

Sustainable harvesting of marine resources at lower trophic levels - *Calanus finmarchicus* and species of mesopelagic fish



DIRECTORATE OF FISHERIES

Thorbjørn Thorvik, Senior adviser. The Norwegian Directorate of Fisheries

Blue bioeconomy, Malmö, May 30th 2018





The overall background:

- Throughout history sea mammals and species of fish at higher trophic levels have been caught
- The oceans cover almost 70 % of the surface of the earth and account for around 50 % of its biological production. However, only about 3 % of our food comes from the sea
- In the future a larger portion of our food will have to come from marine aquaculture. However:

- Further growth and development in marine aquaculture will require new sources of marine feed, like *Calanus finmarchicus* and mesopelagic species
- Increase in global population
- Economic growth in traditionally poor countries
- Seafood is healthy
- Scarcity of arable land and fresh water resources
- Limited potential for growth in traditional fisheries



- An important, almost untapped source for marine feedstuffs is small, marine species at lower trophic level – mesopelagic fish, krill and zooplankton
- The biomass of species at lower trophic levels is huge, and outnumber the size of the fish stocks many times
- Species at lower trophic levels can be utilized both as feed for farmed fish and terrestrial animals. There are also markets for special products for human consumption, health supplement etc.



- Harvesting marine organisms at lower trophic levels like *Calanus finmarchicus* and mesopelagic fish could contribute to solving some of the great challenges of our time

- In the following: More about *Calanus finmarchicus* and mesopelagic species from the perspective of the Norwegian Directorate of Fisheries:

Calanus



DIRECTORATE OF FISHERIES



Photo: Cecilie Broms
Institute of Marine Research



- *Calanus finmarchicus* (CF):
 - Has been harvested in Norway since 2003 in a small-scale fishery on the basis of one experimental licence
 - 513 tonnes were caught in 2015, increased to 660 tonnes in 2016 and 747 tonnes in 2017. In previous years the annual catch was substantially lower
 - CF has so far been utilized as raw material for further processing into special products for human consumption and use (mainly for health- and dietary purposes)

- The future:
 - Harvesting on the basis of an experimental licence will continue at least till 2022
- In 2016 the Directorate of Fisheries presented a proposed management plan for CF. The Institute of Marine Research (IMR) delivered the scientific input to the plan
- The proposed management plan has been through a process of public consultation. However, it has as of today not entered into effect

Some key elements of the proposed Norwegian management plan for CF:



- Based on an estimated standing biomass of 33 million tonnes
- A total annual quota of 165 000 tonnes is proposed for the Norwegian Economic Zone in the Norwegian Sea and the Fishery zone around Jan Mayen
- The determination of the quota is based on a conservative and precautionary approach, «inspired» by CCAMLR's methodology for determining the quota of krill in Antarctica



- Ecological challenge in connection with the harvesting of CF:
 - Vital to avoid damages on important parts of the ecosystem, therefore bycatch of eggs, larvae and juveniles of fish shall be kept as low as practically possible

- Other challenges for future harvesting of CF:
 - Detecting harvestable quantities of CF (using various types equipment, e.g.drones)
 - Larger and more efficient gears (trawl)
 - Right type of vessel (size, processing of catch)
 - Systematic and correct sampling of catches
 - Sufficient surveillance and control
 - Will it be possible to achieve profitable harvesting outside coastal waters?

Mesopelagic species: Include a large number of different species of fish, zooplankton, squid, jellyfish



DIRECTORATE OF FISHERIES

Lanternfish:





- Some characteristics of mesopelagic fish:
 - Large resource, both globally and in the North Atlantic
 - Small, i.e. 3-6 cm
 - Migrates vertically between 200 and 1 000 m depth
 - Vertical migration driven by light throughout the day



- Concentrations in «hot spots». Reykjanes Ridge seems to be a «hot spot» in the North-East Atlantic
- Gulf of Oman is probably one global «hot spot»



- Catch in the North Atlantic:
 - No landings are registered from Norwegian vessels
 - Iceland reported more than 73 000 tonnes of silvery lightfish caught in the three year period 2009-2011 (small quantities after 2011)
 - Russia reported more than 13 000 tonnes of glacier lanternfish in 2001 and 2002 (small amounts in other years)

- Norwegian fisheries authorities in cooperation with marine scientists, the fishing industry and funding agencies are currently discussing future fishing possibilities as to mesopelagic species
- In addition The IMR has launched its Mesopelagic Initiative
- Some reservations as to future exploitation of mesopelagic fish:
 - The knowledge about the enormous size of the biomass at lower trophic levels is not at all new

- A number of big challenges will have to be overcome before this potential can be realized:
 - Various aspects of biological knowledge, including impacts on different parts of the eco-system, e.g. bycatch of commercial species of fish (redfish, argentine, blue whiting)
 - Locating «hot spots», the right depths and time periods
 - The right type of vessels and equipment/machinery onboard vessels
 - The best adapted gear (trawl)
 - The best methods for processing and conserving the catch onboard vessels



- Harvesting a resource where knowledge and experience are not sufficiently developed, (“immature” fisheries) presents specific challenges
- A successful approach in Norway concerning “immature” fisheries, has been experimental fishing by commercial vessels
 - Experimental fishing: Gradually more knowledge is acquired by fishermen/companies and public institutions within marine science and fishery management



- For some years the Directorate of Fisheries has issued experimental licences to Norwegian vessels. In 2017 a total number of 50 licences were issued. By May 23rd 2018 the corresponding figure is 5
- With the exception of one Norwegian vessel the activity has been limited thus far. 2-3 more vessels are expected to participate in 2018
- Why so little activity?
 - Norwegian vessels by and large obtain a good operating margin from other fisheries
 - A number of knowledge gaps have to be overcome, and the costs involved are immense



- The need for funding of research and experimental fishing is crucial
- A kind of burdensharing between fishing boat companies/other actors and different financial sources is necessary and called for
- The rationale behind burdensharing as a kind of public-private cooperation could be:
 - Fishing boat companies and others engaging in harvesting and utilization of mesopelagic fish are eligible for financial support
 - In return their obtained results and knowledge have to a large extent to be shared with others

Basic approach of the Norwegian Directorate of Fisheries:



- Philosophy: A step-by step process of gathering new knowledge.
- Attitude: Hard work by a number of key actors in various public and private organisations will be necessary
- Continue to issue experimental licences to Norwegian fishing vessels
- Assist the Ministry of Trade, Industry and Fisheries in its efforts to establish a licencing scheme



- Observing closely the results from experimental fisheries
- A keen interest in the outcomes from the Mesopelagic Initiative, by IMR and partners
- Success in the medium term:
 - Need to achieve groundbreaking knowledge in a variety of areas
 - Good prospects of a profitable fishery
- Success in a longer time perspective:
 - This new Norwegian fishery will also make a contribution to addressing global challenges such as food safety and high quality food

- If current efforts prove to be successful in the course of some years, The Directorate of Fisheries will start preparing a management plan for harvesting the mesopelagic resource
- Some vital topics in a future management plan:
 - Total allowable catch (TAC)?
 - One TAC for each stock of mesopelagic species, for instance silvery lightfish? Or
 - A TAC for a combination of different stocks, for example covering both glacier lanternfish and silvery lightfish?



- A Norwegian TAC? Or
- A TAC including several coastal states in the North-Atlantic?
- An international approach will require comprehensive international cooperation
- A number of regulatory issues at the national level will have to be examined



DIRECTORATE OF FISHERIES

Thank you for your attention