WORKING GROUP ON SCIENCE TO SUPPORT CONSERVATION, RESTORATION AND MANAGEMENT OF DIADROMOUS SPECIES (WGDIAD; OUTPUTS FROM 2020 MEETING)

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Contents

i Executive summary

Working Group on Science to Support Conservation, Restoration and Management of Diadromous Species (WGDIAD, formerly WGRECORDS), was established to provide a forum for the coordination of work on diadromous species following the disbanding of the Diadromous Fish Committee. The role of the Group is to coordinate work on diadromous species, organize Expert Groups, Theme Sessions and Symposia, and help to deliver the ICES Science Plan.

The Annual Meeting received reports from ICES Expert Groups and workshops working on diadromous species, and considered their progress and future requirements. During the meeting, the following areas were discussed in more detail:

- Outcomes and deliverables from ICES EGs on diadromous fish during the last year;
- A progress report on the International Year of the Salmon (IYS);
- A progress report of the work of the Intersessional Sub Group Diadromous fish (ISSG Diad) of the Regional Coordination Groups (RCGs). The subgroup has a coordinating function and identifies data collection needs for diadromous species in relation to the EU data collection regulation;
- The ongoing work within ICES to evaluate the stock assessment methods used by individual countries in their national eel management plans, and the importance of coordination at the international level;
- A report from The Workshop on relevant geographical area on the temporal migration patterns of European eel (WKEELMIGRATION), in response to the EU request for ICES advice on the effectiveness of the fishing closure periods set up by the Member States in view of deciding on possible future measures to further enhance the protection and recovery of the stock of European eel;
- A theme session proposal for the ICES ASC 2022, to be submitted in 2021, on exotic species (and stocks) and their affect on native species and their fisheries;
- A discussion on a formal ICES/WGDIAD link with diadromous fish scientists in the Pacific within organizations such as the North Pacific Marine Science Organization (PICES) and North Pacific Anadromous Fish Commission (NPAFC);
- A report from The Workshop on Evaluating the Draft Baltic Salmon Management Plan meetings (WKBaltSalMPI and II) on the progress developing a salmon management plan for the Baltic Sea;
- A discussion on collaborating with other ICES EGs relevant to diadromous fish such as Working Group on Biological Parameters (WGBIOP);
- And establishing links with organizations outside ICES working on diadromous fish such as the World Fish Migration Foundation and the International Union for Conservation.

ii Expert group information

Expert group name	Working group on Science to Support Conservation, Restoration and Management of Diadromous Species (WGDIAD)
Expert group cycle	Multiannual fixed term
Year cycle started	2018
Reporting year in cycle	3/3
Chair(s)	Dennis Ensing, UK
	Hugo Maxwell, Ireland
Meeting venue(s) and dates	1-3 September 2020, online meeting (23 participants)
	10 September 2019, Gothenburg, Sweden (42 participants)
	25 September, Hamburg, Germany (39 participants)

1 Summary of work plan

Year 1	Coordinate scientific activities (theme sessions, symposia, EGs, CRRs and reports to EPDSG)
Year 2	Coordinate scientific activities (theme sessions, symposia, EGs, CRRs and reports to EPDSG)
Year 3	Coordinate scientific activities (theme sessions, symposia, EGs, CRRs and reports to EPDSG)

2 List of outcomes and achievements of the WG in this delivery period

2.1 Meetings held in 2020

The Working Group on Science to Support Conservation, Restoration and Management of Diadromous Species (WGDIAD, formerly WGRECORDS) was established to provide a scientific forum in ICES for the coordination of work on diadromous species. The role of the Group is to coordinate work on diadromous species, organize Expert Groups, Theme Sessions and Symposia, and help to deliver the ICES Science Plan.

The annual meeting of WGDIAD was held remotely (by WebEx) from 1-3 September 2020, and chaired by Hugo Maxwell (Ireland) and Dennis Ensing (UK). There were 23 participants in total from nine countries (Annex 1) who participated in the meeting for at least one of the days. For working groups and workshops that were not represented at the meeting, presentations were given by the WGDIAD chairs.

2.2 Opening of annual meeting and adoption of the agenda

The agenda (Annex 4) for the annual meeting was adopted.

2.3 Summary outcomes of the meeting

Outcomes from meetings and activities during the last year include:

- Compilation and discussion of work carried out by EG's under the WGDIAD umbrella, and consideration of their progress and future requirements;
- Coordination of a proposal for a theme session at ICES ASC in 2022, focusing on exotic species and their affect on native species and fisheries for native species ;
- Links with other relevant EGs in ICES;
- An update on the International Year of the Salmon (IYS);
- An update from the Regional Coordination Group (RCG) Intersessional Sub Group Diadromous Fish (ISSG Diad) meetings held at 2020;
- A discussion on the Living Planet Index (LPI) For Migratory Freshwater Fish Report;
- A discussion on a proposal to form a collaborative link with the Pacific diadromous fish scientific community.

3 Reviews of expert groups on diadromous species

During 2020, WGDIAD has coordinated the activities of four Expert Groups and three Workshops related to diadromous species, including three ACOM EGs and three ACOM Workshops. Separate summaries are presented below. At the end of some of the summaries, notes from the post-presentation discussions at the WGDIAD meeting have been added for the record.

3.1 WGEEL – Joint EIFAAC/ICES/GFCM Working Group on Eel

The Joint EIFAAC/ICES/GFCM Working Group on Eel (WGEEL), chaired by Jan-Dag Pohlmann, Germany, met by correspondence via WebEx, from 21 – 28 September, to address five Terms of Reference set by ICES, EIFAAC and GFCM. 47 experts attended the meeting, representing 20 countries, along with a representative of the EU Commission DG MARE.

The Working Group used data and information provided in response to the ICES Eel Data Call 2020 (from 22 countries) and 18 Country Report Working Documents submitted by participants.

For the first time, the annual meeting was held by video conference due to the COVID-19 crisis. Given the lack of experience with this format and the implied uncertainties, the WG started work early and allocated time to a number of tasks prior to the official start of the meeting.

The general concept was well received and some, mostly preparatory, tasks (e.g. data analyses, organization of the workflow, literature surveys) could be at least partly addressed before the meeting. However, it is was generally difficult to dedicate time prior to the meeting as well as during the meeting. The remote format put significant restrictions on communications, exchange and social interactions.

Given the right framework, remote meetings could prove a valuable tool to prepare for EG meetings and provide more time for analyses, discussions and agreements prior to and during the, yet irreplaceable, physical meeting.

The recruitment of European eel from the ocean remained low in 2020. The glass eel recruitment compared to the period 1960–1979 was 0.5 % (provisional) in the North Sea and 6.5 % (provisional) in the Elsewhere Europe series, based on available dataseries (not all series complete). Statistical analyses showed that glass eel recruitment stopped declining in 2011 but remains at a very low level thereafter. For the yellow eel dataseries, no value was reported for 2020 since data collection was still ongoing; the final value for 2019 was 17 % of the level during the reference period.

Landings data were updated according to those reported to the WGEEL, either through responses to the 2020 Data Call or in Country Reports, or integrated by WGEEL using data from its previous reports. As some countries have not reported all their landings, even the raised versions reported here should be considered as minima.

Glass eel fisheries within the EU takes place in France, UK, Spain, Portugal and Italy. Commercial glass eel landings have declined from 2000 tonnes in the 1980s, to around 60 t each in 2019 and 2020, with 55 t in France, Portugal and Spain alone.

Yellow and silver eel landings are not always reported separately, so they are combined here. The total (reconstructed) commercial landings of yellow and silver eels decreased from approx. 20 000 tonnes in the 1950s to reported landings of 2696 t in 2018 (reported by 20 countries) and

2093 t in 2019 (17 countries reporting in time for WGEEL). The average landings of yellow and silver eel from 2014-2018 was 2679 t.

Recreational catches and landings are poorly reported; thus, amounts must be treated as minima but were estimated as 0.66 t for glass eel in 2020, and 245 t for yellow and silver eel combined in 2018 (11 countries reported) and 241 t in 2019 (10 countries reported). Overall, the impact of recreational fisheries on the eel stock remains largely unquantified and while trends over time might be informative, data does not suggest total landings (as reflected in the single reporting from France in 2006, based on an expert estimate, which effectively doubled recreational landings reported from all countries in this year).

Aquaculture production of eel increased until the end of the 1990s, peaking at approx. 8000 t in the mid-2000s, but started to decline to 4000-5000 t today. It should be noted that eel aquaculture is based on wild recruits, and part of the production is subsequently released as on-grown eel for stocking (around 10 million eels in 2016, which, if assuming a mean weight of 20 g would equate to about 200 t. Reporting thereafter is incomplete).

Restocking data for 2019 and 2020 were incomplete at time of writing because some restocking programmes were ongoing or countries known to have restocking programmes did not fully reply to the data call. The numbers therefore refer to the respective last year when most countries reported. Note also, that reporting of restocking is complex and there are inconsistencies in the way countries report restocking (which is why WGEEL classifies them as releases); these issues are constantly being addressed (e.g. updates on data from previous years are reported) in order to improve the data quality, possibly causing inconsistencies with previous reports.

