

2 Of fish and folk



> Fish and human societies have had special connections for millennia. The fabric of this relationship has many strands. For one thing, fish is an important source of food for millions of people, supplying proteins and minerals in a combination offered by almost no other foodstuff. Although the industrialization of fishing has led to the loss of many jobs over the years, around 50 million people worldwide still earn their living by catching fish.



Fish – a prized commodity

> People have always relied upon fish as a basic resource to sustain life – as food and as a source of income. Many fishermen in industrialized countries have had to give up their work. In many developing and newly-industrializing countries, however, fishing is a major branch of employment, not least because fish has developed into an important export commodity. As the main importers, the western industrialized countries have a responsibility to push for a low-impact, socially equitable fishing industry in the exporting nations.

Fish – a foodstuff and the stuff of legends

For millennia fish have been a vital source of human nutrition. Archaeological finds suggest that people have been catching fish since the Stone Age at least. For example, artefacts found in northern German river valleys include fishhooks made from bones and teeth as well as early spears with barbed hooks.

But fish is more than just a food. In many cultures the fish is raised to near-mythical status. The Maori people call New Zealand's North Island Te-Ika-a-Maui – “the fish of Maui”. According to legend the demigod Maui pulled a mighty fish out of the water, which then transformed into the island. In the days of Alexander the Great, inhabitants of the Mediterranean town of Ascalon were such devout worshippers of the goddess Derketo, a mermaid-like being, that eating fish was taboo. The Christians even elevated the fish to a symbol of their faith community. They used the Greek word for fish, *ichthys*, as an acronym. It stands for *Iēsous Christós Theou Hyiós Sōtēr* (Jesus Christ God's Son Saviour).

Today there is little remaining sign of mythical veneration. Fish is a foodstuff and a straightforward trade commodity. According to estimates by the Food and Agriculture Organization of the United Nations (FAO), today a total of 660 to 820 million people are directly or indirectly dependent on fishery. These include the families of fishermen and of their suppliers – the makers of fishing equipment, for instance. The FAO estimates the number of fishermen per se at around 54 million, of which 87 per cent live in Asia alone. Many of them work in small fisheries, and fish production per person is correspondingly low. On average it amounts to just about 1.5 tonnes. For comparison, the figure in Europe is around 25 tonnes per person.



2.1 > A traditional fishhook from New Zealand.



2.2 > The Maori demigod Maui catches a fish, which transforms into the North Island of New Zealand, Te-Ika-a-Maui.

Large-scale versus small-scale?

Experts differentiate roughly between industrial fishery, which operates with factory ships, and artisanal fishery. Beyond this, different countries break the industry down into various other categories.

In Germany and other European countries, for example, fisheries are subdivided into the following three fleet segments:

- Small-scale coastal fishery: carried on with small motorboats which usually put out to sea for a day at a time. The home and landing ports are generally found in smaller coastal locations.

- Small-scale offshore fishery: makes use of vessels between 18 and 40 metres in size. The boats stay at sea for several days and land mainly fresh fish in large ports.
- Large-scale offshore fishery: ships are usually more than 40 metres long and do not necessarily stay within EU territorial waters. Catches are frozen immediately on board and sold throughout the world.

To take another example: in Mauritania, West Africa, distinctions are made between the following types of fishery:

- Small-scale fishery: includes vessels under 14 metres in length without any superstructure (wheelhouse). In many cases these are wooden boats, which may be powered by sails or motors.
- Coastal fishery: covers unmotorized vessels between 14 and 26 metres in length as well as motorized vessels with a superstructure but under 26 metres long.
- Industrial fishery: includes all larger ships that do not fit into the first two categories. Mauritania has its own industrial fleet that exclusively catches octopus. It is mainly made up of trawlers of Chinese origin, which are old and in poor technical condition.



2.3 > Mass processing: Pangasius is filleted in Vietnam for export to Europe.

