Corrigendum

to Short Cruise Report M153

On 05.02.2024, the following corrigendum to the short cruise report of METEOR campaign M153 was communicated to the German Research Vessels Control Centre:

Quote

RV Meteor cruise M153, FS Meteor-Fahrt M153, Projekt TRAFFIC
15.02. - 31.03.2019

see: https://www.pangaea.de/expeditions/bybasis/Meteor%20%281986%29

Cruise report : doi:10.48433/cr_m153

Corrigendum:

In the above mentioned cruise report the mesh size for the RMT8 is reported as 4000 µm. This is wrong. **The correct mesh size is 4500 µm.**

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Quote

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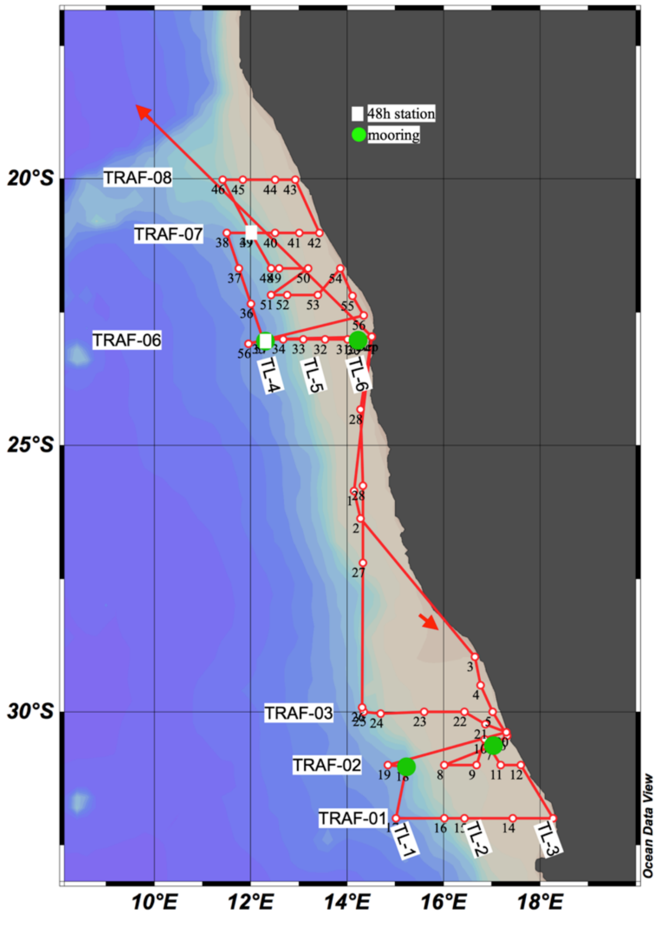
Short Cruise Report

METEOR Cruise N°.153
Walvis Bay (Namibia) – Mindelo (Cape Verde)
15 February 2019 – 31 March 2019

Chief Scientist: Werner Ekau
Captain: Detlef Peter Korte



Track chart and station map of RV METEOR Cruise M153. Bathymetry from ODV. Two main working areas off Namibia and South Africa. TRAF and TL indicate stations on transects, along which alongshore and in-offshore profiles are being produced

Objectives

The cruise METEOR 153 (M153) will contribute to understand the processes involved in forming three different scenarios of food web structure in upwelling systems (fig. 1) and to test the following four hypotheses:

H1: Global climatic changes affect the upwelling intensity in nBUS and sBUS differently.
Recent findings from model studies show a poleward shift in subtropical high-pressure areas due to global climate change (Garcia-Reyes et al., 2015, Rykaczewski et al., 2015, Wang et al., 2015). As a result, the trade winds in the sBUS are intensified, and the wind speeds and upwelling intensities in the nBUS are weakened. Our investigation aims at unravelling how these ongoing changes in the physical forcing will affect the overall productivity regime and the food web structure of the Benguela subsystems.

H2: Different lengths of food chains in the nBUS and sBUS result in different availability of species relevant for fisheries.
Since only 10-20% of the biomass is passed on from one trophic level to the next, more trophic levels in the food chain result in lower biomass in fisheries relevant species, which are often at the end of the food chain. More trophic levels decrease potential fishery yields, as seen in ecosystems dominated by sardines (fig. 1a) as compared to those dominated by horse mackerel (fig. 1c).

