

## **The Coelacanth, *Latimeria chalumnae* Smith, 1939 at the Natural History Museum of Comiso, taxidermic preservation and notes on the other world specimens**

GIANNI INSACCO<sup>1\*</sup>, RIK NULENS<sup>2</sup> & BRUNO ZAVA<sup>3</sup>

<sup>1</sup> Museo Civico di Storia Naturale di Comiso, via degli Studi 9, 97013 Comiso (RG), Italy.

<sup>2</sup> Everstraat 30, 3680 Maaseik, Belgium.

<sup>3</sup> Wilderness studi ambientali, via Cruillas 27, 90146 Palermo, Italy.

\* Corresponding author: [g.insacco@comune.comiso.rg.it](mailto:g.insacco@comune.comiso.rg.it)

**Abstract.** The Museo Civico di Storia Naturale di Comiso is one of the most important poles of scientific-naturalistic popularization in southern Italy, especially in the field of zoology and paleontology. Among its many natural specimens there is a Coelacanth, *Latimeria chalumnae* Smith, 1939 which consisted of an old poorly preserved dry skin, from Madagascar. Due to the remarkable rarity of the specimen we decided to perform a taxidermal restoration work for exhibition purposes. As a result, the specimen is now filed in the international inventory of the Coelacanth Conservation Council (CCC).

**Keywords:** *Latimeria chalumnae*, Madagascar, taxidermy, Museo di Storia Naturale of Comiso, Italy.

### INTRODUCTION

The coelacanths known as fossils lived from Late Devonian to Late Cretaceous (Huxley, 1861; Woodward, 1891; Stensio, 1921) were attributed to a distinct taxonomic group by Louis Agassiz in its famous “Recherches sur les Poissons Fossiles” (1833-1843). Many coelacanth species have been discovered in the fossil record (Cloutier & Forey, 1991). They were considered extinct during the Late Cretaceous period, about 80 million to 70 million years ago. In 1938, a living coelacanth (described as *Latimeria chalumnae*) was caught, for the first time, near the mouth of the Chalumna river in East London, South Africa (Smith 1939, 1956; Courtenay-Latimer, 1979). After this sensational discovery several specimens were captured off the coast of the Archipelago of the Comoros, Mozambique, Kenya, Tanzania and in the South-West of Madagascar (Nulens *et al.*, 2011); other ‘live’ individuals were observed with the help of ROV’s and deep diving teams on their expeditions in the waters off the east coast of Africa and more precisely in the submarine canyons of the Greater St Lucia Wetland Park in Sodwana Bay, which has been declared (GSLWP) World Heritage Site (Hissmann *et al.*, 2006).

The genus *Latimeria* (Smith, 1939) is the only member of the living family Latimeriidae, today represented by two species. The second species (*Latimeria menadoensis*) inhabits the waters of the island of Sulawesi, in the Indonesian archipelago (Pouyaud *et al.*, 1999). Thanks to the rarity of this bony fish, an estimate of the population size was made in 1994 on Grande Comoro Island consisting of about 300 individuals (Hissmann, 1997).

Different preparation techniques have been tested and applied by several institutions, they can be grouped into three categories: taxidermized, skeletonized and stored in alcohol. During a survey of the old collections in the Museo Civico di Storia Naturale of Comiso (MSNC), a salted skin was found, badly preserved, which required a careful conservation in order to stop the deterioration of the skin and, in addition, to ensure the enhancement of the find and its exhibition.

One of the authors, the scientific curator of the Museum (G.I.), has prepared the specimen according to the modern taxidermy techniques, using the traditional methods (e.g., Gestro, 1915; Zangheri, 1981). The fish and part of the skeleton is now stored in the Zoological Collections with the catalogue number MSNC 4502; the permission was given in 2015 by the Italian CITES Scientific Commission of the Ministero dell'Ambiente e della Tutela del Territorio e del Mare.

#### DESCRIPTION OF THE SAMPLE AND CONSERVATION STEPS

The *Latimeria chalumnae* skin was wrapped in newspapers inside a large cardboard box (Fig. 1), with an apparent semi-rigid consistency. When touched it felt oily, typical for the dermal fat remains on the specimen, but also due to moisture retained by the salt. Many of the scales were detached from the skin or came loose at the slightest friction. A label inside the box gave the origin as “Tulear, Baie De Saint Augustin, Madagascar 1987”. No information has been discovered about the collector, it is assumed to come from a local scientist who often had contacts with French zoologists. Morphometric and meristic data are as follows: Total length (from tip of snout to tip of epicaudal right lobe) 1210 mm; head length (to posterior bony edge of operculum) 260 mm, eye diameter 40 mm. First dorsal-fin spines 8; second dorsal fin rays 27; anal fin rays 30; pelvic fin rays 35; anal fin rays 29, superior caudal fin rays 26; epaxial caudal-fin rays 33; hypaxial caudal-fin rays 23. A first glance thought the unique edge cut along the ventral midline of the body, showed the presence of some bones of the first and second dorsal fin, part of the inner bone of the caudal fin and internal cranial bones. All stalked lobed fins (pectoral fins, pelvic fins, anal and second dorsal fin) owned most of their bones. In order to perform pre-restorative tests, we deem to obtain some samples without damaging the



