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EU request on the role of the Total Allowable Catch instrument for fisheries management and conservation of selected deep-water stocks

Advice summary

ICES advises that for the stocks of alfonsinos in subareas 1–10, 12, and 14, deep-water sharks in subareas 5 to 9, blackspot sea bream in subareas 6, 7, and 8, roundnose grenadier in Division 3.a, and roundnose grenadier in divisions 10.b and 12.c, and in subdivisions 5.a.1, 12.a.1, and 14.b.1, it is considered that removing the TACs would generate a high risk of the stocks being exploited unsustainably and not in accordance with the objectives of the Common Fisheries Policy (CFP).

ICES advises that removing the TAC for greater forkbeard in subareas 1–10, 12, and 14 would generate a low risk of being exploited unsustainably.

ICES advises that removing the TAC for roundnose grenadier in subareas 1, 2, and 4 would pose no risk for the stock because this species is largely absent in EU waters of these subareas.

If TACs are removed, ICES provides potential stock-specific alternative management measures such as spatial closures and/or depth restrictions on fishing. A quantitative evaluation of the specific alternative management measures should be conducted previous to any implementation and the efficiency of such methods should be evaluated after a few years to ensure the stock is not over-exploited.

ICES advises that the TACs for deep-water sharks and the roundnose grenadiers could be set at a quinquennial (5-yearly) basis for interannual stability. For the other stocks, the biennial TAC is considered appropriate.

Request

ICES is requested to analyse for a list of stocks (as specified below) the role of the Total Allowable Catch instrument. It is asked to assess the risks of removing TAC for each case analysed in light of the requirement to ensure that the stock concerned remains within safe biological limits in the short and middle term. ICES is further requested to assess the potential contribution of the application of other conservation tools in absence of TACs to the requirement that the stock concerned remains within safe biological limits.

In cases where the uses of TAC should be continued, ICES is asked to analyse a possible approach to contribute to inter-annual stability of TACs.

Table 1 Deep-sea stocks covered in this advice in response to the request.

ICES stocks	Stock code	EU TAC area	TAC 2018 (t)	Type
Alfonsinos in subareas 1–10, 12, and 14	alf.27.nea	3–10, 12, and 14	280	Deep sea
Deep-sea sharks in subareas 1–10, 12, and 14	cyo.27.nea guq.27.nea sck.27.nea	5, 6, 7, 8, and 9	10	Deep sea
Blackspot sea bream in subareas 6, 7, and 8	sbr.27.678	6, 7, and 8	130	Deep sea
Greater forkbeard in subareas 1–10, 12, and 14	gfb.27.nea	Northeast Atlantic (2 TACs: 5, 6, 7, 8, 9)	2182 (1928 and 254)	Deep sea
Roundnose grenadier in Division 3.a	rng.27.3a	3a	223	Deep sea
Roundnose grenadier in divisions 10.b, 12.c, and in subdivisions 5.a.1, 12.a.1, and 14.b.1	rng.27.5a10b12ac14b	8, 9,10, 12, and 14	2099	Deep sea
Roundnose grenadier in subareas 1, 2, 4, 8, and 9, Division 14.a, and in subdivisions 14.b.2 and 5.a.2	rng.27.1245a8914ab	1, 2, and 4	10	Deep sea

* For greater forkbeard there are two more TACs: in subareas 1, 2, 3, and 4, and another in subareas 10–12; these are not included in the request.

Elaboration on the advice

For all of the stocks considered in this advice, except for greater forkbeard in subareas 1–10, 12, and 14 and for roundnose grenadier in subareas 1, 2, 4, 8, and 9, Division 14.a, and in subdivisions 14.b.2 and 5.a.2 (EU TAC areas 1,2, and 4), ICES advises that the risk of detrimental effects on the status of the stocks by having no catch limit is high and not consistent with the objectives of the Common Fisheries Policy (CFP). The risk was found to be low for greater forkbeard and absent for the roundnose grenadier in subareas 1, 2, 4, 8, and 9, Division 14.a, and in subdivisions 14.b.2 and 5.a.2. Because of the paucity of the information, the risk could only be assessed qualitatively. For each of the stocks examined, the rationale for the determination along with potential alternative measures (where available) are provided.