H3: nBUS and sBUS differ in the proportion of “dead end” species.
Dead end species (e.g. jellyfish and salps) feed on primary and/or secondary consumers, but are rarely consumed themselves. They outcompete fishes and increase the export of organic matter to deeper layers. This reduces the energy available for higher trophic levels and the recycling of nutrients within the pelagic realm (fig. 1b).

H4: Differences in the pelagic food webs in the nBUS and sBUS affect the biological CO_2 uptake efficiency in the ocean.
Food webs differ in the efficiency of nutrient recycling. This difference should affect the ratio of carbon to nutrients (C/N/P) in the exported organic material, which in turn strongly influences the CO_2 uptake of the so-called biological carbon pump. Since the sBUS acts as a sink and the nBUS as a source of CO_2, we assume that increased C/N/P ratios in the exported material (fig. 1, downward arrows) promote carbon uptake in the sardine-dominated sBUS, while lower nutrient use efficiency enhances CO_2 emissions in the nBUS.

Narrative

RV METEOR left Walvis Bay 15 February 2019 with calm weather, but no sun. All scientists had arrived one or two days in advance and unloaded the containers.

Shortly after leaving the port, we deployed TRIAXUS. This gear is equipped with a convenient number of probes and devices (e.g. video plankton recorder, CTD and fluorometer) useful to measure temperature, salinity, turbidity, and photosynthetic components like chlorophyll, phycoerythrin and phytocyanin. Measurements of oxygen and nitrate are also possible. A horizontally working echo sounder (EK60, 200 and 300 kHz) allows the assessment of biomass and distribution patterns. A Laser Optical Particle Counter (LOPC) counts the organisms passing the camera. The first of these transects started right after leaving Walvis Bay and went down to the first plankton station at 29° S, 16° E.

On 17 February evening, we reached our first regular station and started the plankton work. We operated on transects along the coast, passing several areas with strong upwelling. Cold water masses with temperatures down to 13 °C were accompanied by strong plankton blooms, mainly, *Noctiluca*. The zooplankton catches were low at these stations.

The first 48-hour station was realised at 30°32' S, 16°50' E. A drifting and a moored sediment trap were deployed. The drifting trap was recovered after two days; the moored trap will remain until the austral winter 2020 to record the seasonal variability in the sedimentation of organic material. After the deployment, we headed towards the southernmost transect of our station grid. The diversity and abundance of plankton increased and the RMT resulted in good samples of mesopelagic fish, one of the target groups of the project besides sardine, anchovy and round herring.

The first stations in South African waters were located along the coast. We observed a strong upwelling of nutrient-rich water masses, extending from Walvis Bay (23° S) up to 31° S, which exhibited a characteristic pattern of smaller singular upwelling cells. These upwelling cells ended up merging together to form a single stretch along the coast, as observed in the Sea Surface Temperature (SST) images. The stations were characterised by vast algal blooms consisting mainly of the dinoflagellate *Noctiluca scintillans*, one of the most commonly occurring bioluminescent organisms in coastal regions of the world. Both fish larvae and small fish were scarce in these waters; the fact that they feed on small crustaceans that develop in a subsequent stage of an upwelling event, could explain their limited number.

Stations on the southern transect (TRAF-01, in the track chart) which was done from the coast towards the open ocean, showed an increasing diversity of the plankton communities and, especially on the outer shelf, small pelagic and mesopelagic fish. The final work on the outer part of the southern transect was a long-term station where we sampled over a period of 67 hours (green circle next to the label TRAF-02 in fig. 3.1). Long-term sediment traps were deployed in both stations that will remain in the area for about 18 months. The traps will be recovered during the next TRAFFIC cruise in the summer 2020. The samples from these stations will then be analysed to determine the annual sedimentation cycle of organic material in the southern Benguela.

After the deployment of the sediment trap we realised a second transect with TRIAXUS, towing the vehicle over a distance of 130 NM, from the long-term station towards the coast until we reached 50 m water depth. With this setting we were able to record the structure of the water bodies as we crossed them and to estimate the respective biomass by means of acoustic probes and video plankton recorder. The collected data will be compared with the results provided by the EK80 echo sounder and the net catches, resulting in a comprehensive picture of the ecosystem.

Two of our multiple opening-closing nets were equipped with nets of 55 and 200 µm mesh size. Both were deployed vertically, which means that the ship was not moving. The MULTI PLANKTON SAMPLER MULTINET®, equipped with nets of 200 µm mesh size, was used to collect living organisms for various physiological, onboard experiments. Such organisms also provided data to investigate the respective depth distribution with daytime. The estimation of oxygen consumption and production of eggs are two methods used to further assess the condition and productivity of small planktonic crustaceans (Copepoda).

