Saya de Malha – an invisible island in the Indian Ocean. The problem of establishing a shallow water marine protected area in the High Seas

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The Mascarene Plateau is a submerged plateau in the South – West region of the Indian Ocean. The plateau extends approximately to 2000 km, from the Seyshelles in the north to La Reunion in the south. The plateau covers an area of over 115 square kilometers of shallow water, with depths ranging from 8 to 150 m. There are several shoals on the plateau one of them is a Saya de Malha Bank that located in the middle of Mascarene Plateau and is a largest shoal in the Indian Ocean. The bank covers an area of 40,808 square kilometers. The nearest land from the bank is Agalega islands (Republic of Mauritius) and distance from these islands to the bank more then 230 miles. So Saya de Malha Bank is largest shallow water habitat in the waters beyond the national jurisdiction. This makes Saya de Malha especially important area from both scientific and conservation standpoint.

India

Seyshelles

Africa

Agalega

Mascarene Plateau

Saya de Malha

Reunion

MADAGASCAR

INDIAN OCEAN

•Square: 115 km²

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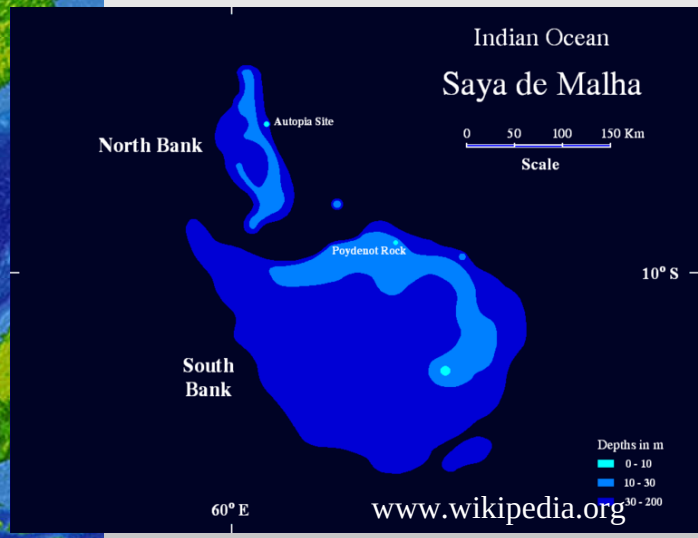
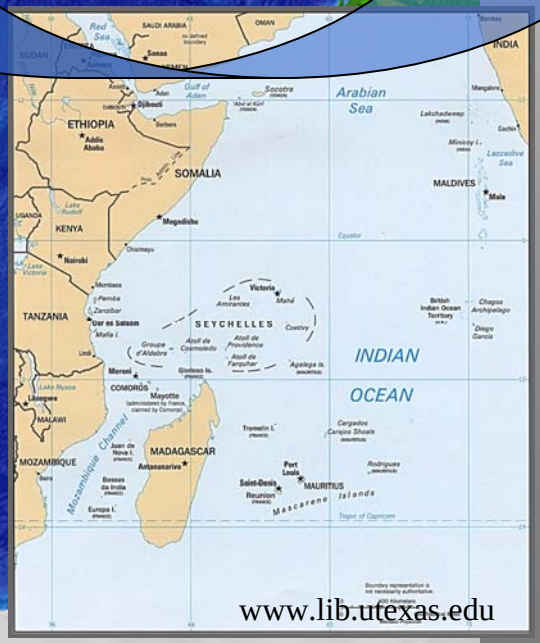


