Commercial fish

Scottish Government
Riaghaltas na h-Alba
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Key message

Indicators, based on stock abundance assessments and fishing pressure, can fluctuate significantly from year to year and across stocks. The single Scottish Sustainable Fishing Indicator (SSFI), a key stocks high-level trend summary, has shown improvement between 2016 and 2018. This does not imply long-term improvement and may hide important detail for particular stocks.

FRV *Scotia* catch of herring

Background

As well as being of key economic and social importance, commercial fish in Scottish waters are also vital components of the biological ecosystems. Larger commercial fish (e.g. cod, hake, whiting) are themselves key predators, so their presence is critical to the correct functioning of the local food web.

The status of most commercial fish stocks of greatest commercial value to Scotland (pelagic mackerel and herring being the two most valuable species, with demersal (in descending order of economic value) being haddock, monkfish (or anglerfish), cod, hake, whiting and saithe (Figure 1)) is evaluated each year by International Council for the Exploration of the Sea (ICES), which uses fishery (Figure 3)

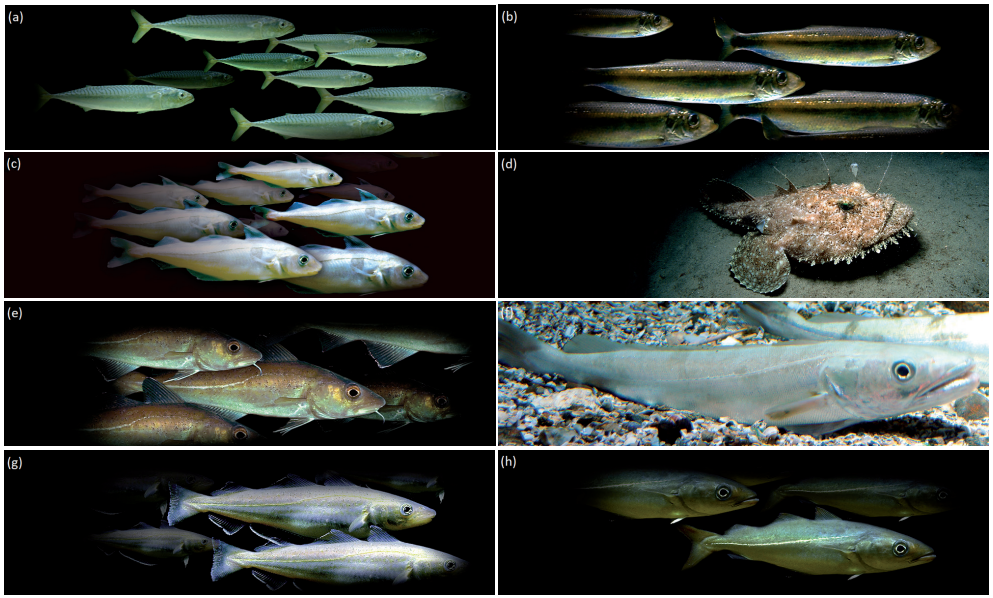


Figure 1:
Fish of greatest commercial value to Scotland: (a) Mackerel; (b) Herring; (c) Haddock; (d) Monkfish (or Anglerfish), photo by TBC; (e) Cod; (f) Hake, photo by Drow Male/CC BY-SA; (g) Whiting; and (h) Saithe. All photos © Marine Scotland unless otherwise stated.

For further information on this topic go to: https://marine.gov.scot/sma/assessment/commercial-fish

and survey data from appropriate countries to estimate three key metrics:

1. Fishing mortality *F*: this is a measure of the mortality pressure exerted by fishing on the stock. It relates to the proportion of a population removed by fishing each year according to a nonlinear relationship, so an *F* of 0.3 indicates roughly 30% removals while an *F* of 1.0 indicates roughly 65% removals.
2. Spawning stock biomass *SSB* or *B*: this is an estimate of the weight (in tonnes) of sexually-mature fish in the population, and is used as a proxy for both abundance and reproductive potential.
3. Recruitment *R*: this provides an estimate of the number of young fish entering the fishable population each year.

