Restructured FIP plans and for December 15, 2019 deliverables

Goal 1 - Plan to Reassess and Monitor the Achievement of Management Targets for Pink and Chum Salmon Production in the Amur Region.

Background

Goal 1 of the Comprehensive Fishery Improvement Plan (FIP) for Ukhta Pink and Chum Salmon Fisheries requires that a plan be developed by December 2019 that describes how pink salmon management targets will be reassessed (ForSea Solutions, 2019). This plan will also include a strategy to determine if pink salmon are meeting these management targets on an annual basis.

Although this focus of Goal 1 in the FIP work plan is pink salmon, these efforts were expanded to include chum salmon. This is the result of finding that existing management targets are likely based on outdated and inaccurate information. Further, there is concern that current methods for estimating chum salmon abundance are too imprecise for management purposes and the Amur fishery was closed in 2019 due to forecasted low summer chum salmon returns. Therefore, this plan will address Goal 1 objectives for both pink and chum salmon.

Area and Salmon Stocks

To facilitate the development of this FIP, the assessment unit has been geographically partitioned into three fishery management areas (Figure 1.1). The first of these is by far the largest and includes all of the pink and chum bearing streams of the Amur River basin. The second area, referred to as the Amur Estuary, consists of smaller streams that flow directly in the Amur River estuary (liman). The third area is a small group of rivers located immediately North of the Amur Estuary and flow directly into Sakhalin Gulf.

Pink salmon are found in all three study areas. However, in the case of the Amur River area, they are restricted to tributaries in the lower portion of the basin (Figure 1.2). Summer chum salmon occur in Amur Estuary area and the lower portion of the Amur River area. Fall chum salmon occur throughout the Amur River area and in the streams of the Amur Estuary (Figure 1.3). Chum salmon also occur in the Sakhalin area, but are thought to be dissimilar from the summer and fall stocks of the Amur.

