



Orientering vedr. rejebestandene

Nuuk 3. November 2011

Journal.: 20.00-11/2011

Brevnr.:

Orientering vedrørende den biologiske rådgivning for fiskeri på rejebestandene ved Vest- og Østgrønland for 2012

Rejer Vestgrønland:

Rådgivningen for fiskeri efter rejer ved Vestgrønland for 2012 er, at fangsterne ikke bør overstige 90.000 tons. Rådgivningen for 2011 lå på 120.000 tons og rådgivningen for 2012 indebærer således en reduktion på 25%.

De væsentligste årsager til dette er:

- faldende biomasse gennem flere år
- fortsat lav rekruttering af små rejer til det kommende fiskeri
- reduceret udbredelse af bestanden
- markant stigning i mængden af små torsk, som forventes at forårsage øget dødelighed

Faldet i rejebestanden har været ventet og rådgivningen har siden 2005 påpeget dette. Bestanden befandt sig på et meget højt niveau fra 2003 til 2006 og har siden været på vej ned. Herunder en kort gennemgang af baggrunden for rådgivningen:

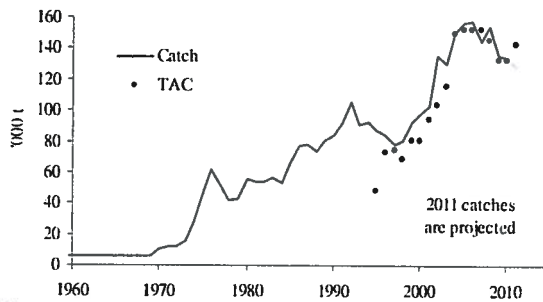
1. De samlede fangster steg fra 80.000 tons i 1998 til 150.000 tons/år i perioden 2004-2008 (figur 1). I 2010 faldt de igen til 134.000 tons, som følge af en lavere kvote i Grønland. Fangsterne i 2011 forventes på 126.000 tons (Canada tager en mindre del (0 i 2008: 6.000 og 2.000 tons i 2010 og 2011)).

Fangsterne t i 2003 – 2005 (150.000 tons /år) udgjorde kun en mindre del af en meget høj biomasse (udnyttelsesraten: fangst/biomasse). Efter bestanden (biomassen) af rejer er faldet udgjort fangsterne en større andel end tidligere og dermed påvirkes bestanden mere.