ICES notes that implementation of alternative measures for these stocks is likely more complex than setting a TAC.

If TACs are removed, a quantitative evaluation of the alternative management measures should be conducted previous to their implementation and the efficiency of such methods should be evaluated after a few years to ensure the stock is not over-exploited.

Alfonsinos (*Beryx* spp.) in subareas 1–10, 12, and 14 (EU TAC areas 3–10, 12, and 14)
Fisheries target concentrations of alfonsinos, mainly on seamounts, and a TAC is considered the most efficient management measure for this targeted catch. The current TAC restricts catch from EU fleets to multi-gear multi-species artisanal fisheries in the ICES areas. This stock comprises two different species, *Beryx splendens* and *B. decadactylus*. Exploitation is mainly on *B. decadactylus*. Given the high prices for at least *B. decadactylus,* and the developed market for the species, catches usually reach or exceed the TAC. ICES considers that removing the TAC would likely result in a high risk of the stock being fished unsustainably and not meeting the objectives of the CFP. A possible alternative measure to the TAC would be measures preventing targeted catch of aggregations. A possible alternative measure to the TAC would be measures preventing targeted catch of aggregations, such as area closures around seamounts.

Deep-water sharks in subareas 1–10, 12, and 14 (EU TAC areas 5, 6, 7, 8, and 9)
The EU list of deep-water sharks (EU, 2013) includes the following taxa: *Apristurus spp., Chlamydoselachus anguineus, Centrophorus spp., Centroscymnus coelolepis, Centroscymnus crepidater, Centroscyllium fabricii; Deania calcea; Dalatias licha; Etmopterus princeps; Etmopterus spinax; Galeus murinus; Hexanchus griseus; Oxynotus paradoxus; Scymnodon ringens,* and *Somniosus microcephalus*. ICES has information and provides advice for three species: Portuguese dogfish (*Centroscymnus coelolepis*), leafscale gulper shark (*Centrophorus squamosus*), and kitefin shark (*Dalatias licha*).

The deep-water sharks are long-lived species with low reproductive rates and have quickly become overexploited. Current advice aims to minimize mortality and avoid targeting, and TACs appear to have stopped targeting of these species. Total landings have been reduced to low levels compared to the historical landings.

Removing TACs would run contrary to the intent to reduce bycatch and avoid directed fisheries of these species, and likely lead to high catches from the reinstatement of directed fisheries, given their high value and past high levels of landings (up to 11 000 tonnes per year). ICES considers that removing the TAC would likely result in a high risk of fishing the stock unsustainably and not meeting the objectives of the CFP.

ICES notes that deep-water sharks are included in the CFP prohibited species list in subareas 1, 4, and 14 (most recently updated in Council Regulation 2018/120; EU, 2018). The three species assessed by ICES are on the list; however, other species of deep-water sharks (e.g. *Centroscymnus crepidater*, *Scymnodon ringens*, etc.) are not. If the TAC for deep-water sharks is removed, the CFP prohibited species list would need to be modified to apply to subareas 5, 6, 7, 8, and 9, and the relevant species of deep-water sharks would need to be added to the list in order to avoid targeting. ICES notes that the use of an expanded CFP prohibited species list for deep-water sharks as an alternative to a TAC may cause management issues for other deep-water fisheries, such as ling, redfish, and black scabbardfish. As for other alternative measures, an evaluation would need to be conducted prior to implementation. ICES further notes that the prohibited species listing would prevent targeting, but not necessarily minimize mortality, as discard survival is close to zero.

There are bans on deep-water gillnets below 600 m and bottom-trawling in waters deeper than 800 m. However, long-lining is not subject to depth or spatial limits and could target deep-water sharks. If the TACs for deep-water sharks are

removed, another management alternative could be to consider a depth-limitation for long-lining (including the black scabbardfish drop-line fishery).