Fig. 1 – Dry skin of *Latimeria chalumnae* at the time of its discovery.

skin and detached scales. Due to the rarity of the specimen, tests have been performed just on skin samples in order to avoid irreparable damages. Therefore the left pectoral fin (Fig. 2) was detached from the skin and put into a saturated solution of sea salt with 5% potassium alum. The fin sample was monitored daily and after a period of 14 days the test gave the expected result. Fast tanning and softening method were subsequently performed, in order to eliminate tissues underlying the dermis, as well as muscle fibers, and to extract the bone components. At the same time the conservator proceeded sculpting a polyurethane manikin respecting dimensions and biometrics of the specimen (Fig. 3, 4). Once the tanning period was ended, a phase of degreasing with “Marseille soap” was conducted in order to remove residual fat content between the scales. Subsequently the skin was washed using an abundant weak flow of water removing soap grease and tanning salts. The scales that detach themselves during the various stages of preparation have been applied on a life-size ‘topographic design’, making it easier re-inserting them correctly afterwards. After drying, carried out exclusively with absorbent paper applied on both sides of the skin, the next cleaning step was performed on a rigid surface by a gentle use of a fish scraper and lancets. These tools have been used with great care, avoiding lacerations, and with the help of borax powder, applied in order to eliminate the muscle fibers and fat traces (Fig. 5). The head was removed, in order to facilitate cleaning of the skin and it was later refixed on manikin. During the whole conservative procedures the following parts have been removed: some internal bones of the skeleton, in particular the bones of the left pectoral fin, the two pelvic bones; the bone of the basal plate of the first and second dorsal fin, the cranium, the otoliths, the gill arch and part of the inner radial bones of



Fig. 2 – The left pectoral fin of the Coelacanth detached from the skin to perform the tanning tests.



Fig. 3 – Sculpture phase of a polyurethane manikin created on a template paper at scale 1:1.

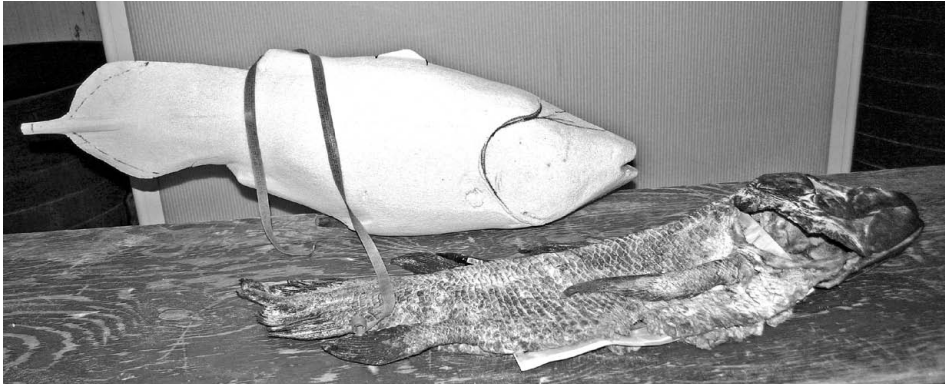


Fig. 4 – Manikin test phase and adjustment while respecting the biometrics of the skin.

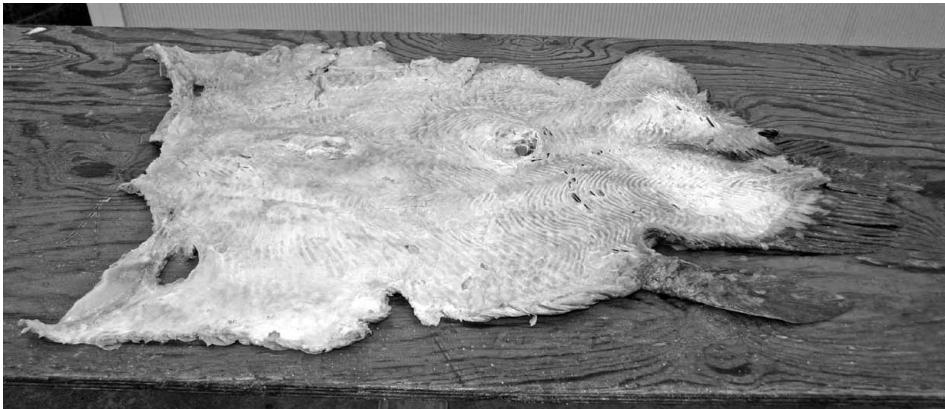


Fig. 5 – Inner side of the skin already been cleaned from muscle fibers and traces of grease. The mark of the bands and muscle segments are very marked and developed.