The bigger MULTINET®, equipped with nets of 300 µm mesh size, and the Rectangular Midwater Trawl (RMT) with a net of 4 mm mesh size, were deployed to catch lager plankton organisms (fish larvae, shrimps) and small nekton. Both gears were towed performing a V-shaped track through the water column. After finishing the station work, the ship headed north reaching Walvis Bay 2 March 2019. At this point, the scientific crew changed, with researchers departing and other arriving.

The first stations in Namibian waters were positioned along the Walvis Bay transect. The transect consists of a series of stations perpendicular to the coast which were, in the past, routinely sampled for long-time data collection, resulting in a time series ranging more than twenty years back. At about 15 NM off Walvis Bay we deployed a sediment trap to collect downward moving organic and inorganic matter from the water column. The samples collected this way, will provide information on the amount and rate of organic matter sedimentation. One additional moored sediment trap was deployed at the end of the transect, at 1900 m water depth, shortly before calling again in the port of Walvis Bay. Both traps will be recovered (along with the two traps deployed in the south) in the forthcoming TRAFFIC cruise into the area. This is foreseen for the austral winter 2020, at which point, a time series of 18 months might have been generated.

During our work at the stations in the northern part of the Namibian box, the wind speed increased steadily to 7-8 Beaufort. This forced us to change the gear deployments. The deployment of TRIAXUS, planned to do a transect from the northwesterly station to the central coast, was postponed and the utilization of the Neuston-catamaran was cancelled. We decided to move directly to the position where the second drifting sediment trap of the Namibian box had been placed.

As no weather improvement was forecasted, we headed straight to the next station, 22° S, at the continental shelf edge. By means of several RMT-hauls we could extend significantly our collection of krill and mesopelagic fish species. We also observed a high amount of jelly fish.

The last plankton stations were performed directly inshore at water depths of 40 to 70 m. At this alongshore transect, we towed the TRIAXUS from station 54 to 56, only interrupted by CTD work and plankton sampling, at stations 55 and 56. Having covered the area with extensive net sampling, we finished the plankton work by performing a transect with TRIAXUS perpendicular to the coast, extending about 270 NM offshore from station 56.

The second deep-water sediment trap was deployed 14 March. After finishing RV METEOR headed towards Walvis Bay, calling in the port 15 March in the morning. During the rest of the day, part of the scientific crew disembarked and the pilot came on board. Logistics was taken care.

The ship left Walvis Bay 16 March at 10:00 local time and headed to Mindelo. On the way, we collected samples by deploying MULTINETS and the Neuston catamaran. Data was gathered by means of the CTD and underway systems for both, acoustic and CO_2 measurements.

RV METEOR called in the port of Mindelo 30 March 2019. The ship sailed more than 5597 NM and spent 374 hours at stations.