Blackspot sea bream (*Pagellus bogaraveo*) in subareas 6, 7, and 8 (EU TAC areas 6, 7, and 8)
Until the mid-1970s, catches of blackspot sea bream were more than 15 000 tonnes annually. Since 2003, TACs have been below 350 tonnes, declining to 130 tonnes in 2018. Original declines in catches reflected a stock collapse that happened in the absence of TACs. Current TACs are less than 1% of the historical catch level. There are anecdotal reports of an increase in abundance, with aggregations of tens of tonnes being encountered by fishing vessels. However, the stock is still at a low level compared to historical levels.

Given the aggregating nature of blackspot sea bream, and the apparent ease with which it can be targeted by artisanal purse seiners as well as bottom and pelagic trawlers, it is clear that a targeted fishery could develop quickly and lead to a substantial increase in fishing mortality on this depleted stock. In addition, the biology of the species is such that it can only sustain a lower fishing mortality compared to the main pelagic and demersal species occurring in subareas 6, 7, and 8. Given the depletion of the stock to just a few percent of original levels, its aggregating behaviour, high prices (10–20 €/kg), and the ability to target this stock, ICES considers that removing the TAC would most likely result in a high risk of the stock being fished unsustainably and not meeting the objectives of the CFP.

Possible alternative measures to the TAC would be measures that prevent the targeted catch of aggregations that can be depleted by active gears, simply by banning such gears from targeting the species.

Greater forkbeard (*Phycis blennoides*) in subareas 1–10, 12, and 14 (EU TAC areas 5, 6, 7, 8, and 9)
The TAC for this species was set in 2003 to limit catches in deep-sea fisheries. Discards have likely always occurred in the shelf fisheries because juveniles are present in these areas. Implementation of the landings obligation may lead to greater forkbeard becoming a limiting (choke) species in the hake, megrim, monkfish, and *Nephrops* fisheries.

The biomass index has fluctuated without trend since 2005. The low catch rates and lack of aggregative behaviour, together with the low prices, imply that greater forkbeard is not likely to be subject to a large influx of targeted effort in comparison to the other stocks addressed in this advice. However, greater forkbeard is locally important for some fleets and, consequently, if the TAC is removed there could be some local increase in effort.

Providing the effort does not increase significantly and the species remains largely as a bycatch, ICES considers that removing the TAC would likely result in a low risk of fishing the stock unsustainably and not meeting the objectives of the CFP.

Roundnose grenadier (*Coryphaenoides rupestris*) in Division 3.a (EU TAC area 3.a)
A lack of regulation up to 2006 led to large catches, which swiftly declined from 11 923 tonnes in 2005 to 2265 tonnes in 2006. The imposition of a TAC of 850 tonnes in 2007 essentially halted the directed fishery, with subsequent catches of under 2 tonnes thereafter.

Historically, very large catches were possible with directed effort. These catches were for fish meal. Surveys show that the current biomass is substantially depleted from the levels of the 1980s and 1990s.

ICES considers that removing the TAC would likely result in a high risk of fishing the stock unsustainably and not meeting the objectives of the CFP. If the TAC is removed, ICES advises that there should be no directed fishery (including for fish meal).

Roundnose grenadier (*Coryphaenoides rupestris*) in divisions 10.b and 12.c, and in subdivisions 5.a.1, 12.a.1, and 14.b.1 (EU TAC areas 8, 9,10, 12, and 14)
The data for these stocks are much more limited than for the other stocks considered in this request. Before the implementation of the TAC, the main fishery was a targeted fishery operating in a number of discrete areas and this has remained the case with TACs. The TACs considerably reduced the targeted fishery. Current fisheries target concentrations of roundnose grenadier on the Mid-Atlantic Ridge. The current TAC restricts catch from EU fleets only. ICES considers that removing the TAC would likely result in a high risk of the stock being fished unsustainably and not meeting the objectives of the CFP.

Roundnose grenadier (*Coryphaenoides rupestris*) in subareas 1, 2, 4, 8, and 9, Division 14.a, and in subdivisions 14.b.2 and 5.a.2 (EU TAC area 1, 2, 4)

In subareas 1, 2, and 4, roundnose grenadier occurs primarily in Norwegian fjords. In EU waters, landings of roundnose grenadier reported in Division 4.a were actually roughhead grenadier (*Macrourus berglax*) as a result of species mislabelling. Roundnose grenadier does not occur to any significant level in EU TAC areas 1, 2, and 4, and the TAC could be removed for these areas.