the epaxial caudal-fin rays. The skin has been softened using an soybean lecithin emulsion that restore the natural elasticity, and further has been also internally treated with borax ointment. Finally the skin has been mounted on the polyurethane manikin. Due to the presence of very thick cosmoid scales, sewing and fastening the skin on the manikin was performed with synthetic thread, staples and cyanoacrylate super glue, anticorrosion metal pins, cotton bandages and clamps have been applied on the mounted specimen, in order to keep and well fix scales to the skin during the drying stage (Fig. 6). A month later, bandages have been lifted and the status of the preparation was checked. The entire specimen was placed in a bath with percolation dimethylketone, in order to better eliminate other traces of greasiness still present on the outer surface and between the scales, after some weeks the skin was completely dry, and the scales which were previously detached have been mounted again and glued with superglue. The mounted skin of the specimen was fixed with Paraloid B72 diluted with dimethylketone,



the eye glasses were rebuilt with the connective tissue around them with Apoxie® Sculpt, appropriately colored with specific acrylic colors. When the work was completed the naturalized coelacanth was mounted on a wooden base with two brass pillars fixed ventrally between the pelvic and pectoral fins (Fig. 7) and displayed in a special showcase for the exhibition “For the Heavens and Seas” which opened on December 13, 2015 and was funded by the Regional Cultural Heritage and Sicilian Identity.



Fig. 6 – The Coelacanth during the drying period.



Fig. 7 – The *L. chalumnae* naturalized on exhibition at the Museo Civico di Storia Naturale in Comiso.

## DISCUSSION

Most of the dry mounted coelacanths that we find in museums and institutions all over the world, have been prepared by local taxidermists from the Comoro Islands. Dry mounted and stuffed coelacanths from the Comoro Islands are easily recognizable. Most of them were filled up with coconut fibers, a commonly used technique by taxidermists for all kind of species. But why did they use this technique for those precious coelacanths as well? Coelacanths could be stored in a 'wet collection' for example? For a poor country like the Comoro Islands this was not an evident solution. One has to build a special tank for storage and the huge amount of special preservation liquid needed was very expensive. One can imagine that for such a large coelacanth (female coelacanths can grow up till 2 meters in length) they need at least ca. 350-400 liters of preservation liquid. So the best way to do was dry mounting. Due to the high temperatures, the tropical circumstances and the lack of good electricity infrastructure, it is not possible to keep the coelacanth or other specimens fresh for a longer time. Sometimes deep-freezers were used to store coelacanths but very often they failed or broke down when the electricity distribution collapsed with the result that coelacanth specimens got rotten and had to be discarded.

The destination of the dried and stuffed coelacanth specimens which were prepared in the Comoro Islands was very different. Since his discovery the coelacanth was and still is the symbol, a kind of national identity of the Comoro Islands. The value of such a coelacanth specimen was high rated. Everyone in the world, not only museums but also private persons, would like to have a coelacanth in their collection and there was a real hunt on coelacanth specimens.

One coelacanth can be found in a typical hand-carved wooden cabinet in the foyer of the President's residence in Moroni, Grand Comoro. Dried and stuffed coelacanth specimens were often used as a gift to foreign presidents and friends of the president of the Federal Islamic Republic of Comoros. So we know that French president Jacques Chirac got a stuffed coelacanth in a hand-carved wooden cabinet, a gift of Mohammed Taki Abdoukarim during the audience on 19 June 1996 in Paris (CCC 276). President Ahmed Abdallah Abderemane of the Comoros presented a preserved dry mounted and stuffed coelacanth, again in a hand-carved wooden cabinet, to the Secretary-General of the United Nations, Dr. Javier Perez de Cuellar, on the occasion of the 40th anniversary of the establishment of the United Nations. The coelacanth was donated by the Comoran Government on 1 October 1985 (CCC 271). This was considered to be the most unusual gift received by the United Nations during its birthday celebration. Other people who got a coelacanth for example were the president of South Korea Chun Doo-hwan (CCC 273) and Chinese president Jiang Zemin (CCC 277). A second category which was interested in having a coelacanth were the museums or institutions in Europe, America and Asia. The third category were foreign people working, sometimes only temporarily, in the Comoro Islands who bought stuffed coelacanths and transported them afterwards to their home countries. These coelacanths, if they still exist, are very difficult to trace, but sometimes we are lucky and are able to trace them, just by coincidence or when the coelacanth is donated to a museum or an institution.

The few of the Madagascan coelacanths are stored in liquid or in a deep freezer. One coelacanth is preserved in liquid in the collection of the Rabesandratana Museum in Toliara also called "Musée de la Mer" (Nelson, 2006; Nulens *et al.*, 2011).

