Joint NWWAC/NSAC Workshop on Skates & Rays Management

Brussels, 09 February 2023

REPORT

WELCOME & INTRODUCTIONS

John Lynch, Chair of the NWWAC/NSAC Focus Group Skates & Rays

John Lynch welcomed all participants to the joint NWWAC/NSAC Workshop on skates & rays management. The workshop was joined by representatives from 8 EU Member States including Denmark, The Netherlands, Ireland, Belgium, France, Spain, Germany, and Portugal. The Chair was particularly pleases to welcome UK representatives to the meeting, since collaboration between the EU and UK is essential for the co-management of these species.

He recalled that the NWWAC has been working on the topic of skates and rays management since 2009. Over the years several recommendations have been put forward, some of which in conjunction with the NSAC, particularly on the last couple of years. He explained that NWWAC members had participated directly in the 2017 workshop on skates & rays management in 2017, and that the present workshop was the follow-on from that event. "*Since 2017 a lot of research has been carried out and it is time to bring all involved up to speed on the results",* he stated. "*These results need to be used to make real progress on those issues where progress has been eluding us over the past years"*.

Referring to the Terms of Reference, the aim is to use the results from the workshop to make concrete proposals to the Commission and the Member States on how to advance the work and the regulation around skates and rays management with complete view of the co-management of these species.

The Chair then explained the proceedings of the workshop, starting with presentations of several research projects with a focus on their results. Then, members were to be divided into smaller breakout groups facilitated by the NWWAC Secretariat, Mo Mathies and Matilde Vallerani, and Vice- chair Alexandra Philippe. He then introduced the workshop moderator, Paddy Walker, who would also assist during the breakout session if any questions arise. Before giving her the floor, the Chair expressed his gratefulness for Walker's participation and willingness to act as moderator of the workshop.

Before introducing the first speaker, Walker invited participants to reflect on what was the most important issue they would like to address at the workshop. Responses were collected in a word cloud and were then to be referred to at the conclusion of the meeting.

STECF CONCLUSIONS ON SKATES & RAYS MANAGEMENT

Graham Johnston, Marine Institute

Graham Johnston presented the recommendations from the STECF Expert Working Group on skates and rays management, which met in September 2022 and which he chaired together with Michael Gras, JNCC. Erik Lindebo participated on behalf of DG MARE.

Terms of reference of the EWG included consideration of the EU and UK approaches for TAC setting, the use of single species sub-TACs or management plans as alternatives to the group TACs and the review of progress made in selectivity, avoidance and survivability studies. Finally, the EWG was also tasked with the consideration of transparent criteria to classify skate and ray species as prohibited species.

Johnston explained that the EWG found pros and cons to both methods for TAC setting. It is important to note that some stocks are only found within the North Sea or other individual ecoregions and that advice is based on previous TACs rather than on landings or advice.

The EWG agreed that the UK method is more conservation-minded and better followed the "spirit" of the advice. This method was extensively was in the December consultations for setting fishing opportunities for 2023.

The ICES system also needs to be taken into account, with category 5 automatically leading reduction in TAC advice. Many skates and rays stocks are classified as category 5, and so improved data and stock assessments are required for these stocks to avoid these precautionary reductions.

Johnston then mentioned alternative approaches to generic TAC, including:

- Splitting TACs between areas, which can be done using different methods, for example on the basis of where landings come from rather than previous TACs;
- Separating Category 3 stocks from Category 5 and 6 as an interim step;
- Doing ssimulations based on different stock sizes.

When discussing management plans, it is necessary to reflect on what they should include, what has been proposed in the past and who needs to be involved. The option of including these species in EU multiannual plans should also be further investigated.

Regarding progress on research done, the EWG didn't look at catch data but it was recognised that a lot of progress has been made since the 2017 workshop. This is especially true regarding survivability studies, with survivability estimates now available for almost all species. The North Sea areas has been particularly well covered on other topics as well, such as avoidance and selectivity.

Johnston explained that the EWG examined the criteria for the prohibited species list in detail, also considering how the list had been used in the past. This topic is currently highly relevant due to new ICES advice, particularly on spurdog. The list is difficult to amend due to it being part of the technical measures regulation.

Concluding the presentation, Johnston stated that it should be possible to switch to single stock TAC advice on some level over the next 2-3 years. ICES is changing its assessment methods, with new methodologies and advice updated in 2022 and 2023 for category 2 and 3 stocks. He also highlighted the importance of meeting regularly with stakeholders to look at practicalities and suggestions on alternative management measures.

Looking at the steps ahead, Johnston mentioned:

- Setting initial single TACs for cat 2 stocks by 2025;
- Continuing with stakeholder meetings and scientific meetings in a multinational involvement, including UK and Norway;
- Combining alternative management measures where appropriate.

ICES WGEF

Jurgen Batsleer, Wageningen University

Jurgen Batsleer started by explaining the ICES assessment process. First of all, ICES gets a request from the Commission and that can go to an expert group, such as WGEF in relation to elasmobranchs, but also be addressed by specific workshops (WKSHARK, WKSKATE) in case it is a one-off advice. The methods/models used by the expert groups are independently peer reviewed by recognized experts as part of a benchmarking process. Then, an advice drafting group prepares advice to be submitted to ACOM approval and finally published.

There are 56 elasmobranch stocks to deal with in different areas, making it quite a heavy workload for WGEF. The majority of these stocks are classified as category 3, 5 or 6, with no reference points.

The data used in the assessment includes landings, discards (which are highly variable, quite an issue for WGEF) and surveys. The latter were the focus of WKSKATE in 2020, which considered whether the available surveys covered the main spatial distribution and represented the whole population. In the case of thornback ray, WKSKATE looked at the stock biomass index, explored combination of different surveys and used the 2 over 5 rule to develop a stock size indicator. It also considered two precautionary principles, the uncertainty cap and the precautionary buffer, the latter causing uncertainty in the WG whether it should be applied or not.

Batsleer then referred to WKLIFEX developing more precautionary methods and advice rules for stocks in Category 3, including Surplus Production models, a novelty for elasmobranchs. Under limited data and information, a surplus production model is useful for stock assessment because it doesn't require information on age or length. Input data includes catches over time, survey data and life-history data. These models were used in WKELASMO and WKBELASMO.