Fishery production per fisher or fish farmer by region in 2010 (Tonnes/year)

Region	Capture	Aquaculture	Capture and aquaculture
Africa	2.0	8.6	2.3
Asia	1.5	3.3	2.1
Europe	25.1	29.6	25.7
Latin America and the Caribbean	6.8	7.8	6.9
North America	16.3	69.0	18.0
Oceania	17.0	33.3	18.2
World	2.3	3.6	2.7

Like Mauritania, many developing or newly-industrializing countries have an old ocean-going fleet – if they have one at all. Offshore fisheries in the latter countries are mainly operated by factory ships based in other countries, which pay licence revenue to the State. This industrially operated fishery is often held up as exploitative in comparison to original artisanal-fishery practices. But it is important not to generalize. There is barely any market in Europe for small pelagic fish, which are mainly fished by Dutch operators in Mauritanian waters and deep-frozen on board. The small fish are only marketed in preserved form, packed in cans or jars. In contrast, the pelagic fish caught off West Africa are largely sold directly in African countries. In many places the deep-frozen fish are hacked out of their blocks of ice in the marketplace itself. In other countries like Senegal, on the other hand, governments issue too many catch-licences to foreign fleets. As a result the fish stocks are overfished. Local coastal fishers rightly fear for their income source.

During the apartheid era the Namibian waters were severely overfished by foreign fishing fleets. This exploitation led to the collapse of the sardine fishery in the 1970s and subsequent closure of the mostly South African owned canneries and reduction plants. After independence in 1990, the Namibian Government focused on developing what was hitherto a small local hake fishery into a fishing industry with state of the art processing

2.4 > The industrialization of fishery raises per-capita production. It is still low in Asia compared to Europe. Intensive feeding and feed optimization means that productivity in aquaculture is higher than in capture fisheries. The figures for North America are probably too high.

plants serving global markets. This was quite an ambitious goal considering that Namibia was a country with only limited fishing tradition. Nowadays Namibia's innovative fisheries policy aims towards sustainable exploitation of the fishery and equitable distribution of the benefits among the Namibian population. Nonetheless, catch limits exceed scientific recommendations and foreign involvement in the fishery remains a concern as social, economic and ecological goals are in conflict on the political stage.

How "small fry" die out

The threat posed by industrial fishery to the livelihoods of artisanal fishermen is not just a developing-country phenomenon. In many industrialized countries, too, smaller family-run fishing businesses have had to give up. In many cases, no successors could be persuaded to take on this hard work. Small businesses were also squeezed by rising fuel costs, so that fishery was often taken over by larger and more efficient operations.

Off the east coast of Canada, the overfishing of cod was to blame for driving hundreds of small family businesses into closure in the early 1990s. Coastal fishermen had long warned that fish were becoming scarcer, in Canadian ocean bays for instance. Nevertheless, the large companies with their industrial trawlers continued to fish further out at sea. Their argument was that coastal fish and the offshore fish stocks had nothing to do with each other.

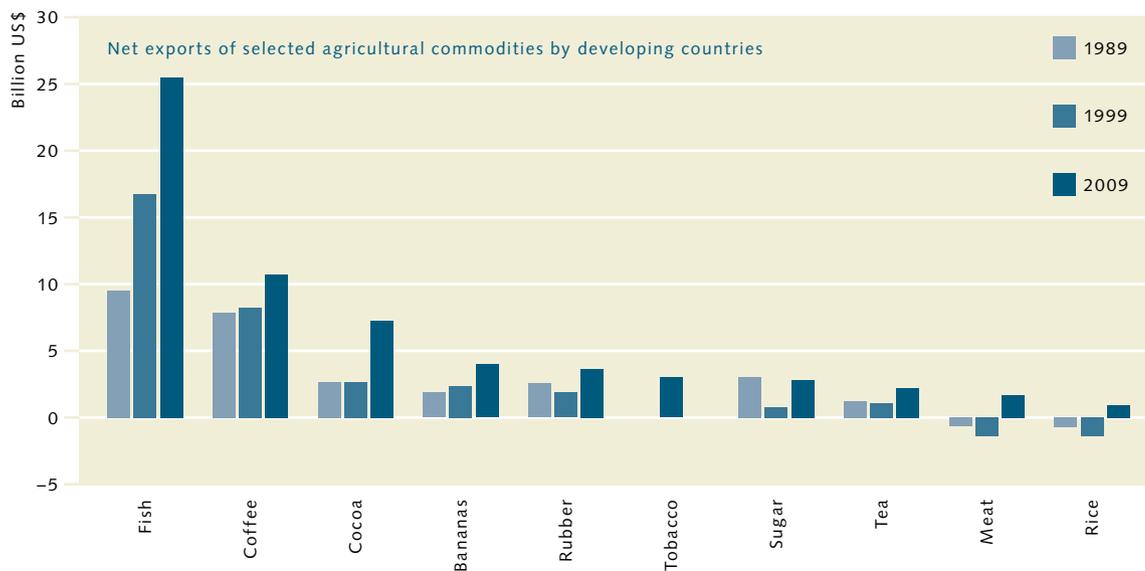
Today we know that this argument was based on false assumptions. In reality they all belonged to a single, large fish population, which was finally definitively overfished at the end of the 1980s. The coastal fishermen lost their livelihoods. Some switched to lobster fishing. Unknown numbers were uprooted and moved away. As a consequence of this rural exodus, the population slumped dramatically in many places along Canada's east coast.