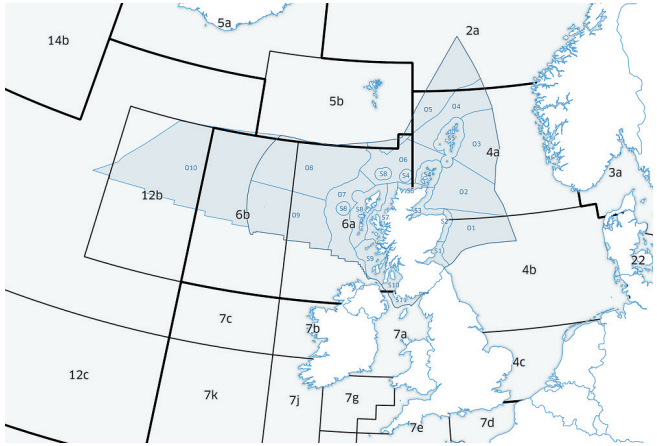


Figure 2:

ICES areas around Scotland with Scottish Marine Regions (SMRs) and Offshore Marine Regions (OMRs). Source: Marine Scotland and ICES.

Key: S1, Forth and Tay; S2, North East; S3, Moray Firth; S4 Orkney Islands, S5, Shetland Isles; S6, North Coast; S7, West Highlands; S8, Outer Hebrides; S9, Argyll; S10, Clyde; S11, Solway; O1, Long Forties, O2, Fladen and Moray Firth Offshore; O3, East Shetland Shelf; O4, North and West Shetland Shelf; O5, Faroe-Shetland Channel; O6, North Scotland Shelf; Hebrides Shelf; O8, Bailey; O9, Rockall; O10, Hatton.

Assessments of the state of the stock typically consist of estimating time series of these three measures, and judging whether the fishery is sustainable and the stock healthy by comparing them to pre-defined management reference points. Stock status advice is provided by ICES (2019) on the basis of discrete stocks, which may be biologically distinct or simply part of an existing management area (Figure 2). The stocks are not in general congruent with the defined Scottish Marine Regions (SMR) or Offshore Marine Regions (OMRs), and it is not possible to provide status indicators for SMRs or OMRs specifically.

Figure 3:

Marine Scotland staff sampling fish at Peterhead fish market. © Marine Scotland.

The length of the fish is measured. One of the otoliths (ear bones) is also taken for subsequent analysis at Marine Scotland Science (MSS) to determine the age of the fish when caught.

Results

The single Scottish Sustainable Fishing Indicator, which summarises trends in fishing mortality across key stocks and how these compare with the fishing mortality rate consistent with maximum sustainable yield (F(msy)), has shown regular improvement over the period 2016 to 2018, the percentage of stocks being fished at or below F(msy) has increased from 46% (2016), to 50% (2017) and to 54% (2018). This suggests either effective management action overall, or broadly beneficial environmental conditions, or a combination of both. While positive, the indicator is a very high level metric, and it remains the case that further improvements are required for some key stocks. Furthermore, the indicator has thus far been estimated for only three years, and would have greater utility if calculated over a longer time period.

ICES stock summaries are presented in this assessment for the eight most valuable fish species to Scotland (in terms of landings value). The analysis for mackerel, as the most commercially important stock for Scotland, see figure 4. The extended section presents stock summary plots and maps of biomass within ICES area for the other stocks assessed: haddock, monkfish, cod, herring, hake, whiting and saithe. Table 1

shows a summary of Fishing mortality (F_{MSY}) and Stock size (MSY $B_{trigger}$) for each of the key commercial stocks considered.

Mackerel (November 2019)

ICES areas 1-8, 9a, 14

The spawning-stock biomass (SSB) is estimated to have increased since 2007, reaching a maximum in 2014, and has been declining since then. It has, however, remained above MSY $B_{trigger}$ since 2008. The fishing mortality (F) has declined since 2003, but is estimated to have remained above F_{MSY}. There has been a succession of large year classes since 2001, with year classes since 2011 estimated to be above average.