Restocking of glass eel peaked in the 1980s with amounts > 100 million glass eels in some years but was followed by a steep decline until 2009 (2.6 t). The amount of glass eels restocked increased until 2014 (49 t, lower market prices guaranteed that glass eels could be purchased for fixed stocking budgets) but decreased thereafter to 32 t in 2018. Total releases of all life stages show a similar development (since dominated by glass eel), with annual releases around 20 - 30 million individuals since 2015.

Further progress was made in terms of recruitment analysis, using a Bayesian assessment model (GEREM), structured to allow the existence of potential different trends among regions, and provide absolute recruitment per zone. The preliminary analyses confirm the trend in recruitment, points out the need of new time-series of recruitment and could provide part of the analytical assessment of the stock in the future.

A first analysis of yellow and silver eel series and their biometric data, has been conducted but there is a large spatial variability of trends of abundance among locations; yet, the analysis of the long-term time-series shows that current silver eel abundance is low when compared to the pre-1980 levels. The analysis of biometric data allowed a first analysis but remains inconclusive and points out missing fields in data collection. Thus, it is considered a work in progress at this time. In the 2021 ICES Data Call on eels, in addition to yearly updates, data on biomass, mortalities and habitat will be requested. This additional data collection is aligned with the tri-annual progress report on the eel management plans to the European Commission by EU member states and has previously been collected in 2018. In preparation of the 2021 data call, WGEEL reviewed the issues that emerged during the last call for these data and drafted a technical proposal for the collection of these additional data.

Emerging threats and opportunities that have been reported over the past decade were reviewed, and diseases, parasites, contaminants and hydropower were identified as routinely reported and thus established threats. Climate change was repeatedly reported in the past; yet, knowledge remains limited. Therefore, it was suggested to possibly broach the issue of climate change,

specific for eels (or possibly all diadromous species), at a theme session of a scientific conference or symposium.

Moreover, the threat of the UK's exit of the EU has raised concerns regarding the accessibility of glass eels for stocking and the potentially increased availability of glass eel from the UK being traded illegally to Asia. The issue of COVID-19 was addressed and impacts were found to fall largely in three categories: i) scientific monitoring, ii) restocking programmes and iii) closures/delays in commercial fishing and loss of markets.
Following their standing annual activity on non-fishery impacts on the stock, the WG has examined the impacts of habitat loss in 2020. The WG i) reviewed the literature on the effects of habitat loss with a focus on the biological processes operating, ii) the national Eel Management Plans and (latest) triannual assessments identifying whether and to what extent the effects of habitat loss have been considered, iii) develop a work plan aiming at the quantification of habitat loss and its effect on eel production in the coming years, and iv) present a number of actual case studies. The review of the effects of habitat loss on the eel stock, indicated that those effects are noted in many studies, in national assessments and Eel Management Plans, but rarely fully accounted for in assessing the state of the stock. Due to the lack of appropriate data, a meaningful quantitative assessment was, however, not possible at the time and therefore it was recommended to include information on the issue in coming data calls (though noting that this is impossible given the current workload and can be done at the earliest in 2022).

The stock annex has been reviewed and updated.

Notes to WGDIAD: Several points were raised during the annual WGEEL meeting for the attention of WGDIAD:

1. Though part of the ICES Report, the Stock Annex is often used as a stand-alone document; it should therefore be considered to assign a separate DOI to the Stock Annex.
2. The ICES ecosystem overviews miss part of the range of the European eel (e.g. the Mediterranean)and input to the generic ToR on ecosystem overviews from other actors (i.e. EIFAAC/GFCM) is requested.
3. The issue of climate change and in particular its specific effects on the European eel stock remain largely unquantified, though potentially important. Since this is likely the case for other diadromous species it should be considered by WGDIAD to follow up on this, possibly in the form of a study group or a future ASC theme session.

Notes from WGDIAD: The group discussed the importance of long-term time-series and the effects of not maintaining these would have for diadromous EGs in general, including WGEEL. WGDIAD supports all efforts to maintain or expand these time-series. With regards to EU data collection the RCGs have started a project to strengthen regional work plans for collection of eel data.

3.2 WKEELMIGRATION – Workshop on the Temporal Migration Patterns of European Eel

The **Workshop on the temporal migration patterns of European eel (WKEELMIGRATION)** was formed to answer the questions posed by the European Commission on the temporal migration patterns of European eel in EU areas. The group was chaired by Alan Walker (UK) and met in Copenhagen, Denmark, 4–6 February 2020. A total of 12 experts attended the physical meeting, but a total of 16 people contributed to the report.
In order to support the European Commission in assessing the effectiveness of the fishing closure periods set up by the Member States and in view of deciding on possible future measures to further enhance the protection and recovery of the stock of European eel, ICES was requested to

give – to the extent possible – advice per relevant geographical area on the temporal migration patterns of European eel, namely:

a) The period of arrival of European glass eel on the different EU shores and the peak time, and whether this has changed substantially since before 2007; ideally the information would be provided by eel management unit (EMU), if not possible then at the next higher aggregate level; areas outside the EU are not to be covered.

b) b) The period of escapement of European silver eel from the different relevant regions in the EU towards the Sargasso Sea and the peak time, and whether this has changed substantially since before 2007; Ideally the information would be provided by EMU, if not possible then at the next higher aggregate level; areas outside the EU are not to be covered.

c) The period of migration of the yellow eel, when relevant, through different relevant regions in the EU and the peak time (when, and from and to where yellow eels migrate), and whether this has changed substantially since before 2007; Ideally the information would be provided by EMU, if not possible then at the next higher aggregate level; areas outside the EU are not to be covered (Idem as question 1). This question is not directly linked to the EU marine fisheries closure but more generally to the Eel Regulation and eel fisheries.

d) In the relevant cases, the period when migrating eels need to pass through narrow passages (e.g. such as the exits of the Baltic and Mediterranean) on the way to their destination, and whether this has changed substantially since before 2007.

e) Furthermore, ICES is requested to assess whether the closure periods set up under the national Eel Management Plans prior to the EU temporal closure are consistent (in terms of periods of the closures) with the periods established following the EU closure. ICES is therefore requested for glass/silver, yellow and silver eel fisheries, to describe (i) the fishery closure periods per EMU area in place from 2000 to 2007, (ii) any changes introduced through EMPs, and (iii) in response to the EU closures in 2018 and 2019.

ICES was requested to coordinate its work with the GFCM so as to avoid possible overlaps or contradictions with the upcoming GFCM research programme.

The group explored data supplied from EU Member States and Norway on time-series of fishery landings and eel monitoring, and reviewed the scientific literature to describe the period and the peak time of abundance of glass, yellow and silver eel stages across EU regions and through narrow straits and whether these have changed substantially since implementation of Eel Management Plans, and whether fishery closures in 2018 and 2019 follow the relevant EC/GFCM temporal closure periods.

There are seasonal and geographic patterns of migration of immigrating recruits (glass eel plus older stages) and emigrating silver eel. Typically, recruits arrive later further north along the Atlantic coasts and much later in the Baltic, whereas arrival patterns in the Mediterranean are more complex.

Silver eel emigrations follow the reverse pattern, typically starting earlier at the furthest distances from the oceanic spawning grounds. Migration typically starts in autumn, there may be a reduction during the cold winter, and may resume again in spring. There appears to be a spring emigration in the Baltic region that can be more pronounced than elsewhere.

The yellow eel situation is more complex and difficult to examine as they do not typically follow discrete migrations. There may be seasonal redistributions of yellow eel in some waters but there was an absence of obvious latitudinal patterns and seasonalities.

There were very few differences in seasonality suggested by comparisons of before and after the EMP implementation. There were only very limited data from which to make these comparisons, but the WK did not identify any biological reasons why substantial differences might have happened.

There were limited data to examine the seasonality of glass and silver eel passage through the narrow water areas of the Baltic and Mediterranean, and the English Channel, but patterns suggested by tracking studies were consistent with migration patterns of nearby areas.

Before 2017, seasonal closures of fisheries were implemented in some countries in the context of their national eel management plans. In 2018 and in 2019, the EU promulgated some measures to restrict eel fishing seasons. Closures in these three periods differed widely in timing and duration, and also with regards to different eel life stages, fishing types, habitat types, and implementation in the whole or only part of an EMU. Most of the fishery closures implemented in 2018 appeared to follow the requirements of the EC closures for that time. It was difficult to ascertain whether or not closures in 2019 appeared to follow the requirements during the 2019/2020 period, but these warrant further investigation before drawing strong conclusions.

In general, uncertainties remain because limited data complicate comparisons across the desired continental geographic scale, across 20 years, and for multiple eel life stages. The WK is confident that it had access to the best available data from fishery landings and monitoring studies, albeit that the complexities of aquatic habitats, their definition and delineation, and life stages complicated analyses. However, the description of fishery closures was more complicated than envisaged, for example it was difficult to make comparisons at EMU-spatial scale because closures are rarely complete across the whole EMU but instead may target certain eel stages, fishing gears or waterbodies within an EMU, and consequently further work is recommended to fully document and analyse these.