Interannual stability of TACs

ICES notes that the TACs for these stocks are currently set on a biennial basis. There is, however, scope for further TAC stability. For the most long-lived and slow growing of these stocks, specifically the deep-water sharks and roundnose grenadier, ICES advises that the TACs could be set on a quinquennial (valid for 5 years) basis. This is because their stock dynamics and current exploitation rates are such that little change in stock development would be expected in a 5-year period. For the other stocks evaluated here the biennial TAC is considered appropriate.

Basis of the advice

Background

The establishment of Total Allowable Catches (TACs) on a stock-by-stock basis is widely used internationally as a management tool to control the exploitation of fish stocks within sustainable levels. In the northeast Atlantic waters, there are over 140 TACs established to manage the various fisheries. In the context of the introduction of multiannual plans for demersal mixed fisheries in the Baltic, North Sea, and Western Waters, as well as of the challenges that the landing obligation poses to the management of these fisheries (e.g. choke species), the EU requested ICES to evaluate the potential risks of removing the TACs for a number of stocks and management units and whether alternative instruments would be adequate to achieve the same goals.

The current advice relates to the deep-sea stocks that were contained in the request and included in the EU regulation for setting of the fishing opportunities for certain deep-sea fish stocks (EU 2016, 22/25). Other stocks will be addressed in a subsequent advice.

Results and conclusions

1) Alfonsinos (*Beryx* spp.)

Vulnerability
Alfonsinos (*Beryx* spp.) are considered a relatively long-lived species with low growth (Friess and Sedberry, 2011). Given their aggregating behaviour and small population sizes on seamounts, alfonsinos are considered to be highly susceptible to target fisheries and to fisheries that follow a cycle of high fishing effort that depletes the stocks, followed by a fallow period which allows stocks to reconstitute (called "pulse fisheries", not to be confused with "electric pulse fisheries"). Such fisheries can result in rapid depletion of stocks (Clark *et al*., 2007; FAO, 2016).

Knowledge gap (*including the limited data available*)
The stock under analysis includes two species of the genus *Beryx*. Differences on the spatial distribution are known to occur between the two species; *B. splendens* is widely distributed over NE Atlantic seamounts, whereas *B. decadactylus* is mainly fished in the Macaronesia area. The stock structure of each species is unknown and recruitment has not been quantified. There are still gaps in the knowledge on growth and reproduction of each *Beryx* species; for example, the analysis of maturity stages assigned to specimens may be difficult to compile as no standardization of maturity stages exists (FAO, 2016).

Potential reaction of fishery to the removal of TAC (*Is a target fishery likely to develop?*)
The removal of TACs is likely to result in the development of targeted fisheries and potential unsustainable exploitation of these species.

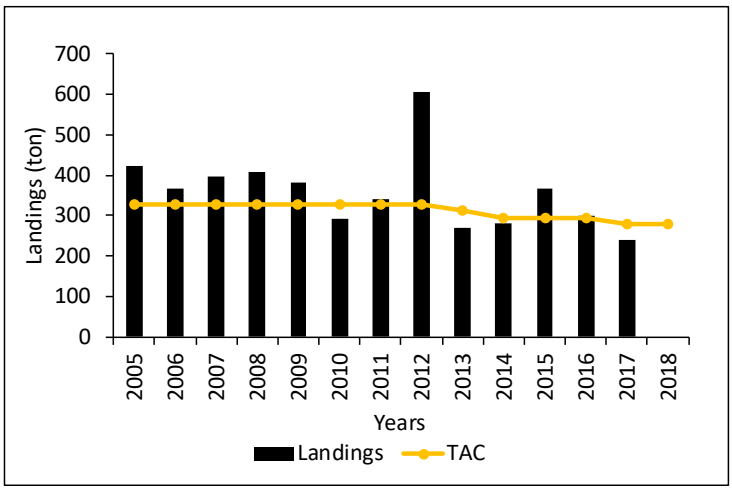

Figure 1 Alfonsinos. Annual landings and TACs.