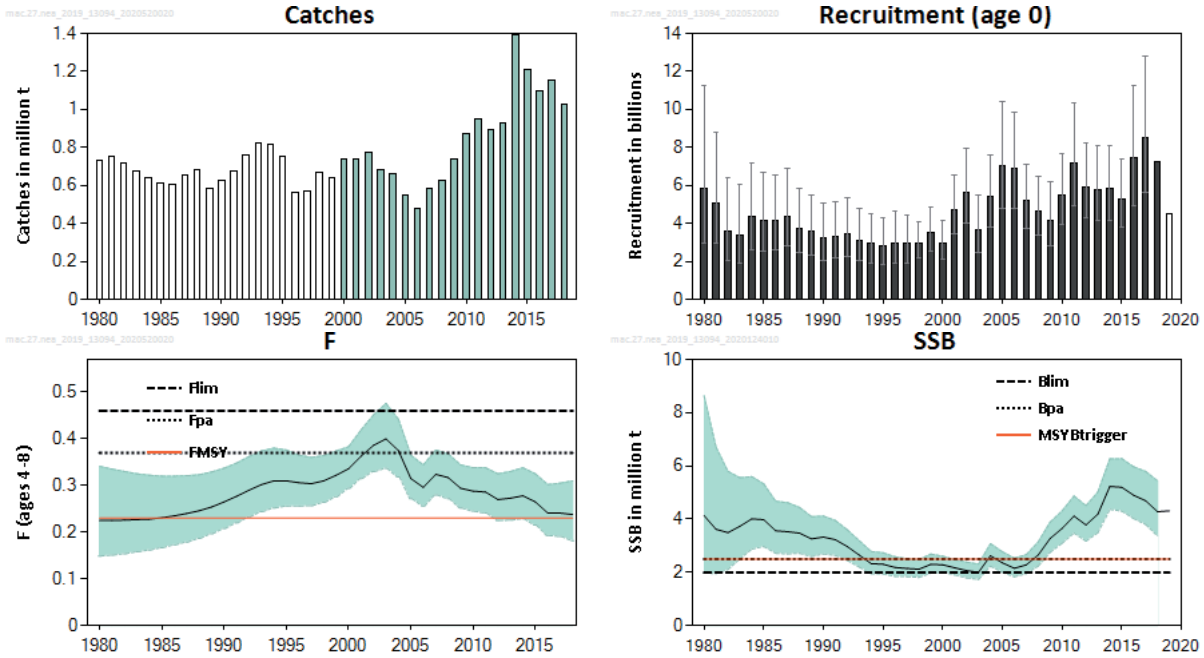


Figure 4:
ICES stock summary plots for mackerel in areas 1-8, 9a and 14. Source: ICES.

Stocks assessed

Table 1:
Summary of Fishing mortality (F_{MSY}) and Stock size (MSY $B_{trigger}$) for each of the key commercial stocks considered. Source: ICES

	Fishing Mortality (F_{MSY})				Stock size (MSY $B_{trigger}$)			
	2016	2017	2018		2017	2018	2019	
Mackerel in ICES areas 1-8, 9a, 14	✗	✗	✗	Above	✓	✓	✓	Above
Haddock in ICES areas 4, 3a, 6a	✗	✗	✗	Above	✓	✓	✓	Above
Haddock in ICES areas 6b	✓	✗	✓	Below	✓	✓	✓	Above
Monkfish in ICES areas 4, 3a, 6	?	?	?	Undefined	?	?	?	Undefined
Cod in ICES areas 4, 3a, 7d	✗	✗	✗	Above	✗	✗	✗	Below
Cod in ICES areas 6a	✗	✗	✗	Above	✗	✗	✗	Below
Herring in ICES areas 4, 3a, 7d	✓	✓	✓	Appropriate	✓	✓	✓	Above
Herring in ICES areas 6a, 7b-l	?	?	?	Undefined	?	?	?	Undefined
Hake in ICES areas 4, 6, 7, 3a, 8a-b, 8d	✓	✓	✓	Appropriate	✓	✓	✓	Above
Whiting in ICES areas 4, 7d	✗	✗	✗	Above	✓	✓	✗	Below
Whiting in ICES areas 6a	✓	✓	✓	Below	✗	✗	✗	Below

Conclusion

The key commercial stocks covered in this assessment summary are some of the most data-rich in the world, and are extensively analysed by internationally-renowned groups. The Scottish Sustainable Fishing Indicator (SSFI) summarises the recent trends in fishing mortality for these stocks, as compared with the estimated fishing mortality rates that should lead to the maximum sustainable yield. The fishing mortality estimates on which the SSFI are based are measured with varying degrees of uncertainty, but they remain the best estimates generated by ICES.

The SSFI shows a steady increase during 2016 to 2018, from 46% to 54%. However, the indicator is a broad summary metric that conceals stock-specific information. As the stocks are biologically distinct, and subject to different management measures, it is important to note cases for which the trends in fishing mortality are increasing. This is the situation for the important mackerel, monkfish and cod stocks summarised above, and more needs to be done to ensure sustainable fishing opportunities into the future for specific stocks.

Knowledge gaps

The knowledge gaps include current data for predation and natural mortality; the impact of climate change on fish stocks; and comprehensive observer coverage for fishing vessels. It is also not possible to make assessments for Scottish and Offshore Marine Regions (SMRs and OMRs) as these are relatively small compared with the scale at which the stocks are assessed.