Tab. 1 – Number of holdings of stuffed and skeleton coelacanth specimens, *L. chalumnae* for country. In Italy is reported a new specimen MSNC 4502 – CCC 300 in specimen and skeleton.

Country	Specimens stuffed	Skeleton
Austria		2
Belgium		1
Comoros	14	
France	5	1
Italy	1	1
Japan	5	
Madagascar	2	
Mozambique	1	
People Republic of China	2	
South Africa	1	
South Korea	1	
USA	1	
<b>Total</b>	<b>33</b>	<b>5</b>

Although, due to the loss of information about his finder or collector, the Coelacanth MSNC 4502 could be the first found in Madagascar than the first official alert issued was off the village of Anakao, south of Toliara (Tuléar) on August 5, 1995 (Heemstra *et al.*, 1996; Nulens *et al.*, 2011).

Taking into account as a guideline the proper international inventory Coelacanth Conservation Council (Bruton & Coutovidis, 1991; Nulens *et al.*, 2011; Nulens, 2012, 2013, 2014, 2015), the specimen of the Museum of Comiso MSNC 4502 and renumbered as CCC 300. To better understand the meaning and importance of copy MSNC 4502 - CCC 300, it was considered appropriate to summarize stuffed and skeleton Coelacanths (*L. chalumnae*) in the world (Tab . 1) , as listed below in order of inventory.

#### COELACANTH STUFFED

- CCC 1      22 December 1938, East London Museum, South Africa
- CCC 35      1963, Muséum d'Histoire Naturelle, Besançon, France
- CCC 126    Early 1983, Foyer of President's residence, Moroni, Grand Comoro, Comores
- CCC 133    November 1985, Karima Restaurant, Domoni, Anjouan, Comoros
- CCC 134    Early 1986, Centre National de Documentation et de Recherche Scientifique, Muséum NDRS, Moroni, Comores.
- CCC 135    4 July 1986, JASEC no. 4 (JASEC no. 3 in EBF), Uyeno (1991), Numazu Deep Sea Aquarium, Numazu, Shizuoka Prefecture
- CCC 136    17 July 1986, JASEC no. 2, Uyeno. (1991), Numazu Deep Sea Aquarium, Numazu, Shizuoka Prefecture
- CCC 137    July 1986, Initially frozen, later dried and stuffed with coconut fibre. Seen in S. Bakari's taxidermy workshop, near Mutsamudu, Anjouan, Comores

- CCC 142 December 1986, Dry mount prepared by S. Bakari, Anjouan. Seen in S. Bakari's Scale Taxidermy workshop, near Mutsamudu, Anjouan, Comores.
- CCC 145 1 February 1987, Sewn crudely with string ventrally before being prepared as dry mount. Seen in S. Bakari's taxidermy workshop, near Mutsamudu, Anjouan
- CCC 146 June 1987, Seen in S. Bakari's taxidermy workshop, near Mutsamudu, Anjouan
- CCC 152 13 June 1988, Initially frozen, then prepared as a taxidermy display specimen, JASEC no. 6., Numazu Deep Sea Aquarium, Numazu, Shizuoka Prefecture
- CCC 162 11 August 1991, Female with 26 pups caught in Mozambique, Museu da Historia Natural, Maputo, Mozambique C.P. 257.
- CCC 166 21 December 1991, Direction de l'Agriculture et de la Forêt (DAF), Mamoudzou, Mayotte (Comoros). Note: this specimen was NOT caught in Mayotte. Mayotte is the only Comoran Island where, until today, no coelacanths were reported.
- CCC 243 8 November 1980, Ibaraki Nature Museum, Japan
- CCC 260 Purchased 1973, MNHN, Paris
- CCC 262 1974, Pathologisch-Anatomisches Bundesmuseum Narrenturm, Uni Campus, Vienna, Austria. Before the coelacanth was skeletonized, the owner and skull collector, a certain Mr. Fritz Kincel, removed the skin from the coelacanth for later reuse on a model. The missing parts like the head, tail and fins were reconstructed in wood and the whole 'new' specimen was painted in a blue color because coelacanths are blue when they come out of the water. In fact, this coelacanths natural 'blue color' fades very rapidly after the specimen died.
- CCC 269 1983, Muséum d'Histoire Naturelle de Toulouse, Toulouse, France
- CCC 270 1984, Museum of Natural History, Beijing, China
- CCC 271 Before October 1985, United Nations, Architectural & Engineering Unit, New York, USA
- CCC 273 1985, Building Sea World Aquarium, Yeongdeungpo-gu Seoul, South-Korea
- CCC 275 Date unknown, (Anjouan), Office de Tourisme, Port La Nouvelle, France.
- CCC 276 ~1990, Musée du Président Jacques Chirac, Sarran, France
- CCC 277 Before 1997, Beijing Museum of Natural History, Beijing, China
- CCC 281 Date unknown, Comoros, Tokyo Custom House, East Kyoto Minato-ku, Japan.
- CCC Ad 1 Date unknown, Comoros, Ylang Ylang Hotel, Moroni, Grand Comoro, Comoros
- CCC Ad 9 Date unknown, Comoros. Private House, Mutsamudu, Comoros.
- CCC Ad 10 Date unknown, Comoros. Private House, Mutsamudu, Comoros.
- CCC Ad 11 Date unknown, Comoros. Private House, Mutsamudu, Comoros.
- CCC Ad 12 Date unknown, Comoros. Private House, Moroni, Comoros.
- CCC Ad 13 Date unknown, Comoros, Private property of a French captain, Mutsamudu, Anjouan, Comoros
- CCC 284 2010, West of Nosy Ve (Anakao) – Toliara, Madagascar. Institut Halieutique et des Sciences Marines, University of Toliara (Tuléar), Madagascar.
- CCC 285 2010. West of Nosy Ve (Anakao) – Toliara, Madagascar. Institut Halieutique et des Sciences Marines, University of Toliara (Tuléar), Madagascar.



