Responsible Sourcing Guide:

Hake

Version 7- May 2013

Merluccius merluccius Image © Scandinavian Fishing Year Book

Some 12,900 tonnes(t) of hake were landed into the UK in 2011, with a first-sale value of £22.5 million (1), but only 200 t of hake were consumed in the UK(2),so most UK caught hake was exported. All species of the genus *Merluccius* can be described as 'hake' on UK markets (3). Six of these species are widely traded on world markets, being caught in temperate waters of the continental shelf and slopes in both the North and South Atlantic and Pacific Oceans.

The six species covered are: North Pacific hake (*Merluccius productus*); Argentine hake (*Merluccius hubbsi*); the Cape hakes (shallow water *Merluccius capensis* and deep water *Merluccius paradoxus*); European hake (*Merluccius merluccius*); and Chilean hake (*Merluccius gayi gayi*) There are other hake species supporting smaller fisheries that are not covered in this guide.

The northern stock of European hake and the South African (*M. capensis* only) hake stocks are considered to be fished sustainably, whilst the North Pacific, southern European and South African *M. paradoxus* stocks are at risk of being fished unsustainably. Hake stocks off Namibia, Peru, Argentina, Patagonia and Chile all suffer from overfishing. Whilst the sustainability of the Argentine fishery used to strongly influence long-term supply and price of hake products, the economic downturn in Spain in particular has had a significant impact on global markets. The South African and North Pacific hake trawl fisheries are currently MSC certified (4).

The purpose of this guide is to outline the status of hake stocks and describe some of the measures being taken to protect them.

BUYERS' TOP TIPS

Know your species

There are many local English and Spanish names for hake caught around the world, and a number of species are called 'common' hake in the local coastal country: so be sure to check the country of origin. The description 'Pacific hake' covers both the US-Canadian species *M. productus* (also known as Pacific whiting), and the Peruvian-Chilean sub-species *M. gayi peruanus* and *M. gayi gayi*.

Know your source of supply and stock status

To understand the sustainability issues affecting hake stocks, you need to know the assessment and management areas from which the fish have been caught. The table on pages 4-5 gives an overview of the status of the various hake stocks.

Seafish Responsible Sourcing Service

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Status of hakestocks March 2013

Biology

Hake feed mainly on fish and squid, and may also feed on smaller hake, thus influencing their stock dynamics. They tend to be slow-growing and late maturing, which makes them prone to overfishing. Most hake species show large vertical movements from near the sea bed, where they spend the day, into mid and surface waters at night to feed. Hake also show substantial offshore and along-shore migrations, a characteristic that is reflected in the large areas used for stock assessment and management (5).

Fisheries and fishing methods

Most hake are taken by bottom trawling, although pelagic trawls are also used in some areas. There are also a number of line and gill-net fisheries that target larger hake, especially in areas of rough (untrawlable) ground in the UK, Spain, Namibian and South African fisheries.

Research

Research on European hake is conducted by a number of European fisheries institutes under the auspices of ICES. Specific topics funded in response to recovery plans include improving mesh selectivity in trawls to conserve juvenile fish, and the identity and characteristics of the 'northern' and 'southern' stocks.

The results of research on hake in South Africa and Namibia quickly feed through to management action supported by the industry in both countries. The Benguela Current Large Marine Ecosystem Programme is a multi-national, ecosystem-based research initiative. There is also collaborative research with overseas institutes, notably Norway's Institute of Marine Research through the Nansen Programme.

Much is known about the Argentine hake and its fishery, with information being provided by a vessel monitoring system and a small, intermittent, observer programme. INIDEP operates a number of research vessels within the Argentine Exclusive Economic Zone (EEZ).

Both the USA and Canada have substantial research programmes on North Pacific hake that cover stock assessment, biology, distribution, environmental change and fisheries impacts, and approaches to conservation of non-target species. This information is used to provide scientific advice upon which Canadian and US authorities develop joint fishery management plans under an international agreement (6).

Assessment

Most assessments of hake stocks rely on commercial catch and fishing effort data, often supported by fishery-independent methods such as research vessel trawl and acoustic surveys (using echo sounders). The methods used to assess hake stocks vary by region and depend on data availability. There are doubts about the accuracy of ageing hake (using otoliths), which detracts from the robustness of stock estimates in several hake stocks.

Where sufficient data on the age or length structure and biological characteristics of commercial catches are available, such as in the European, South Argentine and Chilean stocks, it is possible to undertake an analytical assessment (known as a virtual population analysis) that models the age structure of the stock, spawning stock biomass (SSB) and other population variables, which can be used to evaluate the effects of exploitation on the stock.