The WK has addressed the ToR with the available data and information, but highlighted gaps in the knowledge that limited its ability to provide complete answers.

Notes from WGDIAD: The group noted there are several recommendations in this report regarding data collection on eel that could be relevant to ISSG Diad. An official response from the EC has not been received yet and it would be better to wait for that before taking these forward. WGEEL should comment on the EC response when this becomes available. The ISSG Diad chair present at the WGDIAD meeting expressed an interest to bring any suggestions regarding data collection to the attention of that group. There was also a consensus at the WGDIAD meeting that WGEELMIGRATION should endeavour to publish their findings in a peer-reviewed journal.

3.3 WGBAST – Working Group on Baltic Salmon and Trout

The Baltic Salmon and Trout Assessment Working Group [WGBAST] chaired by Martin Kessler (Estonia) met remotely (by WebEx), 31 March – 8 April 2020. A total of 25 experts from all nine Baltic Sea countries attended the meeting.

The Baltic Salmon and Trout Assessment Working Group was mandated to assess the status of salmon in the Gulf of Bothnia and Main Basin (subdivisions 22–31), Gulf of Finland (Subdivision 32) and sea trout in subdivisions 22–32, and to propose consequent management advices for fisheries in 2021. Salmon in subdivision 22–31 were assessed using Bayesian methodology with

a stock projection model (data up to 2018) for evaluating affects of different catch options on the wild river stocks.

Section 2 of the report covers catches and other data on salmon in the sea, and summarizes information affecting the fisheries and management of salmon. Section 3 reviews data from salmon spawning rivers, stocking statistics and health issues. Status of salmon stocks in the Baltic Sea is evaluated in Section 4. The same section also covers methodological issues of assessment as well as sampling protocols and data needs for assessment. Section 5 presents data and assessed stock status for sea trout.

- Total salmon catches have decreased continuously since the 1990s, although more slowly in recent years. The fishery related mortality for salmon in 2019 (including estimates of unreported, misreported and discarded catches and recently revised estimates for recreational trolling) decreased considerably compared to 2018. This is mainly due to significant decrease of misreporting in the open sea fishery. Reported efforts in commercial salmon fisheries have also remained historically low.

- The number of estimated misreported salmon as sea trout decreased to 600 in 2019 compared to 42 600 in 2018.

- The share of recreational catches of Baltic salmon in sea and rivers has increased over time, and at present, they represent about half of the total fishing mortality. In particular, the offshore trolling fishery for salmon has developed rapidly since the 1990s and early 2000s. According to updated estimates, the total landed (retained) catch from recreational trolling has in recent years ranged from about 15 000 to 25 000 salmon per year.

- Since the 1990s, production of wild salmon smolts has gradually increased in the Gulf of Bothnia and Gulf of Finland. For most rivers in the Gulf of Bothnia, smolt production is predicted to decrease slightly in 2020. Long-term trends for smolt production in southern Main Basin rivers have remained stable or slightly decreasing.

- The current (2019) total wild production in all Baltic Sea rivers is about 2.8 million smolts, corresponding to about 73% of overall potential smolt production capacity. In addition, about 4.7 million hatchery reared smolts were released into the Baltic Sea in 2019.

- Over time, an increasing proportion of the wild salmon stocks have reached the management target (75% of potential smolt production capacity) with high or very high certainty, especially in the northern Baltic Sea. Also in the Gulf of Finland, wild Estonian rivers show recovery. As assessed previously, most weak stocks are located in the Main Basin. Several of the rivers in this area are far below a good state, and have showed a negative development in recent years.

- The exploitation rate of Baltic salmon in the commercial sea fisheries has been reduced to such a low level that most stocks (for which analytical projections are currently available) are predicted to maintain present status or recover at current levels of fishing pressure and natural mortality. However, due to local environmental issues, many weak stocks are not expected to recover without longer term stock-specific rebuilding measures, including fisheries restrictions in estuaries and rivers, habitat restoration and removal of potential migration obstacles. In particular, nearly all Main Basin stocks require such measures.

- M74-related juvenile salmon mortality increased in hatching years 2016–2018, but is expected to again decrease somewhat in spring 2019. It is hard to predict future levels of M74. Recent disease outbreaks and fish with apparent lack of energy, resulting in large numbers of dead spawners and low parr densities in some wild rivers, is another future concern. Most alarming is the situation in Vindelälven and Ljungan where parr densities have collapsed. Despite ongoing research, the reason(s) behind the deteriorating salmon health remains largely unknown.

- Some positive development can be seen for sea trout in the Baltic Sea region, but many populations are still considered vulnerable. Stocks in the Gulf of Bothnia are particularly weak, although spawner numbers and parr densities show signs of improvement. Status for sea trout stocks is generally higher in most of the Main Basin and in southern Gulf of Finland. Populations in Lithuania and Germany are weak, however, probably in part due to natural causes, but they are also affected by coastal fishing.

- In general, exploitation rates in most fisheries that catch sea trout in the Baltic Sea area should be reduced. This also holds for fisheries of other species where sea trout is caught as bycatch. In regions where stock status is good, existing fishing restrictions should be maintained in order to retain the present situation.

Notes from WGDIAD: The group noted and welcomed the marked decrease in misreporting of salmon as sea trout in the Baltic in 2019 compared to previous years. In the discussion the view of the experts was that this change is probably due to a ban on sea trout catches seaward of the four nautical mile limit. Additional causes could be reduced fishing effort due to poor weather conditions during the fishing season, seal predation, and an increased inspection regime. It will be interesting to see how this develops in the coming years.

The work on an EU management plan for salmon in the Baltic is discussed below in the next section.

3.4 WKBaltSalMP – Workshop on Evaluating the Draft Baltic Salmon Management Plan

The Workshop on Evaluating the Draft Baltic Salmon Management Plan (WKBaltSalMP I) met at ICES HQ in Copenhagen, Denmark, on 4-5 November 2019, chaired by Stefan Palm (Sweden) and Eskild Kirkegaard (Denmark). A total of 20 persons attended, including ICES experts, managers from Baltic Sea countries (BALTFISH) and stakeholder representatives. The overall aim was to scope efforts needed in order to evaluate the draft of a multiannual management plan for the salmon stocks in the Baltic Sea, proposed by BALTFISH, and to respond to the associated specific request from the EC.

The second meeting (WKBaltSalMP II) took place 24–28 February 2020 at BIOR Fish Resources Research Department in Riga, Latvia. Thirteen experts attended, including one invited external reviewer. Most of the time at this meeting was devoted to discussions and planning of the final reporting and advice. However, during one afternoon (February 26th) results were presented and discussed with manager and stakeholder representatives (eight additional persons participating).

WKBaltSalMP 1 was tasked with the following ToRs:

a) Clarify the essential factors in the draft management plan upon which basis ICES will give advice. This should include principal discussions regarding:
   1. Use of the current MSY proxy vs. river-specific MSYs as management targets;

2. "Adequate timelines" for stocks to achieve management targets, including whether biological reference points (PSPC) and estimates of current smolt production should be based on the most recent year or an average of several years;
3. Probability levels of attaining management targets.

b) If required following on the discussions under ToR a), identify potential modifications to the proposed management plan that would improve its effectiveness.

c) Produce a clear plan and timeline

As requested, information on river size and estimated potential productivity was compiled and updated following consultation with national experts within ICES WGBAST (Baltic Salmon and Trout Assessment Working Group). Existing and alternative reference points for assessment of stock status and fishing opportunities were also examined. The group concluded that the currently used targets (50% and 75% of the potential smolt production capacity, PSPC) are inconsistent with the overall objective in the draft plan of achieving maximum sustainable yield (MSY). As a precautionary reference point R_{lim} was evaluated, defined as the lowest level of smolt production from which the stock would be expected to recover to its specific MSY-level (R_{MSY}) in one salmon generation, if all fishing was completely closed.

Simulations developed specifically for the workshop allowed evaluation of requested recovery rates of individual wild salmon stocks under alternative commercial fishing scenarios. The simulations examined commercial harvest rates ranging from 0 to 0.9 (encompassing rates that gives maximum yield in the commercial sea fisheries, located between 0.2 and 0.3; Figure 1), with additional values examined below 0.1 to better illustrate impacts on less productive river stocks.

Neither the EC request nor the draft multiannual plan specify criteria for when (i.e. with what probability) a target has been reached. Therefore, stock-specific tables with simulation-based probabilities of smolt production being above alternative targets for each fishing scenario are presented. These analyses only included river stocks currently assessed analytically by ICES. For remaining stocks, such river-specific probabilities could not be determined.

For river stocks not assessed analytically, correlative analyses between total estimated sea survival and recruitment over generations were performed. These results indicate that sea survival seem to play an important role in the development also for these stocks, similar to for those currently included in the ICES model.