The situation of herring fishers on the North Sea was similar. In the 1970s, officials reacted to the collapse of the stock with a fishing ban lasting several years. This enabled

2.5 > Europe, the USA and Japan are the most important importers of fish and fishery products worldwide. China is the main exporter. Norway's position as the second largest exporter is primarily because the country exports especially valuable fish such as salmon.

Top ten export countries	2000 (million US\$)	2010 (million US\$)
China	3,603	13,268
Norway	3,533	8,817
Thailand	4,367	7,128
Vietnam	1,481	5,109
United States of America	3,055	4,661
Denmark	2,756	4,147
Canada	2,818	3,843
Netherlands	1,344	3,558
Spain	1,597	3,396
Chile	1,794	3,394
Top Ten	26,349	57,321
World	55,750	108,562

Top ten import countries	2000 (million US\$)	2010 (million US\$)
United States of America	10,451	15,496
Japan	15,513	14,973
Spain	3,352	6,637
China	1,796	6,162
France	2,984	5,983
Italy	2,535	5,449
Germany	2,262	5,037
United Kingdom	2,184	3,702
Sweden	709	3,316
Republic of Korea	1,385	3,193
Top Ten	43,171	69,949
World	60,089	111,786



2.6 > For many developing countries, fish exports are more important than the coffee and cocoa trade.

herring stocks to recover, but many family businesses did not survive the enforced interruption. Today that fishery is dominated by a few large companies.

In order to avoid such drastic consequences for the people affected, social scientists are urging that more attention be given to sociological aspects in fishery management, rather than concentrating solely on the conservation of fish stocks and the marine environment. They criticize the way that so far, experts from the different disciplines – biology, economics and sociology – seem to collaborate far too seldom. Of course, the sociological approach is labour-intensive and costly, say researchers, because it requires field researchers to travel to coastal regions in order to interview the people affected, the fishermen, in situ and to analyse their situation. Yet this could avert future problems or help to solve them more quickly.

The responsibility of industrialized countries

In recent years, jobs in fisheries in the European countries have undergone varying degrees of decline. Particularly because there is a shortage of alternative jobs, nations like Portugal and Spain continue to maintain large fishing fleets, often kept alive by state subsidies. Denmark and Germany, on the other hand, have drastically reduced the size of their fleets. In these countries the demand for fish,

which has risen in recent years, is increasingly met by means of imports.

Today Europe is the world's most important fish-importing region but the demand for fish varies enormously from one country to another. In 2010 Europe imported fish to the value of 44.6 billion US dollars, around 40 per cent of the worldwide trading volume. The second largest importer is the USA, with Japan in third place. Hence a special role falls to these three regions in the conservation of global fish stocks: consumers in these industrialized countries should make a stand and demand more produce from sustainable fisheries and environmentally sound aquaculture. For wholesale purchasers, in turn, labour conditions in the countries of production are beginning to matter more when they choose their suppliers. Workers in developing and newly-industrializing countries are still often underpaid and receive no social security benefits. Moreover, child labour is often used in these countries, according to FAO data. Children are put to work particularly in artisanal fishery and small family businesses, but it happens on board ships as well. They are also being used as cheap labour to repair nets, to sell fish or to feed and harvest farmed fish. All these problems have now been recognized. It is to be hoped that the first projects and initiatives currently being embarked upon as good examples will set a precedent for the future.

The goodness in fish

> A unique combination of high-quality protein and vital nutrients make fish an invaluable food. Fish is the most important protein source in many developing countries. Fish consumption is highest in China and in western industrialized countries. The fish sold in industrialized countries is mainly deep-frozen, whereas fish is bought and sold fresh in developing countries.