## COELACANTH SKELETONS

- CCC 7 5 September 1954, MNHN, Paris, France  
CCC 92 14 February 1974, Naturhistorisches Museum Vienna, Vienna, Austria  
CCC 262 1974, Pathologisch-Anatomisches Bundesmuseum Narrenturm, Uni Campus, Vienna, Austria. Before the coelacanth was skeletonized, the owner and skull collector, a certain Mr. Fritz Kincel, removed the skin from the coelacanth for later reuse on a model.  
CCC 278 2000 (?), Koninklijk Museum voor Midden Afrika, Tervuren, Belgium.

## COELACANTHS PRESERVED IN ITALY

The number of specimens preserved in Italy is more significant than in other European museums, except the MNHN in Paris.

Unlike the specimen prepared “dry“ MSNC 4502 - CCC 300, all other 5 existing coelacanth specimens in Italy and attributed to the species *L. chalumnae* are preserved in liquid by 3 museums. Description of the finds, following the alphabetical order of the city (Nulens *et al.*, 2011).

**Pavia.** Museo di Storia Naturale of the University of Pavia (Fig. 8).

- CCC 34 1963, Mozambique Channel, length 114cm., Male (?), preserved in Formalin 10%. Millot *et al.* (1972). Sent to Sardinia, on December 10, 1966, as a gift of the Aga Khan to the paleontological Institute of Pavia. The specimen was originally property of Aga Khan IV (Prince Karim Al Hussein). The curator of paleontological museum reported that it was originally smoked and displayed in his yacht. Since the preparation was poor the specimen was offered for sale to different institutions (including the Acquario civico di Milano, director at that time: Prof. Menico Torchio). Later arrived at the Paleontological Museum of the University of Pavia. The Paleontological collections are now included in the Museo di Storia Naturale of the University of Pavia, Italy. The specimen is on display.

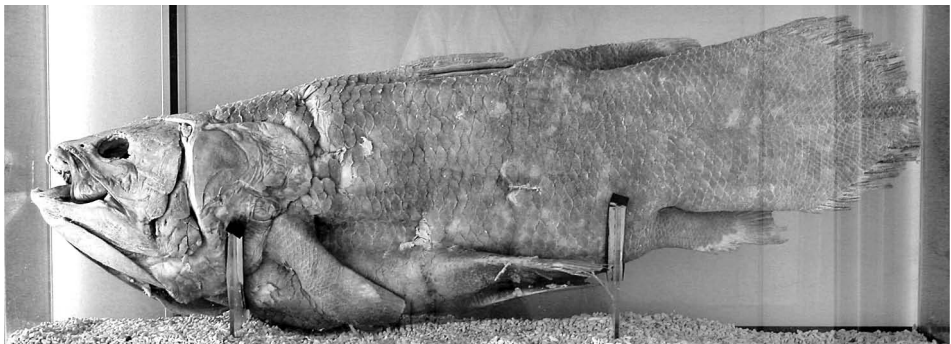


Fig. 8 – *L. chalumnae* CCC 34 at the Museo di Storia Naturale of the University of Pavia.