Figures

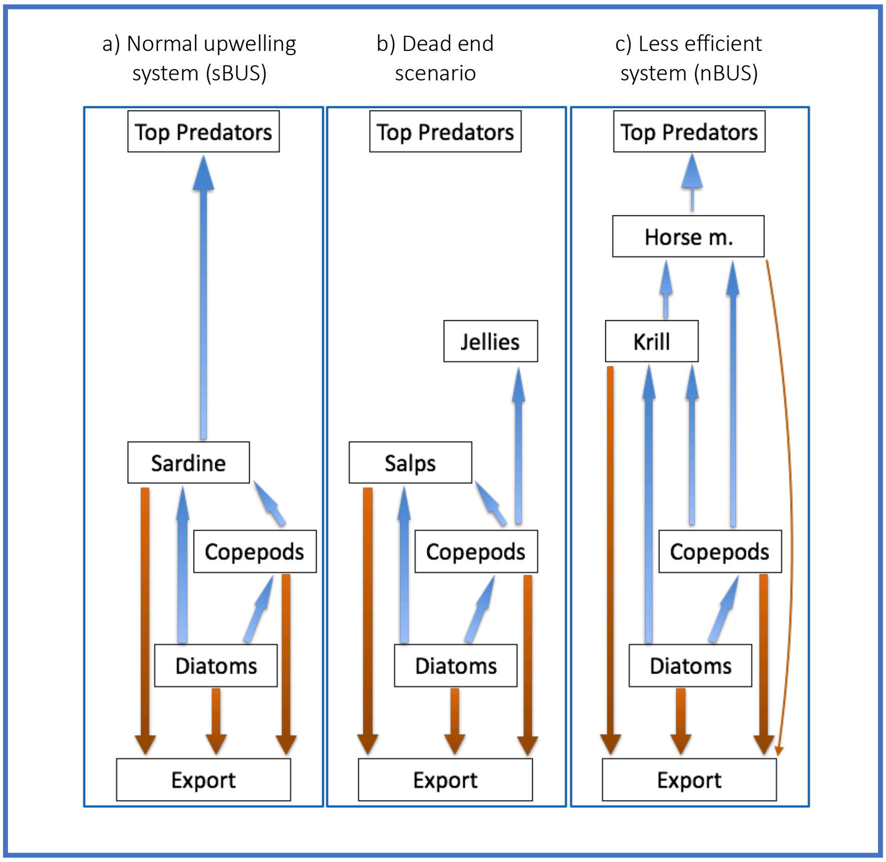


Figure 1 Pelagic food web structure in the Benguela upwelling system and three scenarios with different trophic transfer efficiencies (Horse m. signifies horse mackerel).

Acknowledgements

Our gratitude goes to captain Detlef Korte and his crew for their excellent support during the cruise. The ship time of RV METEOR was provided by the German Science Foundation (DFG) within the core program METEOR/MERIAN. The cruise was part of the project TRAFFIC and financially supported by the SPACES program of the BMBF.

List of Participants

Scientific Party

Name	Discipline	Institution
Ekau, Werner	Ichthyoplankton/Acoustics/Chief Scientist	ZMT
Auel, Holger	Zooplankton ecology	BreMarE
Bröhl, Stefanie	Ichthyoplankton	ZMT
Dudeck, Tim	Acoustics	ZMT
Duncan, Sabrina	Mesopelagics	TI
Eckhardt, André	TRIAXUS	IMF
Fock, Heino	Mesopelagic fish	TI
Hamukoto, Dortea	Zooplankton	UNAM
Harmer, Rachel	TRIAXUS	IMF
Heinatz, Knut	PrimProd, TrophicDeadEnds	IMF
Horton, Matt	Ichthyoplankton	DAFF/UCT
Hüge, Fabian	Biogeochemistry	ZMT
Jacobs, Leon	Physical Oceanography	DEA
Joppien, Marlena	Biogeochemistry	IfBM
Koppelmann, Rolf	PrimProd, TrophicDeadEnds	IMF
Lahajnar, Niko	Biogeochemistry	IfBM
Makhetha, Mbulelo	Physical Oceanography	DEA
Martin, Bettina	PrimProd, TrophicDeadEnds	IMF
Mathiske, Annabel	Zooplankton ecology	BreMarE
Meiritz, Luisa	Biogeochemistry	IfBM
Moloto, Tebatso	PrimProd, Fluorescence	CSIR
Müller, Carolin	Ichthyoplankton	ZMT
Rixen, Tim	Biogeochemistry	ZMT
Sell, Anne	Mesopelagic fish	TI
Shapange, Brave	PrimProd	UNAM
Siddiqui, Claire	Biogeochemistry	ZMT
Shikudule, Natalia N	Zooplankton	UNAM
Verheye, Hans M.	Zooplankton, SecProd	UCT
Wallschuß, Sina	Biogeochemistry	UCT
Wilhelm, Margit	Mesopelagic fish	UNAM
Wischnewski, Fanny	Physical Oceanography	ZMT
Würth, Randi	Zooplankton ecology	BreMarE
Raeke, Andreas	Weather technician	DWD

Crew

Name	Rank
Korte, Detlef Peter	Master
Apetz, Derk-Ude	Chief Mate
Gräber, Christian	1st Mate
Werner, Lena	2nd Mate
Hinz, Michael	Doctor
Neumann, Peter Gerhard	Chief Eng.
Brandt, Björn	2nd Eng.
Wilhelm, Jan Erik	3rd Eng.
Mehlig, Olaf	SET
Voigt-Wentzel, Heinz Joachim	1st Electronic
Schulz, Harry	2nd Electronic
Seidel, Stefan	Sysman
Lange, Gerhard	Fitter
Wolf, Alexander	Boatswain
Behlke, Hans-Joachim	AB
Drakopoulos, Evgenios	AB
Hildebrandt, Hubert Hans	AB
O'Keefe, Darren	AB
Lison, Olaf Gerald Ralf	AB
Rauh, Bernd Wolfgang	AB
Schabeck, Henry	AB
Erdmann, Ole Hans Wilhelm	Motorman
Sebastian, Frank	Motorman
Schroeder, Manfred	Motorman
Götze, Rainer	Cook
Wernitz, Peter	Cook
Tober, Martina Hella	1st Stewardess
Schmandke, Harald	2nd Steward
Shi, Wubo	2nd Steward
Chen, Xiyong	Laundryman
Mönnich, Niklas	Apprentice
Staffeldt, Felix	Apprentice