The RFB rule is also another method WKLIFEX has been looking at. The biomass ration refers to survey trends, the fishing proxy is using length data and a biomass safeguard is applied. However, this methodology is not straightforward. "*The biomass safeguard is similar to Btrigger, you need to use the lowest point of your survey which is an issue as it is often zero*", explained Batsleer.

Looking at future steps, there will be two benchmarks, WKBELASMO 2023 and 2024. In 2023 WGEF will have to prepare advice for 25 stocks including quadrennial advice. Of these, for 11 category 3 stocks WKLIFEX methods will be used. Finally, it will also have to explore conservation status advice.

Walker asked whether, with some species moving to category 2, these could fit into management plans when there are species with different assessments. Batsleer replied that there is still a lot of uncertainty around the surveys and that having reference points will help to pinpoint the situation, allowing to progress into management measures. Johnston added that in his opinion, it would be reasonable to treat differently those stocks for which more information is available.

RAYWATCH & RAYSCAN

Laura Lemey, ILVO

Laura Lemey started her presentation by introducing Raywatch, a 2-year EMFF funded project aiming at collecting data on seven skates and rays species in the NWW and in the North Sea, specifically regarding the extent of discards after capture and the percentage that survive in the process.

Lemey explained that rays have commercial importance within Belgian fisheries, but that the fishery has a low economic value. Skates and rays are usually discards in fisheries targeting sole and plaice and are managed under one TAC. They are considered as choke species and an exemption for high survivability is in place to minimise the choke risk. She also mentioned the project was relevant to the existing roadmap aiming at increasing selectivity and survivability.

Under Raywatch, observers collected information on length and weight of the 7 species involved. Vitality scores were given with a categorical scale from a (high vitality) to d (dead). Age, temperature, depth and sorting time were also measured. One year and a half of sampling resulted in 18000 length measurements, with thornback and spotted rays being the main species.

Results looked at both historical fleet data and observer data. Lemey reported that there were different length distributions for thornback ray and spotted ray, but that many individuals were caught below the minimum landing size for Belgian fisheries. Looking at age data, 80% of catches were below 5 years of age and the maximum age reported was 14-15 years. The index of average percentage error was considered as well. Regarding maturity stages, results highlighted that immature stages were prevalent, with 65% of sampled individuals that had not been able to reproduce yet. This was also confirmed by analysis with maturity ogives and by looking at catch proportion against length at maturity.

Lemey concluded that sampled individuals were mostly immature and usually smaller than the estimated length (quite species-specific in terms of length).

Looking at the length-weight relationship for thornback and blonde ray, females tend to be bigger than males for thornback, in line with other research. No difference was noted between blonde rays females and males, but this could be due to the small size of the adult sample. Lemey added that because rays mature slower, they are more vulnerable to overfishing.

She then moved to vitality scores and showed a graph including an analysis of vitality scores for different species. Most individuals (70%) scored as a or b. There is often correlation between air exposure time

and immediate mortality: the longer the sorting time, the higher mortality and the lower vitality scores. The project also looked at correlation between fishing duration and immediate mortality but no clear pattern could be identified. A little trend was found in relation to temperature differences (from sea bottom to top) but more data needs to be collected.

The project produced several recommendations:

- Data collection is essential and other species should be investigated;
- Standardisation of methods is important. It is necessary to investigate which ones should be used;
- It is vital to get survivability estimates for less common species and to consider mortality due to predation and infection after discarding;
- It is important to decrease fishing mortality and increase vitality;
- New methods being developed like cameras on board are encouraged and the use of AI to look at vitality scores should be investigated;
- Minimum landing size doesn't have any biological benefits for rays, as they were not able to reproduce, and could be increased;
- Management should be considered without generalising results for skates & rays species.

Lemey then quickly mentioned another project, RayScan, which has developed a ray recognition application which provides assistance in identifying the five most common ray species within the Belgian fishing industry. The aim is to minimise misidentification of species, as researchers had noticed that the fleet was catching the opposite to what was being observed. A workshop on species identification confirmed that misidentification was an issue. ILVO would like to increase the number of species covered by the app and in the future also provide translation into other languages.

CUCKOO RAY SURVIVABILITY

Matthew McHugh, Bord Iascaigh Mhara

Matthew McHugh presented on a BIM research project focusing on cuckoo ray survival. He explained that this species was given a survivability exemption to the landing obligation to facilitate further research. This study built on previous vitality assessments on board, showing that this ray species performed very well.

BIM conducted a full captive-monitoring survivability experiment on cuckoo rays caught on board an otter trawler in the Irish Sea using a single-rig otter trawl with 120 mm diamond-mesh codend. The vessel targeted blonde ray in an area southeast of Howth Harbour in the Irish Sea. Test cuckoo rays were sourced from commercial duration tows. Control rays were obtained from tows of reduced haul duration to

help track mortalities potentially associated with on board holding, transit and the onshore holding facility.

Catches were landed directly onto the deck and remained there until the trawl was redeployed or stowed away. Cuckoo rays were held onboard for up to three days in 3 x 310 litre tanks. The holding tanks were supplied with a flow through of sea water and sand to provide refuge, helping reducing stress levels while in captivity. Any mortalities at sea were measured, sexed, and recorded for inclusion in the overall survival estimate. Live rays were sampled in the same manner prior to condition assessments ashore.

The onshore monitoring facility was located on Dun Laoghaire pier, around 50 meters from where the vessel landed. The system was developed to ensure the least movement possible from the vessel to the container on land.

McHugh explained that methods included both condition assessments, measuring vitality, reflex and injury, and ongoing assessments, with rays maintained in a closed recirculating system and observed for up to 23 days.

The Kaplan-Meier survival plots for test and control ray were used to assess survival over 15 days of captivity and survival over a longer period was estimated using predictive modelling over 25 days. Reflexes were analysed using the Reflex Action Mortality Predictor (RAMP) method by summing the scores for each individual fish and the total was standardised to fall between 0 and 1. With four possible reflexes, each reflex was given a score of 0.25. Injury scores were also standardised to fall between 0 and 1, with the injury type for each individual having a potential score of 0.33, 0.66 or 1 depending on the severity of the injury.

McHugh reported that a total of 12 test hauls and two control hauls were carried out over seven days fishing. Tow duration had a mean of 224 minutes for test tows and 50 minutes for control tows. Bulk catch had a mean of 293 kg. Cuckoo ray numbers were relatively low with a total of 61 test and 12 control fish caught. A total of 39 test cuckoo rays were retained for captive observation (22 died while at sea), while 9 control rays were retained (3 died at sea). Test ray mortality was 36% on vessel and 48% in holding system, while for control ray these were 25% and 33% respectively. The model used predicted an estimated overall survival rate of 11% over 25 days.