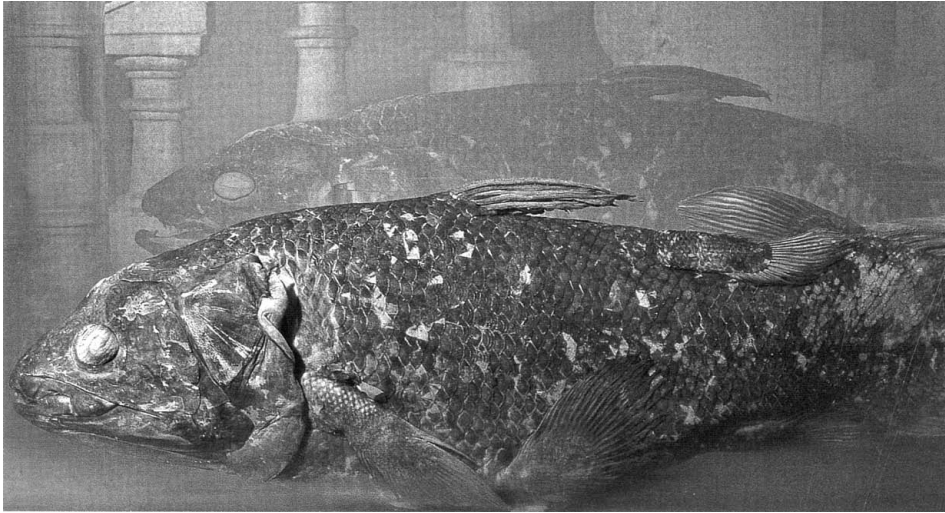


Fig. 9 – The three *L. chalumnae* specimens preserved in a glass case at the Museo Regionale di Scienze Naturali of Torino (Picture from: LANZARDO, 1998).

**Torino.** Museo Regionale di Scienze Naturali (Fig. 9).

- CCC 111 December 1978. Off Iconi, Grand Comoro, depth of capture 700-800 m, length 130cm (Elter 1980), ~40kg. On display in a 4% formalin solution. The coelacanth was collected from the fishermen by Dr Erik Domini who worked at the Comoros at that time. Five hours after death the coelacanth was frozen at a temp of -30°C and kept at that temperature during the trip from the Comoros to Italy.
- CCC 114 August 1979. Iconi, Grand Comoro. Depth of capture 150 m., length 122 cm. Frozen, 2 hours after capture.
- CCC 115 September 1979. Iconi, Grand Comoro. Depth of capture 150m, length 100 cm. Frozen, 2 hours after capture.

**Trieste.** Museo Civico di Storia Naturale (Fig. 10).

- CCC 113 10 December 1978. Iconi, Grand Comoro. Depth of capture 150m., length 135cm. Frozen at -30°C, 5–6 hours after capture. On the label it is written that the specimen was a gift to the Trieste Natural History museum by Dr Erik Domini, to honour the memory of the former Director, Dr Edoardo Gridelli of Trieste. In EBF this specimen was assigned to the museum in Torino. After the tank was unexpectedly leaking during a night, the more than 200 litres preservation liquid affected the museum library room below the coelacanth exhibition room. A restoration team under supervision of Mr. Andrea Dall' Aste and Mr. Sergio Martinichich decided to build a new and safe display aquarium for the coelacanth. A new tank was made and donated by Mr. Flavio Bacchia and executed in AlMg alloy, with a security tank below the display tank. The coelacanth exhibition was reopened on December 25, 2012.

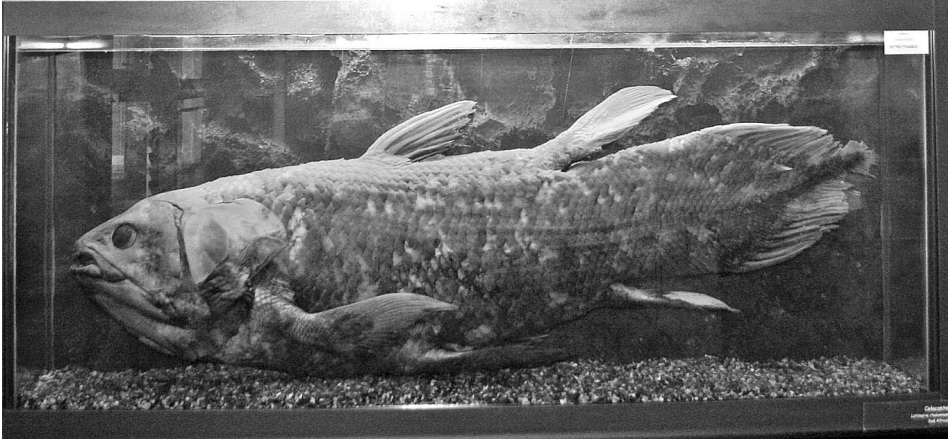


Fig. 10 – *L. chalumnae* CCC 113 at the Museo Civico di Storia Naturale of Trieste.

## CONCLUSIONS

About 314 are the coelacanth specimens preserved in the world and stored in liquid, rarely naturalized dry and skeleton (Nulens *et al.*, 2011; Nulens, 2011, 2012, 2013, 2014, 2015).