Overall Station List

CTDO – Probe for conductivity, temperature, depth, and oxygen

MNv-55 – Vertical multi-net, 55 µm

MNv-200 – Vertical multi-net, 200 µm

MNo – Obliquely towed multinet 300/500 µm

RMT – Rectangular midwater trawl 4000µm

Neuston – Neuston catamaran 500 µm.

Ship station	Latitude	Longitude	Date	Start Time (UTC)	Water depth (m)	CTD	Fluoroprobe	MNv-55	MNv-200	MNo	RMT	Neuston	Sed./Mooring	TRIAXUS
Walvis Bay	22°57' S	14°30' E	15.02.19	07:00										
M153_01	25°51' S	14°08' E	16.02.19	04:53	286									1
M153_02	26°23' S	14°16' E	16.02.19	08:52	308	1	2	1	1	1				1
M153_03	28°58' S	16°38' E	17.02.19	17:18	53	1	1	1	1	1				1
M153_04	29°30' S	16°45' E	17.02.19	22:07	106	1	1			1				
M153_05	30°00' S	17°00' E	18.02.19	02:06	129	1	1	1	1	1				
M153_06	30°28' S	17°19' E	18.02.19	06:59	60	1	1	1	1	1		1		
M153_07	30°39' S	17°01' E	18.02.19	10:51	170	5	4	3	4	5	3	3	1	
M153_08	31°00' S	16°00' E	19.02.19	19:14	320	1	1	1	1	1	1	1		
M153_09	31°00' S	16°40' E	20.02.19	03:23	255	1	1		1	1				
M153_10	30°32' S	16°51' E	20.02.19	08:01	189								1	
M153_11	31°00' S	17°10' E	20.02.19	12:02	195	1	1	1	1	1				
M153_12	31°00' S	17°35' E	20.02.19	16:25	57	1	1	1	1	1				
M153_13	32°00' S	18°15' E	20.02.19	23:39	59	1	1	1	1	1		1		
M153_14	32°00' S	17°25' E	21.02.19	05:27	161	1	1	1	1	1	1			
M153_15	32°00' S	16°25' E	21.02.19	13:12	402	1	1	1	1	1	1			
M153_16	32°00' S	16°00' E	21.02.19	19:36	800	2	1	1	1	1	1			
M153_17	32°00' S	15°00' E	22.02.19	05:56	2300	2	1	1	1	1	1	1		
M153_18	31°03' S	15°14' E	22.02.19	18:54	1270	15	1	4	5	9	7	4	1	
M153_19	31°00' S	14°50' E	25.02.19	14:26	2100	1	1							1
M153_20	30°23' S	17°17' E	26.02.19	10:00	56	1		2				1		
M153_21	30°14' S	16°51' E	26.02.19	15:24	166						1			
M153_22	30°00' S	16°25' E	26.02.19	18:10	180	1	1	2	1	1	1	1		
M153_23	30°00' S	15°35' E	27.02.19	02:38	250	1	1	2	1	1	1	1		
M153_24	30°02' S	14°42' E	27.02.19	11:38	500	2	1	2	1	1	1	1		
M153_25	30°00' S	14°20' E	27.02.19	19:16	1200	2	1	2	1	1	1	1		
M153_26	29°55' S	14°18' E	28.02.19	02:36	1100						1			