2) Deep- water sharks

Vulnerability
Deep-water sharks are commonly considered to have very low population productivity and, consequently, are able to sustain very low rates of exploitation. However, given the diversity of species included in the EU list (EU, 2013) and, especially, the differences in their spatial distribution and productivity, the vulnerability to exploitation varies. The high economic value for some of these species makes them desirable for exploitation.

Knowledge gap (*including the limited data available*)
For most of the species, and in particular for Portuguese dogfish and for leafscale gulper shark, the two most valuable species, the stock structure is unknown. Historical fishery data are incomplete, mostly because of the misreporting and lack of species discrimination.

Potential reaction of fishery to the removal of TAC (*Is a target fishery likely to develop?*)
Targeting deep-water sharks is achievable in some areas and with some gears. Given the high value of deep-water sharks livers, target fisheries may arise as a consequence of TAC removal.

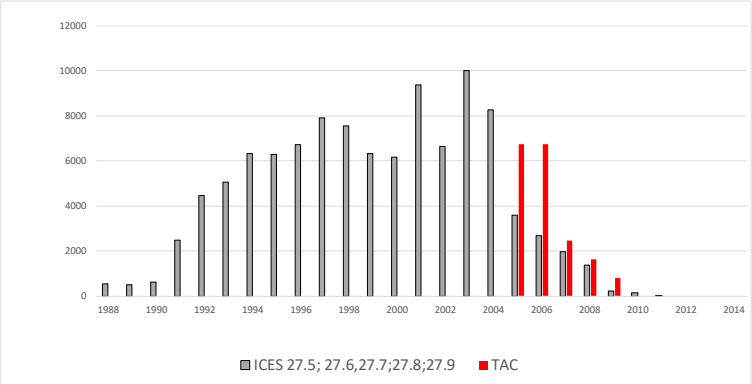

Figure 2 Deep-water sharks. Combined annual landings and TACs.

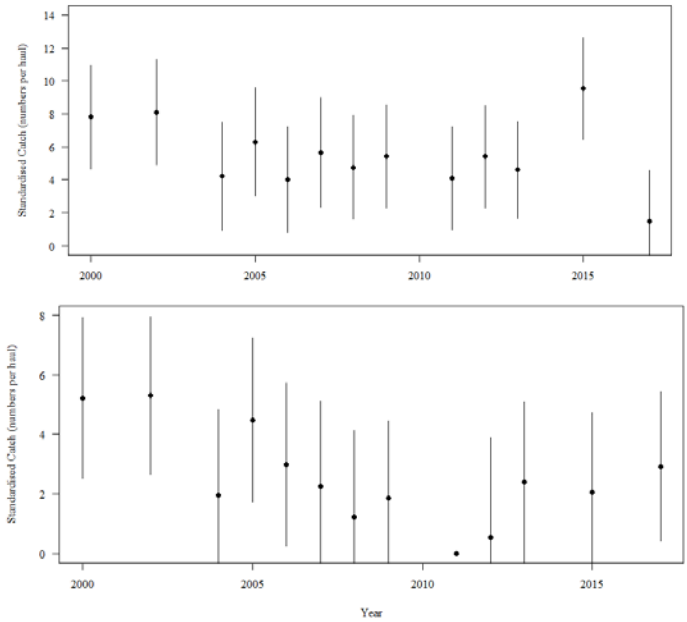

Figure 3 Deep-water sharks and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Standardized abundance index for leafscale gulper shark (top) and for Portuguese dogfish (bottom) in Scottish deep-water surveys 2000 to 2017 (error bars = ±2 standard error).

3) Blackspot sea bream

Vulnerability
The species was estimated to be able to sustain only moderate fishing mortality, lower than the main demersal species in subareas 6, 7, and 8 (hake, monkfish, sole, and megrim), primarily because of its male-first hermaphroditic biology, where exploitation occurs well before the age where 50% of individuals are mature females. As a consequence the biomass of mature females can easily be depleted.

