Chapter 7

Science, fishers' knowledge and Namibia's fishing industry

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> In the [first] decade, management of the hake resource has been confounded by uncertainties surrounding the size of the resource. There were two conflicting estimates of abundance, depending on whether the survey or the commercial [data] was used, complicating the recommendation of a [total allowable catch]. The survey index indicates … that the population is currently overexploited. In contrast, the estimate obtained from a surplus-production model, based on commercial catch and effort data, indicates that abundance is currently close to pristine levels. (Van der Westhuizen: 313)

> And now I feel the fish have really now evolved into these learned [creatures]. They got doctorates. They're really clever now. Now you gotta wake up. And the fish that pops it's head up … you must jump on it and take your cut … Either [the fish] has gone, or it got clever. (Bob, Namibian hake longline skipper.03 07 2009)[1]

The world's oceans are overfished (Pauly et al.: 2007). One of the responses to this from the fishing industry has been to try to fish more 'scientifically'. However, as indicated in the first of the above quotes, the science of fisheries management is not without uncertainties, conflicts and contestations. The failure of conventional science to provide the basis for managing the world's fisheries in a sustainable manner has sparked a countermovement

1 Interviews with Namibian longline and trawl fishers took place in Walvis Bay Namibia in 2009 and 2010. Names were changed to maintain their anonymity.

towards an ecosystem approach to fisheries management (FAO). This approach aims at holistic management; it considers fisheries as components of complex social and ecological systems requiring a balancing of diverse and often conflicting goals (Paterson et al.: 2007).

In this chapter we explore the meanings that scientists and fishermen share with regard to fish stocks. We show that while there are differences in approach, both groups share the same concerns, and ultimately their perspectives may well be complementary and contribute to preserving the threatened fisheries.

This chapter has been written by an interdisciplinary team of researchers based in South Africa and Namibia. All share an interest in fishing and fish stocks. Paterson is a German-trained modeller of knowledge-based systems who lives in Namibia and who conducted all the interviews. Jarre is a marine-systems ecologist who worked in Denmark before moving to Cape Town. Green and Norton are both anthropologists and are based in Cape Town.

The trawler and longline hake fishers in the northern Benguela have a perspective on sustainable fishing that is often ignored or neglected. Their knowledge is often treated either as anecdotal or as simply filling a gap that more ‘scientific’ measures or approaches offer. Within the science community, however, there is increasing sensitivity towards alternative ways of knowing about fish (Ommer et al.: 2011), such that it is not always easy to distinguish between ‘a scientist’ and other kinds of fish researchers.

In this chapter we provide narratives of Namibian trawlers and longline captains, which illustrate how they make sense of catching hake. The narratives were collected via interviews conducted between 2009 and 2010 following the methodology for local-knowledge interviews described by Neis, Schneider et al., (1999). Namibia’s hake longline and trawl fleet is comprised of corporately owned vessels. When the interviews were conducted, 63 demersal trawl vessels and 13 longline vessels were licensed to operate in

Namibian waters, but it is not known how many were active. Following the recommendations of Davis and Wagner, snowball sampling was used to identify eight trawler and six longline captains who were reputed to be highly experienced. To honor our obligation to consider the risks and benefits that may derive from participation in research (Carruthers and Neis: 2011) we provided sufficient information to allow participants to give free and informed consent.

We show how the captains determine where the fish are, how many and which species to catch, as well as how best to do so in a context where: i) the resource is threatened; ii) quotas are set by the government for their highly capitalized employers; iii) they have to ensure their own livelihoods, and those of their families.

Scientists who provide advice for managing fishing, and the fishers who actually catch the fish, have shared interests but their respective understandings of fisheries provide insights at different temporal and spatial scales, and at different levels of detail. On the one hand, fisheries management has traditionally focused on determining the maximum amount of fish that may be harvested. This calculation is invariably based on a set of assumptions that are often inexplicit, and generally ignore the possibility of different modes of calculation, as well as different understandings of the nature of the resource. Moreover its very rationale is to catch as many fish as possible within what the resource will allow. Fishers, on the other hand, aim to create value from fishing, which involves deriving economic benefits from their catches, as well as maintaining their particular way of life at sea. Although profits from high catch rates are not unimportant to fishers, the daily processes of fishing and being at sea involve complex interactions between fishers and the marine environment, and give rise to more complicated considerations than simply aiming to catch as many fish as possible on any given day.