Storing them in a preservative liquid formaldehyde-based or alcohol ethanol was the most common method, while the dry storage with coconut fiber was the most widespread in the Comoro Islands.

The coelacanth MSNC 4502 - CCC 300 is the first dry mounted specimen and partial skeleton in Italian collections and the first one of Madagascar origin. It also appears to be the sixth stuffed individual preserved in Europe, of which five specimens are housed in French institutions (Tab. 1), all of which collected in the Comoro Islands.

According to a comparison of the estimated length of the Comiso specimen MSNC 4502 - CCC 300 in relation to measurements performed on other discovered coelacanths (Heemstra *et al.*, 1996; Nulens *et al.*, 2011; Nulens, 2011, 2012, 2013, 2014, 2015), we can be sure that our coelacanth could be a male specimen weighting about 30-35 kg.

In Madagascar in 1995-2012 (Heemstra *et al.*, 1996) about 24 specimens were caught in Toliara site (Nulens *et al.*, 2011; Nulens, 2011, 2012, 2013, 2014, 2015) and together with specimens MSNC 4502 - CCC 300 they belong to a highly localized populations of *L. chalumnae* who lives in the submarine canyon of Toliara (Green *et al.*, 2009). This finding stresses the importance of protecting the Toliara area as it has been made for the submarine canyons of the Greater St Lucia Wetland Park in Sodwana Bay, World Heritage Site (Hissmann *et al.*, 2006).

**Acknowledgements.** We warmly thank Prof. Carlo Violani (University of Pavia, Italy) and Prof. Giorgio Carnevale (University of Torino, Italy) for useful comments and revision of text, which improved a previous draft; Thank are also due to Dr. Edoardo Razzetti (University of Pavia) who provided the picture of Pavia specimen.

## RIASSUNTO

### Il Celacanto, *Latimeria chalumnae* Smith, 1939 del Museo di Storia Naturale di Comiso, conservazione tassidermica e note su altri esemplari preservati nel mondo

Il Museo Civico di Storia Naturale di Comiso costituisce uno dei più importanti poli di divulgazione scientifico-naturalistici presenti nell'Italia meridionale soprattutto nel campo della zoologia e paleontologia. Tra i suoi numerosi reperti naturalistici annovera un Celacanto, *Latimeria chalumnae* Smith, 1939, una vecchia pelle secca e mal conservata, proveniente dal Madagascar. Considerata la notevole rarità del reperto è stato messo in atto un intervento di preparazione tassidermica per fini espositivi. L'esemplare inoltre è stato incluso nell'inventario internazionale del Consiglio Conservazione Celacanto (CCC).

## REFERENCES

- Agassiz J. L. R. (1833-1843). *Recherches sur les Poissons Fossiles*, Imprimerie de Petitpierre, Neuchatel.
- Ambrose T., Paine C. (1993). *Museum Basics*. London, New York, Routledg.
- Bruton M.N. and Coutouvidis S. E. (1991). An inventory of all known specimens of the coelacanth *Latimeria chalumnae*, with comment on trends in the catches. *Environmental Biology of Fishes* 32(1-4): 371-390.
- Cloutier R. and Forey P. L. (1991). Diversity of extinct and living actinistian fishes (Sarcopterygii). *Environ. Biol. Fishes* 32: 59-74.
- Courtenay Latimer M. (1979). My story of the first coelacanth. *Occas. Pap. Calif. Acad. Sci.* 134: 6-10.
- Elter O. (1980). Il Celacanto - Exposition Catalog from the "Museo Regionale di Scienze Naturali" in Torino (Italy), May-June.
- Forey P. L. (1991). *Latimeria chalumnae* and its pedigree. *Environ. Biol. Fishes* 32: 75-97.
- Fricke H., Hissmann K., Schauer J. and Plante R. (1995). Yet more danger for coelacanths. *Nature* 374: 314.
- Gestro R. (1915). Il naturalista preparatore (imbalsatore-tassidermista). Milano, Ulrico Hoepli Editore.
- Green A., Uken R., Ramsay P., Leuci R., and Perritt S. (2009). Potential sites for suitable coelacanth habitat using bathymetric data from the western Indian Ocean. *South African Journal of Science*, Vol. 105, 151-154.
- Heemstra P.C., Freeman A.L.J., Yan Wong H., Hensley D.A., & Rabesandratana H.D. (1996). First authentic capture of a coelacanth, *Latimeria chalumnae* (Pisces: Latimeriidae), off Madagascar. *South African Journal of Science* 92: 150-151.
- Hissmann K., Fricke H. and Schauer J. (1998). Population monitoring of the coelacanth (*Latimeria chalumnae*). *Conserv. Biol.* 12, 759-765.
- Hissmann K., Fricke H., Schauer J., Ribbink A.J., Roberts M., Sink K. and Heemstra P. (2006). The South African coelacanths - an account of what is known after three submersible expeditions. *S. Afr. J. Sci.* 102, 491-500.
- Huxley T.H. (1861). Preliminary essay upon the systematic arrangement of the fishes of the Devonian epoch. Figures and descriptions illustrative of British organic remains. *Mem. Geol. Surv. U.K.* Dec. 10: 1-40.
- Lanzardo D. (1998). *Arca Naturae. Le Collezioni "invisibili" del Museo Regionale di Scienze Naturali di Torino*. Giorgio Mondadori, 176 pp.
- Martin, R. (1970). D'utiles détails sur le coelacanth. *Promo. Al'Camara* 16: 25-35.
- McAllister, D.E. and Smith C.L. (1978). Mensurations morphologiques, dénombrements méristiques et taxonomie du coelacanth, *Latimeria chalumnae*. *Naturaliste canadien* 105: 63-16.
- McCosker, J.E. (1979). Inferred natural history of the living coelacanth. *Occ. Pap. Calif. Acad. Sci.* 134: 17-24.
- McCosker, J.E. and M.D. Lagios M.D. (1979). The biology and physiology of the living coelacanth. *Occ. Pap. Calif. Acad. Sci.* 134: 1-175.
- Millot J., Anthony J. and Robineau D. (1972). Etat commenté des captures de *Latimeria chalumnae* Smith (Poisson, Crossopterygien, Coelacanthide) effectuées jusqu'au mois d'octobre 1971. *Bull. Mus. Nat. Hist. nat., Paris*, 3e serie, no. 53, *Zoologie* 39: 533-548.
- Nelson Joseph S. (2006). *Fishes of the World*. John Wiley & Sons, Inc. 4<sup>th</sup> Edition; XIX: 601 pp.
- Nulens R., Scott L., Herbin M. (2011). An updated inventory of *Latimeria* spp. *Publications in Aquatic Biodiversity Smithiana Special Publication* 3, 12 September 2011.