Knowledge gap (*including the limited data available*)
Three bottom trawl surveys (EVHOE-WIBTS-Q4, SpGFS-WIBTS-Q4, and IGFS-WIBTS-Q4) take place in the area of the stock, but the species is currently rarely caught in these surveys (less than 1% of hauls catch the species). Survey data are currently not informative and not used as indicator of stock size.

As consequence of low catch level the stock is not subject to EU-DCMAP (Data collection multi-annual programme) sampling. Sampling would hardly be feasible because of the rarity of catch.

Potential reaction of fishery to the removal of TAC (*Is a target fishery likely to develop?*)
The fish has a high price. Since the TAC was established, the trawl and seine fisheries have avoided aggregations. There are currently significant aggregations and without the TAC (or alternative measures) these could be easily targeted beyond what is sustainable.

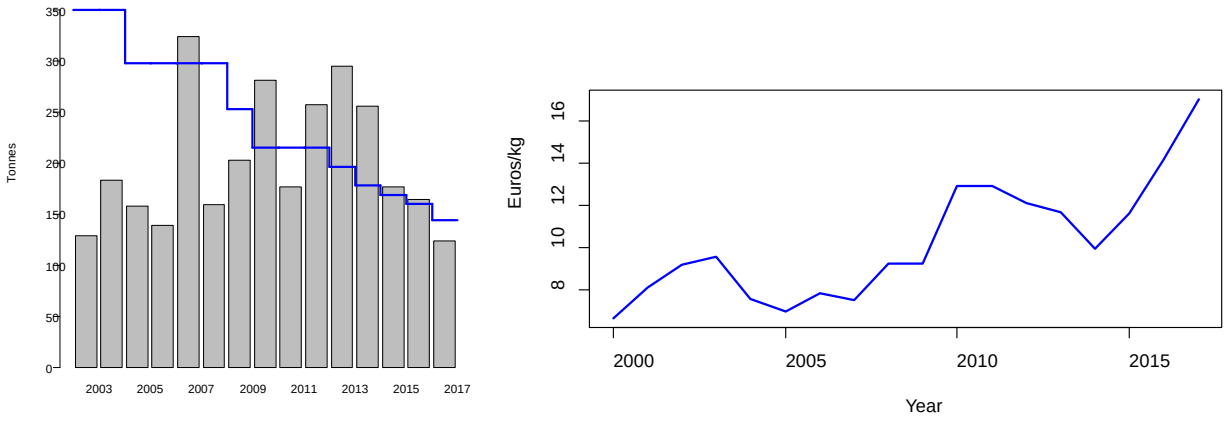

Figure 4 Blackspot sea bream, in ICES subareas 6, 7, and 8. Annual landings and TAC (blue line). Mean price per year of fish landed by French vessels (right panel).

4) Greater forkbeard (*Phycis blennoides*) in subareas 1–10, 12, and 14 (the Northeast Atlantic and adjacent waters)

Vulnerability
Discards are estimated to be high and are concentrated on the small individuals.

As greater forkbeard is mainly a bycatch species, the effort on this species depends on the effort of the main fleets on the target species (hake, monkfish, megrim, and deep-sea species).

Greater forkbeard has an estimated longevity of less than 15 years (Casas and Pineiro, 2000). The low catch rates and lack of aggregative behaviour, together with the low prices compared to the targeted species, imply that greater forkbeard is likely the least vulnerable of the species considered in this advice.

Knowledge gap (*including the limited data available*)
The discards cannot be quantified for the whole stock and are very variable from year to year. The commercial length frequencies are only partially available from some countries and areas, and the historical series is short.

There are no data available on age compositions and maturity stages/fecundity.

Potential reaction of fishery to the removal of TAC (*Is a target fishery likely to develop?*)
Apart for some fleets for which this species is locally important, greater forkbeard is a bycatch species. If the TAC is removed it could be expected that these fleets would increase the effort. The total EU TAC has been not landed since 2013, and few EU member countries landed the quota assigned.