Ship station	Latitude	Longitude	Date	Start Time (UTC)	Water depth (m)	CTD	Fluoroprobe	MNv-55	MNv-200	MNo	RMT	Neuston	Sed./Mooring	TRIAXUS
M153_27	27°12' S	14°19' E	28.02.19	18:35	130	1					1			
M153_28	25°45' S	14°20' E	01.03.19	05:10	130									1
Walvis Bay	22°57' S	14°30' E	02.03.19	06:00										
M159_29	23°00' S	14°15' E	02.03.19	14:56	90	1	1	2	1	1				
M159_30	23°01' S	14°13' E	02.03.19	17:45	130								1	
M159_31	23°00' S	14°00' E	02.03.19	19:40	130	1	1		1	1	1	1		
M159_32	23°00' S	13°32' E	03.03.19	01:04	180	2	1	2		1	1	1		
M159_33	23°00' S	13°05' E	03.03.19	07:20	400	1	1		1	1	1	1		
M159_34	23°00' S	12°40' E	03.03.19	13:31	1200	2	1	2	1	1	1	1		
M159_35	23°00' S	12°15' E	03.03.19	22:36	2050	10	2	4	6	4	6	2	1	
M159_36	22°20' S	12°00' E	05.03.19	20:31	2100	2	1			1	1	1		
M159_37	21°40' S	11°45' E	06.03.19	04:41	2100	2	1	1	1	1				
M159_38	21°00' S	11°30' E	06.03.19	13:07	2000	2	1	1	1	1	1	1		
M159_39	21°00' S	12°00' E	06.03.19	22:21	1000	10	2	2	3	4	4	2	1	
M159_40	21°00' S	12°30' E	08.03.19	08:32	400	1	1	1	1	1	1	1		
M159_41	21°00' S	13°00' E	08.03.19	16:45	180	1	1	1	1	1				
M159_42	21°00' S	13°25' E	08.03.19	20:32	75	1	1	1	1	1				
M159_43	20°00' S	12°55' E	09.03.19	04:40	75	1	1	1	1	1		1		
M159_44	20°00' S	12°30' E	09.03.19	08:44	180	1	1	1	1	1		1		
M159_45	20°00' S	11°50' E	09.03.19	15:13	400	1	1	1	1	1	1			
M159_46	20°00' S	11°25' E	09.03.19	21:28	800	2	1	1	1	1	1			
M159_47	21°00' S	12°00' E	10.03.19	10:32	1000								1	
M159_48	21°40' S	12°25' E	10.03.19	17:08	1000	2	1	1		1				
M159_49	21°40' S	12°35' E	10.03.19	20:31	600	1			1	1	4			
M159_50	21°40' S	13°11' E	11.03.19	05:19	180	1	1			1		1		
M159_51	22°10' S	12°25' E	11.03.19	12:13	1200	1	1			1		1		
M159_52	22°10' S	12°45' E	11.03.19	17:12	443	1				1	4	1		

Ship station	Latitude	Longitude	Date	Start Time (UTC)	Water depth (m)	CTD	Fluoroprobe	MNv-55	MNv-200	MNo	RMT	Neuston	Sed./Mooring	TRIAXUS
M159_53	22°10' S	13°23' E	12.03.19	00:55	187	1	1				1	1		
M159_54	21°40' S	13°51' E	12.03.19	07:38	30	1	1	1	1	1		1		1
M159_55	22°11' S	14°06' E	12.03.19	14:32	30	1	1			1		1		1
M159_56	22°34' S	14°21' E	12.03.19	19:18	30	1								1
M159_56	23°06' S	11°58' E	14.03.19	06:58	3000									1
M159_58	23°00' S	12°19' E	14.03.19	11:30	1900								1	
Walvis Bay	22°57' S	14°30' E	15.03.19	08:00										
Walvis Bay	22°57' S	14°30' E	16.03.19	08:00										
M153_58	17°10' S	08°01' E	18.03.19	07:03	4900	1				1		1		
M153_59	14°30' S	05°04' E	19.03.19	07:01	5600	1				1		1		
M153_60	11°59' S	02°18' E	20.03.19	07:01	5600	1				1		1		
M153_61	09°28' S	00°15' W	21.03.19	07:02	5400	1				1		1		
M153_62	06°50' S	02°54' W	22.03.19	07:00	4200	1				1		1		
M153_63	04°08' S	05°40' W	23.03.19	08:00	4200	1				1		1		
M153_64	01°25' S	08°26' W	24.03.19	08:00	4200	1				1		1		
M153_65	00°53' N	10°54' W	25.03.19	08:02	4200	1				1		1		
M153_66	01°60' N	12°12' W	25.03.19	20:03	4200	1				1		1		
M153_67	03°08' N	13°31' W	26.03.19	07:59	4200	1				1		1		
M153_68	04°14' N	14°49' W	26.03.19	20:01	4200	1				1		1		
M153_69	05°25' N	16°11' W	27.03.19	08:00	4200	1				1		1		
M153_70	08°32' N	18°47' W	28.03.19	07:57	4200	1				1				
Mindelo	16°54' N	25°00' W	30.03.19	16:50		**109**	**50**	**52**	**50**	**75**	**50**	**47**	**8**	**9**