2.7 > Fish consumption in 2009, by region and development status. Viewed in terms of continents alone, Asia leads the world in total consumption

Taurine, selenium & other essentials

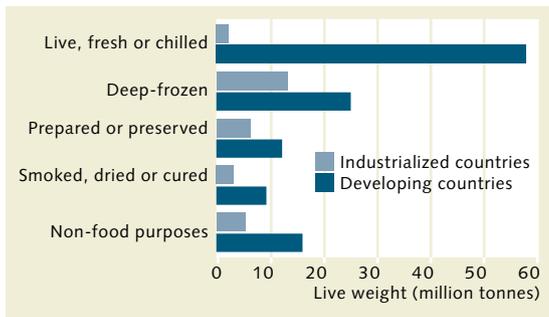
Compared with the world cereal harvest of around 2.2 billion tonnes per annum, the total global fish and seafood production of around 140 million tonnes seems very modest. Nevertheless fish is extremely important for human nutrition. It not only contains healthy protein but also many nutrients that do not occur in such quantity and diversity either in cereals or other crops or in meat. So fish makes an essential contribution to a healthy diet.

Its most important constituents include proteins, certain fatty acids, vitamins and minerals. The specific nutrients supplied by fish include:

- low-fat muscle meat containing 15 to 20 per cent protein, in the case of lean fish like pollock, cod or haddock;
- large quantities of unsaturated fatty acids, particularly omega-3 fatty acids, in the case of fatty fish like salmon and mackerel;
- iodine;
- selenium, a chemical element that is an important component of proteins. Proteins containing selenium can intercept free radicals and are thought to prevent cancer;
- taurine, a metabolite product of protein that is important for the development of the brain and retinal tissue. Moreover it plays a key role in the development of cell membranes and in the detoxification of the body.
- vitamin D, which very few foods contain in worthwhile amounts. Vitamin D mainly occurs in fatty fish;
- niacin, vitamin B₆ and vitamin B₁₂;
- all the important amino acids for human nutrition, including those known as “essential amino acids” which the human metabolism cannot synthesize itself.

Whereas average fish consumption in the 1960s was 9.9 kilograms, by 2010 annual per-capita consumption had risen to 18.6 kilograms. But fish consumption varies massively from country to country depending on local traditions and supplies. Fish is especially important in many developing countries because it is often the only afford-

	Total food fish supply (million tonnes live weight equivalent)	Per-capita food fish supply (kilograms per year)
Africa	9.1	9.1
North America	8.2	24.1
Latin America and the Caribbean	5.7	9.9
Asia	85.4	20.7
Europe	16.2	22.0
Oceania	0.9	24.6
Industrialized countries	27.6	28.7
Other developed countries	5.5	13.5
Least-developed countries	9.0	11.1
Other developing countries	83.5	18.0
China	42.6	32.0
World excl. China	83.0	15.1
World	125.6	18.4



2.8 > In the industrialized nations fish is mainly bought and sold deep-frozen (2010). Sophisticated cooling chains make this possible. The fish often comes from offshore fisheries and is landed frozen prior to onward distribution. In developing countries fish is predominantly bought and sold alive or fresh. In some cases it is chilled during transportation.

able and relatively easily available source of animal protein. In Bangladesh, Cambodia and Ghana, for instance, around 50 per cent of animal protein is supplied by fish. Often it is the only source of numerous other important nutrients, too. In many African countries south of the Sahara, the people traditionally make little use of fish – in Congo, Gabon or Malawi, for example – although fish could actually make a substantial contribution to human nourishment. In the year 2009, fish supplied 16.6 per cent of the total worldwide consumption of animal protein and 6.5 per cent of total protein, i.e. animal and plant protein combined.

Smoked, fresh or frozen?

Fish and seafood are traded and transported in different forms around the world. For 2010 the proportions were as follows:

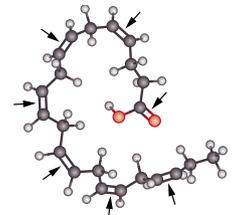
- live, fresh or chilled: 46.9 per cent;
- deep-frozen: 29.3 per cent;
- prepared and preserved: 14.0 per cent;
- smoked, dried, cured: 9.8 per cent.