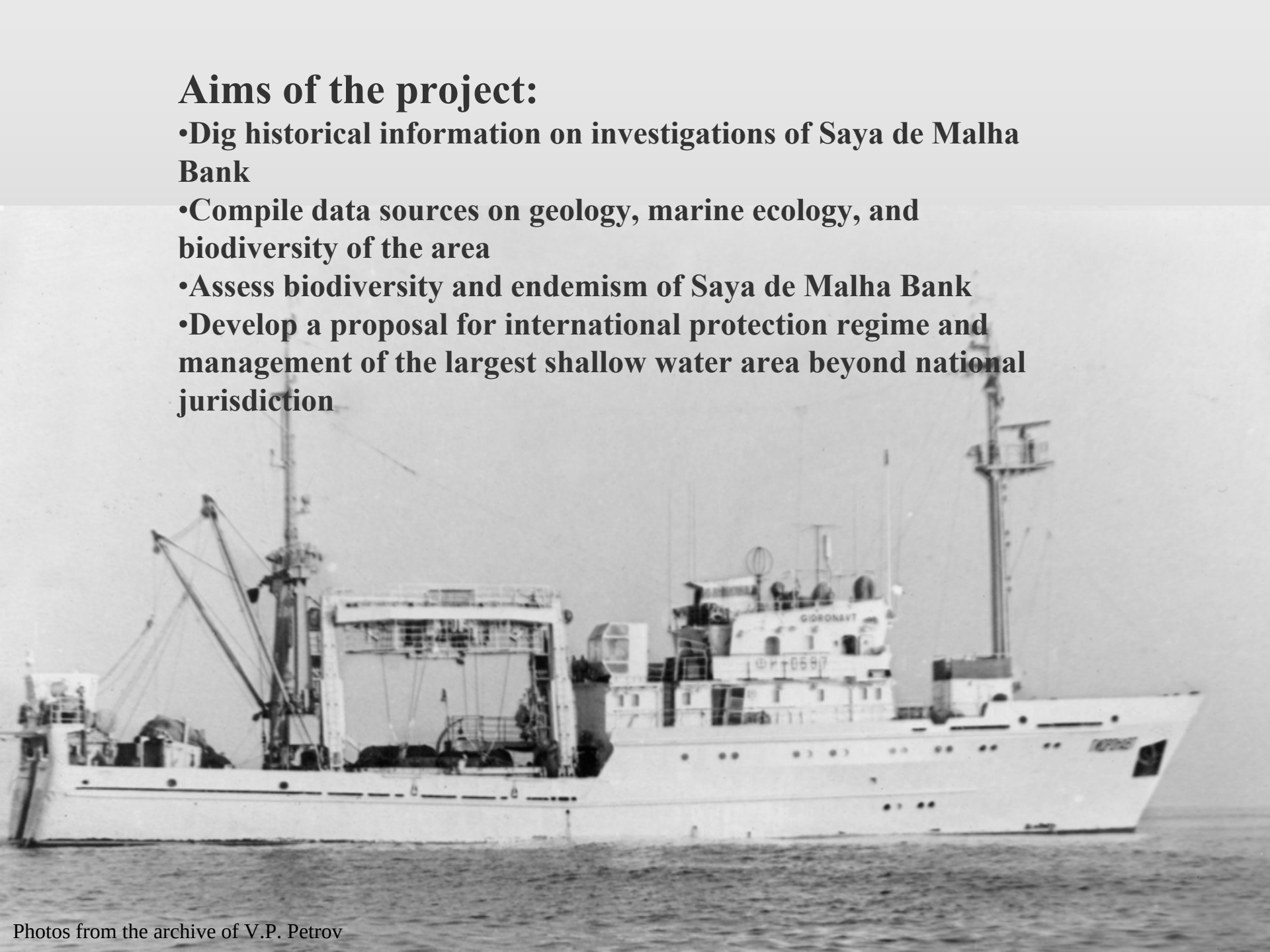


08º30’ - 12º0’ S
59º30’ - 62º30’ N

•Minimum depth: 7 m
•Square: 40,808 km²
•Distance for the nearest land: more than 230 miles
•Located entirely in the High Seas

Aims of the project:

- **Dig historical information on investigations of Saya de Malha Bank**
- **Compile data sources on geology, marine ecology, and biodiversity of the area**
- **Assess biodiversity and endemism of Saya de Malha Bank**
- **Develop a proposal for international protection regime and management of the largest shallow water area beyond national jurisdiction**

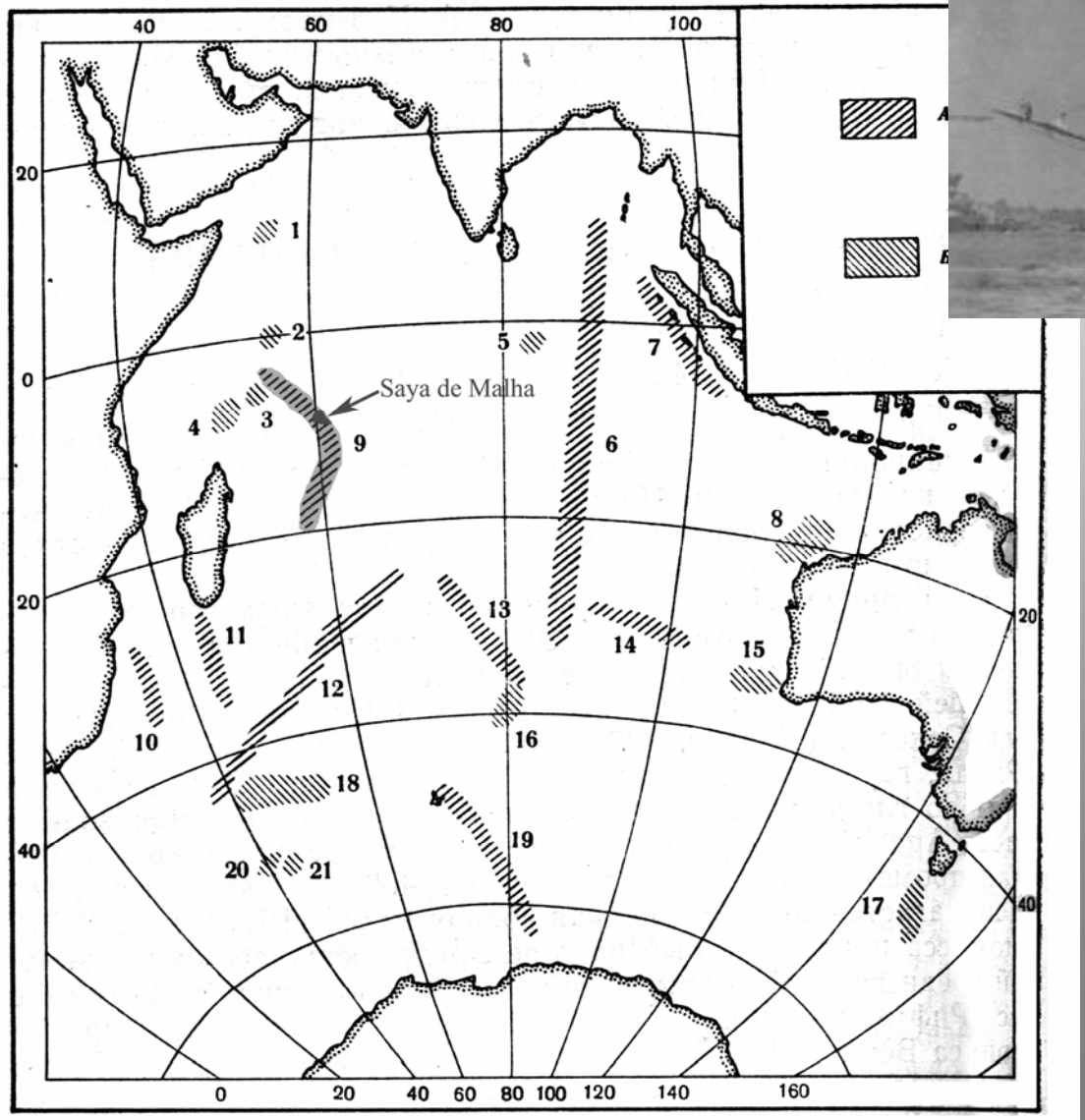


Photos from the archive of V.P. Petrov

The Saya de Malha Bank was extensively visited by research vessels from the beginning of the 20-th century up to the late 1980s. The first documented visit to the bank was The Percy Sladen Trust Expedition organized by John Stanley Gardiner on board the sailing- steaming RV Sealark in 1905.

The period from the mid-1960s to early 1980s was the time of the greatest Soviet fisheries expansion in the Indian Ocean. The Ministry of Fisheries of USSR considered the western Indian Ocean as an area of the great potential resources which only slightly exploited by coastal artisan fisheries and long-lining but never by ground trawling. In that period Soviet expeditions worked in all parts of the IO.