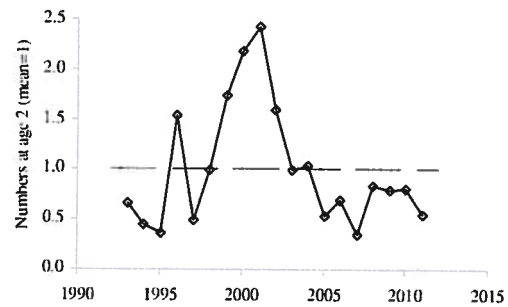
2. De biologiske undersøgelser (surveys) viser, at rejebiomassen fra 2003 til 2011 er faldet til et niveau, der svarer til den biomasse, der var tilstede i slutningen af 1990'erne (figur 3).
3. Fangstraterne jf. logbøger (CPUE-indekset) viser et mindre fald fra 2008-2010, men en stigning i 2011 til samme høje niveau som i 2005-2008. Der har gennem flere år været bekymring for, at CPUE - indekset ikke afspejler udviklingen i bestanden og i 2011-stigningen i CPUE- indekset ses samtidig med, at de biologiske undersøgelser siden 2003 har vist et fald (figur 3).
4. Torsk (torsken spiser rejer): Forekomsten af torsk har historisk haft en stor indflydelse på rejebestanden, der falder ved stigende torskeforekomster. De biologiske undersøgelser fra 2011 viser, at bestanden af torsk er steget og at et stort antal torsk fra 2009(fisk på ca. 20 cm) er udbredt over hele Vestkysten og at forekomsten nu overlapper rejefelterne mere end dengang 2003 årgangen af torsk kom ind. Den stigende forekomst af torsk vurderes til at være medvirkende til faldet i rejebestanden.
5. Rekruttering (tilgangen af små rejer) af 2-årige rejer faldt igen i 2011 til et lavt niveau (figur 2). Antallet af 2-årige rejer er medvirkende i forudsigelserne om størrelsen af den fiskbare biomasse 2-4 år senere og da rekrutteringen har været lav siden 2005 kan der ikke forventes en umiddelbar opgang i rejebestanden. Der er desuden et lavt antal rejer af den størrelse (15–22 mm CPL), der forventes at gå ind i fiskeriet næste år. Dette giver anledning til bekymring for rekruttering til fiskeriet allerede i 2012.
6. Fiskeriet har i flere år koncentreret indsatsen til stadig mindre områder og fiskeriet foregår i dag i området nord for Store Hellefiskebanke og i Diskobugten, hvilket svarer til rejefiskeriet udbredelsesområde i slutningen af 1990'erne.
7. Den matematiske model, der benyttes i rådgivningen inddrager fangsterne (det samlede udtag af bestanden), fangstrater (CPUE fra logbøger) og biologiske undersøgelser (surveys på biomasse), samt et mål for biomassen af torsk (fordi torsk spiser af rejer). Modellen er modificeret i forhold til tidligere år, blandt andet for at sikre at fangstraterne og de biologiske undersøgelser vægtes ligeligt (figur 3). NAFO vurderer at denne model er bedre til at følge udviklingen i bestanden end den tidligere model, der vægtede fangstrater langt over de biologiske undersøgelser.
8. Modellen viser, at ved fangster på 90.000 tons i 2012 er risikoen for at overskride den bæredygtige dødelighed (Z_{msy}) på 31 %. NAFO's videnskabelige råd noterer, at denne risiko er højere end givet i tidligere rådgivninger, hvilket accepteres, da modellen indikerer at biomassen (B_{msy}) forbliver over et kritisk niveau. Det videnskabelige råd anbefaler derfor at fangsterne ikke overstiger 90 000 t.
9. Af den af Naalakkersuisut vedtagende forvaltningsplan for rejefiskeriet i Vestgrønland fremgår det "at kun i yderst ekstreme tilfælde kan være tale om årlige udsving i TAC'en på mere end 10%. På den anden side er der også enighed om at en tilpasning af TAC'en til den videnskabelige rådgivning ikke må strække sig over en længere periode end 3 år".

Der sker store ændringer i økosystemet i disse år i det Nordvest Atlantiske område. Rejebestandene i Canada er også reduceret på meget kort tid. En af forklaringerne er, at der - specielt i Canada - er registreret store ændringer i havtemperaturen og at der samtidig er en stigende forekomst af torsk.

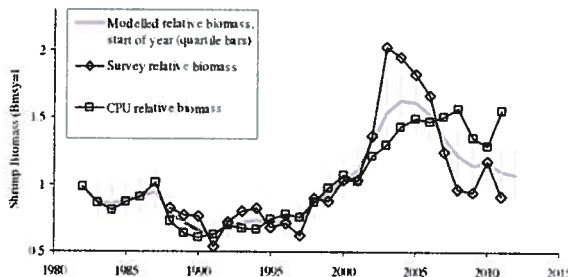
- ❖ For forvaltningsområdet (SFA6) nord for Newfoundland er kvoterne fra 2010 til 2012 reduceret med samlet 40 % fra 86.000 tons til 52.000 tons.
- ❖ Flemish Cap er lukket for fiskeri fra 2010. Fangster i 2003 var på 63.000 tons og i 2011 er fiskeriet lukket; og
- ❖ på Grand Bank er rådgivningen halveret over 3 år fra 25.000 til 17.000 og til 9.000 tons.