Production models may also be used to estimate the response of a stock to fishing and how much of the stock may be harvested without depleting its spawning potential. In their most basic form, they only require catch and fishing effort information, but information on age or length structures can be incorporated. This is the

preferred approach for the South African hake stocks. Until recently, a single combined stock assessment was conducted for the South African hakes (*M. capensis* and *M. paradoxus*). In response to conditions set on the MSC certification of the trawl fishery, each species is now assessed separately, using commercial catch data in an age-structured production model, supported by biological sampling of the catch by observers at sea and trawl surveys. The assessment of the Namibian stocks has been conducted along similar lines, using age-structured production models with commercial catch data.

Maximum Sustainable Yield (MSY) and the Precautionary Approach (PA)

Current ICES advice on hake stocks is given on the basis of MSY and the precautionary approach (7). MSY means fishing at a level that takes the maximum catch (yield) that can safely be removed from a fish stock, on a continuous basis, whilst maintaining its long-term productive capacity, and is achieved by keeping the stock above the biomass action point **MSY$B_{trigger}$.** The precautionary approach aims to limit fishing mortality (F) and catches to levels that avoid depleting the stock's reproductive capacity, keeping its SSB above its biomass reference level (defined as **B_{pa}**).

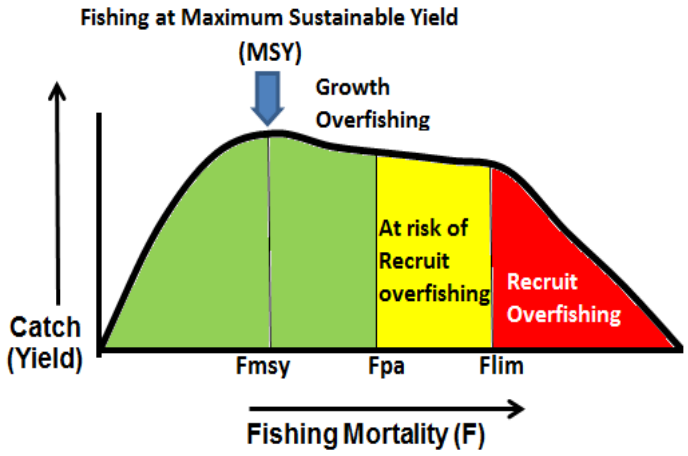
These concepts are illustrated in the schematic (Fig.1). This shows how catches from an unfished stock would increase in line with exploitation (or fishing mortality, F), up to a point where the total mortality on the stock causes so many fish to be caught at a relatively small size (and discarded or landed) that the potential production of the stock due to growth of individual fish is not realised ('growth overfishing'). The peak of this curve represents MSY and indicates where **F_{MSY}** lies.

However, providing sufficient fish survive to become adults and spawn, they may still have the reproductive capacity to replace themselves.

Stock collapse can occur when fishing mortality reaches a level (**F_{lim}**) such that removals from a stock are so high, and its spawning capacity is so diminished, that fewer and fewer juveniles are produced. So, not only is the size of the stock being reduced by too high a level of exploitation, but there are fewer juvenile fish to replace those that are caught, and stock levels are likely to fall even lower ('recruit overfishing"). The yellow area between the green (inside safe limits) and red (outside safe limits) zones in the schematic represents levels of F or SSB that management should seek to avoid to ensure that the stock has a high probability of remaining sustainable.

Scientific advice given under the twin MSY/precautionary approach strategy will aim to either achieve catches consistent with fishing levels that would result in **F_{MSY}**, or reduce fishing mortality to return the stock to within safe biological limits (>**B_{pa}**). For many fish stocks, including hake fisheries in Northwest Europe and South Africa, parties exploiting the stock have management plans, and scientific advice is provided on catches that are compatible with such plans.