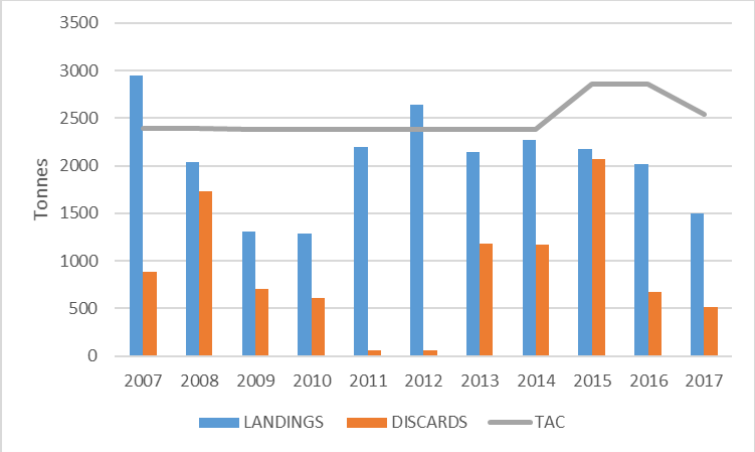

Figure 6 Greater forkbeard (*Phycis blennoides*) in subareas 1–10, 12, and 14. Annual landings, discards, and TAC.

5) Roundnose grenadier in Division 3.a

Vulnerability
The species is known to be long-lived, recruitment is intermittent, and strong year classes are rare. There has been no sign of significant recruitment since the early 1990s.

Knowledge gap (*including the limited data available*)
The only current data is the abundance from the shrimp survey. It is unclear whether the survey covers properly the whole stock habitat.

Potential reaction of fishery to the removal of TAC (*Is a target fishery likely to develop?*)
An active fishery for fish meal was halted by the TAC. Without a TAC (or alternative measures) such a fishery could resume.

6) Roundnose grenadier in divisions 10.b and 12.c, and in subdivisions 5.a.1, 12.a.1, and 14.b.1

Vulnerability
The species is known to be long-lived. In this area the stock is known to form aggregations.

Knowledge gap (*including the limited data available*)
There is no current survey for this stock in these areas. Fisheries are intermittent, making fisheries data difficult to interpret.

Potential reaction of fishery to the removal of TAC (*Is a target fishery likely to develop?*)
Unpredictable owing to the mobility of involved fleets.

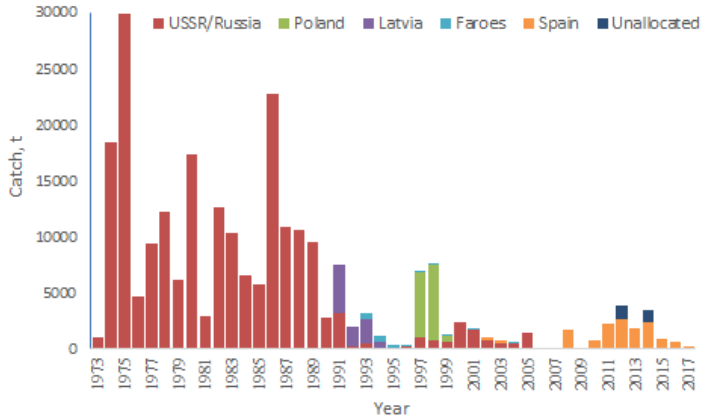

Figure 7 Roundnose grenadier in divisions 10.b and 12.c, and in subdivisions 5.a.1, 12.a.1, and 14.b.1. International catches in 1973–2017.

7) Roundnose grenadier in subareas 1, 2, and 4

Vulnerability
The species is known to be long-lived. In this area the stock is known to form aggregations.

Knowledge gap (*including the limited data available*)
There is no current survey for this stock in these areas. Fisheries are intermittent, making fisheries data difficult to interpret.

Potential reaction of fishery to the removal of TAC (*Is a target fishery likely to develop?*)

Unpredictable owing to the mobility of involved fleets.

Methods

The existing data on effort, official landings, ICES catch estimates, survey indicators, price at first sale, and biological characteristics were used to evaluate the risk of removing the TAC for the various stocks. Since there is no analytical assessment and the absolute fishing mortality (F) is not known for these stocks, the request could only be answered in a qualitative manner on the basis of the existing data from the assessment and available sources. For several of the stocks (e.g. alfonsinos, roundnose grenadier), the information was particularly limited.