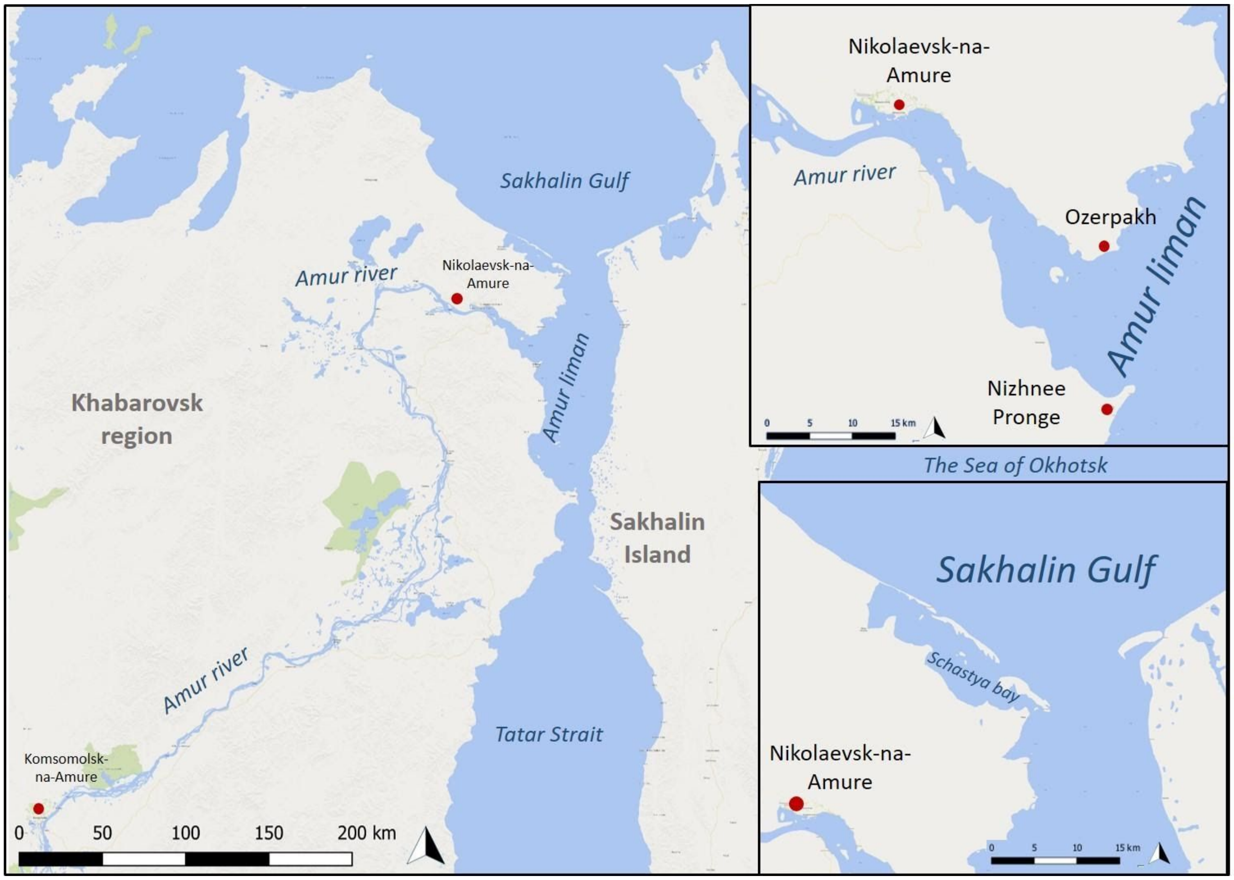

Figure 1.1. Map of assessment area showing boundaries that define the three fishery management areas: Amur, Amur Liman, and Sakhalin Gulf.