Figure 1: Schematic of ICES' MSY and PA reference points in relation to fishing mortality and Yield

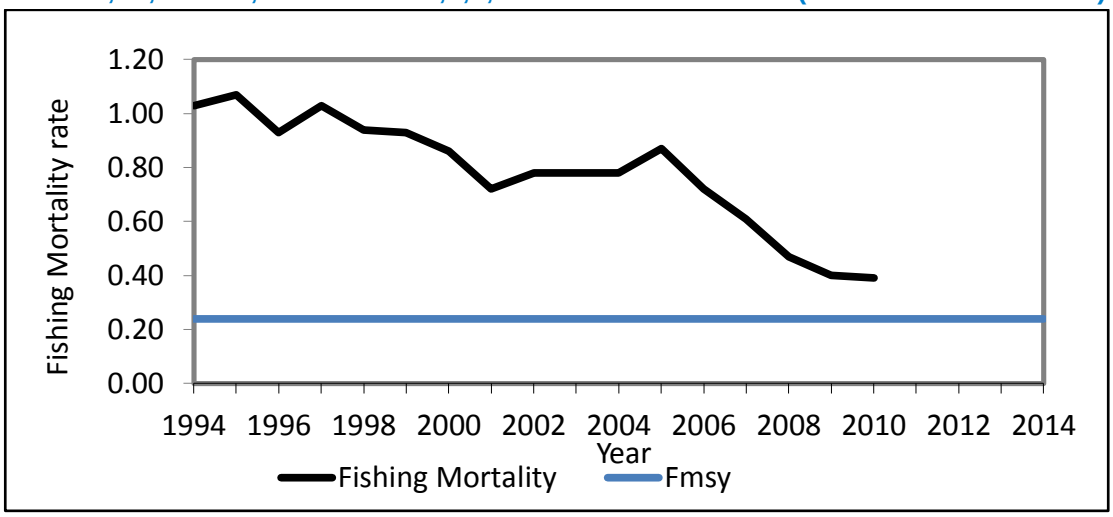


Management Stock (colour coded to map Fig 4)	Agreed TAC 2013 (t)	Advisory TAC 2013 (t)	Scientific advice and management
Inside safe biological limits			
South African shallow water cape hake (*M. capensis*)	156,075 (both species together)	36,408	Spawning Stock Biomass (SSB) of *M. capensis* has been well above $MSYB_{trigger}$ for 30 years (8). Though fishing mortality is not explicitly estimated, this indicates a healthy population that is not overfished. The TAC is set using an Operational Management Plan that uses time series of both commercial and survey catch per effort data to forecast future catches of the two separate stocks of South African cape hake (*M. capensis* and *M. paradoxus*), and is limited by the conservation needs of the weakest stock.
European hake, *(M. merluccius)* northern stock: ICES Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d.	55,105 (10) All EU waters combined	45,400	There was no new assessment in 2012, and the stock status is based on the length-based assessment carried out in 2011 (9). There have been several high recruitments recently and SSB has increased since 1998 and was estimated to be at a record high in 2011. Though fishing mortality has been decreasing in recent years, it is still above F_{MSY} and catches have regularly exceeded the agreed TAC by 30%+ in recent years. A recovery plan agreed by the EU in 2004 (11), which has not been evaluated by ICES, is scheduled to be replaced by a long-term management plan aiming towards MSY. ICES' advice is given on the basis of the transition towards the MSY approach. See Figs 2 and 3 p 6 and 7.
Stocks at risk of being outside safe biological limits and below biomass action point MSYBtrigger			
North Pacific hake (Pacific whiting: *M. pruductus*)	251,809 (2012) (consistent with the default harvest rate and adjustments in the Treaty)	192,746 (2012)	There are three stocks of Pacific hake, of which the large coastal stock is the most abundant commercial fish stock on the Pacific Coast. The latest assessment indicated a reversal of the long-term decrease in SSB following good recent recruitment, though the estimate of SSB at the start of 2012 remains below the management target (40% of the unfished stock level) (12). Harvest levels of coastal Pacific hake are set within a bilateral agreement between the United States and Canada (the Pacific Whiting Treaty), which includes adjustments for carry over from the previous TAC year.
South African cape hake Deep-water (*M. paradoxus*)	156,075 (both species together)	119,668	The SSB of *M. paradoxus* has improved more rapidly than expected since 2007 and was just below $MSYB_{trigger}$ in 2012. An Operational Management Plan (see *M. capensis*) is in place which enables the TAC to be set in relation to the MSY of *M. paradoxus* (8).
European hake *(M. merluccius)* Southern stock ICES division VIIIc, IX and X	14,144 (10)	10,600	There was no new assessment in 2012, and the stock status is based on the assessment carried out in 2011. Recruitment has been high since 2005 and SSB has increased consistently since 1998, but its status relative to any potential biomass reference points is unknown. Fishing mortality has been stable over the last decade and is well above F_{MSY} (9). A recovery plan agreed by EU in 2005 (13) has not been evaluated by ICES, which provides advice on the basis of a transition to the MSY approach.