- Nulens R. (2011). Additions to the Coelacanth Inventory published in Smithiana Special Publication 3, 12 September 2011, Update 1, dd. 21 November 2011.
- Nulens R. (2012). Additions to the Coelacanth Inventory published in Smithiana Special Publication 3, 12 September 2011, Update 2, dd. 21 December 2012.
- Nulens R. (2013). Additions to the Coelacanth Inventory published in Smithiana Special Publication 3, 12 September 2011, Update 3, dd. 27 December 2013.
- Nulens R. (2014). Additions to the Coelacanth Inventory published in Smithiana Special Publication 3, 12 September 2011, Update 4, dd. 28 December 2014.
- Nulens R. (2015). Additions to the Coelacanth Inventory published in Smithiana Special Publication 3, 12 September 2011, Update 5, dd. 29 December 2015.
- Ogiso, T. 1986. Island of the coelacanth. *Expert* 71: 610. (In Japanese).
- Pouyaud L., Wirjoatmodjo S., Rachmatika I., Tjakrawidjaja A. and Hadiye R.K. and Hadie W. (1999). Une nouvelle espèce de coelacanth. Preuves génétiques et morphologiques. *Comptes Rendus des Sciences Naturelles*, vol. 322 (3): 261-267.
- Schliewen U., Fricke H., Schartl M., Epplen J. and Paabo S. (1993). Which home for the coelacanth? *Nature* 363: 406.
- Smith J.L.B. (1939). A living fish of Mesozoic type. *Nature* 143: 455-456.
- Smith J.L.B. (1956). *Old Fourlegs: The story of the Coelacanth*. London: Longman Green.
- Stensio E.A. (1921). *Triassic Fishes from Spitzbergen*. Vienna: Adolf Holzhausen.
- Suzuki, N. & K. Tanauma. (1984). Coelacanth fishing by native fishermen. pp. 8-9. In: *Proceedings of First Symposium on Coelacanth Studies, Tokyo*. (In Japanese).
- Suzuki N., Suyehiro Y. And Tamada T. (1985). Initial report of expeditions for coelacanth - Part 1 - Field studies in 1981 and 1983. *Sci. Pap. Coll. Arts Sci., Univ. Tokyo* 35: 37-79.
- Thys Van Den Audenaerde D.F.E. (1984). Le coelacanth des Comores, *Latimeria chalumnae* curiosité zoologique, fossile vivant ou animal aberrant? *Afrika-Tervuren* 30: 90-103.
- Uyeno T. (1991). Observations on locomotion and feeding of released coelacanths, *Latimeria chalumnae*. *Env. Biol. Fish.* 32: 267-273.
- Woodward A.S. (1891). *Catalogue of Fossil Fishes in the British Museum (Natural History)*. British Museum (Natural History), London. Vol. 2: 567 pp.
- Zangheri P. (1981). *Il naturalista*. Milano, Ulrico Hoepli Editore.