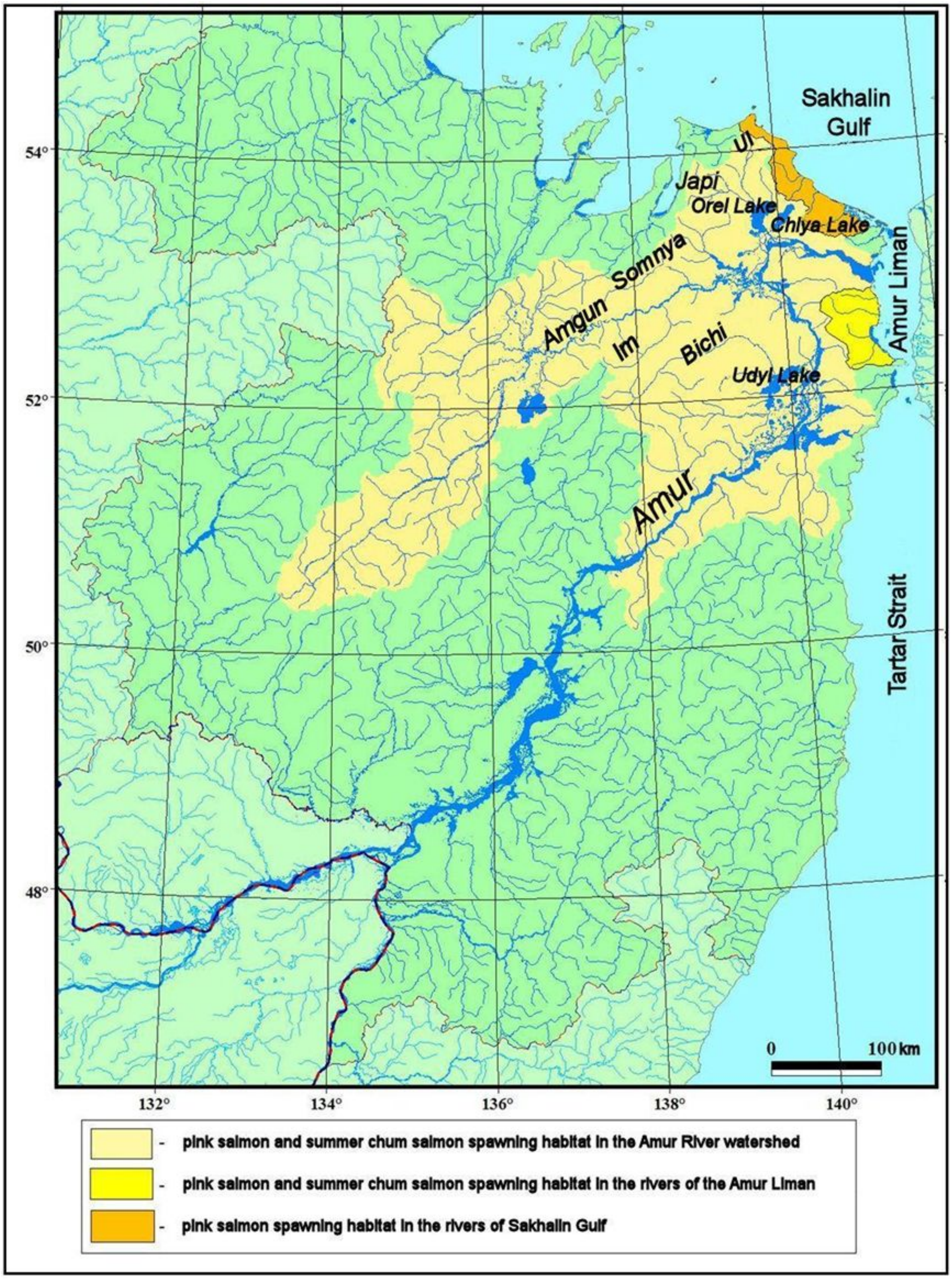

Figure 1.2. Spawning habitats of pink salmon and summer chum salmon in the Amur River watershed and the rivers of the Amur Liman and the Sakhalin Gulf