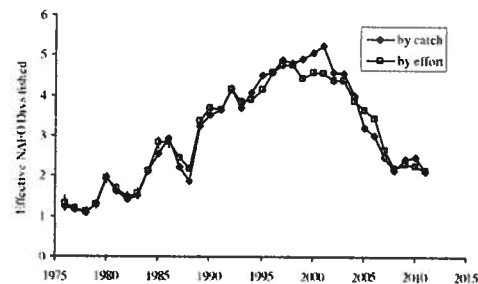
Figur 1. Totale fangster (2010: Grønland 134.000 tons, Canada 5.000 tons) og kvoter (2011: Grønland 124.000 tons, Canada 18.597 tons).



Figur 2. Mængden af små rejer, der forventes at bidrage til fremtidens fiskeri.



Figur 3. Bestandens udvikling fra 1975-2011.



Figur 4. Bestandens udbredelsesområde (fra logbøger). Fra 1975 til 2011.

Rejer Østgrønland:

Rådgivningen for rejebestanden ved Østgrønland for 2012 er uændret på 12.400 tons. Kvoterne har siden 2004 været sat til 12.400 tons. Fangsterne faldt voldsomt fra næsten 13.000 tons i 2003 til under 3.000 tons i 2008. I 2009 og 2010 steg fangsterne igen til henholdsvis 4.600 og 3.700 tons. 2011 forventes at ligge under 2.000 tons. Rådgivningen er baseret på data fra fiskeriet (fangstrater fra logbøger) og fra biologiske undersøgelser i årene 2008-2011. Fangstraterne antyder, at bestanden er stabil, men der er usikkerhed om, hvorvidt fangstraterne afspejler udviklingen i bestanden. Usikkerheden skyldes ikke mindst, at det er uklart, hvorvidt de faldende fangster skyldes økonomi eller en negativ udvikling i bestanden. De biologiske undersøgelser viser stor variation i biomassen over de fire år og giver derfor ingen klare signaler.

Bilag 1 og bilag 2 er de engelske sammendrag af rådgivningen fra NAFO for henholdsvis Vest- og Østgrønland.

GN har skrevet og fremlagt i alt 11 dokumenter, der tilsammen danner baggrunden for rådgivningen for Vest- og Østgrønland. Rådgivningen for rejer er formuleret på det seneste møde under NAFO/ICES, som blev afholdt 19.-26. oktober 2011. På mødet deltog i alt 15

forskere fra Canada, EU, Norge, Rusland og fra Grønland (GN) deltog seniorforsker Michael Kingsley og afdelingschef Helle Siegstad. Den officielle rådgivning findes på NAFOs (www.NAFO.int) hjemmeside. Den engelske rapport over rådgivningen fra NAFO består af mere end 100 sider A4, som Departement og Styrelsen for Fiskeri modtager en kopi af.

Med venlig hilsen

Helle Siegstad
Helle Siegstad
Afdelingschef

Bilag 1. Northern shrimp in Subareas 0 and 1

Background: The shrimp stock off West Greenland is distributed in Subarea 1 and Div. 0A east of 60°30'W. A small-scale inshore fishery began in SA 1 in the 1930s. Since 1969 an offshore fishery has developed.

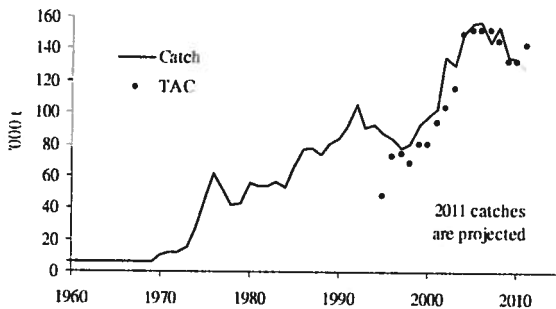
Fishery and Catches: The fishery is prosecuted mostly by Greenland in SA 1 and Canada in Div. 0A. Canada did not fish in 2008 and fished little in 2009, but has since resumed fishing. Recent catches are:

| Year | Catch ('000 t) | | TAC ('000 t) | |
|------|----------------|---------|--------------|--------|
| | NIPAG | STATLAN | Advised | Actual |
| 2008 | 152.9 | 148.6 | 130 | 145.7 |
| 2009 | 135.5 | 133.5 | 110 | 133.0 |
| 2010 | 134.0 | 134.0 | 110 | 133.0 |
| 2011 | 126.0 | | 120 | 142.6 |

1 Provisional.

2 Total of TACs set by Greenland and Canada.

3 Predicted to year end by industry observers.



Data: Catch, effort, and position data were available from all vessels. Series of biomass and recruitment indices and size- and sex-composition data were available from research surveys. Series of cod biomass and cod consumption were also available.