Variations in these percentages depend on region and on consumer behaviour. Many developing countries lack the infrastructure to be able to transport chilled or deep-

frozen fish to all customers. Fish is mainly offered on the coast or beside large lakes, directly where it has been caught. In other parts of the country the use of fish is far less widespread. In industrialized countries, on the other hand, the vast bulk of fish is sold as a deep-frozen product and is generally imported nowadays. To a lesser extent, fish is eaten smoked, salted or marinated in these countries. Some seafood like oysters are even eaten alive.

In the year 2010 around 20 million tonnes of fish and seafood were utilized in the non-food segment. The vast majority of this was processed into fishmeal and fish oil, predominantly for use in aquaculture.

Furthermore, fish and seafood or extracts derived from them are used in the manufacture of cosmetics and medicines. Over the past 20 years the cosmetics and pharmaceuticals industries have increasingly recognized fish wastes as a valuable resource. In the past these waste products were simply disposed of. Today they are quite matter-of-factly used in production.



2.9 > Long fatty acid molecules like DHA consist primarily of carbon (dark grey) and hydrogen (light grey). Fatty acids are unsaturated if carbon atoms are linked by double bonds because they are missing hydrogen atoms.

Famous fish oil

Fatty fishes like mackerel, salmon or herring contain large amounts of so-called omega-3 fatty acids. These are some of the healthy, unsaturated fatty acids that help to strengthen the immune system and prevent cardiovascular disease.

The labels “saturated” and “unsaturated” are the technical terms used in chemistry to denote how many hydrogen atoms occur in the long molecule chains of fatty acids. Unsaturated fatty acids contain little hydrogen. Docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) are especially beneficial.

DHA is important for the development of the brain and the eyes, while one of the uses of EPA is for the treatment of rheumatoid arthritis. These two long-chain highly unsaturated omega-3 fatty acids are found almost exclusively in marine fish and marine algae. Phytoplankton is able to generate these two omega-3 fatty acids on its own, whereas fish cannot synthesize the substances themselves. Instead, the fatty acids are taken in by plankton feeders as they feed, and passed up through the food chain to predator fish. The highest contents of DHA and EPA are found in mackerel. Land plants also contain omega-3 fatty acids – particularly alpha-linolenic acid, large amounts of which are found in rapeseed, soya and walnut oil. But this compound is far less effective in the human body than DHA and EPA.



2.10 > A Senegalese fish seller carries a large fish, a capitaine. In West Africa fish are usually sold fresh as there are often no means of refrigeration.

Cereal in place of fish fillet?

Critics emphasize that people should refrain from consuming fish so as to conserve fish stocks and the marine environment. Their opponents argue that there are hardly any alternatives; virtually no other food is a substitute for the unique combination of nutrients in fish. This applies particularly to the nourishment of people in developing countries, for whom alternative foods are unaffordable or quite simply unavailable.

It would also be difficult to replace the full amount of fish and seafood, some 140 million tonnes, entirely with plant-based foodstuffs. Ultimately wild fish and seafood are organically generated foods whose growth depends solely upon the photosynthesis carried out by phytoplankton. By contrast, most vegetable or cereal production

requires the use of fertilizers and plant protection products. In addition, large areas of land are necessary for arable farming, some of which can only be obtained by destroying natural habitats. The amount of land area needed to replace the worldwide total marine catch of around 80 million tonnes of wild fish and seafood can only be roughly estimated, partly because protein content or nutritional value varies from one fish species to another and from one crop to another, and partly because the fertility of different soils varies enormously. Based on the assumption of cereal farming on averagely productive soils, worldwide it would take an area of land at least the size of France to match the nutritional value of the global wild fish catch. It is clear, however, that the worldwide fishing industry does need to be converted to the sustainable management of fish stocks.

CONCLUSION

Source of nutrition and income for millions

People have always relied upon fish as a basic livelihood resource. Estimates by the Food and Agriculture Organization of the United Nations (FAO) put the number of fishermen worldwide at 54 million. Counting their families and the suppliers of fishing equipment, 660 to 820 million people today are directly or indirectly economically dependent upon fisheries.