Fin damage and bleeding head were the predominant injuries for all vitality scores, followed by bleeding body and bleeding tail. Mean reflex scores for each vitality demonstrated a higher level of impairment for fish in poorer condition. Mean injury scores varied little in relation to vitality score due to levels of bruising in all vitality scores. Combined injury & reflex scores showed a positive correlation with vitality.

McHugh concluded that survival results of 16% over 15 days down to 11% over 25 days suggest likely poor post-release survival of cuckoo ray due to the capture process in the Irish otter trawl fishery. 42% of control cuckoo rays were still alive after 15 days observations. It is unlikely that the holding system was at fault, as key water quality parameters were all at acceptable levels and constantly monitored during the study. Moreover, the same holding system was previously used in a study on seine caught plaice which resulted in high survival rates. According to McHugh, a tag-based survival study where cuckoo ray could be released almost immediately might help elucidate clarify whether high cuckoo ray

mortality rates are due to the capture process or to the species susceptibility to captive monitoring issue.

He then mentioned the SURF project, done in collaboration with Ifremer. The fleet segment involved in the project is the French otter bottom trawlers targeting demersal fish (mainly anglerfish) in the Celtic Sea and northern Bay of Biscay. No selective device is used other than mandatory minimal mesh size. The method consists in cuckoo rays monitored in captivity and sampled by vitality score. Experimentation was carried out mainly in winter and summer. 143 fish in total were held in captivity and 1720 were observed for vitality. The final survival per trip was estimated between 4% and 26%, with a high between-vessel variability. The survival of control fish was less than 100% (winter: 35%, summer: 80%), relatively low compared to other skates. As survival rates vary between vessels, there appears to be a mitigation potential based on fishing practices (e.g., depth, fishing duration, selectivity device). Results indicate that mortality of controls is partly linked to non-optimal holding conditions. A correction may be applied based on observed survival rates of controls.

THORNBACK RAY SURVIVABILITY (FIP)

Laura Lemey, ILVO

Lemey presented the results of a post-capture survival study on thornback ray caught by flyshoot in the Eastern English Channel, done in collaboration with SINAY, Nausicaá and FROM Nord, of which the latter coordinated the project. The method included measuring:

- Vitality with the categorical scale from a (high vitality) to d (dead);
- Reflex using the RAMP score;
- Injuries in differed body regions (head, body and tail).

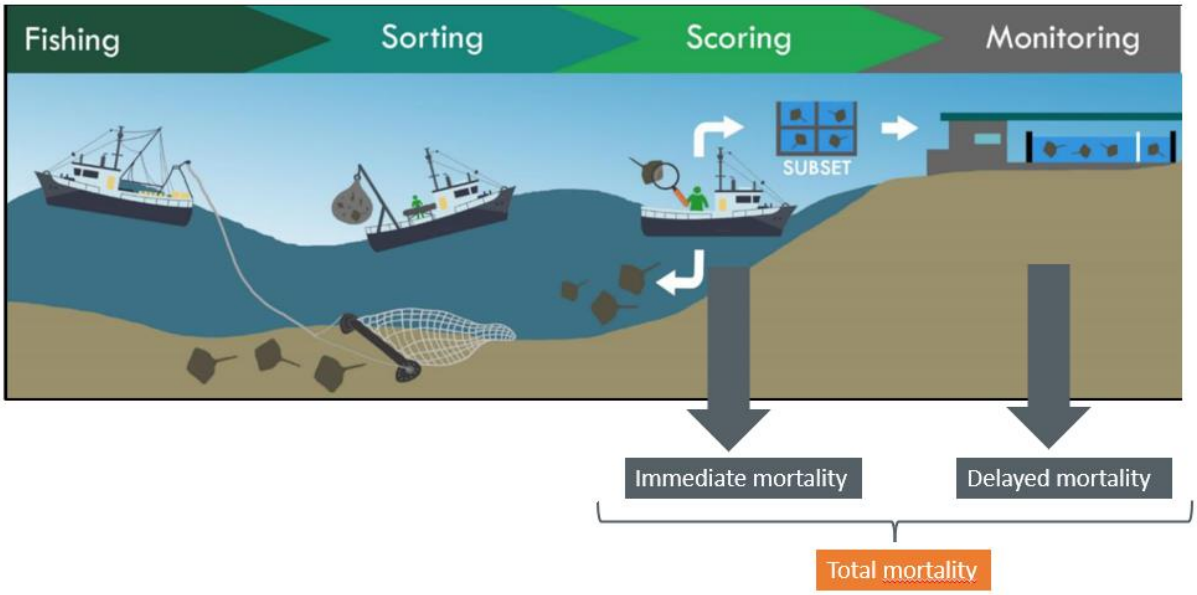
The total mortality was calculated taking into account immediate mortality at sorting and delayed mortality at monitoring.

Four trips were done from June to September, with fishing times ranging from 33-50 min. 459 lengths and vitality scores were given and 67 individuals were taken to the lab (15% of caught individuals).

Lemey shared a graph with the different length distributions of individuals caught at sea and of those who were brought to the lab, showing that lab individual provided a good representation of the lengths at sea. She similarly showed the different vitality classes allocated per trip at sea and those scored once rays arrived in the lab. Also in this case, the subset taken to the lab was representative of what was caught at sea. The injury score was looked at in correlation with the vitality class and the RAMP score at sea. Those individuals that scored “c” in the vitality scale at sea had higher chance of dying in the end. Also, it was noted that the higher the injury, the more likely the individual was going to die.

Looking at survival probability over all trips, immediate mortality was 4.57%, delayed mortality was 24.02% leading to a total discard mortality of 27.48%. Delayed mortality per trip showed a lot of variability between trips. Investigating what might cause these variations could be a good point for

reflection in future work. Lemey concluded by discussing survival probability per vitality class, pointing out that individuals with vitality class c had more chance of dying, with 38% of delayed mortality.



BRIDGING KNOWLEDGE GAPS FOR SHARKS AND RAYS IN THE NORTH SEA

Jurgen Batsleer, Wageningen University

Batsleer introduced a research project to gain better insight into the survival of rays after capture and into the life cycle and spatiotemporal distribution of rays and sharks, with the participation of VisNed and the Dutch Fishermen´s Union. The goal was to produce information to give substance to the roadmap for skates and rays and to agreements (CFP) in the shark and ray recovery action plan (MSFD).