Areas of the Indian Ocean studied by the Soviet fisheries expeditions in the 1960-89s (Scherbachev et. al, 1989)



First research expedition to the islands of the western Indian Ocean organized by John Stanley Gardiner on board R.V. **Sealark in 1905 (www.tmbl.gu.se)**

2. Equator Seamountain; 3. Fred's Seamountain; 5. mountain of Anastasiy Nikitin; 6. East-Indian mountain ridge; 9. Mascarene mountain ridge; 10. Mozambiquean mountain ridge; 11. Madagascar mountain ridge; 12. West-Indian mountain ridge; 13 Central-Indian mountain ridge.

Literature search yielded in listing 26 Russian expeditions which visited Saya de Malha Bank and contributed to the study of particular aspects of the regional geology, oceanography, seascapes and biodiversity.

List of Russian expeditions worked at the Saya de Malha bank

Dates	Organising institution or vessel owner	Boat	Reference
1961-1964	AzcherNIRO	Vladimir Vorobjov (Four cruises)	Nesis, 1993
1974	AzcherNIRO 4th cruise	Chatir-Dag	Fedorov et. all, 1980
1975-1977	Production-Search Association of Fish Searching and Research Fleet for the Southern Basin PA SRF(YUGRYBPOISK)	Professor Mesyatsev (Two voyages)	Nesis, 1993
1976	AzcherNIRO	Chernomor	Nesis, 1993
1976-03-23 1976-06-12	P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences (IORAS)	Academik Kurchatov, 22nd cruise	Scherbachev et. all, 1989
1977	AzcherNIRO, Shirshov Institute of Oceanology/RAS (SIORAS)	Ichtiandr	Fedorov et. all, 1980
1978-01-26 1978-03-31	Association of Fish Searching and Research Fleet for the Southern Basin PA SRF(YUGRYBPOISK)	Zvezda Krima	Nesis, 1993
1980	Production-Search Association of Fish Searching and Research Fleet for the Southern Basin PA SRF(YUGRYBPOISK)	Elsk	Nesis, 1993
1981-12-31 1982-05-16	Production-Search Association of Fish Searching and Research Fleet for the Southern Basin PA SRF(YUGRYBPOISK)	Lesnoy	Nesis, 1993
1981	Marine Hydrophysical Institute of the Ukrainian Academy of Sciences (MHI)	Academik Vernadskiy, 24th cruise	Milchakova et.all, 2005
1982-09-20 1983-03-04	AzcherNIRO	Fiolent	Nesis, 1993
1984	Marine Hydrophysical Institute of the Ukrainian Academy of Sciences (MHI)	Academik Vernadskiy	Milchakova et.all, 2005
1984	Russian Federal Research Institute of Fisheries and Oceanography (RIFO)	Odissey, 33th cruise	Sirenko, 1993
1984-01-12 1984-03-20	Russian Federal Research Institute of Fisheries and Oceanography (RIFO)	Academic Knipovich	Nesis, 1993
1984-01 – 1984 -05	Institute of the Biology of the Southern Seas NASU (Inst.Bio.South.Seas)	Professor Vodjanitski, 16th cruise	Grese, 1988
1986	Institute of the Biology of the Southern Seas NASU (Inst.Bio.South.Seas)	Academik Kovalevskiy	Nesis, 1993
1987-1990	Scientific production association 'UzhMorGeologia' UzhMorGeologia	Issledovatel(Two voyages) 17 cjezd profsojusov(Two voyages)	Scherbakov, Zhivago, 2001
1989	Shirshov Institute of Oceanology/RAS (SIORAS)	Vitjaz, 17th cruise	Nesis, 1993

In general on the Saya de Malha Bank were 26 expeditions from 20 vessels. Partly results of these explorations were published we found 30 papers in Russian and 10 in English.

Summary of Soviet investigations 1960-1980s

- **Expeditions 26**
- **Vessels 20**
- **Publications in Russian 30**
- **Publications in English 10**

Submersible **TINRO-2**

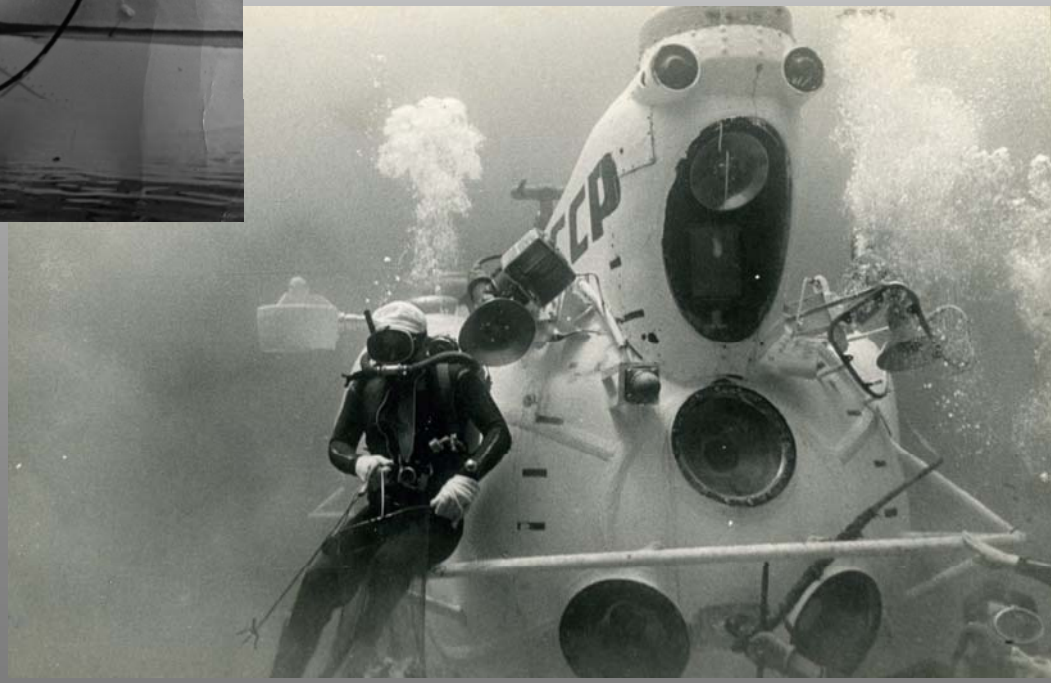
Photos from the archive of V.P. Petrov

Several explorations with submersibles were conducted on Saya de Malha and other seamounts of the Indian Ocean. In particular the investigations on Saya de Malha were conducted on board R.V. Odissey with a submersible SEVER 2.

