (CCC 182), have been found floating at the water surface off Tanzania.³⁰ A large coelacanth (179 cm, 98 kg; CCC 162), pregnant with 26 pups, was caught between 40 m and 44 m on the continental shelf off Pebane in northern Mozambique in August 1991.^{12,30}

The discovery of a coelacanth at a depth of only 69 m off Pumula (and at 54 m in the Diepgat Canyon) suggests that they may live shallower than previously thought, at least at the southern end of their range, which means that they may be more accessible to mixed-gas divers, as well as to shallow-water remotely operated vehicles and research submersibles, for study. Many aspects of coelacanth biology and behaviour have not been documented, including whether they guard their young after birth and the diet and habitat preferences of the young.

The shallower depths at which coelacanths appear to live off South Africa, compared to the Comoros, Tanzania or Madagascar, may be a consequence of their relatively low tolerance of high water temperatures and low oxygen saturations.^{21–26} As oxygen saturations are lower in warmer water, they may tend to live deeper in the warmer waters of the tropics and shallower in the cooler subtemperate waters off South Africa's east coast. Mike Fraser has reported that, although the surface water temperature on the day of the discovery (22 November 2019) was about 25 °C, there was a marked thermocline at about 15 m from the bottom where the recorded temperature fell to 17 °C.

The discovery of a living coelacanth off the South Coast of KwaZulu-Natal also reveals how little we know about marine life off our coast, despite intensive research, increasingly intense deep diving ventures and long-term commercial and recreational fishing pressure. That coelacanths have been living undiscovered off the heavily fished south coast of KwaZulu-Natal, despite the high profile of the fish over the past 80 years, suggests that many remarkable discoveries remain to be made in our oceans.

ACEP and other programmes that promote and facilitate multi-disciplinary research in our marine environment should therefore continue to receive priority financial and logistical support, and recreational divers should be encouraged to collaborate with scientists so that their valuable observations can be included in the scientific dialogue. More effort should also be made to create organised platforms that make it possible for 'citizen scientists', especially deep divers, to participate meaningfully in scientific research. The possibility of creating an offshore Marine Protected Area off Pumula, without unduly impacting on the activities of recreational anglers, also needs to be considered.

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