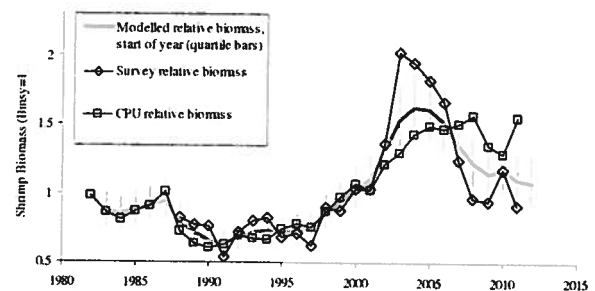
Assessment: An analytical assessment framework was used to describe stock dynamics in terms of biomass (B) and mortality (Z) relative to biological reference points.

The model used was a stochastic version of a surplus production model including an explicit term for predation by Atlantic cod, stated in a state-space framework and fitted by Bayesian methods. MSY (Maximum Sustainable Yield) defines maximum production, and B_{msy} is the biomass level giving MSY .

A precautionary limit reference point for stock biomass (B_{lim}) is 30% of B_{msy} and the limit reference point for

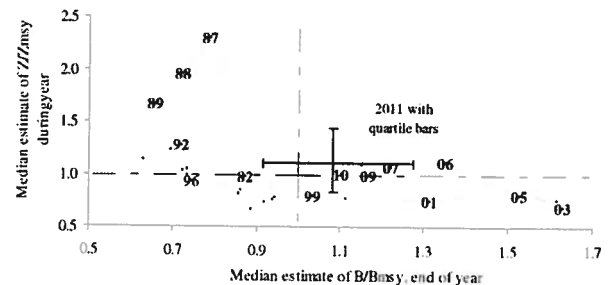
mortality (Z_{lim}) is Z_{msy} . Recent CPUE values have stayed high, while the area fished has contracted and survey biomass indices have decreased, and the index is now considered to be of questionable reliability. Therefore in the 2011 assessment, the model accepted was modified from that used in foregoing years to give equal weight to CPUE and survey indices of biomass. The resulting median estimate of MSY was 135 000 t/yr.

Indices of how widely the stock and the fishery were distributed were calculated from catch positions in the fishery and the survey.



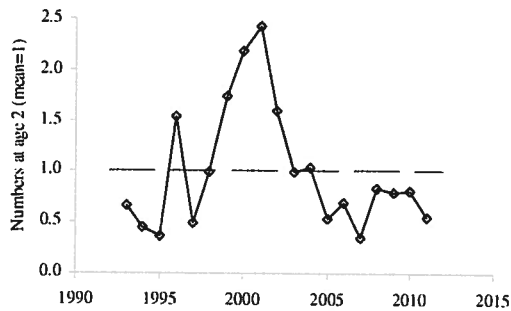
Biomass. A stock-dynamic model showed a maximum biomass at the end of 2003, with a continuing decline since; the probability that biomass will be below B_{msy} at the end of 2011 with projected catches at 126 000 t was estimated at 38% and risk of its being below B_{lim} at less than 1%.

Mortality. The mortality caused by fishing and cod predation (Z) is estimated to have stayed below the upper limit reference (Z_{msy}) from 1996 to 2005, but is now estimated to have averaged 6% over the limit value since 2006. With catches projected at 126 000 t the risk that total mortality in 2011 would exceed Z_{msy} was estimated at about 59%. Atlantic cod is widely distributed on the West Greenland shrimp grounds in 2011 and predation is expected to remain high



Recruitment. The stock structure in 2011 is deficient in shrimps of intermediate size 15–22 mm CPL, presaging poor short-term recruitment to both the fishable and spawning stocks; numbers at age 2 in 2011 are at 55%

of the series mean, so medium-term recruitment is also expected to be poor.