A simplified stable-state population dynamics model was constructed to study trade-offs between mixed (sea) and stock-specific (river) fisheries in terms of achievable catches and proportions of stocks above/below reference points. This analysis illustrated that when the mixed fishery harvest rate is low all river stocks can achieve MSY, whereas when this harvest rate increases, smaller (less resilient) stocks fall below this target. That some smaller stocks fall below MSY (or even move towards extinction) does not make a noticeable difference to the total yield. Hence, there exists an inbuilt conflict between overall production aims and protection of weak stocks that can only be resolved if mixed-stock sea fisheries for Baltic salmon are kept at a low level.

The report also contains requested comments on the draft management plan. The workshop identified that the draft has a strict focus on commercial sea fisheries, although the relative importance of recreational fisheries for Baltic salmon has increased significantly over time. The current two management units for EU commercial fisheries (subdivisions 22 to 31 and Subdivision 32) are further maintained in the draft, whereas evidence has accumulated that salmon are migrating between these areas more than previously recognized. The draft finally does not address management of hatchery-reared Baltic salmon more than marginally, despite large ongoing releases for various purposes in most countries.

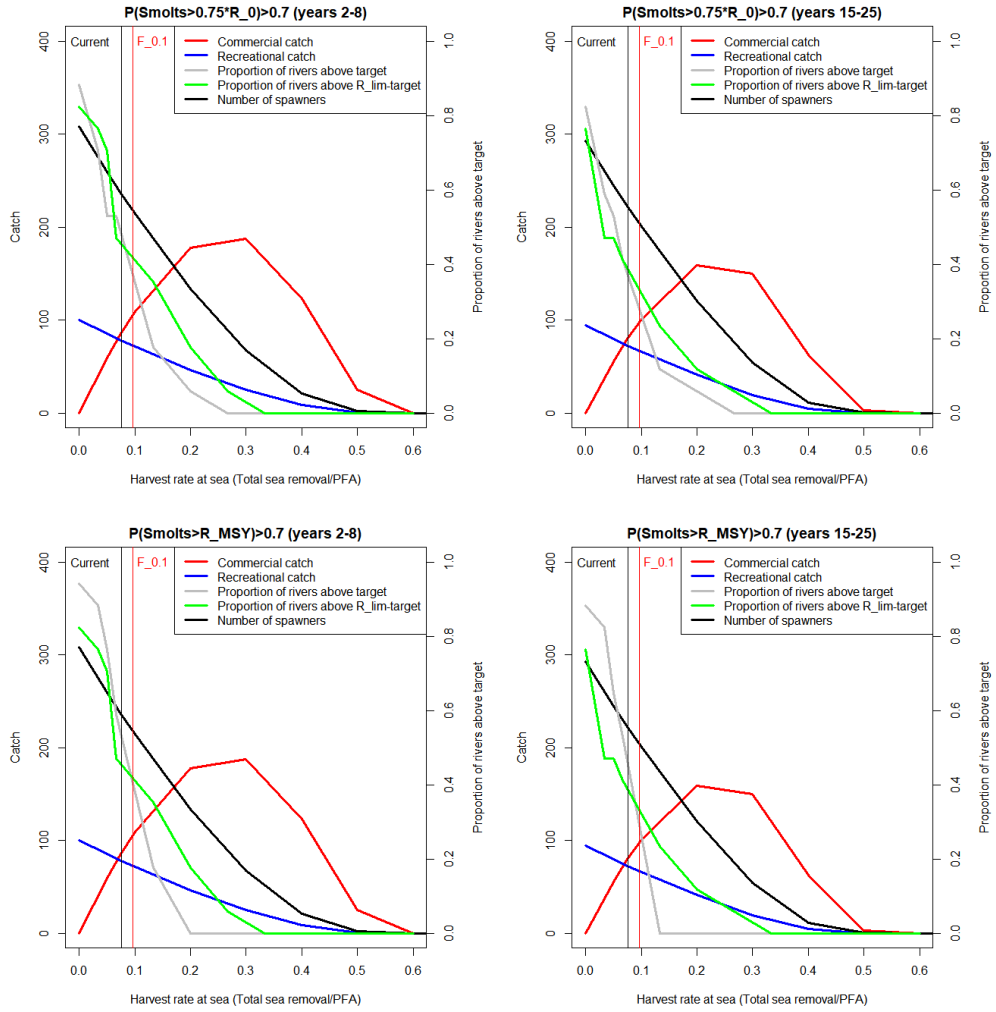

Figure 1. Trade-off between number of rivers meeting different management objectives, total number of spawners in rivers, and the commercial catch at sea. Panels show different combinations of applied target (i.e. 0.75×R_0-proxy and stock-specific R_{MSY}; cf. Figure 4.2.1) and time frame (2–8 and 15–25 years). Green line shows the number of rivers for which P(Smolts >R_{lim}).

Notes from WGDIAD: There was a discussion around the topic of Baltic Sea mixed-species fisheries in relation to this work. It was suggested experts in that particular field should see this report and comment on it. The group also noted that the need for this work in the Baltic Sea highlights how important the work of the North Atlantic Salmon Conservation Organisation (NASCO) has been in managing high seas fisheries for salmon in the Atlantic.

3.5 WGNAS – Working Group on North Atlantic Salmon

The Working Group on North Atlantic Salmon [WGNAS] chaired by Martha Robertson (Canada) met in via web conference, 24th of March–2nd of April 2020. There were in total 33 participants, representing 12 countries from North American Commission (NAC) area and the North-East Atlantic Commission (NEAC) area: Canada, USA, Iceland, Norway, Finland, Ireland, UK (England and Wales), UK (Scotland), UK (Northern Ireland), and France. Information was also provided by correspondence from, Faroes, Portugal, and Spain for use by the Working Group.

WGNAS met to consider questions posed to ICES by NASCO and also generic questions for regional and species Working Groups posed by ICES.

In summary of the findings of the Working group on North Atlantic Salmon:

In the North Atlantic, exploitation rates on Atlantic salmon continue to be among the lowest in the time-series.

Nominal catch in 2019 was 868 t. This was 179 t below the updated catch for 2018 (1047 t) and 294 t and 437 t less than the previous five and ten year means, respectively.

The provisional estimate of farmed Atlantic salmon production in the North Atlantic area for 2019 was 1750 kt; production of farmed Atlantic salmon in this area has been over one million tonnes since 2009 and in 2019 provisional worldwide production of 2504 kt was almost 3000 times the catch of wild Atlantic salmon.

In 2019, in five European countries, incidences of red spots and rashes on the underbelly (with cases of external lesions, ulceration and haemorrhaging) on returning fresh-run salmon were observed. The disease was mainly reported in 1SW fish in the period from late May to mid-August. In response to this emerging issue, a workshop was hosted by the Norwegian Institute for Nature Research (NINA) in November 2019. It was agreed the disease be named 'red skin disease' (RSD). Discussions took place on establishing diagnostic criteria and surveillance and sampling protocols for RSD. It was agreed that a common international database of records would be set up to track future occurrences of RSD. A full report on RSD has been published.

Specific for the NEAC area, exploitation rates on NEAC stocks continue to decline and catches in 2019 were 743 t. This was 217 t below the updated catch for 2018 (960 t) and 26% and 35% below the previous five-year and ten-year means respectively. Northern NEAC stock complexes, prior to the commencement of distant-water fisheries, were considered to be at full reproductive capacity. The southern NEAC stock complexes however, were considered to be suffering reduced reproductive capacity.

Specific for the NAC area, the 2019 provisional harvest in Canada was 94 t, approximately 19% higher than the finalized 2018 harvest of 78 t and the second lowest in the time-series since 1960. The majority of harvest fisheries on NAC stocks were directed toward small salmon. In recreational fisheries, large salmon could only be retained on 16 rivers in Québec.

In 2019, 2SW returns to rivers for all regions of NAC were suffering reduced reproductive capacity.

The continued low and declining abundance of salmon stocks across North America, de-spite significant fishery reductions, strengthens the conclusions that factors acting on survival in the first and second years at sea, at both local and broad ocean scales are constraining abundance of Atlantic salmon.

In Greenland, a total catch of 29.8 t was reported for 2019 compared to 39.9 t in 2018. North American origin salmon comprised 71.5% of the sampled catch.

There are no mixed-stock fishery options at West Greenland in 2018, 2019 and 2020 that would be consistent with a 75% probability or greater of simultaneously meeting the management objectives for the seven stock complexes.

The Working Group previously reviewed developments in modelling and forecasting the abundance of Atlantic salmon using the Bayesian life cycle model. The life cycle model improves on the stock assessment approach currently used by ICES to estimate abundance of post-smolts at sea before any fisheries. In 2020, no major update was provided. The computational speed of the model was slightly improved. A comparison of results provided by PFA models and the life cycle model is in preparation.

The Regional Database and Estimation System (RDBES) will replace the current ICES Regional Database (RDB) and InterCatch systems. RDBES does not currently support recreational catch data. However, data standards are essential and there may be schema structures currently within

RDBES that could be applied to the Atlantic Salmon Data Call and database format. The Working Group and RDBES Steering Group will continue to liaise to facilitate future opportunities to align.