First, Batsleer explained the work package related to survival rates of rays that are returned to the sea after being caught by the main Dutch demersal fisheries. This was addressed in two phases. A first exploratory phase during which it was decided to work with flyshoot and beamtrawl fisheries and with thornback and spotted ray. During the second phase discards survival was measured. Monitoring was done over 21 days, with 9 trips catching 183 thornback rays in TX3 and 134 in SL45. For spotted rays, catches were 140 and 28 respectively. Then a recirculation system was built in a climate room, with 12 tanks and water coming straight away from the sea to avoid climatic shock for rays. Monitoring was also 21 days long.

Batsleer outlined the main outcomes on discards survival:

- For beamtrawl, survivability for spotted ray was 46% and for thornback was 50%.
- For flyshoot, survivability for spotted ray was 78% but the sample size was very low. For thornback ray the sample was larger and survivability reached 81%.

Vitality could be a good indicator to measure survivability, but this is questionable for flyshoot.

The second work package related to spatiotemporal distribution. Information was collected with data storage tags measuring depth and temperature, with a pop-off mechanism releasing the tag after 1.5 years. Overall, 160 individuals were tagged and 26 recaptured. Results showed a very local distribution for the majority of rays, however, some individuals were retrieved off the coast of Denmark. Migration between 7e and 7d was observed as well.

Looking at the animals' activity over the day, much activity was recorded in morning and evening times, while the animals spend the time during the day lying flat on the seafloor. Batsleer added that it is still not clear whether this behaviour is affected by daylight or age or diet. There's a PhD ongoing looking at this and should provide conclusions in two years.

McHugh asked whether vitality work was also done with tagging. Batsleer replied that they didn't do tagging to measure survivability, only to study migration. He also added that they only tagged rays with high vitality scores.

INNORAYS

Jurgen Batsleer, Wageningen University

Batsleer explained that INNORAYS aimed at improving our knowledge-base for North Sea rays using Electronic Monitoring. The project finished in December 2022 after three years.

Skates and rays are data limited species; landings are well documented but data on discards are questionable. Manual monitoring provides accurate identification, but it's labour intensive and can only be done on a small sample.

He introduced how electronic monitoring on board works, with cameras on sorting belts, GPS receiver on board and an EM control centre. The videos recorded by the cameras are checked manually in an office onshore, where rays are counted. There are also observers onboard to validate the remote work. However, when counting rays video review seems to count more than on board. On the contrary, when counting the number of species, there is underestimation from the video review. Batsleer concluded that video review improves sampling coverage and is cheaper than manual monitoring. However, manual review is time consuming, is less accurate in species identification and doesn't allow for precise size/weight measurement.

The use of computer video technology and automated counting system was also considered. The computer is able to count and differentiate species, but its efficiency depends on the level of complexity on the sorting belt. A system prototype was tested on board of some of Dutch vessels to check its robustness in adverse weather conditions. Next steps include investigating thornback ray population structure using genetic tools looking at close-kin market recapture. DNA sampling will also be carried

out looking at all elasmobranchs. The aim is to combine all this to get more information on life cycle and history of these species.

McHugh asked whether the camera could be used in the trawl to see the fish in the gear, as this would help avoiding certain areas. Batsleer replied that cameras were mainly used to check fish behaviour in the net to improve selectivity. Designing this type of methodology within the net would be difficult for the quality of the image. Artificial Intelligence might be helpful on this in the future.

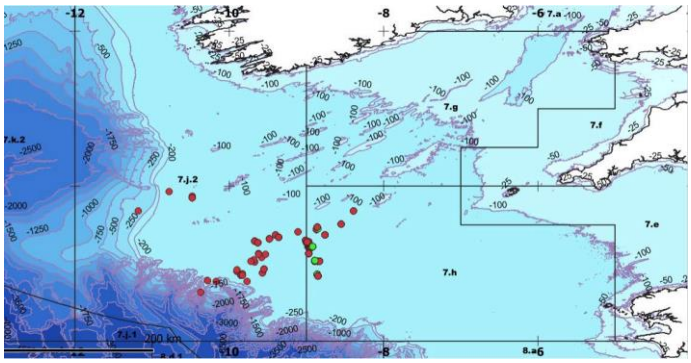
IMPROVING KNOWLEDGE OF SKATE AND RAY BYCATCH BY BOTTOM TRAWLERS IN THE NORTH WESTERN WATERS

Xulio Valeiras, Centro Oceanográfico de Vigo

Xulio Valeiras presented the RAPANSEL project, which aims to improve the identification of the species caught in bottom trawling as bycatches. The project is structured in two main tasks: the preparation of an identification guide and the characterisation of common skate species through molecular and morphological identification.

Skates and rays species are characterised by high morphological variability, which makes it very difficult to identify species. Misidentification prevents proper fishing management and assessment. RAPANSEL developed an identification guide for fishers, a very simple visual material with species common name and FAO code. It was printed so that it can be brought on board. A poster with similar information was also prepared.

Valeiras then explained the work related to the second task about morphological characterisation. Genera *Dipturus* has 4 species in the area: common blue skate, flapper skate, Norwegian skate and longnosed skate. They may be misidentified, affecting the accuracy of survey and landings data. Except longnosed skate, all are on the EU list of prohibited species and are considered "critically endangered" by the IUCN.



Sampling of skates was carried out onboard bottom trawlers at ICES 7 area. Morphological and molecular identification/analysis was performed in 418 samples. For the analysis, 29 morphometric characters of 17 adult specimens were used, to avoid errors due to the allometric growth of the skates. Results indicated that morphometry might not be a useful identification tool to differentiate species.

For genetic analysis, a piece of muscle tissue was dissected from fresh specimens. Morphological identification errors were detected and confirmed molecularly: *D. intermedius* gets confused with *D. oxyrhinchus* and *D. intermedius* gets confused with *D. flossada*. Therefore, it is confirmed that there are difficulties in identifying species correctly, even for observers. This misidentification has an impact on

the quality of scientific data, as well as on commercial landing and discard information, and thus on the assessment of fish stocks. The results obtained in the molecular and morphometric identification indicate that within the *Dipturus* genus of the sampling area there is a large percentage 92,63% of samples corresponding to the species *Dipturus cf. flossada*, and a low percentage of individuals of *Dipturus cf. intermedius*. The existence of two species that are confused must be considered in the review of the list of threatened species, including both species of the *D. batis* complex as well as other species of the *Dipturus* genus such as *D. oxyrinchus* and *D. nidarosiensis*, which are also distributed in the fishing area. The two *D. batis* species appear to have very different abundances in catches, which could be an indicator of different abundances of the two populations and affect their status. More research and higher quality data are needed for assessment.