State of the Stock. Modelled biomass is estimated to have been declining since 2004. At the end of 2011 biomass is projected to remain slightly above B_{msy} . Total mortality for the year is projected to exceed Z_{msy} . Recruitment to the fishable stock, in both the short and the medium term, is expected to be low.

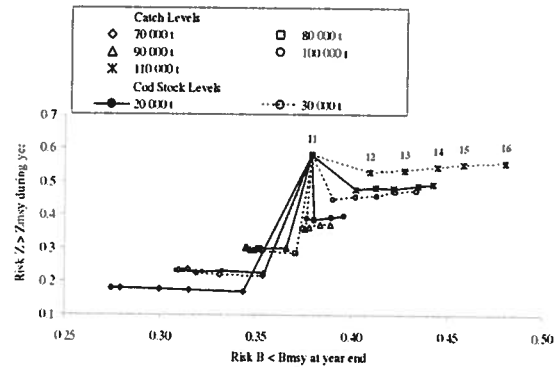
Short-term predictions: Estimated risks for 2012 with an “effective” (the amount of cod biomass overlapping the shrimp biomass) 20 000 t cod stock are:

| 20 000 t cod | Catch option ('000 t) | | | | | | |
|-------------------------|-----------------------|------|------|------|------|------|------|
| | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| Risk of end 2012 (%) | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| falling below B_{msy} | 33.1 | 34.4 | 35.5 | 37.5 | 38.1 | 40.2 | 41.3 |
| falling below B_{lim} | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| exceeding Z_{msy} | 13.4 | 17.0 | 22.7 | 30.7 | 38.7 | 47.8 | 55.1 |

Medium-term Predictions:

Predicted probabilities of transgressing precautionary limits after 3 years in the fishery for Northern Shrimp on the West Greenland shelf with ‘effective’ cod stocks assumed at 20 000 t (20kt) and 30 000 t(30kt) were estimated at:

| Catch (Kt/yr) | Prob. bio-mass < B_{MSY} (%) | | Prob. bio-mass < B_{lim} (%) | | Prob. mort > Z_{msy} (%) | |
|---------------|--------------------------------|-------|--------------------------------|-------|----------------------------|-------|
| | 20 Kt | 30 Kt | 20 Kt | 30 Kt | 20 Kt | 30 Kt |
| | 60 | 27.4 | 29.2 | 1.6 | 2.0 | 14.0 |
| 70 | 30.0 | 31.9 | 1.5 | 2.1 | 17.7 | 22.7 |
| 80 | 32.2 | 34.9 | 1.6 | 2.2 | 22.7 | 29.0 |
| 90 | 36.1 | 38.8 | 1.8 | 2.3 | 30.7 | 37.2 |
| 100 | 38.0 | 41.3 | 1.8 | 2.4 | 38.8 | 45.8 |
| 110 | 42.2 | 44.5 | 1.8 | 2.4 | 48.3 | 54.8 |
| 120 | 44.6 | 47.8 | 1.8 | 2.6 | 56.2 | 61.8 |



Recommendation: Recent catch levels are not estimated to be sustainable. Scientific Council therefore recommends that catches in 2012 should be reduced substantially.

The risk of exceeding Z_{msy} at a catch level of 90 000 t with an effective cod stock at the 2011 level in 2012 is estimated to be around 31%. Scientific Council notes that this risk is higher than was recommended in previous assessments. This is because model results indicate a stationary stock above B_{msy} at this risk level of exceeding Z_{msy} . Scientific Council therefore recommends that catches in 2012 should not exceed 90 000 t.