2020 was the first year a standardized data call was issued to WGNAS member countries/jurisdictions. The Data Call should provide data that can be used by the WGNAS to address the NASCO request. In previous years, the data requested in the Data Call would have been compiled by members of the Working Group and summarized in the report. The ICES Data Call resulted in more prompt and more complete reporting for some countries where in the past the collation of catch data had been difficult and incomplete.

Outgoing chair is Martha Robertson (Canada), incoming chair is Dennis Ensing (UK).

Notes from WGDIAD: A workshop lead by jurisdictional experts and modellers to train the participants in the use of the life cycle model and to formalize the workflow of the new modelling framework will take place from the 5th to the 8th of January 2021 via teleconference.

3.6 WKSALMON – Workshop for North Atlantic Salmon At-Sea Mortality

Reductions in marine survival have been implicated as the primary reason for the North Atlantic pattern of declines in Atlantic salmon abundance over the past five decades. With the goal to improve the scientific assessments and advice for the conservation of wild Atlantic salmon (*Salmo salar* L.) in the North Atlantic, ICES in consultation with NASCO convened a series of workshops (WKSALMON, Chairs: Gérald Chaput (CA) and Niall Ó Maoiléidigh, (IRL) to explore how best to integrate available data on salmon for use in models to advance the conservation of wild salmon at sea.

WKSALMON was given the following ToRs:

a) Identify data sources that could inform estimates of at-sea salmon mortality and the associated available data, including data from North Atlantic salmon as well as ecosystem data (such as oceanographic time-series, plankton surveys, International Ecosystem Summer Survey in the Nordic Seas (IESSNS), pelagic or demersal fish surveys);
b) Develop a 'data call' that will integrate these sources with existing ICES databases;
c) Evaluate the appropriateness of data and methods used to estimate at-sea salmon mortality;
d) Identify data gaps and develop recommendations for future data acquisition;
e) Evaluate modelling approaches to integrate marine data fully to cover the whole life cycle of Atlantic salmon in the context of the 'Likely Suspects' Framework (see http://www.nasco.int/sas/pdf/archive/papers/2018/SAG_18_04_AST%20Likely%20Suspects%20Framework%20Update.pdf);

WKSALMON organized a scoping workshop in Copenhagen, Denmark, on 24-28 June 2019, with 24 participants from nine different countries for the purpose of identifying data sources that could inform estimates of at-sea salmon mortality as well as ecosystem data including oceanographic time-series, plankton surveys, pelagic or demersal fish surveys that de-scribe the marine ecosystem occupied by Atlantic salmon.

Reductions in marine survival have been implicated as the primary reason for the North Atlantic pattern of declines in Atlantic salmon abundance over the past five decades. With the goal to improve the scientific assessments and advice for the conservation of wild Atlantic salmon (Salmo salar L.) in the North Atlantic, ICES in consultation with the North Atlantic Salmon Conservation Organisation (NASCO) convened a series of workshops to explore how best to

integrate available data on salmon for use in models to advance the conservation of wild salmon at sea. The first workshop (WKSalmon) was held 24–28 June 2019 for the purpose of identifying data sources that could inform estimates of at-sea salmon mortality as well as ecosystem data including oceanographic time-series, plankton surveys, pelagic or demersal fish surveys that describe the marine ecosystem occupied by Atlantic salmon.

Atlantic salmon populations are broadly distributed in the western and eastern continental areas of the North Atlantic (42 to 68°N). There are extensive population-specific data on life-history traits including growth rates, maturation, marine survival and fisheries exploitation across the distributional range of the species. Reconstructions of abundance extending five decades are available for regional groups of populations. Atlantic salmon is a pelagic marine species, and groups of populations from the North Atlantic utilize common feeding areas at key points of the marine phase. The absence of synoptic and systematic marine surveys for Atlantic salmon preclude a full understanding of its distribution and population dynamics at sea.

Knowledge of marine ecosystem components relevant to Atlantic salmon including physical and biological oceanography, prey, competing species, and potential predators is extensive although the temporal (seasonal, annual) and spatial scales of coverage of these data are highly variable and does not overlap with the entire anadromous phase of salmon. The physical oceangraphic features monitored by remote sensing including sea surface temperature and indices of primary production have the highest spatial resolution, and the broadest domain coverage that encompasses the entire North Atlantic and months when salmon are at sea. The indices of secondary production have a broad spatial and temporal coverage, but a lower resolution compared to remote sensing indices. The pelagic fish community is sparsely sampled, with the best coverage in the Northeast Atlantic for May, and July–August and no current coverage in the Northwest Atlantic.

The options for testable hypotheses are constrained by the availability and representativeness of monitoring data for the components of the marine ecosystem occupied by Atlantic salmon. Few of the datasets described, in particular for Atlantic salmon, are readily available as open data or from websites. The most readily available data are for climate indices and physical oceanographic features. The large amount of ecosystem information is compiled and maintained within a diverse community of scientific experts with to date limited cross fertilization and networked analyses. The time-scales and spatial scales of observations are variable, of differing complexity requiring a range of analytical skill sets, but seemingly extractable with some concerted effort.

A second workshop is currently being planned for February 2021.

Notes from WGDIAD: The group noted apparent delays withinWKSALMON as since June 2019 no further WKSALMON meetings have been held, although WKSALMON planned to hold a modelling workshop during 2020. Since the 2020 WGDIAD annual meeting it has become clear to the WGDIAD chairs this workshop has now been provisionally scheduled for February 2021.

3.7 WGTRUTTA – Working Group with the Aim to Develop Assessment Models and Establish Biological Reference Points for Sea Trout (Anadromous *Salmo trutta)* Populations

Summary of Year 3 – 2019 – for WGDIAD

Sea trout are the anadromous migratory form of the brown trout (*Salmo trutta*) which go to sea to feed and mature as adults prior to returning to spawn, usually in their natal rivers. Extensive overviews of sea trout fisheries and biology have been prepared for ICES by the Study Group on Anadromous Trout (SGAT) (ICES, 1994) and the Workshop on Sea Trout (WKTRUTTA,

WKTRUTTA2); (ICES, 2013, 2016). This Working Group builds on the scene-setting work of WKTRUTTA 1 and 2.

Stock declines, e.g. in areas where marine mixed-stock fisheries prevail (e.g. the Baltic) and where there is salmon farming, have raised concerns about our lack of knowledge of the complex and variable life cycle of this species. Sea trout have historically taken second place to Atlantic salmon in national fishery assessment programmes and management priorities. As a result relatively few sea trout stocks have been studied for sufficient time to allow the development of population models.

By using abundance data from different life stages, information on habitat quality and fisheries data etc., the Working Group will develop and evaluate different ways to model sea trout populations. Models taking into account e.g. habitat variation within rivers and between catchments, occurrence of lakes, migration obstacles and resident trout etc. will be evaluated. Biological Reference Points (BRPs) will be developed and considered across the natural range of sea trout.

The WG is delivering through 3 subgroups (SG):

SG1: Database group
SG2: Population models, examining the effects of salmon, and resident trout
SG3: Trout recruitment vs. habitat score systems/Stock recruitment relationships based on sea trout life history

The fourth meeting of the WGTRUTTA took place in Dorchester, UK from 25 February to 1 March, 2019. The meeting was chaired by Johan Höjesjö (Sweden) and Alan Walker (UK). The meeting was attended by 15 experts from eight countries. The sub groups presented on progress to date and their plans for the workshop and coming months.

<u>SG1 Database</u>

The purpose of the database (DB) is to inform the WG what data are available, and is to compile information from a selection of rivers across Europe with long-term data on parameters such as juvenile densities, habitat characteristics and, if available, abundances of ascending spawners and out-migrating smolts, in order to:

- facilitate the development of population dynamic models about sea trout;
- provide basic information on population dynamics and life history variation of sea trout in different areas and stream types;
- facilitate identification of geographical areas with data deficiencies (e.g. absence of stock-recruitment data and/or habitat mapping) that hampers the development of assessment methods;
- prioritize regions or specific areas for future monitoring and research programs.

Two database (DB) templates have been prepared: Environmental Data and Bio-ecological Data.

The database structure is complete, having been developed to take account of all the requests by other SGs regarding information required about sea trout rivers and their stocks. Recognizing the vast amount of potentially useful data but the limited time and resource available to work on filling the database, the WG decided that the DB should be as encompassing as possible, including index rivers/data plus others, but also for data providers to highlight data that are available but where they don't have the time to input.

A questionnaire to capture details of the methods used to sample trout and habitat characterization revealed few common methodological approaches that are uniform across all countries. The majority of fish sampling is done at 'whole site' scale though some is targeted at selected habitat types within the site. Most fish sampling is of a specified wetted area rather than for a unit of

time. The number of electrofishing passes varies from one to three, depending on sampling method and objectives. Most surveys target both trout and salmon. Surveys are conducted mostly in spring and autumn, but some in summer. Habitat characterization has been documented by water velocity, depth, substrates, aquatic vegetation, shade and slope. Velocity is most often measured only through observation. The same applies to substrate, aquatic vegetation and shade. In a further complication there seems to be substantial variation in the substrate classes and categorizations, for example the granularity size classes and shade. In contrast, depth is typically directly measured. Slope is most often measured from maps or a GIS.