Several explorations with submersibles were conducted on Saya de Malha and other seamounts of the Indian Ocean

R.V. ODISSEY and submersible SEVER-2 in 1981

”Hydronaut” Base in Sevastopol was operating in the 1970-80s a fleet of the first generation of submersibles.



Submersible TINRO-2

Photos from the archive of V.P. Petrov

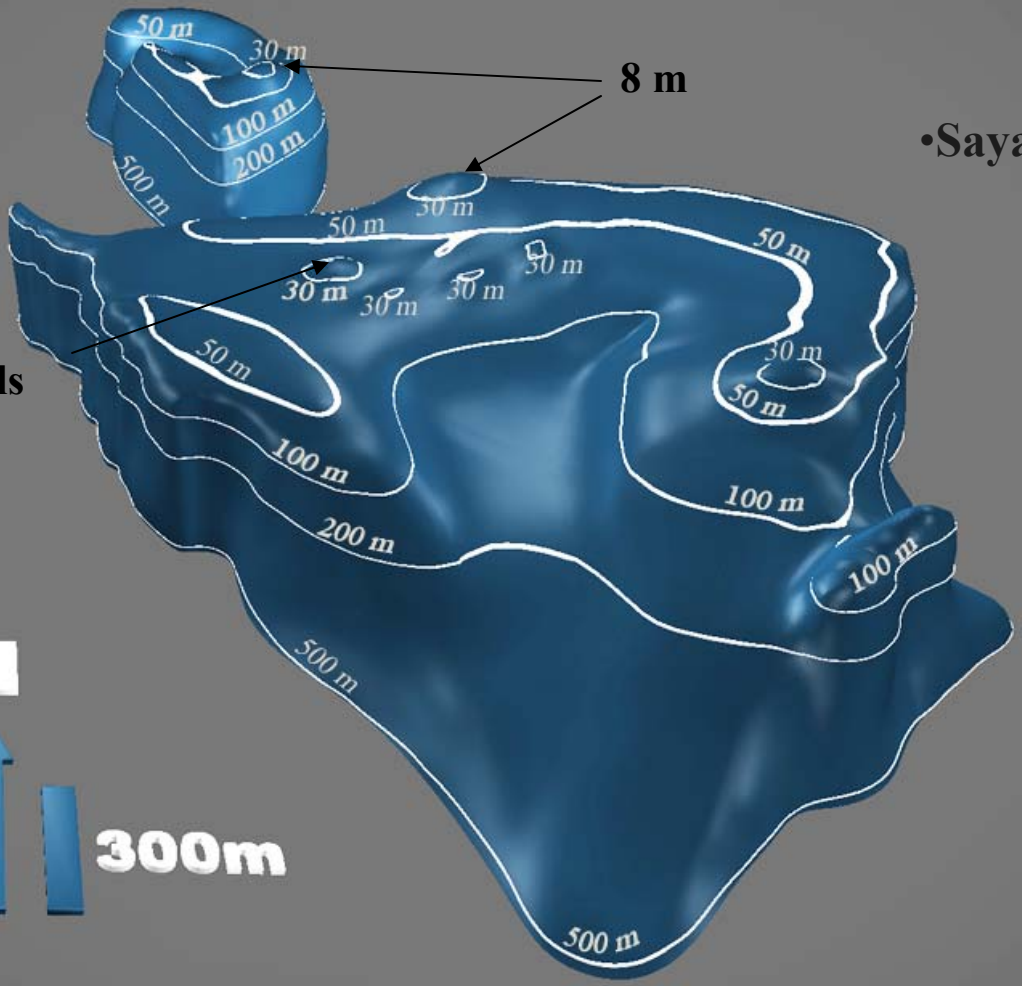
It is in fact Bank composed of two separate structures; the smaller North bank and the huge South bank. There are two shallowest sites known on the bank, with a depth of 8 meters. Saya de Malha is similar to Pacific atolls. Tope of the South bank has a complex structure. Its fringing reef is 20-25 miles wide. Lagoon is deeper then in the Pacific atolls. Median depth of lagoons on the Pacific is 46 m, on Saya de Malha it ranges from 70 m (in the north) to 140 m (in the south). There are more then 20 coral hills and ridges rising up to 30-50 m on the accumulative flat. Hills have similar structure to intralagoon reefs of other atolls. Thus the Saya de Malha bank can be related to submerged atolls.