Special Comments: Scientific Council were not in a position to predict the cod stock so assumed that the cod stock in 2012 would be at the same level as 2011 in its analysis. Should the cod stock increase beyond this assumption catches may have to be decreased further.

Sources of Information: SCR Docs 04/75, 04/76, 08/62, 11/50, 11/51, 11/52, 11/55, 11/57, 11/58, SCS Doc. 04/12

Bilag 2: Northern shrimp in Denmark Strait and off East Greenland

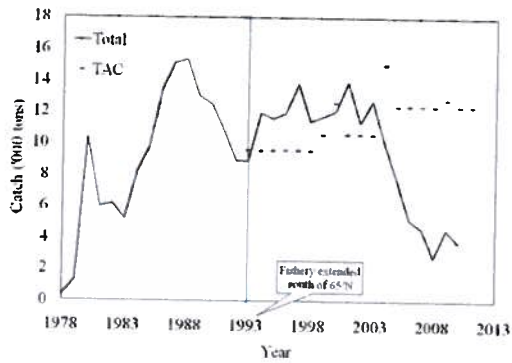
Background: The fishery began in 1978 in areas north of 65°N in Denmark Strait, where it occurs on both sides of the midline between Greenland and Iceland. Areas south of 65°N in Greenlandic waters have been exploited since 1993. Until 2005 catches in the area south of 65°N accounted for 50 - 60% of the total catch but since 2006 catches in the southern area accounted for 25% or less of the total catch.

Fishery and Catches: Two nations participated in the fishery in 2011. Catches in the Iceland EEZ decreased from 2002-2005 and since 2006 no catches have been taken. Recent catches and recommended TACs are as follows:

| Year | Catch ('000 t) | | TAC ('000 t) | |
|------|------------------|-------------|---------------|--------------------------|
| | NIP AG | Recommended | Greenland EEZ | Iceland EEZ ¹ |
| 2007 | 4.6 | 12.4 | 12.4 | |
| 2008 | 2.8 | 12.4 | 12.4 | |
| 2009 | 4.6 | 12.4 | 12.8 | |
| 2010 | 3.7 | 12.4 | 11.8 | |
| 2011 | 1.1 ² | 12.4 | 11.8 | |

¹ Fishery unregulated in Icelandic EEZ;

² Catch till October 2011.



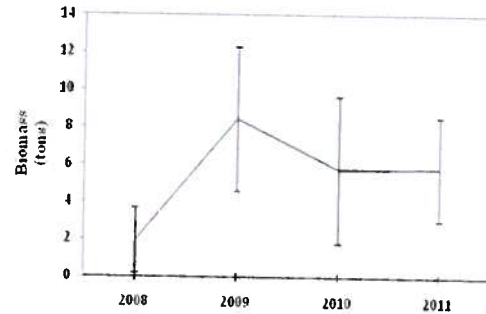
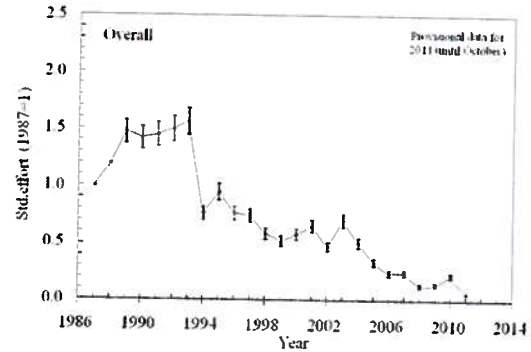
Data: Catch and effort data were available from trawlers of several nations. Annual surveys have been conducted since 2008.

Assessment: No analytical assessment is available. Evaluation of the status of the stock is based on analysis of commercial fishery data and survey data.

Recruitment: No recruitment estimates were available.