The SG are liaising with ICES and their Regional Database and Estimation System (RDBES) working towards a time when ICES will host the WGTRUTTA DB.

Overall, the sea trout database, consisting of both environmental and bio-ecological components, was completed and populating it with data are well underway. The WG has further created an inventory of data collection methods across the distribution area highlighting the fact that there are few common and uniform methodological approaches across all countries. An inventory of PIT tagging infrastructure has also been created and will be made available via a mapping tool.

<u>SG2 developing population models examining effects of resident trout and salmon</u>

A literature review manuscript entitled "Brown trout *Salmo trutta*: a review of ecological factors affecting the abundance and life history of anadromous fish" has been published in Fish and Fisheries, providing the necessary tool for validating and developing population models. It remains challenging to identify resident vs. anadromous origin, and to predict future life history - while growth rate is implicated it is not a simple predictor.

The original plan to review or develop population models that would explicitly account for the interaction between freshwater resident and migratory brown trout was not pursued because it was found that several sea trout models are available or are being developed elsewhere. A new model on climate change effects would be useful, but is unlikely in the next year (2021) because not enough is known about the explanatory relationships. A theoretical Bayesian Population Dynamics Model for Baltic Sea Trout was identified, having been partly developed in Finland. This model was not fully developed and tested during the WG term, but this is anticipated within the next WG term.

A document on knowledge gaps and associated research requirements has been drafted listing potential research projects grouped under themes such as life history, assessment of state, management of impacts; climate change; ecosystem services and socio-economics.

Finally, two papers have been produced using a set of length-based indicators in different catchments to assess the status of a stock and identify where pressures may have had an impact (Shephard *et al.*2018, 2019).

<u>SG3 developing the trout habitat scoring system (THS)/ SG4 developing stock recruitment (SR) life history</u>

In October 2018, Subgroups 3 and 4 merged and identified four task areas to address the ToRs:

1. Identify key rivers across Europe with suitable data that could be used for establishing or developing models (index rivers) (ToRa);
2. Carryout a stock indicator/pressure state analysis of individual stocks and the underlying cause and effect mechanisms (ToR b);

3. Develop and build on the Swedish THS model, available electrofishing data and other sea trout stock dynamics data, such as S/R or pseudo S/R to build a Bayesian sea trout population model (ToRb);
4. Bring the outcomes forward into a management framework and/or the development of BRPs, either local or regional (ToR c).

To acquire good data from smolt emigration rates existing PIT tagging infrastructure in rivers throughout the distribution area can be used. WGTRUTTA partners provided nine such catchments for incorporation into the DB.

In 2018 SG3 developed a set of indicators to assess the status of a stock using index catchments and identify where pressures may have had an impact and caused a change based on the work of WKLIFE who summarized a set of length-based indicators (LBI) and reference points (RP). Tested on six rivers it was concluded that LBIs are useful to give an overview of changes in stock structure.

Potential smolt production capacity of rivers was evaluated by combining the THS Model with juvenile trout density data. THS was initially categorized according to substrate, velocity, shade and riparian complexity. The THS models developed with data from Sweden, testing the importance of different habitats and adding other descriptor variables (such as Latitude and Longitude), demonstrated that stream width and depth were important as continuous variables and by adding covariates such as distance to the sea, latitude, longitude and altitude, the model explained 75% of the variation. A model based fry and parr abundance, including the THS and Lat and Long was the best fit. The Random Forest model with depth, altitude, distance to the sea, lat, long, and year explained much of the variation in juvenile trout density, but a linear model may be more appropriate when extending the geographic area outside Sweden.

A breakpoint analysis was applied to 0^+ trout data from Northern Irish rivers that were expected to be dominated by sea trout rather than resident trout to identify potential reference levels. This was successful for THS score 1, 2 and 3 but not 0. This suggests it is worth testing this outside the Baltic.

Stock recruitment relationships using data counts, returning stock estimates, catches, and juvenile abundance surveys for sea trout populations within catchments were explored by applying several curve fitting approaches (including Beverton-Holt, Ricker, Hockey Stick). These relationships could be used as a Biological Reference Points (BRP) for sea trout but no single model/curve was shown to be a universally good fit for all catchments; instead a suite of tools may be more promising, especially if they can be grouped around a relatively limited number of possible stock recruitment relationship. The challenges of developing and applying a BRP approach to sea trout throughout Europe is proposed to be a major task for the next WG term.

Other issues.

WGTRUTTA has come to the end of its three-year cycle and a resolution to ICES has been submitted and subsequently approved for a second term running from 2020-2023.

Notes from WGDIAD: Stock assessment is complicated by the identification of sea trout as salmon and vice versa. Several people sitting on both WGTRUTTA and WGBAST. For the next 3 year term beginning in 2021, WGTRUTTA would like to see some of the tools developed in the WG to be applied/explored in WGBAST. The final report from WGTRUTTA (which was due 31/12/2019) has been published as of 15th of May 2020.

4 New Expert Groups

A workshop to harmonize reporting on key commercial eel fisheries was discussed in WGEEL in 2019 to be held in 2020 but this has been postponed until 2021 for now to allow some clarification about data requirements.

4.1 Proposed/approved for 2021

The Workshop for Salmon Life Cycle Modelling (WKSalModel) is a new EG approved for 2021. WGNAS has developed pre-fisheries abundance (PFA) run reconstruction and forecast models of abundance of Atlantic salmon at the stock complex (North America; South Northeast Atlantic, North Northeast Atlantic) and regional scales (for six regions in North America; for 8 jurisdictions in Southern NEAC; for 7 jurisdictions in Northern NEAC) for the provision of ICES catch advice for NASCO and to better understand population dynamics. A new Bayesian Life Cycle model has been proposed to improve the biological realism and to advance exploration of factors that are driving salmon abundance. The Life Cycle model development is led by Etienne Rivot (Institut Agro, France) and several collaborators (Maxime Olmos, Rémi Patin, Pierre-Yves Hernvann) using WGNAS data.

Following discussions at the 2020 WGNAS meeting, and in preparation for a future Benchmark, and the application of the Life Cycle model by WGNAS for the assessment and multiyear catch advice, a workshop of jurisdictional experts and modellers to develop competencies in using the Life Cycle Model and to formalize the workflow of the new modelling framework was recommended to take place in late 2020 or the latest January 2021.

The Workshop for Salmon Life Cycle Modelling (WKSalModel), co-chaired by Etienne Rivot (Institut Agro, France), Gérald Chaput (DFO, Canada) and Dennis Ensing (AFBI, UK) will meet by web conference 5–8 January 2021 to address the following ToRs:

a) Advance the Bayesian Life Cycle model for the assessment of North Atlantic salmon (Salmo salar);
b) Train ICES experts in the use of this Life Cycle model, that is currently coded in R and NIMBLE (https://r-nimble.org/);
c) Improve and formalize the workflow from data specification, preparation, and maintenance to the production of the assessment and for provision multiple year forecasts and catch advice;

WKSalModel will report to ICES WGNAS in March 2021 and by 24 April 2021 for the attention of ACOM.

5 Theme Sessions and Symposia

5.1 Theme sessions

A tentative proposal for a Theme Session for the 2022 ASC focused on species which inhabit or move through transition zones , either permanently or as a gateway between freshwater bodies and the sea and how these species can be affected (disrupted) by non-native species (be they introduced, exotic, invasive or alien). The focal point of the theme session would be on the disruptions to and changes in previously commercially viable fisheries in these transitions zones. This would not be limited to anadromous or diadromous fisheries but rather any fishery or cultivation (arthropods, algae etc.) affected by the presence of non-native species. The theme session would be split into two subgroups with a morning session on algae and invertebrates and an afternoon session on vertebrates. This proposal for a theme session was discussed on the back of the recent increases of pink salmon abundance in the Atlantic. Dennis Ensing and Hugo Maxwell agreed to convene the session. This proposal will be submitted before summer 2021 deadline. We see this as an opportunity for an exchange of ideas, information and new techniques for data collection and management of non-native species (new fisheries) as well as methods for habitat restoration.

5.2 Symposia

There were no specific proposals for symposia, but it is interesting to note a final wrap-up IYS symposium is currently being planned.

6 International Year of the Salmon (IYS)

The IYS is an international framework for collaborative outreach and research, and is conceived as an intensive burst of internationally coordinated, interdisciplinary, stimulating scientific research focused on salmon and their relation to people. New technologies, new observations, and new analytical methods, some developed exclusively during the IYS, will be focused on knowledge gaps that prevent a clear understanding of the future of salmon in a rapidly changing world. Activities under the IYS framework culminated during 2019, but research and outreach will continue through to 2022.