McHugh asked if there was a geographical separation of the species in the analysis. Valeiras replied that the project is still running and that differences in spatial distribution can be expected. However, data is not enough to confirm that.

A SUMMARY OF RECENT CEFAS SKATE AND RAY RESEARCH, WITH CASE STUDIES OF DATA-LIMITED SPECIES FROM COASTAL AND OFFSHORE WATERS

Sophy McCully Phillips, Jim Ellis, Cefas

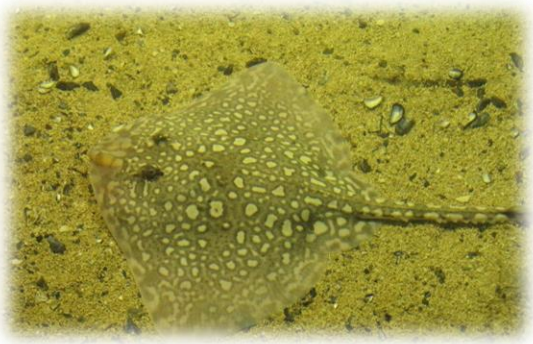
Sophy McCully Phillips and Jim Ellis gave a broad overview of the work done and ongoing by CEFAS:

- Regarding spatial distribution, having data is very important for consideration of stock units. Therefore, extensive trawl surveys are carried out collecting data from around the British Isles. Some trawl surveys can have some suspicious records (coding errors and misidentifications).
- Work has also been done on longer term temporal changes, as historical data brings important perspective on recent changes (e.g., indices using trawl surveys from the 1990s onwards).
- Tagging studies looking at movements and behaviour of thornback ray between different TAC areas to assess appropriateness of stock units.
- Electronic tagging has also been used to provide information on post-release mortality. Work on survival aimed at providing information on at-vessel mortality from a range of inshore fleets and information on survival, all relevant to the landing obligation.
- In terms of reproductive biology, extensive macroscopic data were collected on maturity-at-length for several species. However, data are still limited on egg-laying rates/fecundity. There is ongoing work on nursery grounds and quantitative measurements for validating maturity are planned, as well as an updated analyses of maturity data.

- There is ongoing work on age and growth studies, reviewing existing parameters, other data sources (tagging, length frequency). Next steps include the collection of contemporary vertebral samples.
- Feeding ecology is also being looked at, improving understanding of feeding modes for future ecosystem / trophic / multispecies models.
- Finally, the impacts of contaminants have also been considered since there is potential for bioaccumulation and biomagnification in elasmobranchs due to their high position on the trophic chain. Recent studies indicate some large skates may have mercury concentrations greater than seafood health guidelines.

McCully Phillips and Ellis added that the species for which more data are available are spotted, thornback, blonde and cuckoo ray. Species that are usually more data limited include both inshore (undulate and small-eyed ray) and offshore species (sandy and shagreen ray).

The case of small-eyed ray was particularly interesting, as research showed good numbers in the Irish Sea survey but not in other surveys. This discontinuous distribution can be explained by this species being predominant locally. Moreover, trawl surveys have limited spatial overlap with the species' habitat, therefore a dedicated survey effort would be needed for more robust monitoring. The status in the English Channel is uncertain, but data are even more limited for the Atlantic coasts of France, Spain and Portugal. McCully Phillips and Ellis concluded that more robust biological studies are required.



For both sandy ray and shagreen ray, life history data are very limited. CEFAS carried a study as these species have commercial importance and are harvested as part of generic TAC. Occurrence was mapped in 7 surveys over a 18-year period corresponding to approximately 16,000 hauls. Sandy ray occurs along the outermost part of the continental shelf and slope in the Celtic Sea, including the Porcupine Bank. Occasional records were made from the Rockall Bank and northern North Sea. This species is most common at 300 – 450 m depth. The occurrence of shagreen ray in the same surveys was slightly more widespread and predominantly in shallower waters of 100-200m depth. These surveys were used as platforms of opportunity to collect samples of each species across a number of years. Collaborative research effort resulted in the most comprehensive sample size studies: 54 shagreen rays and 116 sandy rays. A suite of biological parameters was taken from these specimens. Overall, these studies concluded that these two ray species are more vulnerable than others managed under the group TAC, especially in relation to the large body size.

BEST PRACTICES (AVOIDANCE, SELECTIVITY, AND HANDLING)

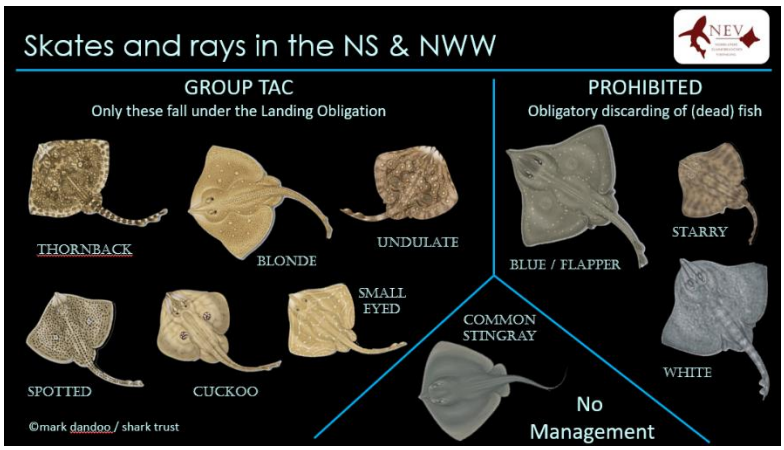
Irene Kingma, Dutch Elasmobranch Society

Irene Kingma gave an overview of the progress done avoidance, selectivity and handling best practices in the context of skates and rays exemptions to the landing obligation. She explained that rays species in the North Sea and in the NWW can be divided into three categories: the ones managed under the group TAC and falling under the landing obligation, the prohibited species and the common stingray, for which there's no specific management.