Neither governments nor the fishing industry can guarantee the recovery and future sustainability of depleted fish stocks by relying simply on contemporary scientific understandings of fish and fishing, as if these are somehow value-free. Any decisions made about fishing in Namibia would benefit from including fishers' knowledge, and from a conversation between scientists and fishers that develops a holistic and shared eco-knowledge.

Counting fish: catch targets and bio-economic models

The focus on profit making with little regard for the preservation of fish stocks emerged in Europe in the late nineteenth century, with the development of industrialized trawling. At the time, eminent biologists such as Thomas Henry Huxley believed that the natural abundance of fish populations could never be overfished. Nevertheless, concern was soon expressed about the decline of cod catches. As early as 1902, this concern led to the establishment of the International Council for the Exploration of the Seas – an intergovernmental European body tasked with co-ordinating research, and later with providing management advice.

Fluctuations and failures in the fishing industry spurred the desire to control the variability of catches, whether these were considered natural or induced by the impact of fishing (Smith: 1994; Bavington: 2009). This wish to understand and minimize fluctuations in catch rates in order better to guide capital investment and trade, led to the widespread acceptance of mathematical modelling to predict the reproductive behaviour of fish populations. This early and close link between classical fisheries science and economics is reflected in the terminology of the field, which reflects the seamless transition through which biological organisms become objects of accountancy, and were then seen as 'stocks', 'assets' and 'resources'. In their paper titled 'The Actor Enacted: The Cumbrian Sheep in 2001', John Law and Annemarie Mol present an argument that led them to consider Cumbrian sheep as 'a sheep multiple' (2008: 65). They emphasise, however, that this multiplicity is not a plurality, but rather a convergence of complex and intricate relations between the variant versions thereof. Similarly, it can be argued that reducing fish to value-bearing economic units reduces the 'fish multiple' by emphasising certain relations and ignoring others.

For nearly a century, fisheries science regarded fish as discrete, unrelated populations, and assumed that the productivity of such fish populations was largely independent of their physical and chemical environment as well as of the social-ecological changes in the fishery. In this paradigm, mainstream fisheries science assumed that the recruitment of young fish into the fishable population could be predicted based on the size of the adult population. It also assumed that the size of the adult fish population could be manipulated by fishing pressure (see, for example, Finlayson: 1994). Consequently, fisheries management, guided by scientific advice, has focused on regulating fishing pressure by controlling the number of boats, the sizes of fishing nets and the total amount of fish that may be caught annually (Lalli and Parsons: 1993).

In the case of Namibian hake, for instance, the total allowable catch is determined by means of a population model that includes data related to 'catch per unit effort' (that is, the amount of fish caught as a function of hours fished or days spent at sea), as well as abundance indices derived from research surveys. Although information extracted by scientists from fishers' logbooks and catch-data offers a potentially rich source of information, fisheries management tend to be reactive rather than pro-active. That is, as Neis and Kean (2003) have shown, scientists and managers tend to assume that fishing practices remain constant and thus formulate their ideas and policies using outdated information.

The collapse of many of the world's most important fish populations such as Atlantic cod, Californian sardines and Peruvian anchovies indicates that the scientific approach has not been successful (Daw and Gray 2005; Degnbol 2003; Finlayson: 1994). Consequently fisheries science is divided on questions regarding forms of modelling and the effectiveness of management interventions (Bavington: 2009). In Namibia, quantitative stock assessment, and associated concepts and processes, are increasingly contested as it becomes clear that the notion of discrete fish populations as a unit of management has limitations (Roux and Shannon: 2004).

The use of catch per unit effort as an index of abundance is also considered problematic by many scientists (see, for example, Maunder et al.: 2006) because it assumes that effort is constant. In fact, effort is influenced by gear changes and corresponding changes in fishing efficiency. Data obtained from research surveys can also be problematic because such surveys tend to be conducted with specific equipment, and confined to certain times and areas. Furthermore, fish mortality is difficult to quantify accurately because landings and catches are not the same: harvesters discard fish at sea, both intentionally (if a catch is unwanted) and unintentionally (when fishing nets tear, for example). In addition, the two species of hake that live in Namibian waters – the shallow-water hake and the deep-water hake, with their specific life-history strategies and population dynamics, are currently assessed together because industry catches allegedly cannot be separated into species. Yet, as Roux and Shannon demonstrate, research findings using the concept of single stocks in the Namibian context cannot adequately account for the environmental effects on the two fish populations, the variability of natural mortality, the many interactions of organisms in the ocean, or the effects of fishing on the food web.