Management Stock (colour coded to map Fig 4)	Agreed TAC 2013 (t)	Advisory TAC 2013 (t)	Scientific advice and management
Stock outside safe biological limits.			
Argentine hake *M. hubbsi* Northern stock, North of 41° S	85,000	54,000	SSB has been below safe biological limits since 1998. Low recruitment over past decade, means stock is likely to be recruitment overfished. Fishing mortality is considered too high for recovery with no recovery plan. Catch recommendation is intended to restore SSB levels, but TACs are often set higher than advised and there is substantial misreporting (14).
Argentine hake *M.hubbsi* southern stock South of 41°S	277,000	279,000	SSB has been below the safe biological limit since 2008 and fishing mortality is well above the target for recovery, and increased in 2011. Recent year classes have had little impact on the stock due to fishing pressure. There is no recovery plan in place and, though TACs have recently been set in line with scientific advice, landings have exceeded TACs (14).
Peruvian hake *M. gayi peruanus*	13,748	13,748 plus juvenile by catch limit.	SSB in 2011 (most recent available) was some distance outside safe biological limits, though the 2012 autumn survey indicated increased density of hake as a result of favourable environmental conditions. Fishing mortality has been very high and caused growth overfishing in 2007 (last available) (14). The fishery's Management Rules aim to achieve recovery in the medium-term and include technical measures to protect juveniles and closed areas. TACs have been continually reduced in recent years.
Chilean hake *M. gayi gayi*	40,000	40,000	Since the stock crash in 2004, SSB has been outside safe biological limits and was estimated in 2012 to have not recovered from the 2006-2007 situation. Fisheries managers have reduced the level of TACs, causing fishing mortality to drop considerably during the last five years to below the target level. TACs have been set in accordance with scientific advice, and a recovery plan was implemented in 2012 (14). Management measures already in use include a juvenile escape device for the industrial fleet, regulations on mesh size and size of the gear, and closures for stock recovery and reproduction purposes.
Patagonian *M. australis*	23,00 (2012)	22,000 (2012)	Following a peak in 2004, recruitment has been decreasing, and the 2008-2010 year classes were the lowest recorded. SSB has declined over the past 10 years to its lowest recorded level, but is estimated to be just inside safe biological limits. Fishing mortality has been above the recommended level for 9 years (14). No recovery plans are known to be in place.
Namibian cape hakes *(M. paradoxus & M. capensis)*	170,000 (2012/13)	130,000	A new stock assessment in 2012 estimated the combined species stock to be close to the depleted levels observed since 1990, and at one third of MSY levels (14). A management plan was recently implemented with the goal to recover the fishery to MSY level. However, TACs in recent years have generally been set higher than recommended.
Reference points not defined			
European hake Mediterranean	23,069 (FAO 2011)	No advice	No assessment

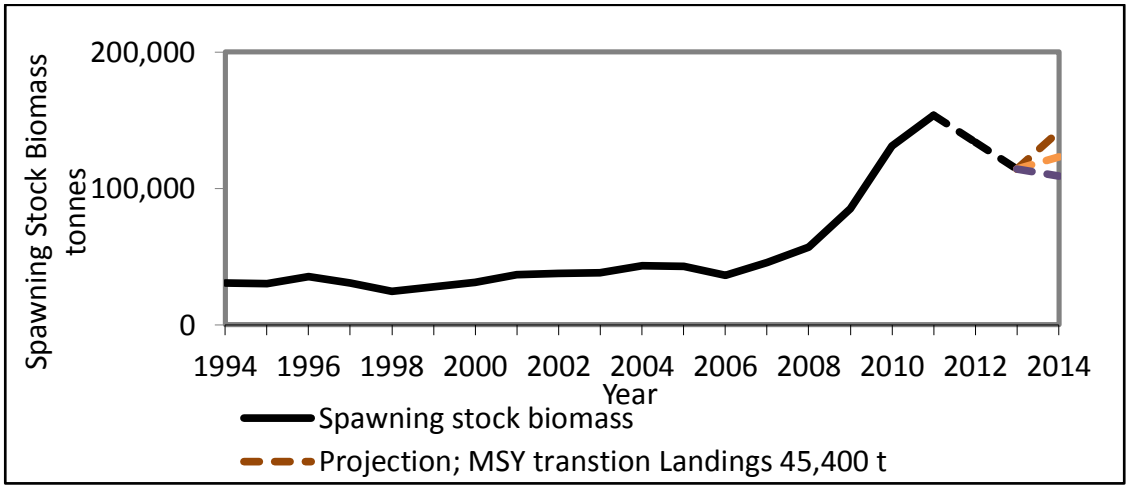
Stock trajectories

Figure 2. Fishing mortality trajectory for European hake, Northern stock: ICES Division IIIa, Sub-areas IV, VI, and VII, and Divs VIIIa,b,d, ICES 2011 assessment (no assessment in 2012).