She recalled the rationale for the exemption (established originally in 2018). Options for alternative management to group TAC are being explored but will not be implemented in short time. Moreover, selectivity is an option in some fisheries and pretty high survival has been proven for a few species in some fisheries. In this context, the high survivability exemption is the only short-term option. She noted that the correct use of the survival exemption can lead to filling in the data gaps and leading to sustainable long term management solutions.

As stated in the exemption request from the Scheveningen Group, Member States needed to issue best practice guidelines on appropriate avoidance and selectivity measures that should be followed by fishers when making use of the exemption. The first step to optimise survival is avoidance. When this is not possible, selectivity comes in with measures such as deterrents (light/necro/magnets), raised fishing line, escape panels and grids. The third and last step would relate to handling - prompt release, handling the animal with care and keeping it wet.

Three years after the implementation of the exemption, there is better understanding of biology of the species. Kingma reflected on the opportunities this brings to the situation. An option would be to ask experts to give a qualified estimate of the survival levels in different fisheries based on the knowledge there is. For example, if we know thornback has a 60% survival in pulse trawl it could be estimated that spotted ray, which is a species with a softer skin and body, might have a lower survival rate. This way knowledge gaps would become clearer. "*This would provide indication on which species / metiers you would need to have improvements to justify having a high survival exemption*" she explained. She highlighted the importance of collaboration between scientists and fishers to fill the gap and let fishers become a part of the management solution. In this regard, she mentioned the good advisory work produced regularly by the NSAC and the NWWAC.



Looking at progress made in terms of measures implemented and ongoing research, Kingma reported that:

- In terms of avoidance, no mandatory measures have been implemented. Voluntary measures include avoidance of known spawning / nursery areas, however no data was collected to confirm the uptake. A spurdog avoidance program has been launched in the UK but it didn't result in relevant change in behaviour. There is the intention to include abundance studies in the work done by Raywatch and INNORAYS.
- In terms of selectivity, a maximum landing size has been implemented in The Netherlands, while France has established a maximum landing weight. Voluntary measures include the use of the flip up rope in Belgium and of the raised fishing line in the Irish Sea, however their uptake remains unknown. Ongoing research is focusing on several topics, such as benthic release panel with LED, rigging *Nephrops* trawl, electric deterrents, lights and magnets.
- In terms of handling on board, Kingma explained that, while there is no mandatory measure implemented, there are several handling guides available, but their uptake is largely unknown. No research is ongoing on this topic at the moment.

Therefore, a limited number of mandatory actions has been implemented. Some voluntary measures have been established but there's no uptake data. Research has produced some promising results that need further scrutiny. According to Kingma, ppromising gear developments and new technologies (lights and electricity) should be looked at in the next phase. Another important next step will be the revision of the landing obligation exemptions for the post 2023 period. Finally, bycatch targets in the Action Plan to Conserve Fisheries Resources and Protect Marine Ecosystems should also be considered.

BREAKOUT INTO WORKING GROUPS

Participants were divided into three heterogeneous groups and asked to reflect on the following topics:

Harmonisation of TAC setting approach between the EU and the UK noting the STECF 22-03 conclusion that "both methods have their pros and cons but neither approach is optimal for management of the exploitation of skates and rays". Given the differences observed between the two methods, how feasible is it that they can be harmonised, and should a third option be considered – e.g., sub-TACs and MAPs?

Sub-TAC for specific species (e.g., listed as prohibitive species) & inclusion of specific species in MAP and development of bespoke management plans for specific species, management approaches including the usefulness of Minimum Landing Size. What process should be put into place to start including elasmobranchs in the MAP? What are the first steps to identify stocks for sub-TACs and/or inclusion in a MAP? Is this a good approach, or should the suggestion of the EWG to see the MAP as an alternative management approach to the current situation be further explored?

Prioritisation of specific species for survivability research. Is it possible to further prioritise this work, or are there any alternatives?

Best practices (avoidance, selectivity, and survival) & socio-economic impacts of changed management plans. Up until now not much progress has been made. How could the proposals made by the EWG be implemented for "Species-specific measures based on the biology and behaviour of skates and rays are a promising ways forward to improve avoidance, selectivity and survival and could these be included in a bespoke management plan"?

PLENARY SESSIONS ON RESULTS FROM BREAKOUT SESSIONS

GROUP 1

The group agreed that the UK method to TAC setting is more in line with the ICES approach, but it is a political decision whether using the UK or the EU approach.

Landings by data could be used for setting sub-TAC for specific species, but this could bring issues in terms of relative stability. Separate TACs could be used to protect vulnerable species, however they might lead to confusion and more discards if not managed properly. More misidentification issues are also likely to arise.

The group agreed that an alternative to the group TAC is needed. The MAP option would allow to take a more regional approach into account with single stock TAC or group TAC for vulnerable species, with additional measures like minimum landing sizes and other biological sensible measures. A proposal was made to raise the minimum landing size to 55 cm. Reflecting on gear considerations, the group was unsure how selectivity could be improved due to lack of biological data. Research should not focus on exemptions to the LO only but consider existing knowledge gaps on gear selectivity.

The group also considered the possibility of aligning TACs to the biannual ICES advice cycle, as it is done for deep sea species.

Overall, the group concluded that single TAC should be established for North Sea thornback ray and NWW cuckoo ray since they are both category 2 stocks. Other stocks should be managed through regional measures, with the possibility to discuss spatial measures such as closed areas.

Regarding survivability research, the group reflected on what the key new survival study would be. Participants agreed on the need for a workshop, looking at how vitality scores can be combined in different metiers. Could vitality scores be used as means to fill data gap? How to do it? This should be a joint meeting of stock assessors and survivability experts, possibly organised by ICES to ensure participation of UK experts. This could also be a relevant exercise in preparation of the new Discard Plan post 2023 to update the exemptions.

Mathies explained that ACs can make recommendations to the Commission but not directly to ICES. The advice requesters, i.e., DG MARE, should put this request forward to ICES. McCully Phillips replied that ICES Working Groups can also make recommendations to ICES ACOM, therefore WGEF could recommend for a workshop to be held on the topic. Batsleer indicated that there could be an opportunity to put this forward to the ACOM in March.