The consideration of wider ecosystem structures and functions is a major challenge for fisheries research and management in the Benguela in the 21st century (Degnbol and Jarre: 2004; Roux and Shannon: 2004). Calls for more integrated management in accordance with the ecosystem approach to fisheries have generally gained ascendancy over the last two decades. Many scientists are now emphasising the need for better knowledge about the structures and functioning of marine social-ecological systems under variability and change, and aiming to integrate both qualitative and quantitative information into management advice (see, for example, Ommer et al.: 2011).

Scientific knowledge is the product of social as well as ecological factors (Finlayson: 1994; Latour: 1999; Neis, Felt et al.: 1999). Fisheries science seems to be shifting away from an accountancy approach and towards a more qualitative ecosystem approach in acknowledgment of the complex social-ecological interactions that shape fisheries systems. One important aspect of this shift is the recognition that closer attention to, and increased understanding of, the ways in which fishers make sense of fishing, as well as of their experience and knowledge, may contribute to improving the status and quality of fisheries.

Navigating social-ecological seascapes

Hake-trawler and longline skippers in Namibia are usually employed by fishing companies who own the boats and fishing gear (Draper 2001; Paterson, 2010). Hake trawlers in Namibia use sophisticated fishing gear and navigation equipment, and can carry up to a hundred metric tons of fish. As noted earlier, skippers have three primary considerations – the fish, their employers' interests, and their own livelihoods, including those of their crew. These considerations create a context of often-competing goals.

In 1990, newly independent Namibia inherited over-exploited fish populations, including various kinds of hake. Subsequent management of the fishing industry was geared towards rebuilding its capacities along more inclusive lines, and ensuring that fish populations were large enough to ensure the industry's longevity. The need to rebuild fish stocks is a tricky target, as the interests of capital require generous total allowable catch quotas in order to grow and maintain company income from year to year. The Namibian government faces a dual and contradictory imperative. On the one hand, the state has to ensure the longevity of the industry through healthy fish stocks. On the other hand, it has to protect the interests of capital because it is both a gainful employer of their citizens and a source of tax revenue.

The skippers earn a substantial income from fishing, and obviously want to maintain the lifestyles to which they have become accustomed. While their basic salaries are fixed, they earn 'fish money' based on landings, as well as on the seasonal and market-based calculations of their employers. Depending on the nature of the target market at any given time, companies will ask for either quantity or quality – that is, many small fish to sell to a depressed market, or larger, better-looking fish to sell to markets where consumers are spending more. Fishers change their practices according to what their companies demand, the fish they are able to find (often not the same thing), and what they think the fish populations can sustain in order to make sure that they can fish again the next day. In other words, skippers hardly ever have one simple overriding interest when deciding when, where or what to fish. By the time they are on their boats, their context has already shaped the range of possibilities open to them.

The status of the resource, the economic interests of the government and the fishing companies, as well as the living standards of the skippers and their crews, all come together in the notion of 'the quota'. Fishing permits or 'rights' are held not by the skippers but by fishing companies, and the permits are linked to quotas allocated by the government. Each quota represents a share of the total allowable catch. Quotas are set at the end of April each year, when the fishing companies are informed of their allocated quota. Prior to this, the fishing companies do not know if they will receive a quota, what size it will be, or on what grounds it will be calculated. The size of the quota allocated to each company determines the pace and intensity of subsequent fishing activities. Some companies aim to catch as much fish as possible in the hope of securing an additional quota either from the government or from other companies; others spread their quotas out to ensure that they have at least some work throughout the season. If there is no quota, vessels will not be sent to sea, and the skippers and their crews will earn no commission. Thus the quota frames the politics of fishing.

Narratives from fishing captains

The skippers whose views are presented here have between 12 and 40 years of fishing experience. The trawlers catch fish by dragging a net over the seabed behind their vessels, whereas longliners use a 20-mile-long fishing line from which they suspend hooks. The line is set close to the ground and held in position by anchors, weights and floats. In both cases, fishing trips take about a week depending on the catch. The need to maintain the quality of a catch, as well as the quantity of fuel and provisions they can carry, limits the length of the trips to a maximum of ten days.