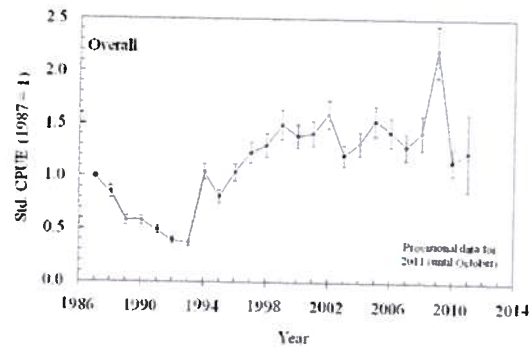
Exploitation rate: Since the mid 1990s exploitation rate index (standardized effort) has decreased, reach-

ing the lowest levels seen in the time series from 2008 - 2011.



Biomass: The biomass index from 2008-2011 varied greatly with no clear trend.

CPUE: Combined standardized catch-rate index for the total area decreased steadily from 1987 to 1993, showed an increase to a relatively high level in 1998, and has fluctuated around this level since. There are concerns as to whether the 2009 value properly reflects the state of the stock.



State of the Stock: The stock biomass is believed to be at a relatively high level, and to have been there since 1998.

Recommendation: Scientific Council finds no basis to change its previous advice and recommends that catches should remain below 12 400 tons in 2012.

Special Comments: The predominant fleet, accounting for 40% of total catch, has decreased their effort in recent years, which gives some uncertainty as to

whether recent index values are a true reflection of the stock biomass. This decrease may be related to the economics of the fishery.

Sources of Information: SCR Doc. 03/74, 11/56, 11/54.

Bilag 3. NAFO's svar på spørgsmål fra Nalaakersuisut

c) Audit of management plan for Northern Shrimp fishery to the west of Greenland

Scientific Council considered a request from the Government of Greenland to

'audit the shrimp management plan to be available simultaneous with, or preferably immediately before, the annual shrimp advice in November 2011 with a view to include recommendations in the determination of the shrimp TAC for 2012.'

and further

'as the shrimp group in the Scientific Council has estimated that the current reference points in section 20 of the shrimp management plan are too conservative, the Scientific Council is furthermore requested, with reference to Section 20 in the management plan, to recommend specific threshold values as the appropriate threshold reference points in relation to Bmsy, Blim and Zmsy as soon as the limits of the biomass is exceeded.'

The 'management plan' referred to is a management plan for the fishery for Northern Shrimp that was adopted by the Greenland Self-Government in July 2010. The request made to Scientific Council is not specific about what is to be understood by 'audit'. Scientific Council will find it helpful if the Government of Greenland consults the Greenland Institute of Natural Resources or other experts with a view to more exactly defining its requirement.

Scientific Council observes, however, that a full evaluation of a complete set of fishery management procedures (a 'Management Strategy Evaluation', or MSE) is normally based on a set of linked simulation models, all complex, and is too big a task to be undertaken in the course of an SC meeting. A full MSE can be expected to take two to three years to complete and to require several meetings and workshops.

d) Stock status of *P. montagui* in Subareas 0-1

(SCR Doc. 11/070 and 11/053)

The Scientific Council is asked for advice *on whether the stock of the main retained bycatch species *P. montagui* is within safe biological limits and on measures that might be applied in the fishery for *P. borealis* to maintain the stock of the main retained bycatch species *P. montagui* within safe biological limits.*

Information was available from logbooks in the fishery for *P. borealis* and from the annual West Greenland trawl survey.

Overall, *P. montagui* appears to occur at a density of the order of 1% of that of *P. borealis*. Its distribution is different: it is relatively rare north of the northern margin of Store Hellefiskebanke, and south of that limit it occurs in shallower water than *P. borealis*, possibly associated with a greater tolerance for colder water. Its distribution is more localised than that of *P. borealis*, and although it is seldom caught as clean catches but almost always associated with *borealis* there are known to the industry small areas where catches of *montagui*, sometimes large, can dependably be made.

Logging of catches of *P. montagui* is irregular. Vessels of the coastal fleet fishing bulk shrimps for processing in Greenland undoubtedly catch *montagui* from time to time; the catch composition is estimated by sampling at the point of sale and the price adjusted accordingly. However, this fleet component records practically no *montagui* in logbooks, logging all catches as 'PR99'—i.e. bulk shrimp. Offshore trawlers are more apt to log catches of *montagui*, but it is impossible to be certain that records are complete.