To evaluate each stock included in the request, six questions pertaining to the fishery were examined. A similar approach was used to respond to an EU request on a combined dab and flounder TAC and potential management measures besides catch limits in 2017 (ICES, 2017). The questions examined were:

1. Was the TAC restrictive in the past?
2. Is there a targeted fishery for the stock or are the species mainly discarded?
3. Is the stock of large economic importance or are the species of high value?
4. How are the most important fisheries for the stock managed?
5. What are the fishing effort and stock trends over time?
6. What is the maximum effort of the main fleets that may be expected under management based on F_{MSY} (ranges) for the target stocks, and has the stock experienced similar levels of fishing effort before?

For some of the evaluated stocks, not all questions could be answered. In particular questions 5 and 6 could be treated only in part, primarily because in some areas TACs are applied to stocks that are only small bycatch in other fisheries and, as mentioned above, these stocks have very limited data available to base the evaluation upon.

In addition, the overall risk for the stocks have been considered in terms of their biology (aggregating, sex change, long lived, low productivity, forage fish, ecosystem importance) and in terms of their catchability, e.g. the degree of population overlap with key fisheries, presence of refuges, ability to be directly targeted). In order to synthesize the conclusions on the questions in the request, the following considerations were added to provide a consistent process and summary approach:

1. Does the species/stock/group (hereafter just called stock) have characteristics that places it at high relative risk?
    a. In terms of its general biology, e.g. aggregating, sex change, long lived, low productivity, forage fish, ecosystem importance;
    b. In terms of its catchability, e.g. degree of population overlap with key fisheries, presence of refuges, ability to be directly targeted.
2. Is the present TAC/management influenced by past unsustainable practices?
    a. If yes, are those fisheries still active?
    b. Was the stock targeted?
3. Can these or new unsustainable practices return if the TAC is removed?
    a. Can they be targeted with the present fleet?
    b. Are they heavily discarded?
    c. Is the stock valuable?
4. Are there alternatives to a TAC to manage this stock?
    a. Can they be managed as companion species through target TACs (if applicable)?
    b. Can they be spatially managed?
    c. Any other mechanism?

For each stock, the available information was summarized in terms of the vulnerability of the stock, knowledge gaps (including the limited data available), the potential reaction of the fishery to the removal of TAC (Is a target fishery likely to develop?), and potential alternative management measures.

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Annex 1

Table 2 Latest assessment and current advice by stock.* Deep-water sharks based on the ICES assessed species: Portuguese dogfish (*Centroscymnus coelolepis*), leafscale gulper shark (*Centrophorus squamosus*), and kitefin shark (*Dalatias licha*).

Stock	ICES cat.	Assessment type	Input indices	Trend F	Trend B	Advice	Discards included	Exploitation
alf.27.nea	5.2	Catch only	Landings	Unknown	Unknown	Landings: 224 tonnes	Not included; discarding is considered less than 10% in the Azores and unknown in the rest of the areas.	
gfb.27.nea	3.2	Survey trends-based assessment	IE-IGFS-WIBTS-Q4 FR-EVHOE-WIBTS-Q4 SP-PORC-WIBTS-Q3 SP-NSGFS-WIBTS-Q4 SDS PT-CTS (UWTV (FU 28-29)	Unknown	Increasing	Landings: 1346 tonnes	Discarding is substantial, but only partially quantified.	
rng.27.1245a8914ab	6.2	Catch only	Landings	Unknown	Unknown	Landings: 65 tonnes	Unknown	
rng.27.3a	6.3	Catch only	Norwegian shrimp survey index	Unknown	Very low	Zero	Included in the assessment	
sbr.27.6-8	6.3	Catch only	Commercial catches for subareas 6, 7, and 8	Unknown	Very low	Zero	Not included; discarding is considered negligible (between 0.6 and 1.3% of total catches from 2014 to 2017). Recreational catches are unknown but may be significant.	targeted
Deep-water sharks*	6.3	Catch only	Landings and Scottish deep-water survey	Unknown	Unknown	Fishing mortality should be minimized and no targeted fisheries should be permitted.	Unknown	bycatch