The notion of a quality catch is important in determining how the fishers proceed, and this notion of quality is itself contingent on market conditions and how the company has strategized to meet market demands. A prime-quality longline hake is put on ice, and then flown to Spain to be sold whole and, importantly, looking as if it has just been pulled from the water. Trawled fish is headed and gutted on board, and then processed on shore into frozen fillets, loins and other portions that are sold supermarkets in Europe, USA and South Africa. A company's strategy is usually a negotiation of market conditions and their fleet's cost effectiveness. The fishers' strategy, in turn, is a negotiation of the company's demands and conditions at sea. As Allan, captain of a longline vessel, explains (09 07 2009):

> You'll end up with say 35 tons of fish for a very good trip. And you can do that in three days if it is possible, but you work your people to death … If you catch fish in a five-day period, your quality is excellent, very good, because you can space it out nicely. If

> you catch like eight tons every day, then your people get tired and you start to lose quality, because the guys work too fast. They leave the fish too long in the bin, and then they handle it too roughly, and scales come off and your fish doesn't look too good.

To maintain catch rates the skippers need to ensure that their boats follow the fish. As a trawler moves away from a shoal there will be fewer live fish in the net, so the skippers turn around to get back to the fish. Once a longline has been set, however, the skipper is committed to remaining in place for a 24-hour period. So, before resetting the line, the skipper tries to make sure that the fish are still in the area (Paterson: 2010). Indications from the current catch are examined. If the fish are already dead when hauled in, it is likely that the shoal passed by much earlier, and the chances of catching more fish in the same spot are small. If the fish are still alive, there is a good chance that they might still be active in the same area, and might bite again if the line is reset. In addition, if the hooks are deep in the throats of the fish, it means the fish were hungry, and keen to bite.

The fishers' movements at sea are thus informed by the state of the fish, and their interpretation of the catch. Fish and fishers are intertwined through their mutual interaction with the equipment, and the production of fishing knowledge is an ongoing process that relies on the technology of fishing and fish behaviour, as much as it does on the experience of the fisher. Following Law and Mol's line of thought, and looking at the fish as actors, the perspective of the fisher illuminates other aspects of the 'fish multiple'.

A successful fishing trip is one where the catch is good and the costs are low. A skipper wants to spend as little time as possible searching for fish. Although Namibian hake longline and trawler fishers have sophisticated fish-finding equipment available, this technology allows them to 'see' only the fish that are below the vessel or going into the net. Thus, knowing *where* to fish is not only a question of technology, but also about personal experience and an ability to network with other fishers. Some fishers discuss which areas are yielding good catches, and many will choose fishing areas based on the catch rates and the quality of the fish being caught in that area by other fishers. Not all skippers follow what others are doing, however. Some have strong personal preferences for particular areas, as longliner Bob explains (03 07 2009):

> Every skipper's got his 'farm'. People say that area belongs to me, to Bob, that's Bob's grounds, leave him alone. If trawlers're here and I'm here, they say, 'Ok sorry, we give you way.' Because they know I go there. That's my place, ja, that's my area. That's where I like [to work]. Coz the fish is nice, generally the fish is nice.

Similarly, Michael skippers a 55-metre trawler, and mostly fishes in the waters off Walvis Bay, at a depth of around 800 metres. He notes (23 02 2009):

> You can go check on the records of our vessel, we only stay in the deep water there … and there is not a lot of vessels. Maybe one or two you get, but not every trip also … all my trips is in the deep. I think I am now the only one here at the company that's [fishing in the deep].

Their preferences for particular areas reflect these skippers' attitudes to the sea. Both know where to find the fish that they are looking for. But, besides these target-oriented considerations, their preferences are infused with a sense of proprietorship. Bob calls his fishing area 'his farm'; Michael talks about exploring areas where nobody has trawled. Although he is aware of the risks he takes by fishing in uncharted waters, he is reluctant to give away his hard-earned tracks to another fisherman. He prefers to do his own thing rather than fish in the company of other trawlers. Fishing in 'the deep' is infused with a sense of adventure and the added danger of strong swells.

Finding 'a piece of fish' in the vastness of the seascape is a challenge that requires an understanding of what the fish are likely to do, and this is informed by the long-term relationship that fishers have with the sea. Knowledge of the impact of the weather, the seasons, and the phases of the moon on fish is important. Catches are usually smaller during strong winds and high swells. At full moon, fishers expect to find shallow-water hake in shallower water, and at new moon they head for deeper waters. Bob notes that he expects the fish to move to deeper water during strong winds, while longline skipper Allan says (09 07 2009): 'Fish tend to always go into the wind. I don't know why 'coz they're on the bottom but they know when the wind starts to blow. Especially two days before the wind, then the fish normally bite, and then they normally move up against the wind.'