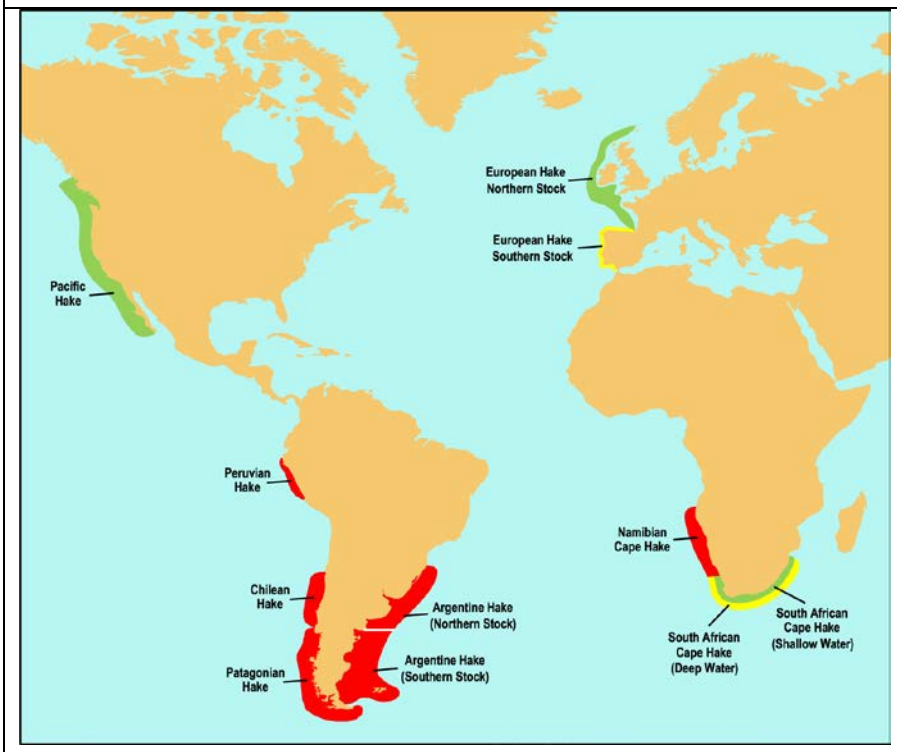
The only reference point set is F_{MSY} (blue line). Fishing mortality has fallen substantially, but remains above F_{MSY}. Catch advice for landings (45,400 t) aims to achieve F_{MSY} by 2015 in line with the MSY transition plan.

Figure 3: SSB trajectory European hake, Northern stock: ICES Divs IIIa, Subareas IV, VI, and VII, and Divs VIIIa,b,d, ICES 2011 assessment extrapolated forward in 2012 (black dotted line).



Although no reference points are set, the stock is now considered to be inside safe biological limits and above candidates for $MSYB_{trigger}$. The dark brown line represents the projection if the landings were in line with the advice for transition to MSY by 2015, and the orange line the projection for an agreed TAC of 55,100 t. The purple line represents the projection for landings of 68,900 t, which exceeded the agreed TAC but is similar to the estimated landings of 73,100 t in 2010, which was the last year where there was a full set of data.

Figure 4: Worldwide distribution for the main hake stocks (colour keyed to Table 1)



Key	Stock status
	Inside safe biological limits
	At risk of being outside safe biological limits
	Outside safe biological limits
	Reference points not defined

Organisation key

ICES: The International Council for Exploration of the Sea. Responsible for providing scientific advice for North East Atlantic fishery management.
EU: The European Union manages fisheries within the European Exclusive Economic Zone.
MSC: The Marine Stewardship Council is an independent non-profit organisation that promotes responsible fishing practices and certifies sustainable fisheries.
DEAT: Dept of Environment and Tourism, South African Government.
MFMR: Namibian Ministry of Fisheries and Marine Resources.
INIDEP: Instituto Nacional de Investigación y Desarrollo Pesquero, Argentine government marine research institute.
SAGPyA: (National Institute for Fishery Research and Development) Agriculture, Livestock, Fishing and Food Secretary, Argentine.
DFO: Dept of Fisheries and Oceans, Canadian Government.
NMFS: National Marine Fisheries Service, US Government.
PFMC: Pacific Fishery Management Council, US Fisheries management body.
Subsecretaría de Pesca, Gobierno de Chile.
USDA: United States Department of Agriculture, USA.