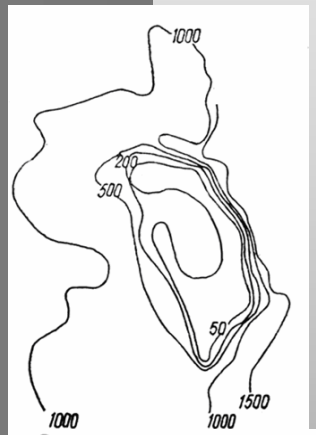
Depth and relief

•Saya de Malha is submerged atoll

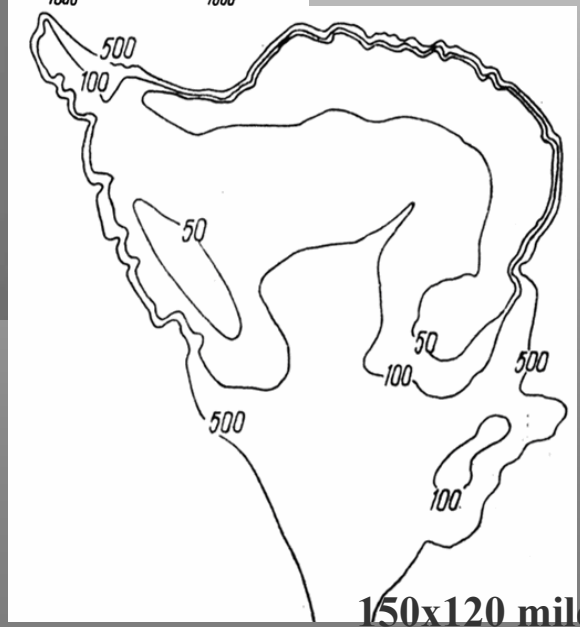
8 m

coral hills





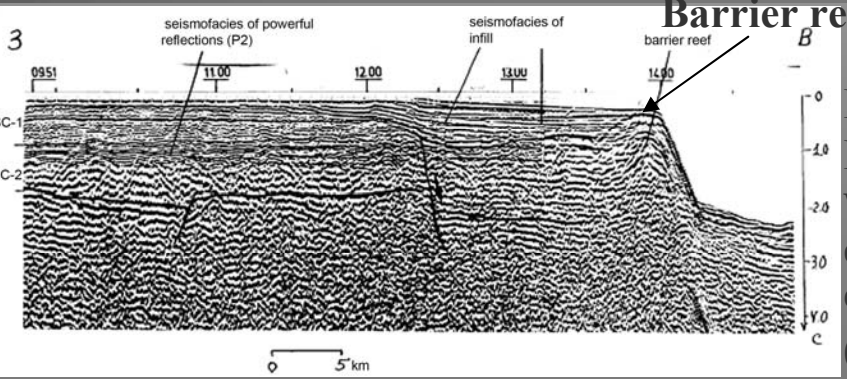
80x25 miles
North Bank



150x120 miles
South Bank

(Grese, 1988)

Barrier reef



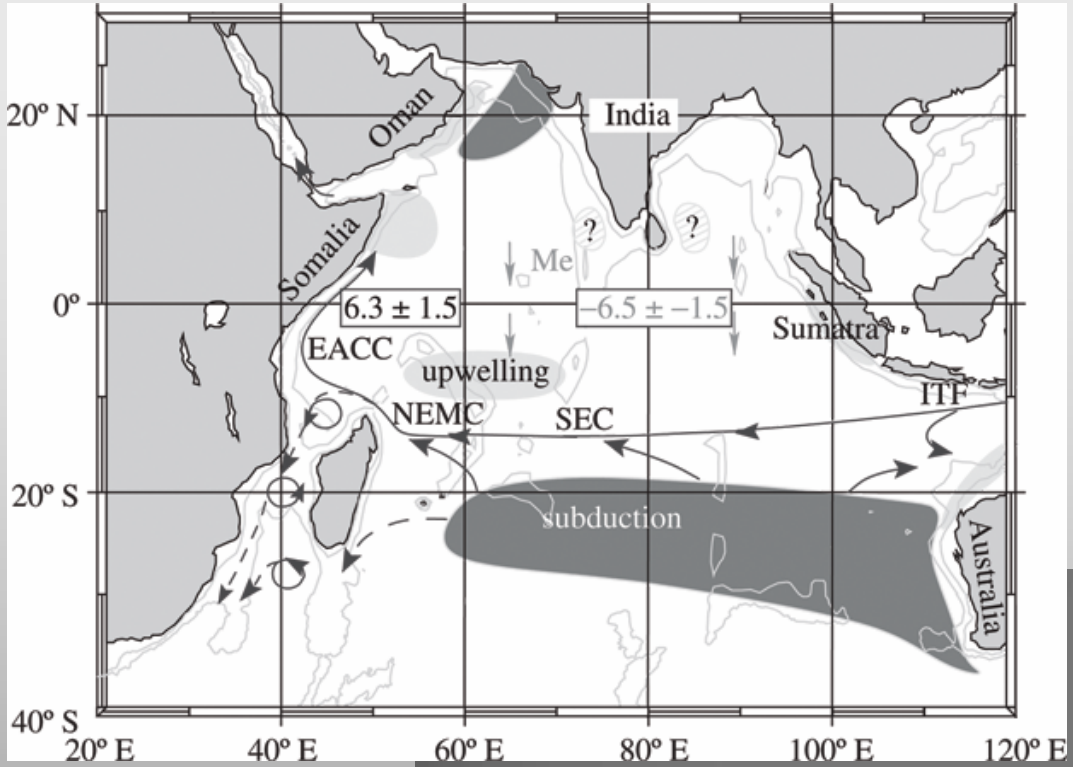
East slope of the Bank (11° S)

Wave pattern near the upper edge can be explaied by exist of barrier reef

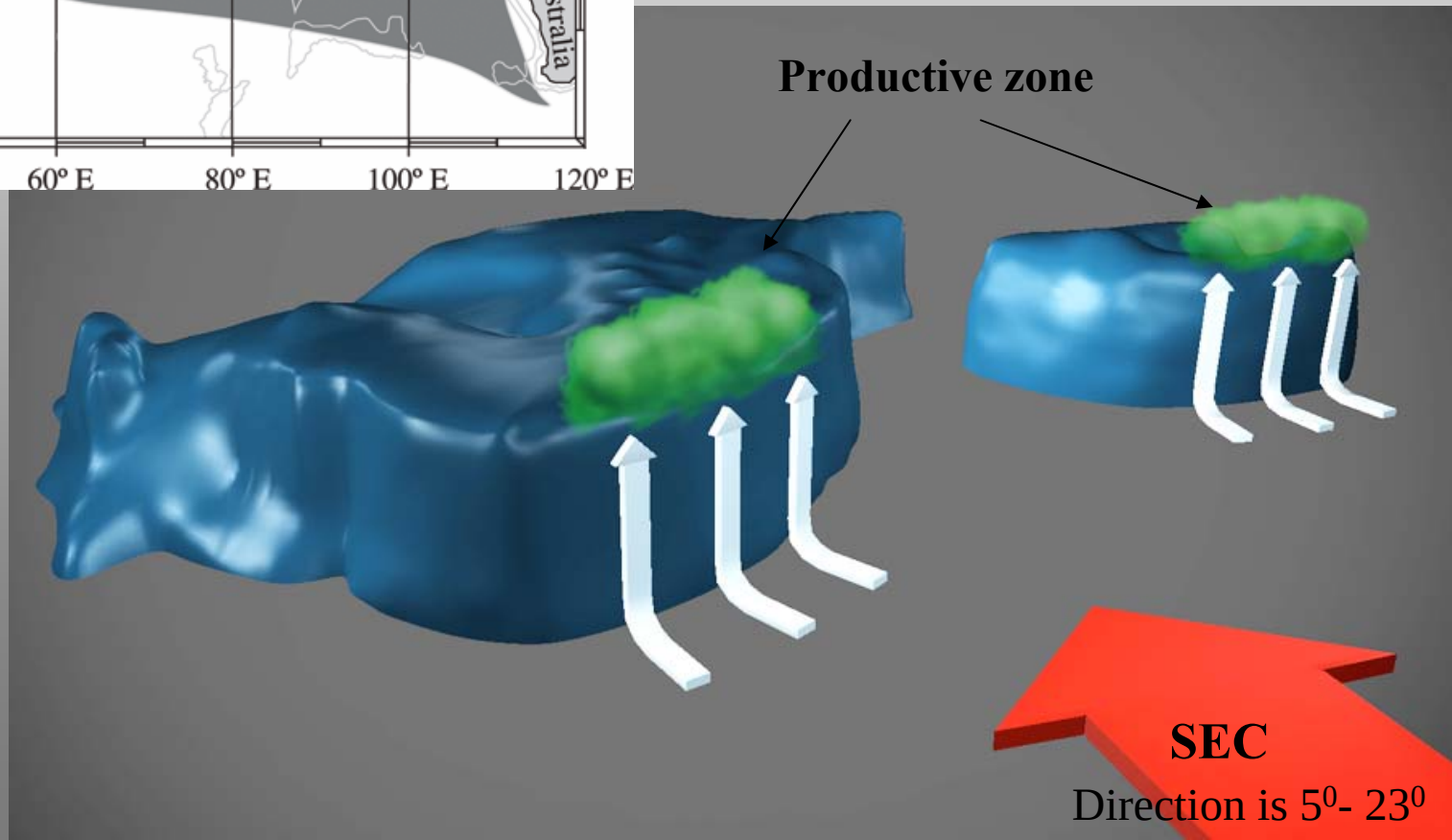
(Scherbakov, Zhivago, 2001)