This tacit knowledge of the marine environment, as well as the interactions that guide the fishers' movements and actions at sea, is augmented by explicit documentation. In their logbooks, fishers record the time, date, and position, as well as information such as the weather conditions, the swell, water temperature, etc. The quality of the catch is also noted, including the species, the quantity, and the size of the fish caught. When other sources of information fail, skippers consult their own logbooks to see where they have found fish under similar conditions in the past. The information in these logbooks is the only form of fishers' knowledge that is currently shared with the Ministry of Fisheries, and used for fisheries management.

Greater than the sum of its parts: an ecosystem approach

Fishing is not simply about catching as much fish as possible. As has been shown, fishers navigate a highly complex, politicized context in order to balance different interests and objectives. The future of fisheries management depends on a greater degree of collaboration between scientists and fishers to than currently practised. Focusing on the differences helps to reveal important issues that require resolution, but it can also deflect attention from what these two groups have in common. A focus on the ways in which scientists and fishers can complement one another reveals the potential for new forms of knowledge creation within fisheries management.

Traditional stock assessment science related to the productivity of fish tends to be removed from the larger marine environment, and remains isolated from the socio-political and economic context of fishing. A reductionist focus on the mathematics and statistics of stock assessment distances classical fisheries science from the phenomenological and experiential relationship that fishers have with the ocean. Fishers' knowledge tends to be regarded as unimportant in this knowledge economy as they are perceived to be closer to labour than to capital. Managers in the fishing industry, on the other hand, see themselves as subject to shareholders and profit making, and, as noted, earning short-term profit making can be in tension with the sustainability of the industry because decisions are based on bio-economical, statistical ways of estimating fish population sizes, and these have been proven to be unreliable. The focus on mathematical modelling ignores questions of ontology, as well as how the various parties or actors relate to fishing resources on a personal and professional level. This means that the intentions behind research and policy decisions tend to be taken for granted, and while this approach remains unexamined, it can be considered a 'natural' way to proceed.

This reliance on quantitative information and statistical testing of hypotheses is data-intensive and requires costly and extensive at-sea surveys. Research costs, however, speak to a fundamental commonality between stock assessment science and the economics of fishing, namely the central importance of the commodity value of the resource. After all, only economically valuable fisheries can afford to be subjected to sophisticated stock assessment. The aim of the state to maximize the long-term profitability and sustainability of the high value natural resource through sophisticated assessment is mirrored in the economic strategies of individual companies, which also want to ensure long-term profitability. So called 'quota management' is a concept that some Namibian trawling companies apply to ensure that their quota will last throughout the year. Instead of catching as much as they can, they lower the frequency of fishing trips and try to keep the factory supplied with fish, and their employees with work, throughout the year. A company's lack of quota has implications for the fishers, who also prefer long-term maintenance of livelihoods and living standards above short-term financial gain. Bob explains (23 06 2010):

> 'I saw [a guy] yesterday on the beach, and he said to me – 'What's going on, are you working again.' And I said, 'No, I'm waiting for quota'; and I thought the last time I saw you I was waiting for quota – this is my flipping life – this is no good, this is no flipping good. And it's making me sick. You see, I'm a person that before it's happened I start to worry. Before I come to my lowest financial situation possible I already start making myself sick. I know, I'm good for two months still, but I'm already sick because I'm already thinking about the end of two months' time and I'm already sick. […] I'm very, very unsure – and also, I'm proud – I won't be able to go to the bank and say to the bank: 'listen, you know, this month [I am earning less].' No ways.'

Thus it can be argued that both fisheries science and fishers have a vested interest in the sustainability of the industry and in the continued health of the fish population that will ensure ongoing work. A more inclusive attitude, such as that reflected in the ecosystem approach to fisheries management mentioned earlier, goes beyond the central focus on the instrumental value of the commodity, emphasising instead the intrinsic value of the species within the wider ecosystem, and the social processes that both rely on and affect it.