Status and trend assessments

Region assessed	Status with confidence	Trend with confidence
All Scotland		

The following tables summarise traffic-light assessments for each of the key commercial stocks considered. Source: ICES

Mackerel in ICES areas 1-8, 9a, 14

		Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✗	✗	✗	Above	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	–	Not applicable	B_{MGT}	–	–	– Not applicable

Haddock in ICES areas 4, 3a, 6a

		Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✗	✗	✗	Above	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	○	✓	✓	Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	–	Not applicable	B_{MGT}	–	–	– Not applicable

Haddock in ICES areas 6b

		Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✓	✗	✓	Below	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	–		B_{MGT}	–	–	–

Monkfish in ICES areas 4, 3a, 6

		Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	?	?	?	Undefined	MSY $B_{trigger}$	?	?	? Undefined
Precautionary approach	F_{pa},F_{lim}	?	?	?	Undefined	B_{pa},B_{lim}	?	?	? Undefined
Management plan	F_{MGT}	–	–	–	Not applicable	B_{MGT}	–	–	– Not applicable
Qualitative evaluation	-	↗	→	↗	Increasing	-	↗	↘	↘ Decreasing

Cod in ICES areas 4, 3a, 7d

	Fishing pressure				Stock size			
	2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✗	✗	✗ Above	MSY $B_{trigger}$	✗	✗	✗ Below trigger
Precautionary approach	F_{pa},F_{lim}	○	○	✗ Harvested unsustainably	B_{pa},B_{lim}	○	✗	✗ Reduced reproductive capacity
Management plan	F_{MGT}	–	–	– Not applicable	B_{MGT}	–	–	– Not applicable

Cod in ICES areas 6a

	Fishing pressure				Stock size			
	2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✗	✗	✗ Above	MSY $B_{trigger}$	✗	✗	✗ Below trigger
Precautionary approach	F_{pa},F_{lim}	✓	○	○ Increased risk	B_{pa},B_{lim}	✗	✗	✗ Reduced reproductive capacity
Management plan	F_{MGT}	–	–	– Not applicable	B_{MGT}	–	–	– Not applicable

Herring in ICES areas 4, 3a, 7d

	Fishing pressure				Stock size			
	2016	2017	2018		2016	2017	2018	
Maximum sustainable yield	F_{MSY}	✓	✓	✓ Appropriate	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓ Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	– Not applicable	B_{MGT}	–	–	– Not applicable

Herring in ICES areas 6a, 7b-l

	Fishing pressure				Stock size			
	2016	2017	2018		2016	2017	2018	
Maximum sustainable yield	F_{MSY}	?	?	? Undefined	MSY $B_{trigger}$	?	?	? Undefined
Precautionary approach	F_{pa},F_{lim}	?	?	? Undefined	B_{pa},B_{lim}	?	?	? Undefined
Management plan	F_{MGT}	–	–	– Not applicable	B_{MGT}	–	–	– Not applicable
Qualitative evaluation	-	↘	↘	→ Stable	-	✗	✗	✗ Below possible reference points

Hake in ICES areas 4, 6, 7, 3a, 8a-b, 8d

	Fishing pressure				Stock size			
	2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✓	✓	✓ Appropriate	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓ Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	– Not applicable	B_{MGT}	–	–	– Not applicable

Whiting in ICES areas 4, 7d

	Fishing pressure				Stock size			
	2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✗	✗	✗ Above	MSY $B_{trigger}$	✓	✓	✗ Below trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓ Harvested sustainably	B_{pa},B_{lim}	✓	✓	○ Increased risk
Management plan	F_{MGT}	–	–	– Not applicable	B_{MGT}	–	–	– Not applicable

Whiting in ICES areas 6a

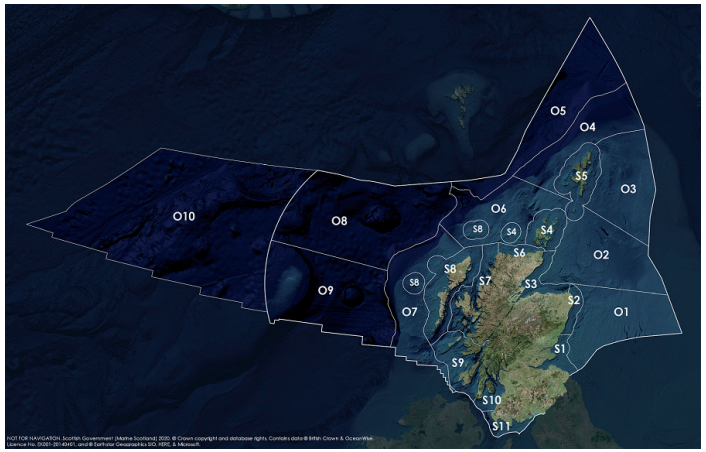
	Fishing pressure				Stock size			
	2015	2016	2017		2016	2017	2018	
Maximum sustainable yield	F_{MSY}	✓	✓	✓ Below	MSY $B_{trigger}$	✗	✗	✗ Below trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓ Harvested sustainably	B_{pa},B_{lim}	✗	✗	✗ Reduced reproductive capacity
Management plan	F_{MGT}	–	–	– Not applicable	B_{MGT}	–	–	– Not applicable