The bank lies within the South Equatorial Current. The SEC delivers relatively high levels of nutrients to the near-surface waters of the central and northern regions of the plateau, compared with the southern regions of the plateau. This is partly due to upwelling. This may drive increased production of phytoplankton, which would in turn be expected to fuel increased abundances of zooplankton and higher trophic levels.

Oceanography

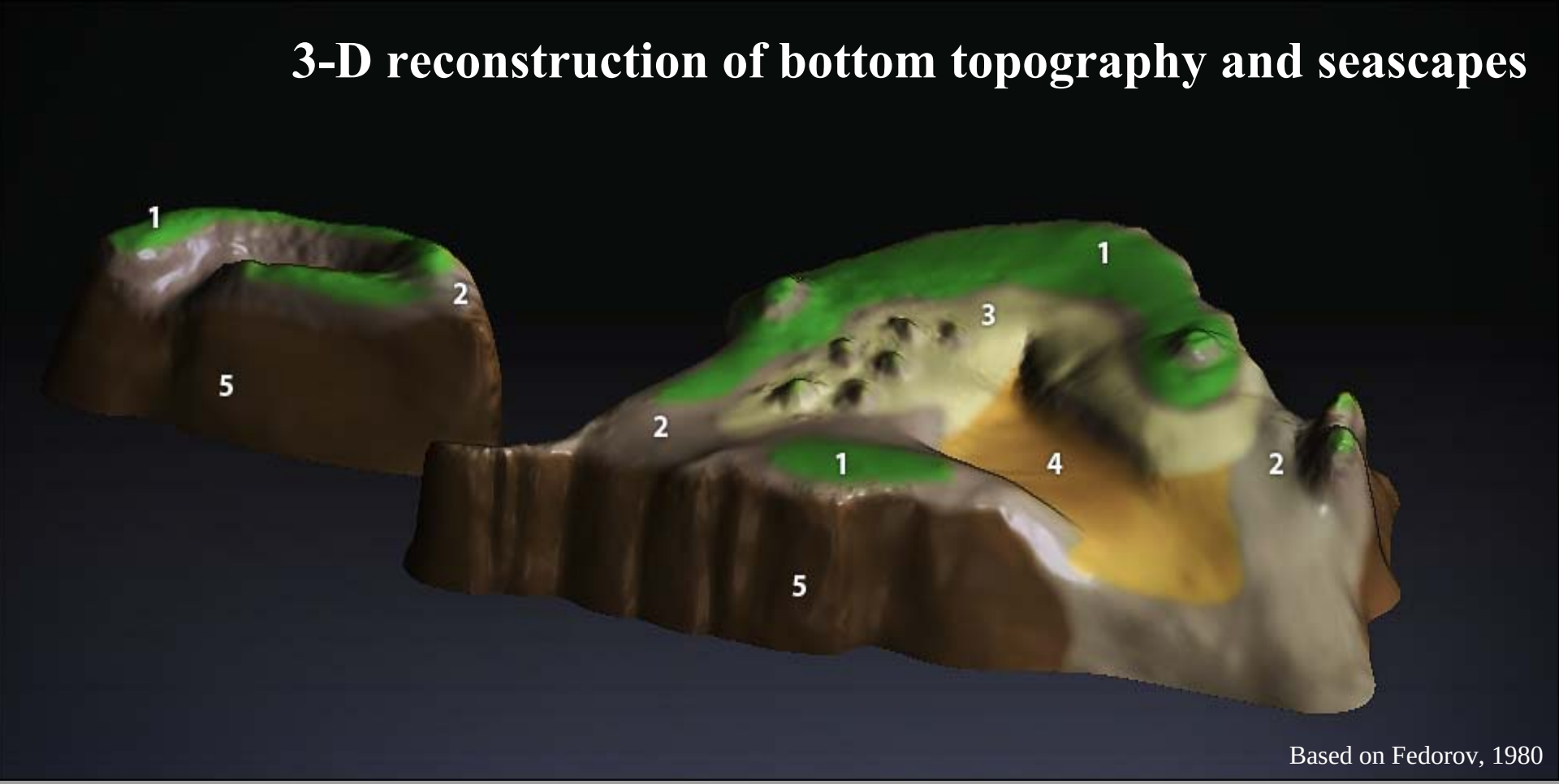


Schematic of the Indian ocean circum equatorial current with subduction (dark gray), upwelling (light gray) (Schot at all.,2002)