The extensive at-sea surveys required for stock assessment can only be carried out a few times per year. This contrasts starkly with to the day-to-day engagements of the fishers, many of whom spend more time at sea than on land, and who experience an interconnected, interactive relationship between themselves and the fish, mediated through their fishing vessel and fishing equipment (Draper: 2001; Paterson: 2010). The GPS and sonar technologies used by scientists are not dramatically different from the technologies that fishers use. The technologies that are used for fish-finding and navigation by fishers and scientists at sea were originally developed for military purposes. In scientific surveys these technologies are combined with sampling techniques that aim to provide a comprehensive picture of a fishing area, including the distribution of fish. Scientific surveys offer an 'external' view that claims to measure resources objectively. The fishers, through their daily engagement, have a perspective of the sea space that is at the same time more localized and more detailed. This does not imply that the knowledge that fishers gain through their work is categorically different from scientific knowledge. Fishers and scientists both employ cartographic techniques, and use the same three-dimensional model of sea space determined by longitude, latitude and water depth. The use of this spatial grid and GPS technology reinforces the re-creation of space as an exploitable resource which plays a part in the functioning of capitalist economies (McHaffie 1995; Paterson, 2007). Whereas the bio-economic or scientific approach claims to be objective, the fishers' insights are context specific and rich in detail. As Michael put it (23 02 2009): 'Unless you have trawled there you don't know that area'.

It can be argued that this difference in scale, while seeming to reflect a mismatch between the two forms of knowledge, offers an important opportunity for integration.

Combining a large-scale overview with detailed local knowledge has the potential to provide a more complete understanding of the ecology of fishing (Neis et al.: 1999). Finlayson's analysis of the collapse of Canadian cod shows how social and cultural factors influenced the production and interpretation of scientific knowledge and its application for fisheries management. On this basis, it can be argued that there are no grounds for positioning fishers with their lived experience and scientists with their statistics of stock assessment on opposite sides of the table. Both forms of knowledge are necessary, and are produced in response to social and ecological contexts.

The shift to the ecosystem approach to fisheries management demands a fisheries science that is both holistic and contextual, and the central tenet of this is a consideration of fish and fishers as part of an interconnected social-ecological system. This approach has the potential to provide a qualitative understanding of ecosystem roles and functions, as it looks at fish and fishers within the complexity of an ecosystem that includes the entire food web, as well as various energy flows and exchanges. Although, in its ideal formulation, the ecosystem approach to fisheries management seems to have more in common with fishers' daily experience at sea than the purely statistical focus of traditional fisheries science, it would be counter-productive to view either quantitative fisheries science or fishers' knowledge as coherent or 'monolithic'. This would ignore the inherent complexity of both perspectives, and prevent discussion based on common ground and partial connections, where potentially interesting new collaborations could be generated (Duggan et al.: forthcoming).

Many of those involved in catching and researching fish acknowledge the value of expertise held by others. Scientists collect data from fishers (usually from their logbooks), and Namibian hake skippers acknowledge the expertise of the scientists. Examples of successful collaborations include identification of local sub-populations (Wroblewski: 2000) and research around catch rates in joint demersal-fish surveys (Wieland et al.: 2009; 2011).

Conclusion

Namibia's hake-trawler and longline fishing captains have a deep knowledge of the fish they hunt. They develop this knowledge amid a cluster of economic, ecological and social interests that include their own personal needs, as well as those of the companies they work for. The knowledge that fishers produce in the course of their work at sea, and how they apply it, is not categorically different from the knowledge that scientists produce and apply in fisheries management. That is, the processes by which fishers and scientists gather data are mediated by the same kinds of technologies, and both fishers and scientists create meaning from this data from the perspectives current within their own cultural, political and economic contexts. Uncertainties in cultural and political contexts can influence scientists to interpret the same set of data differently at different times (see Finlayson 1994, for example). In the case of industrial fisheries, such as Namibia's hake fisheries, both fishers and scientists are entangled in industry networks. Fishers operate multi-million dollar fishing vessels on behalf of large companies, which, in turn, generate a large proportion of the country's GDP and employ thousands of people. These factors are pertinent to the interests of the Namibian government, whose mandate it is to manage the country's resources to the benefit of the Namibian public. Fishers, fishing companies and government scientists have vested interests in maintaining fish stocks so that they yield maximum, yet sustainable, catches. However, neither fishers nor the scientists, on their own, have the means to accurately assess the status of fish stocks. As is the case with information and communication technologies (see Rivett et al. in this volume), contemporary technologies are often unable to answer certain questions or provide solutions to specific problems. Users of the technology have other critical insights, and are potentially able to contribute to making useful, context-specific knowledge. For fishers, knowledge of the fish as actors is crucial for fishing success. This knowledge reflects an important part of the fish 'multiple', and should be considered as important to fisheries management as the numerical data that informs the assessments of fish stocks.

Considering the uncertainties around stock assessment, as well as the documented need for more holistic fisheries management approaches and broader knowledge bases, it seems clear that fisheries management in Namibia, as elsewhere, would benefit significantly from creating platforms for dialogue between fishers and scientists.

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