Status and trend assessment legend

Status assessment (for Clean and safe, Healthy and biologically diverse assessments)		Trend assessment (for Clean and safe, Healthy and biologically diverse and Productive assessments)	
	Many concerns		No / little change
	Some concerns		Increasing
	Few or no concerns		Decreasing
	Few or no concerns, but some local concerns		No trend discernible
	Few or no concerns, but many local concerns		All trends
	Some concerns, but many local concerns	**Confidence assessment**	
	Lack of evidence / robust assessment criteria	**Symbol**	**Confidence rating**
	Lack of regional evidence / robust assessment criteria, but no or few concerns for some local areas		Low
	Lack of regional evidence / robust assessment criteria, but some concerns for some local areas		Medium
	Lack of regional evidence / robust assessment criteria, but many concerns for some local areas		High

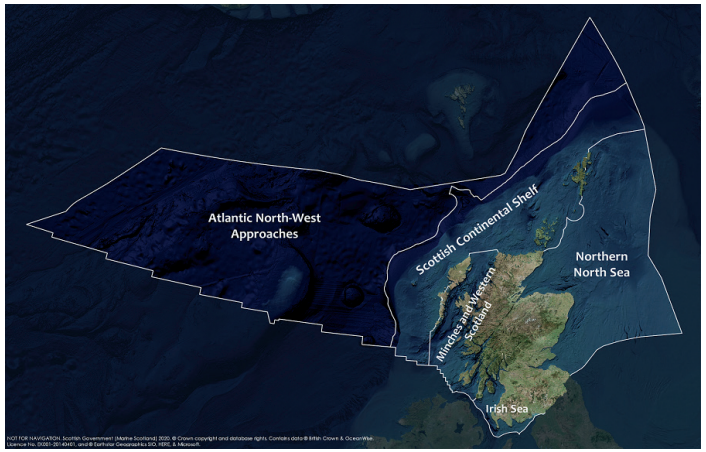
Overal confidence

Assessment regions

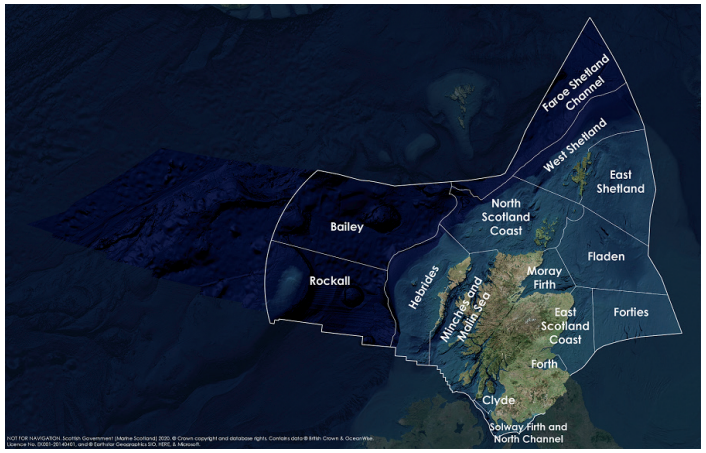


The Scottish Marine Regions (SMRs; S1 – S11) and the Scottish Offshore Marine Regions (OMRs, O1 – O10)

Key: S1, Forth and Tay; S2, North East; S3, Moray Firth; S4 Orkney Islands, S5, Shetland Isles; S6, North Coast; S7, West Highlands; S8, Outer Hebrides; S9, Argyll; S10, Clyde; S11, Solway; O1, Long Forties, O2, Fladen and Moray Firth Offshore; O3, East Shetland Shelf; O4, North and West Shetland Shelf; O5, Faroe-Shetland Channel; O6, North Scotland Shelf; O7, Hebrides Shelf; O8, Bailey; O9, Rockall; O10, Hatton.



Biogeographic, Charting Progress 2 (CP2) Regions. These have been used as the assessment areas for hazardous substances.



Scottish Sea Areas as used in Scotland's Marine Atlas 2011. These are sub divisions of the biogeographic, or Charting Progress 2 (CP2), Regions.

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NatureScot
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

JNCC
Joint Nature Conservation Committee

SEPA
Scottish Environment Protection Agency

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