Some owners avoid catching *montagui* completely, others have customers that will accept it. It appears that some vessels will occasionally target *montagui*, especially when short of quota for fishing *borealis*, and they sometimes record catch sequences, including repeated large catches of *montagui*, that are not consistent with sustained efforts to avoid it. In all fleet segments weights of *montagui* are not withdrawn from quotas, which apply to *borealis* only. The fishery for *montagui* is therefore only indirectly regulated, by the species's being less acceptable to the markets and by its being almost always mixed with *borealis*, which is quota-restricted.

The only fishery-independent information on *montagui* is that available from the West Greenland trawl survey executed annually by the Greenland Institute of Natural Resources. The survey has never had the investigation of *P. montagui* among its design objectives, and effort is allocated principally according to the distribution of *P. borealis*. Given the localised and shallow-water distribution of *montagui*, catches of *montagui* in the survey are therefore spo-

radic and survey results an inaccurate measure of trends in biomass. Scientific Council does not think that biomass indices from the trawl survey as at present conducted constitute a satisfactory means of determining whether the stock of *P. montagui* is within safe biological limits. Scientific Council recommends, however, that the Greenland Institute of Natural Resources should analyse the results of previous surveys to find out whether, or how, it might be possible to alter the basis on which the survey is designed to improve its usefulness for monitoring the state of the stock of *P. montagui*.

Scientific Council concluded that it cannot now formulate advice on whether the stock of *Pandalus montagui* is within safe biological limits.

Scientific Council considered the following as possible measures that might be applied in the fishery for *P. borealis* to afford some protection to the stock of *P. montagui*, without suggesting that they exhaust the possibilities:

- Require the reliable logging of catches of *P. montagui* and make the records available to fishery scientists and managers.

Scientific Council considers this measure to be indispensable and a necessary precursor to any other measure whatever.

- impose a shallow limit on fishing for *P. borealis* of for example 170 m on the West Greenland coast between for example 60°45'N (approximately the latitude of Kap Desolation) and 68°15'N (approx. the latitude of the northern edge of Store Hellefiskebanke).

This would give a measure of protection to *P. montagui*, given its distribution in shallower water than that preferred by *borealis*, and would in some measure also benefit the stock of *P. borealis* by preferentially protecting the smaller sizes. This restriction would apply to all fleet components.

- Apply the present bycatch regulations, which require fishing to be moved by a regulated distance if a bycatch limit is exceeded, to *P. montagui*.

This measure would greatly protect *P. montagui* given that no licenses are issued for any fishery on it. However, it would also thereby forgo the commercial benefits of the catches now being taken.

- Impose limits on catches of *P. montagui* separate from those enacted for *P. borealis*;

Catch limits on *P. montagui* might be called 'bycatch limits', implying catches under licences for *P. borealis*, or 'TACs', implying that licences would be issued for fishing *montagui*, but either way it would become necessary to assess the status of the stock of *montagui* and to decide on catch limits that would protect the stock without unnecessary restriction on the fishery for *borealis*. Data sources, assessment methods and forecasting techniques are lacking and would have to be developed.

- manage a joint fishery for the two species;

This implies that licences would be issued and TACs and quotas set for the two species without distinction. Stock assessments and advice would be provided for the two species as a joint stock, although some level of separate evaluation would probably also be necessary to ensure that neither was over-exploited. This management would look much like the present, except that catches of *montagui* would be withdrawn from quotas. Such a management regime might be expected to provide considerable protection for *montagui*, as it would be withdrawn from quotas on the same footing as *borealis* in spite of its lower market value.

Scientific Council has not considered all the implications of these different possibilities and does not at the present time recommend all or any for implementation, with the exception of the first *i.e.* the accurate recording of catches. Scientific Council considers that reliable and accessible catch records are a *sine qua non* even for attempting to evaluate the effects of different management options, let alone developing the methods and procedures necessary for implementing any of them.