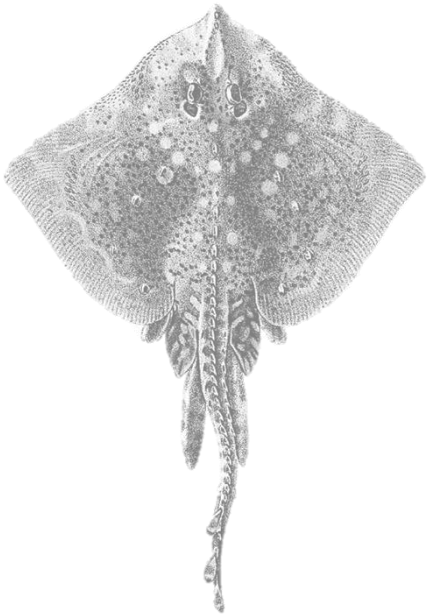
The ACs could also recommend that regional Member States Group request in their Joint Recommendation on the new Discard Plan that the topic of minimum and maximum landing sizes is further explored by ICES.

GROUP 2

The group started by discussing whether TACs are really needed for abundant species and how the ICES advice is translated into TACs and quotas. An alternative TAC framework could be addressed. It is important to realise that there is a wide range of problems across a big geographical range – some areas have problems, some have less of a problem, some species have issues, some don't. It would be interesting to reflect where TACs are actually needed and what would happen if a species had no TAC, what it would mean in terms of management.

Participants pointed out that in some cases TAC setting is not coherent with a stock, e.g. cuckoo ray. The UK method seems more respectful to the species from a manager's point of view.

There could be a more coherent way to think about managing the stocks. Non-quota species can be under very strict management rules, which makes sense if a stock is under pressure. However, it is important to reflect on how a new measure would correspond with the landing obligation. Any new measure must be seen in a biological as well as industrial sense and consequences on both aspects should be taken into account. Participants argued that specific sizes could be prohibited and this could avoid the landing obligation. In the case of spurdog, large females over 1 meter must be released, while the remaining falls under the landing obligation, therefore a size methodology could be possible. The best approach here would probably be to evaluate information on each species and establish how to best to manage each.



It was pointed out that the exploitation of single stocks is not good under group TACs. TACs can cover more than one management area, but they need to match some biological aspects. ICES uses initial landings data to start the advice. If there are any problems at this starting point, then in theory all follow on advice would be compromised. This was an issue for blonde and spotted ray. Therefore, this could compromise stock specific TACs.

Participants noted that the undulate ray benchmark maintained the management area, but this changed for thornback ray and cuckoo ray's was maintained with a caveat.

If a stock was to be protected, high survival should be used in a constructive way, however, this is very species and metier specific.

The group agreed with a proposal to start off with a stock for which solid information is available and identify a single TAC, keeping in mind the need to avoid choke situations. However, it is important to recognise that it is not realistic to assume that all skates & rays stocks could be upgraded to category 1 in the future. Moreover, protected species need to stay protected. In this regard, immediate release continues to be an important measure. Feedback on enforcement of this measure is much needed.

The use of MAPs as alternative to the group TAC is dependent on species and whether they were caught in target fisheries. The need for specific inclusion might be a possibility. Some species could be included in the wider demersal MAP, but it makes no sense to make MAP for stocks on their own, MAPs are for managing fisheries overall.

Participants reflected on whether introducing individual TACs could actually be beneficial or if there would be brought in to manage the commercial fleet only. It was concluded that monitoring is important also for unregulated fisheries to see if a targeted fishery is developing. It would be sufficient to monitor landings, however the issue remains of the lack of capacity to monitor well understood species. Data on discarded prohibited species is lacking. Better indication is needed on which species are associated with which fisheries to identify management measures.

The group then looked at the species on the prohibited species list and highlighted the need for scientific dispensation for these species. There could be a differentiation within the list, such as “untouchable species” and those who are prohibited but managed in terms of retention for scientific purposes.

Regarding data gaps and vitality scores, the group agreed with the need for more samples on vessel mortality. Data quality is important as well.

The discussion led to a recommendation to evaluate all survival studies to date, looking at whether the data behind them is reliable. This is essential to ensure the exemptions to the Landing Obligation can continue and thus chokes can be avoided. Environmental variables should be considered as well. There should be wide acknowledgment that while more data is needed, it also takes time to secure that data.

The group highlighted the real need to promote reporting of bycatch. Moreover, it is important to gather more information on life history that could feed into the IUCN project. An overview of geographical information is also needed.

Focus should be on gears increasing survival and the content of abrasive material in the gear should be reduced. The implementation of the Plastics Directive might have implications in this regard. More attention should be given to the use of lights on gears. Electromagnetic products forcing avoidance should also be investigated, especially in terms of health and safety. Skates and rays behaviour before and after interacting with these gears should be looked at, ensuring that no other predators are attracted to the net. A science-industry partnership should be launched to trial gears with these tools.

Regarding prioritisation of ssurvivability research, it would be helpful to have STECF making a list of what information is lacking and where information is lacking to decide on survivability exemptions. It would be also important to have clearer indications on how much evidence managers want. Participants agreed that survival studies are especially

needed on those species on the prohibited species list. The list could have two appendixes, one with strictly protected species and the other with species potentially available for scientific research permits, which would help data collection. Moreover, all available research should be evaluated to see if some could be referred to other species. It would be important to consider if the data is reliable enough to infer vitality scores to less common species for estimation of survival.

The group finally discussed best practices to improve avoidance, agreeing that there are different selection patterns between fishing gears. Participants mentioned Dutch trials on New Zealand netting which improves the condition of fish brought on board. It was also pointed out that the catch composition affects individuals' conditions. Minimising abrasive material in the gear could increase survival and marketability.

It was agreed that the Technical Measures regulations should be more flexible to allow for the introduction of innovative gears. This in particular would allow fishers and scientists to get together and work on trials. It is very important to facilitate fishers working with institutes and researchers.

Olfaction should be taken into account as any fish in the net is a stimulant. The soak time could limit the interaction, but that needs to be investigated to investigate the behaviour of predatory fish. Lights sound promising but must be better evaluated, including from the socio-economic consequences point of view. Further scrutiny on the effects of lights and other sensory measures is needed. Survival could also be increased by installing water sprays, but this should also be further investigated and discussed with fishers.

GROUP 3

Regarding TAC setting, the group agreed that the UK approach was more precautionary. However, it would be more important to reflect on an immediate issue with the definition of stock and stock boundaries. Participants were in favour of regional and local management, with smaller areas for TACs preferable. Regional policies in this regard are too wide and it makes it easy for a species to fall under the wrong category. For example, restrictions may not be appropriate if a species isn't found in an area.