Primary Partners of IYS are the North Pacific Anadromous Fish Commission (NPAFC) and North Atlantic Salmon Conservation Organization (NASCO) - international inter-governmental organizations established to conserve anadromous salmon in the North Pacific and Atlantic oceans respectively http://www.npafc.org/new/science_IYS.html and //www.nasco.int/iys.html

An update on specific activities under IYS relevant to the WGNAS, WGDIAD, ICES and NASCO is provided below.

1. The "Likely Suspects" conceptual framework for evaluating marine mortality in Atlantic salmon has now resulted in the establishment of the ICES Workshop for North Atlantic Salmon At-Sea Mortality (WKSALMON, see section 3.6 of this report).
2. A NASCO working group was established to produce the State of North Atlantic Salmon report, which was published on December 13th 2019.
3. The symposium 'Managing the Atlantic salmon in a rapidly changing environment – management challenges and possible responses' was held alongside the NASCO Annual Meeting on June 3-4 2019 in Tromsø, Norway, and the proceedings are expected to be published as part of the outreach programme under IYS.
4. A workshop held in Vancouver, Canada, in January 2019 focused on identifying representative time-series of data and associated meta-data to understand salmon status and trends. The aim of the Workshop is to determine how well or poorly these datasets represent salmon status and trends for reasonably broad geographic areas. The primary goal of this workshop will be to identify a series of legacy datasets and standards associated with major categories of data. Later, a separate workshop will focus on identifying the coastal and high seas climate and oceanographic data that can be linked to salmon data.

Since the WGRECORDS meeting in September 2016, Wojciech Wawrzynski (Head of Science Support) and Niall Ó Maoiléidigh (SCICOM Member) are now the ICES representatives to IYS and will be feeding information back to WGDIAD and other WGs as becomes available.

At the meeting an update on IYS was provided by IYS Director for the North Pacific Region Mark Saunders. Although the IYS focal year 2019 has passed some interesting events happened during 2020. Particular highlights were the 2019 and 2020 marine surveys targeted to better understand Pacific salmon winter ecology in the Gulf of Alaska.

7 Proposals for Publications

There were no specific proposals for publications.

8 Update from the Intersessional Sub Group Diadromous fish (ISSG Diad) of the Regional Coordination Groups (RCG)

The Intersessional Sub Group Diadromous fish (ISSG Diad) of the Regional Coordination Groups did not physically meet during 2020, but instead met multiple times by teleconference. Membership of the group consists currently of 21 experts representing 11 EU Members States and one ICES member. Members are nominated by the National Correspondents. The group is chaired by Tapani Pakarinen (Finland).

ISSG Diad reported (by WebEx due to agenda clashes) to the RCG Baltic and RCG North Atlantic, North Sea and Eastern Artic. ISSG Diad was also represented at the RCG Liaison Meeting and Decision Meeting, as well as the meeting of the Scientific, Technical and Economic Committee for Fisheries (STECF).

The overall task of the ISSG Diad is to progress development of the regional work/sampling plans for data collection for diadromous species/stocks (Atlantic salmon in the Atlantic and Baltic, sea trout in the Baltic, European eel throughout its natural range) and quality assurance of those data. For 2020 the following tasks were set by the RCGs in the Liaison and Decision Meeting:

- Work towards regional sampling plans (depending on FishPi2 outcomes).
- Work towards a pilot study to identify a standardised method for the collection of catch and biological data on recreational fishing for eel, both retained and released catch
- Investigate levels and effects of mis- and unreporting of diadromous fish in fisheries
- Work with end-users on issues such as evaluation of electrofishing programmes for salmon and sea trout, and establishment of Data Quality Assurance Systems for diadromous fish.
- Work with the end-users and the RDBES steering group and developers to make best use of the RDBES
- Continue work with end-users on selection of index rivers (= water bodies) for eel, and sea trout (Baltic)
- Keep abreast of Data Calls for diadromous fish
- Consider the collection of economic data of migratory species in freshwater
- In the Baltic investigate different possibilities to share costs between countries with few and countries with many salmon rivers according to their stock exploitation level

ISSG Diad did not make much progress on the 2020 tasks due to the Covid-19 pandemic, as was reported at the WGDIAD meeting.

Further points related to ISSG Diad that were discussed were:

- Plans to ask MSs to deliver proposals for index rivers for eel, including yellow eel surveys
- Need for improved communication between ISSG Diad and end-users
- Regionally important species that are not considered under DFC, e.g. sea trout (outside the Baltic Sea area), shad, lamprey, smelt etc.
- The need to further improve communication between ISSG Diad and ICES, specifically regarding the issue on how questions from ISSG Diad get transferred to the WGs and the way ICES Secretariat picks up recommendations from ISSG Diad and transfers them to the relevant EGs.

9 Future coordination of Science on Diadromous Species

9.1 Participation in Fisheries Resources Steering Group (FRSG) meeting during the ASC

Because of the postponement of the 2020 ICES ASC there was no official Fisheries Resources Steering Group (FRSG) meeting in 2020.

9.2 Atlantic – Pacific Diadromous fish science link

After discussions in 2019 there was consensus that WGDIAD should reach out to diadromous fish scientists beyond the Atlantic basin and establish some form of collaboration. This idea was worked on intersessionally and cumulated in Mark Saunders of the North Pacific Anadromous Fish Commission (NPAFC) joining the 2020 meeting to discuss possible avenues for collaboration, not just with the NPAFC but with the wider scientific community working on diadromous fish in the Pacific. The group agreed that WGDIAD, ICES, and Mark Saunders should work on a proposal for this collaboration intersessionally.

Since the WGDIAD meeting in September several meetings have been held between various parties in order to advance these ideas. The overall objective is to establish a formal and permanent link between the scientific communities of the North Atlantic and North Pacific working on diadromous fish to exchange ideas on methodologies, create novel ways to mobilize data, establish networks, and organize symposia. It will specifically aim to form a community of practice for the North Pacific and North Atlantic diadromous species scientific communities to share ideas and priorities and to collaborate on scientific methods and the development of related symposia/workshops, as well as to create new infrastructure to maximize diadromous fish data mobilization.

This Pacific-Atlantic diadromous fish science link could possibly be part of the United Nations Decade of Ocean Science for Sustainable Development (2021-2030), which aims to create a new foundation, across the science-policy interface, to strengthen the management of the ocean. But further discussions on how to shape and position this link are required before a decision can be made whether to submit a proposal.

9.3 Links with other EGs

The working group would like to strengthen links with relevant non-diadromous fish groups such as the Working Group on Biological Parameters (WGBIOP), Working Group on Application of Genetics in Fisheries and Aquaculture (WGAGFA), Working Group on Recreational Fisheries Surveys (WGRFS) and Working Group on Environmental Interactions of Aquaculture (WGEIA).

The group noted that currently a salmon scale exchange between institutes is underway to calibrate the ageing of salmon using scales, under the banner of WGBIOP. For now this is limited to the Baltic, but there has been communication between the WGDIAD chair and the scientists leading this work to expand this to the Atlantic in the future. The group also noted that such an exercise would also be useful for sea trout.

9.4 Links with groups outside ICES

The working group expressed a desire to intensify links with the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) and Mediterranean groups involved in the management of eel.

In addition the working group took note of The Living Planet Index (LPI) for migratory freshwater fish Technical report 2020. This is an initiative of the World Fish Migration Foundation, commissioned to the Zoological Society of London. A discussion was had on why WGDIAD had not been involved in this report as ICES EGs would have been able to provide data for such initiatives. It was agreed that the most likely reason for this was the fact that the authors of this report were largely unknown to members of WGDIAD. It was therefore suggested that WGDIAD should reach out to this group and try to establish a working relationship for future collaboration. On a related topic it was also noted that some diadromous fish are on the International Union for Conservation of Nature Red List. This is another organization where WGDIAD has no formal links with and could benefit from data and expertise from ICES diadromous fish EGs. Here too a suggestion was made for WGDIAD to endeavor to establish a link with this organization.

10 Election of officers

Dennis Ensing (UK) was re-elected as co-chair for the period 2021-2023.

11 Any other business

There was no other business.

The next meeting will be held during the ICES ASC 2021 in Copenhagen, Denmark, at a date to be confirmed between 6-9 September 2021.

The meeting was closed at 17.30.