Distribution of seascapes of the bank is determined by structural characteristics of the bank.
1 – submerged fringing reef (sediments: gravel – pebble. Dominant taxa: macrophytes, madreporarian corals, sponges; 2 – slopes and foot of reef (foraminiferous – algal sand. Dominant taxa: *Spatangus purpureus* (Echinoidea), *Priapulus* sp.); 3 – shallow lagoon (accumulative flat composed of fine silt. Dominant taxa: *Brisaster* sp. (Echinoidea) and *Trochostoma* sp.); 4 – deep lagoon (accumulative flat composed of muddy sand). Dominant taxa: *Prionospio* sp., 5 – slope (limestone). Dominant ecological group: seston feeders.
(slide 11) Seagrass (with the dominance of four species of *Thalassodendron* and *Halophila*) and macroalgae beds extend to over 80-90% of the fringing reef area. Stony corals projective coverage is estimated to be in the range of 10-20% of the reef area. Underwater investigations display irregular distribution of coral reefs in the circular top of the Bank. Most frequently occurring taxa are acropores, pocilopores, big *Porites* sp. and *Heliopora* sp. Saya de Malha is a unique large seagrass biotope in the open sea.

3-D reconstruction of bottom topography and seascapes



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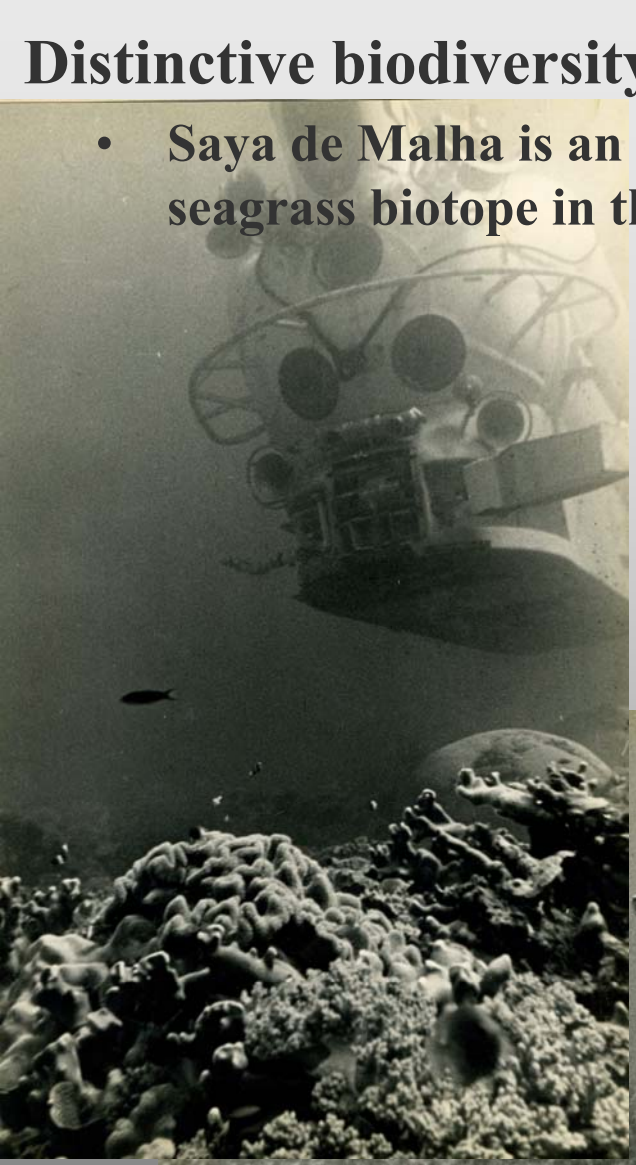
Distinctive biodiversity features

- **Saya de Malha is an unique seagrass biotope in the open sea**



Thalassodendron ciliatum

Halophila decipiens

Photo V.S. Petrov

www.seagrasswatch.org

Species diversity assessments are compiled for particular taxonomic groups. The most comprehensive data sets are available for fishes, mollusks (especially cephalopods) and decapod crustaceans. In the Saya de Malha area 43 fish species are known, 7 species (from 5 families) dominate. This number is low compared to Madagascar (160 species, 66 families), Seychelles (124 species, 16 families), and Mozambique (109 species, 54 families). However, most of specimens from Saya de Malha were obtained from areas suitable for trawling while the reef fish fauna remained practically unstudied.

On the Saya de Malha Bank 142 species occur (102 from 36 families of the Gastropoda, 32 species (from 10 families of the Cephalopoda, and 8 species from 3 families of Bivalvia). For the western Indian Ocean in general 2500 species (75 families) of the Gastropoda, 667 species (49 families) of the Bivalvia, and 39 species (6 families) of the Polyplacophora are reported.

Other groups of invertebrates are poorly studied: only 4 genera of Anthozoa, 2 speices of the Annelida, and 3 species of Echinodermata are reported for Saya de Malha. At the same time only for Seychelles 151 echinoderm species are known while 419 live in the entire western Indian Ocean. Many taxonomic groups do not have any records for Saya de Malha (Poriphera, Nematoda, Nemertini, Tunicata, Chemichordata). Species diversity of Saya de Malha is clearly underestimated. In particular, no special methods of collecting taxa inhabiting sea grass biotopes were applied.

Biodiversity

Fish:

Saya de Malha: 43 species, dominate 7 species (from 5 families)
Madagascar: 160 species, 66 families
Seychelles:124 species, 16 families
Mozambique:109 species, 54 families

Invertebrates:

Saya de Malha: 142 species
Gastropoda: 102 (from 36 families)
Cephalopoda: 32 species (from 10 families)
Bivalvia: 8 species (from 3 families)

Western Indian Ocean:
Gastropoda:2500 species (75 families)
Bivalvia: 667 species (49 families)
Polyplacophora: 39 species (6 families)

Other groups:

Saya de Malha:
Anthozoa:4 genera
Annelida: 2 speices
Echinodermata: 3 species

Seychelles:
Echinodermata: 151 species


Photo V.S. Petrov

Western Indian Ocean: Echinodermata: 419 species

- **Biodiversity is still poorly investigated**

Several species described from the Saya de Malha as new for science have not been recorded elsewhere and may be considered as conventional endemics of the area. These include 2 species of cephalopods (+ another 2 for southern part of the Mascarene Ridge), 1 species of giant *Tridacna* clam (Bivalvia) and 5 species of fish. Some taxa may be endemic for the entire Mascarene Ridge area (as shown for 2 species of swimming crabs). For the studied groups this yields a figure of 5% endemism at the species level. Taking into account the limited knowledge of the Saya de Malha and the neighboring insular areas / underwater rises biota, the level of endemism may be higher, especially for the groups which do not have long-lived planktonic larva (i.e. some fish and crustaceans with parental care of offspring).