Around 140 million tonnes of fish and seafood per year are used for human consumption. Set against the global production of cereals of around 2.2 billion tonnes, that figure is comparatively low. Owing to its unique combination of nutrients, fish makes a major contribution to a healthy diet. It supplies proteins, healthy fatty acids, vitamins and other elements essential for health such as iodine and selenium. Furthermore, in developing countries fish is often the only affordable and relatively easily available source

of animal protein. In some regions on Earth fish can provide up to 50 per cent of the total animal protein in people's diets. This is the case, for example, in Bangladesh, Cambodia and Ghana.

In the year 2009, fish supplied 16.6 per cent of the total worldwide consumption of animal protein.

Asia is home to the largest numbers of fishermen by far. Many work in small-scale operations, and fish production per person is correspondingly low at about 1.5 tonnes on average. For comparison: the figure in Europe is around 25 tonnes per person.

In many industrialized countries the number of artisanal fishers has declined. The lack of a successor to carry on the business or the poor economic outlook has led many of them to shut down their businesses. A contributory reason has been the overfishing of fish stocks in some regions. Social scientists recommend that in future, fisheries management should not consider the state of fish stocks in isolation but pay more attention to the possible social consequences of such management.

Bibliography

Charles, A., 2010. Good Practices in the Governance of Small-Scale Fisheries, with a Focus on Rights-Based Approaches. Prepared for the Food and Agriculture Organisation of the United Nations Regional Workshop on Small-Scale Fisheries.

Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department, 2012: The state of the world fisheries and aquaculture 2012.

Miller, K., A. Charles, M. Barange, K. Brander, V.F. Gallucci, M.A. Gasalla, A. Khan, G. Munro, R. Murtugudde, R.E. Ommer & R.I. Perry, 2010. Climate change, uncertainty, and resilient fisheries: Institutional responses through integrative science. *Progress in Oceanography* 87: 338–346.

Ommer, R.E., 2010: The Coasts Under Stress project: a Canadian case study of interdisciplinary methodology. *Environmental Conservation* 37, 4: 478–488.

Perry, R.I. & R.E. Ommer, 2003. Scale issues in marine ecosystems and human interactions. *Fisheries Oceanography* 12, 4: 1–10.

Perry, R.I. & R.E. Ommer, 2010. Introduction: Coping with global change in marine social-ecological systems. *Marine Policy*, 34, 4: 739–820.

Perry, R.I., R.E. Ommer, M. Barange, S. Jentoft, B. Neis & U.R. Sumaila, 2011. Marine social- ecological responses to environmental change and the impacts of globalization. *Fish and Fisheries*, 12: 427–450.

www.fischinfo.de/

www.mri.bund.de

Table of figures

pp. 30/31: 2007 Hans-Guenter Mueller/Flickr/Getty Images;
fig. 2.1: online: http://en.wikipedia.org/wiki/File:MAP_Expo_Maori_Hame%C3%A7on_13012012_4.jpg, Date: 28.12.2012/
Vassil; fig. 2.2: Wilhelm Dittmer, 1866–1909, Te Tohunga. London, Routledge, 1907/National Library of New Zealand; fig. 2.3: LookatSciences/laif; fig. 2.4: after FAO (2012); fig. 2.5: after FAO (2012); fig. 2.6: after FAO (2012); fig. 2.7: after FAO (2012); fig. 2.8: after FAO (2012); fig. 2.9: maribus; fig. 2.10: Patrick De Wilde/laif

Reproduction, translation, microfilming, electronic processing and transmission in any form or by any means are prohibited without the prior permission in writing of maribus gGmbH. All the graphics in the World Ocean Review were produced exclusively by Walther-Maria Scheid, Berlin. The list of illustrations states the original sources which were used as a basis for the preparation of the illustrations in some cases.

Publication details

Project manager: Jan Lehmköster

Editing and text: Tim Schröder

Copy editing: Dimitri Ladischensky

Coordinator at the Cluster of Excellence: Dr. Jörn Schmidt

Editorial team at the Cluster of Excellence: Dr. Jörn Schmidt, Dr. Rüdiger Voss, Dr. Kirsten Schäfer

Design and typesetting: Simone Hoschack

Photo-editing: Petra Kossmann, Peggy Wellerdt

Graphics: Walther-Maria Scheid

Printing: DBM Druckhaus Berlin-Mitte GmbH

Paper: Recyc satin, FSC-certified

ISBN 978-3-86648-201-2

Published by: maribus gCmbH, Pickhuben 2, 20457 Hamburg

www.maribus.com

ClimatePartner 
climate-neutral