12 References

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Annex 1: List of participants

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Annex 2: Terms of Reference

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Raise the profile of the group by maintaining international scientific co-operation in the study of diadromous fish species and provide a mechanism through which issues relating to these species and their environment, including also aspects connected to estaurine and fresh water habitats used by these species, can be addressed and coordinated within the ICES science plan.	There is a need to coordinate and draw the various elements of ICES work together to support the management advice provided for multiple species of diadromous fish, particularly in delivering commitments under various regulations, including the EU-Habitats and Water Framework Directives and the EU Eel Regulation.	1.4; 2.1; 3.1	Year 1, 2 and 3	Report of the WG and maintenance of a previously established network of diadromous fish experts.
b	Identify scientific needs and propose activities, including experts groups, theme sessions and symposia, to support the implementation of the Science Plan and the work of SCICOM and ACOM Experts Groups on diadromous species and review their outputs.	ICES is well placed to coordinate scientific activities which generate up to date information on the biology and ecology of diadromous species, threats to their status, including climate change, and advice on measures to be taken to restore habitats and ecosystems, and rebuild depleted populations.	1.7; 5.1; 6.1	Year 1, 2 and 3	Organise theme sessions, symposia or expert groups. Co-ordinate feedback from these sources for use in publications and CRR documents. Liaise with and support chairs of EGs and WKs to achieve their aims.
c	Assist EPDSG and ICES to integrate important activities with those of other Expert Groups reporting to EPDSG, other SGs and/or ACOM.	Issues relating to, for example, rare and data limited species are widely dispersed across the ICES Science plan. This group provides a focal point for both internal and external communication and reporting of new developments and concerns regarding diadromous fish.	4.4; 5.2; 5.4	Year 1, 2 and 3	Keep ICES abreast of important issues relating to Diadromous fish species and ensure these issues are communicated within the ICES community to relevant EGs and SGs.

Annex 3: New Resolutions

The working group drafted new resolutions for the period 2021-2023:

Working Group on the Science to Support Conservation, Restoration and Management of Diadromous Species (WGDIAD)

The **Working Group on Science to Support Conservation, Restoration and Management of Diadromous Species** (WGDIAD), chaired by Dennis Ensing, UK (2021-2023), and Hugo Maxwell, Ireland (2019-2021) will meet by correspondence and annually at the ICES ASCs in September 2021, 2022 and 2023 to work on ToRs and generate deliverables as listed in the Table below.
WGDIAD will report on the activities of each year to FRSG by 31 December of that year.

Terms of Reference

a) Collate and publish an inventory of working groups and international research programmes in the study of diadromous fish, as a framework to promote exchanging resources, approaches, and best practices;

b) provide a mechanism through which issues relating to diadromous fish species and their environment, including also aspects connected to estuarine and freshwater habitats used by these species, can be addressed and coordinated within the ICES science plan;

c) Identify scientific needs and propose activities, including experts groups, theme sessions and symposia, to support the implementation of the Science Plan and the work of SCICOM and ACOM Experts Groups on diadromous species and review their outputs and list recommendations and/or conclusions

d) Assist FRSG and ICES to integrate important activities with those of other Expert Groups reporting to FRSG, other SGs and/or ACOM.

ToR descriptors[1]

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
a	Collate and publish an inventory of working groups and international research programmes in the study of diadromous fish, as a framework to promote exchanging resources, approaches, and best practices.	There is a need to coordinate and draw the various elements of ICES work together to support the management advice provided for multiple species of diadromous fish, particularly in delivering commitments under various regulations, including the EU-Habitats and Water Framework Directives, Data Collection Multi Annual Programme, and the EU Eel Regulation, but also in exchange of ideas, discussing different approaches, and promoting best practices.	Ecosystem science, Impacts of human activities, Observation and exploration, Conservation and managemant science	Year 1, 2 and 3	Report of the WG and maintenance of a previously established network of diadromous fish experts.
b	Provide a mechanism through which issues relating to diadromous fish species and their environment, including also aspects connected to estuarine and freshwater habitats used by these species, can be addressed and coordinated within the ICES science plan.	WGDIAD brings together experts in the field of diadromous fish ecology, management, and conservation. Through the mechanism at the group's disposal the particular issues of diadromous fish management are addressed anc coordinated in accordance with the ICES Science Plan	Ecosystem science, Impacts of human activities, Observation and exploration, Conservation and managemant science, Emerging techniques and technologies, Seafood production	Year 1, 2 and 3	Organize theme sessions, symposia or EGs. Liaise with experts of other EGs, and relevant sources outside ICES on issues relevant to diadromous fish, and report back on these activities in the annual report

[1] Avoid generic terms such as "Discuss" or "Consider". Aim at drafting specific and clear ToR, the delivery of which can be assessed

c	Identify scientific needs and propose activities, including experts groups, theme sessions and symposia, to support the implementation of the Science Plan and the work of SCICOM and ACOM Experts Groups on diadromous species and review their outputs and list recommendations and/or conclusions.	ICES is well placed to coordinate scientific activities which generate up to date information on the biology and ecology of diadromous species, threats to their status, including climate change, and advice on measures to be taken to restore habitats and ecosystems, and rebuild depleted populations.	Ecosystem science, Impacts of human activities, Observation and exploration, Conservation and managemant science, Emerging techniques and technologies, Seafood production	Year 1, 2 and 3	Organize theme sessions, symposia or expert groups. Coordinate feedback from these sources for use in publications and CRR documents. Liaise with and support chairs of EGs and WKs to achieve their aims.
d	Assist FRSG and ICES to integrate important activities with those of other Expert Groups reporting to EPDSG, other and/or ACOM.	Issues relating to, for example, rare and data limited species are widely dispersed across the ICES Science plan. This group provides a focal point for both internal and external communication and reporting of new developments and concerns regarding SGs diadromous fish.	Ecosystem science, Impacts of human activities, Observation and exploration, Conservation and managemant science, Emerging techniques and technologies, Seafood production	Year 1, 2 and 3	Keep ICES abreast of important issues relating to Diadromous fish species and ensure these issues are communicated within the ICES community to relevant EGs and SGs.

Summary of the Work Plan

Supporting information

Priority	The Working Group will provide the mechanism to coordinate scientific activities relating to diadromous fish species and their environment in support of the ICES Science Plan. It will also permit ICES to respond fully to requests from NASCO and the EU/FAO/IUCN/CITES for scientific advice on management strategies, research needs and data deficiencies.
Resource requirements	Meeting facilities at the ASC in 2021-2023, including teleconferencing facilities
Participants	National representatives and other invited experts working with diadromous species
Secretariat facilities	Secretarial support for organization of the meeting and preparation of the report.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	The proposal originates from FRSG but will have direct significance to ACOM for advice from WGNAS, WGBAST, and WGEEL in particular.
Linkages to other committees or groups	Besides FRSG, there are linkages to the SCICOM Steering Groups Ecosystem Observation, Human Activities, Pressures, and Impacts, and Ecosystem Processes and Dynamics and all Expert Groups working on issues of relevance for diadromous species in relation to improving scientific understanding and coordinating scientific activities.
Linkages to other organizations	NASCO, FAO, EIFAAC and GFCM, HELCOM, CITES, NPAFC.

Annex 4: Agenda for WGDIAD 2020

Annual meeting - Working Group on Science to Support Conservation, Restoration and Management of Diadromous Species [WGDIAD]

Chair: Dennis Ensing and Hugo Maxwell

1-3th September 2020 14.00-18.00 (CET), by WebEx

Agenda:

Tuesday September 1st

14.00 – 14.15 Welcome and Introductions

14.15 – 14.30 Adoption of the Agenda and Appointment of a Rapporteur

14.30 – 14.40 WGDIAD ToRs for 2018 to 2020

14.40 – 15.00 Intersessional Activities 2019-2020

15.00 - 16.00 Presentation and discussion WKEELMIGRATION – Workshop on relevant geographical area on the temporal migration patterns of European eel: Alan Walker.

16.00 – 16.20 Break

16.20 – 17.20 Presentation and discussion WKBaltSalMP - Workshops on Evaluating the Draft Baltic Salmon Management Plan: Stefan Palm.

17.20 – 18.00 ASC Theme Session proposals for ASC 2022 and symposia: Hugo Maxwell.

Wednesday September 2nd

14.00 – 15.00 Presentation and discussion WGEEL – EIFAAC/ICES/GFCM Joint Working Group on Eel : Jan-Dag Pohlmann.

15.00 – 16.00 Presentation and discussion WGBAST – Working Group on Baltic Salmon and Trout: Martin Kesler ?

16.00 – 16.20 Break

16.20 – 17.20 Presentation and discussion WGNAS – Working Group on North Atlantic Salmon: Hugo Maxwell.

17.20 – 18.00 Presentation and discussion WKSALMON - Workshop for North Atlantic Salmon At-Sea Mortality: Dennis Ensing.

Thursday September 3rd

14.00 – 15.00 Presentation and discussion WGTRUTTA/WGTRUTTA2 – Working Group on Sea Trout: Johan Höjesjö

15.00 – 15.30 Proposals for new Expert Groups

15.30 – 16.00 Update on International Year of the Salmon (IYS): Dennis Ensing.

16.00 – 16.20 Break

16.20 – 16.30 Update from the EU DCF Regional Coordination Groups Intersessional Group Diadromous fish (ISSG Diad): Marko Freese.

16.30 – 17.15 The Way Forward discussion

- THE LIVING PLANET INDEX (LPI) FOR MIGRATORY FRESHWATER FISH Report

- How can we increase attendance and promote work on diadromous species within ICES?
- Links with non-diadromous EGs (WGBIOP, WGAGFA, etc.)
- North Pacific Anadromous Fish Commission (NPAFC)/PICES

17.15 – 17.30 WGDIAD 2021-2023 resolutions

17.30 – 17. 45 Election new co-chair

17.45 – 18.00 Any Other Business

18.00 Close Meeting