Management and conservation measures

Hake is prone to overfishing due to its slow growth and the relatively old age at which females reach maturity. The key management issues are:

Capture of juveniles

It is important to control mortality of the juvenile fish to enable them to contribute more to reproduction and yields. An EU emergency plan in 2001 addressed excessive mortality of small hake in the northern European stock, using mesh size restrictions in specific areas off SW Ireland and in the Bay of Biscay (see Fig.5), and there are similar measures in many other hake fisheries. There are often cultural and economic difficulties in reducing catches of small hake, for which there are strong markets in some countries, and hake constitutes an important part of the inshore vessels' catch.

Excessive fishing effort

It is difficult to avoid further depleting already low stocks in multi-species fisheries, but recovery plans for both northern and southern European hake stocks include catch and fishing effort controls. To improve stability, agreed TAC are changed by no more than ±15%. As a result,TACs may be higher than recommended by scientists (e.g. Namibian and northern Argentinian hake stocks). The Operational Management Plan used for the South African hake fisheries aims for high catch rates and MSY, and fishing effort has been reduced accordingly.

Illegal landings

TACs have been exceeded in many hake fisheries. Catches in some South American hake fisheries often exceed the TAC by as much as 30%, and annual landings of Northern European hake have exceeded the TAC since 2009 (9).

Management control

Better management of hake fisheries allows the stocks to return to a productive state. The northern European hake stock has recovered since the introduction of measures in 2001; the North Pacific hake fishery has recovered from a low point in 2004; and the South African hake fishery has recovered strongly in recent years. The success of these recovery plans requires determination by Governments, plus industry acceptance and compliance.

There are the beginnings of both these elements in the South American fisheries, but these stocks remain at relatively low levels. Landings of Chilean hake have shown a significant decline, from a peak of over 100,000 t in 1999-2003 to 42,000 t in 2010 (14).

Environmental impacts

Most hake are taken by bottom trawling, which can cause damage to the sea bed and seabed-living organisms. However, the patchy distribution of fishing effort, and soft bottom sediments favoured by hake, limit this type of ecosystem effect.

Both trawl and long-line fisheries can result in seabird mortalities, but these can be minimised by implementing mitigation measures, as seen in the South African trawl fisheries. Conservation protection for non-fish bycatch in the Chilean hake fishery uses closed areas (seabed-living habitats) and technical measures (seabirds).

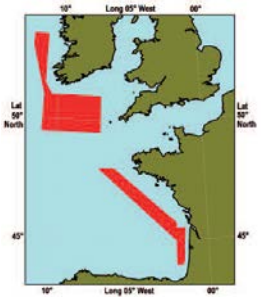


Figure 5: EU restricted area to conserve hake by mesh sizeand limiting fishing effort (11).

Product characteristics and seasonal cycles

The types of product vary by hake species and country of origin. Most fisheries produce a mix of fresh and frozen products. The fresh material is mainly for local consumption or on-shore processing, although some line-caught fish are chilled and air freighted as high value product. Fresh products include gutted, headed and gutted (H&G), and fillets. Most internationally traded product is partially processed, and then frozen at sea, and further processed ashore either in the country of landing or at final destination. Processed and frozen at sea product includes H&G and fillets and is frequently the highest quality available. Hake may breed throughout most of the year. The spawning in different sea areas is shown below.

	J	F	M	A	M	J	J	A	S	O	N	D
European hake												
Argentine hake												
Chilean hake												
Pacific hake												
Cape hakes												
Namibia *M. capensis*												
South Africa												
		Spawning					Peak spawning					

Supply chain standards

Responsible practice in the chilled and frozen supply chain depends on correct catching, gutting, washing,chilling or freezing, processing and handling practices throughout the chain. There are standards which cover these aspects from capture to retailer:

- **Seafish Responsible Fishing Scheme.**Sets best practice standards for fishing vessels, based on British Standards Institution specifications (BSi: PAS 72:2006) (15); and
- **British Retail Consortium (BRC) Global Standard and Safe & Local Supplier Approval (SALSA) certification.** Designed to raise standards in the seafood processing and wholesaling sectors.

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*European legislation available on: http://europa.eu/

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