The option of separating TACs in two different Celtic Sea areas was discussed, as it could better reflect the stock areas. However, separating the TACs could in turn create issues with quotas and relative stability. It is an issue of biological isolation and stock limits. It was also pointed out that the ICES benchmarks planned for blonde, spotted and thornback rays could produce a negative change in category. It would not be realistic to assume that all skates and rays stocks could be upgraded to category 2, as the advice may indicate decrease for next year.

It was argued that the focus should be on species that are important for fishers, for example splitting the TAC for thornback ray could be very interesting. However, it is not clear how this should be done and which would be the impacts. Other participants replied that priority should be given to species at risk. It is also important to acknowledge that not all countries fish the same species.

Overall, everyone agreed that it is essential to have surveys that cover areas widely, applying an ecosystem approach to fisheries. Scientific data needs to be representative of the situation at sea and

should be in accordance with what experienced by fishers. The group agreed that fishers' perception should have a more prominent role in the stock assessment. It is important to consider that there is delay between the information retrieved through fishers perception and its translation into management measures. Mixed fisheries scenarios are quite complex and can have very difficult political implications. It is vital that the scientific information provided ensures fisheries predictability for the sector.

Participants agreed that the incorporation of skates & rays in MAPs should be recommended, as it would provide clarity on their management also with international countries. However, it is important to acknowledge that discussions around this can be quite political.

The group also discussed REM and how it could feed into the scientific assessment. For example, data could be going into national institutes directly. There could be confidentiality issues but more robust estimates are needed and there is also the necessity to investigate how to apply precautionary buffers. Better data would provide better advice.

Participants pointed out that in Belgium there is a project ongoing where all data on board goes directly to a platform only accessible from ILVO. This has proven to be more efficient that CCTV and has been tested in 5 vessels in Belgium and will be scaled to the whole demersal fleet.

Small scale fisheries still remain an issue in this regard, as REM is not mandatory for them. However, REM could be extremely useful simply to know the speed at which a vessel is travelling, which is crucial to spatial and temporal information on fishing effort, which could be very useful to take into account in management choices. It is important to highlight that the scientific data collected with this method wouldn't be used for enforcement purposes, to ensure trust from the fishing sector.

It was agreed that the use of MAPs is no immediate solution – it is very important to discuss implications, thresholds and their rationale. In this regard, a case study approach should be prioritised, looking at management measures for specific stocks and areas which could then be shared and considered for implementation in different areas. It is also important to take into account that gears can be quite different across countries and regions.

Regarding survivability, the group pointed out that a great amount of work has been carried out since 2017, especially in the North Sea. Cuckoo and thornback rays were the most studied species. Participants proposed to first focus on prohibited species and on smaller individuals, providing data on minimum and maximum landing sizes, to prove that survivability has improved. It was acknowledged that studying these rare species can be very difficult and that increasing the number of survivability studies has many practical issues. More specifically, these experiments are complex, expensive and time consuming. However, improving current knowledge is crucial for justifying the exemptions to the landing obligation. Information on existing exemptions needs to be updates and reinforced and participants agreed that, in this regard, it is important to be pragmatic. If two species are similar and co-occur in the same fishery, there should be flexibility to incorporate information from one into the other, exploiting these intra-species connections.

It was argued that a change of focus could be helpful, deriving patterns that can be applied more widely rather than focusing on each species. For example, this could be easily applied to handling practices. However, participants agreed that the implementation of best practices on board is questionable.

Reflecting on the socio-economic aspects, members pointed out that there is massive shortage of experts on the topic. However, TAC setting can have huge knock-on socio-economic effects. Future planning is lacking, but it would be useful and important to carry out "what if" exercises and consider cause-effect scenarios to better understand the impact of exemptions and TAC changes.

Focusing on the last question, the group agreed that there are some projects ongoing focusing on sensory behaviour, but they are very expensive, with high technological investments, and are not prioritised in any countries. For example, research is ongoing on the use of magnet and lights to improve selectivity, but it is not clear how these technologies could impact target species. Scent could be another important element to consider for sharks. It was pointed out that ORE developments could provide information on electromagnetic effects on fish. Finally, participants mentioned the "Let there be light" project, funded by the EMFF and implemented in Belgium, which is doing selectivity tests with lights in the net. The project is still ongoing, and it is too soon for results at the moment.

PLENARY SUMMARY & NEXT STEPS

At the start of the meeting the delegates were asked to say in one word what, in their opinion, the most important issue is that they would like to address in the day's workshop.

This resulted in the following:

- Sense of urgency
- Complexity: species and areas
- Collaboration
- TAC-setting – single-species
- Geographical scale
- Prioritisation: knowledge gaps and species
- Localised fisheries
- Co-management

During the presentations and discussions, the group addressed most of the issues that were identified in the morning. The breakout groups discussed came up with recommendations.

Addressing the specific questions asked at the breakout group sessions:

- When comparing the EU and UK methods for TAC setting it seems that the UK method follows ICES advice more closely, this method was extensively used in the December consultations for setting the fishing opportunities 2023.
- Developing management plans, or including skates and rays in the current MAPs, seems to be a good way forward. For example, one group made a stepwise approach starting with the a single-TAC for those stocks for which we have the most information and developing alternative management options for the other species. Other groups had similar ideas, including developing 'what if' scenarios to identify socio-economic benefits. A suggestion for a roadmap was presented at the start of the meeting. Referring to the 'sense of urgency' expressed at the start of the meeting, this process could and should be started in the short term.
- Workshops, hosted by ICES, to address specific issues were suggested:
    - to address survivability - bringing together all available information on survival, vitality and metiers in order to identify data gaps and develop proxies for species survivability without having to research all species-metier combinations;
    - to address best-practices - assimilating all available knowledge on the biogeography of skate and ray species in order to identify areas or life-stages where it would be necessary and possible to avoid catching individuals.
- There was a high level of collaboration and cooperation at the meeting and the group came up with a number of concrete proposals as a way forward. This is a format which could be repeated in the future.

CLOSE

Mo Mathies, Executive Secretary NWWAC

Mathies thanked Walker and all participants for their contributions. She explained that the workshop results will be discussed within the NWWAC/NSAC Focus Group on Skates & Rays in order to develop recommendations to the Commission.

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