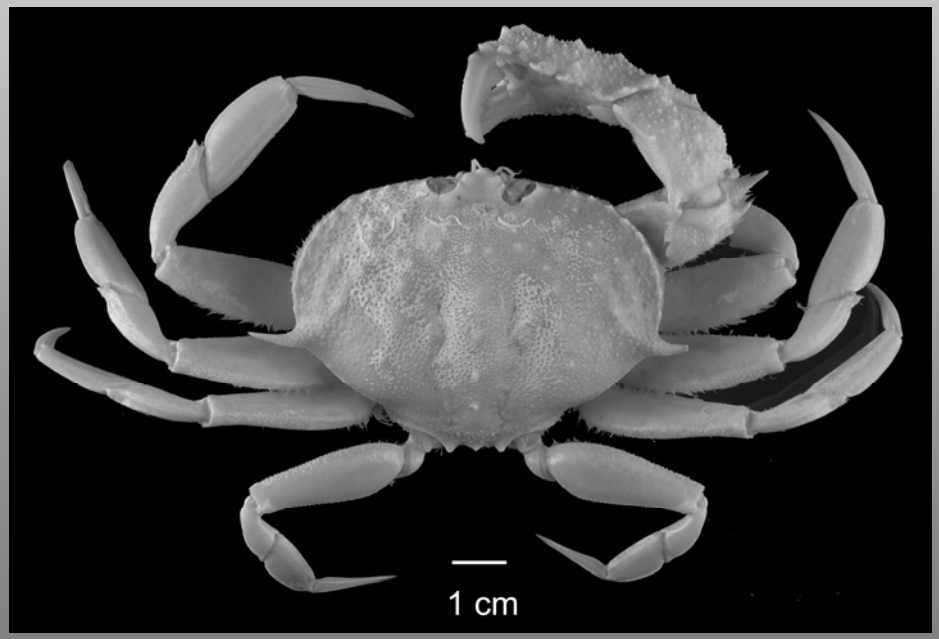
Even at the current, by far not sufficient level of knowledge several characteristics of natural history of Saya de Malha may be considered as unique, first of all the most extensive sea grass biotopes in the middle of the open ocean. Increased productivity of the area and the occurrence of several commercial fish species and invertebrates make Saya de Malha an attractive fishing ground. Russian fishery investigations revealed the areas suitable and safe for trawling. Bottom trawling in the limited area where no regulation exists may irreversibly destroy seagrass and coral biotopes and cause depletion of particular species. Although Russia now is revitalizing its distant water fishery it is unlikely that either Russian Federation or Ukraine as another country which has inherited Soviet oceanic fishery tradition come back to the western Indian Ocean as fishing nations. However increasing development of the international “flag of convenience” fishery poses a serious potential (or even actual as we know very little about the present situation) threat to Saya de Malha.

Biodiversity: endemics

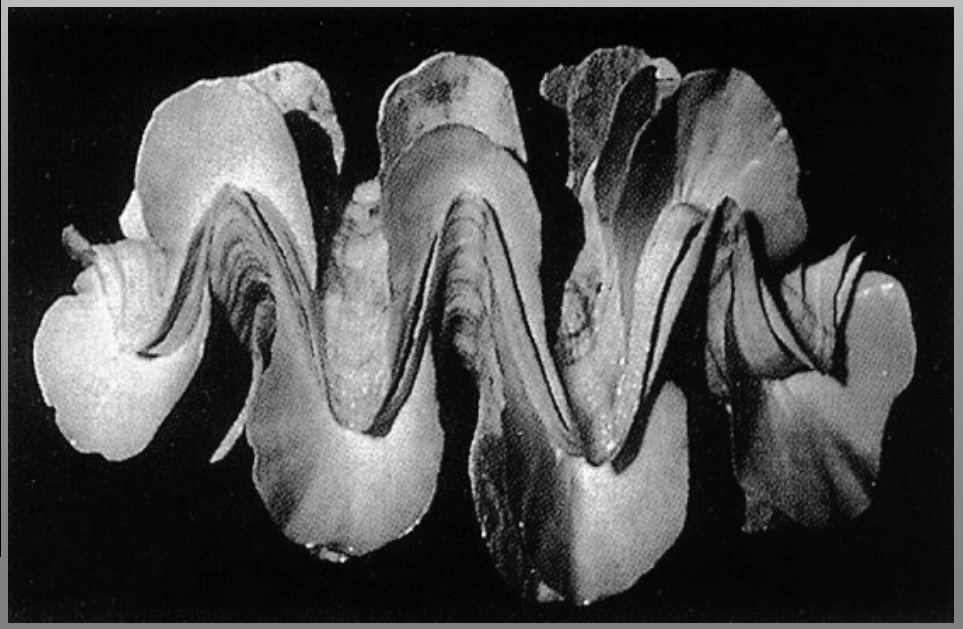
Saya de Malha:

Cephalopods: 2 species
Bivalvia: 1 species
Fish: 5 species
Crabs: 2 species

- **For the studied groups this yields a figure of 5% endemism at the species level**



Yet undescribed species of *Mursia* – similar to the Philippine and Madagascar species but not the same (Spiridonov & Apel, 2007)



Tridacna rosewateri (Sirenko,1999)

Further work on the assessment and development of a management plan for Saya de Malha as a potential High Seas marine protected area should focus on the following priorities:

- **Further inventory of available collections and material in the archives of research institutions**

- **Organisation of an international expedition to assess the current status of coral and seagrass biotopes to compare to historical data**

- **Development of remote sensing approach to the assessment of major biotopes and monitoring of visiting by vessels (Radarsat images)**

- **Detailed assessment of potential threats to Saya de Malha biodiversity from fishery (particularly under flags of convenience) and other factors (i.e. climate change)**

- **Proposing a framework for management partnership for Saya de Malha.**

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