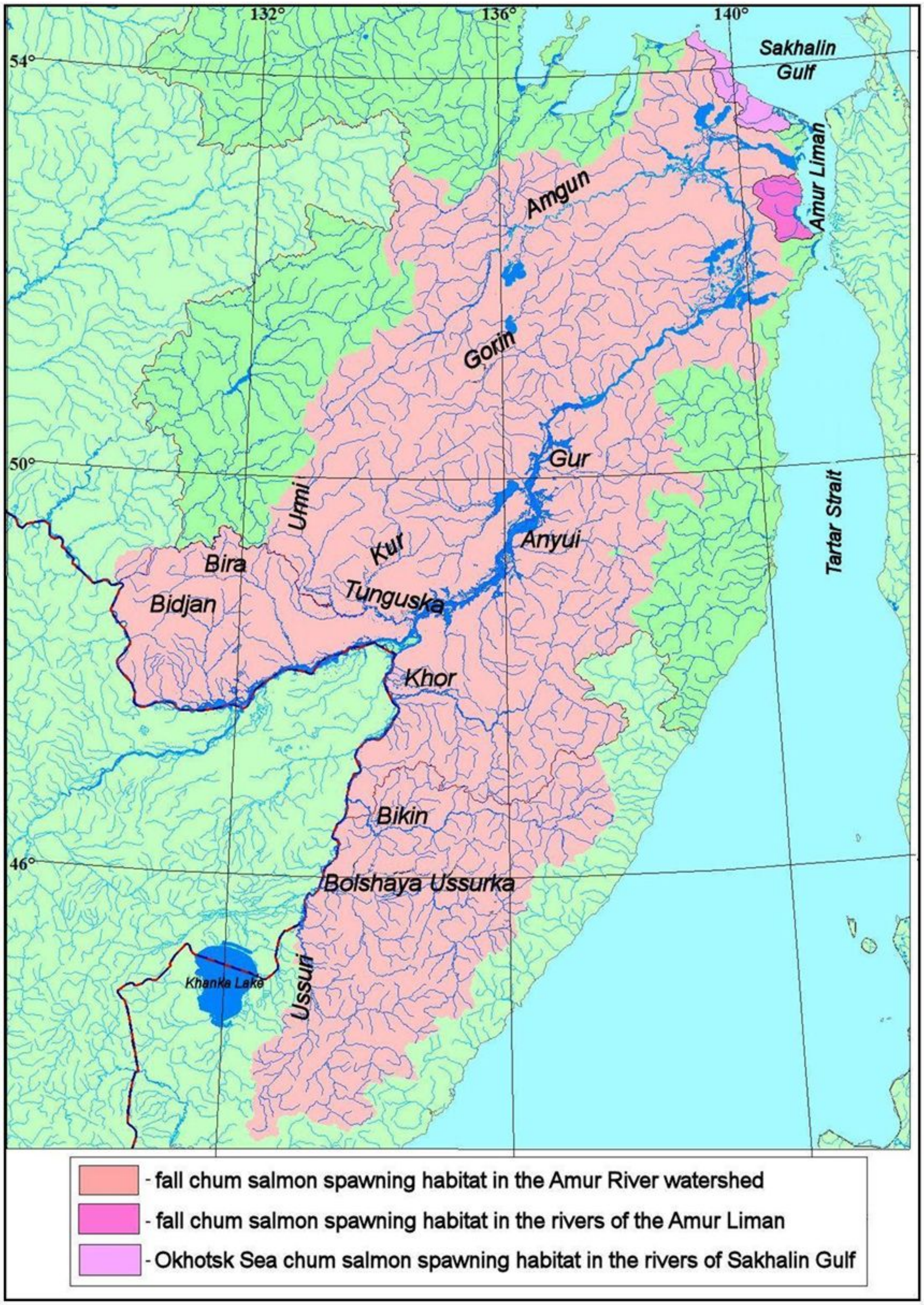

Figure 1.3. Map of fall chum salmon spawning habitat of the Amur River watershed and the rivers of the Amur Liman and Sakhalin Gulf

Reassessing Management Targets

Management targets are intended to set levels of spawner escapement that are sustainable over the long-term and optimize fish production. Theoretically, such levels can be determined from population recruitment modeling using estimates of annual spawner numbers and the estimated number of adult recruits produced from each of the parental years. In making these estimates it is usually necessary to have information on total run-size and/or fishery harvest rates. In addition, it is usually necessary to have at least 20 data points (brood years) to successfully resolve the underlying population recruitment function. Such information is not available for the fish populations in the three study areas of this FIP. Therefore, until such information becomes available an alternate approach to management targets is necessary.

The alternative approach proposed here is to examine recruitment modeling results for other populations of Russia and Alaska for which enough data have been collected and analyzed. Optimal or other levels of management reference points are often stated in terms of the number of spawners required to produce the number of adult offspring that match these target levels. These management reference points would then be converted to a standardized measurement of spawner density, either by spawning area or stream length.

An attempt will be made to obtain as many examples as possible of spawner densities that were predicted to achieve desired fishery production levels. In most cases, this reference level will be the density of spawners that matches the theoretical point of maximum sustainable yield (MSY).

Once this information is assembled and analyzed, recommendations will be made for desired management targets for pink salmon, summer chum, and fall chum for each of the three areas described by this FIP. This recommendation will be based upon a synthesis of information gathered and will include appropriate adjustment for dissimilarities in habitat condition and marine survival characteristic of the source information.

Methodology to Assess the Achievement of Spawner Escapement Targets

The primary means to assess achievement of management targets will be annual estimates of spawner densities for each species and study area. In addition, for the Amur River area, a secondary approach will also be investigated to assess target achievement. This secondary method will be based on estimating total run-size for each group of fish near the mouth of the Amur River. Total escapement will be estimated by subtracting fishery harvest from the run-size. Spawning densities will then be estimated as the total escapement divided by spawning habitat area. Additional description of these two methods follow.

Measuring Spawner Density

Index streams that will be surveyed each year to count the number of spawning pink and chum salmon have been tentatively identified. Pink and summer chum salmon surveys would generally be conducted during late August. Spawning surveys for fall chum would be conducted in October. A summary of proposed survey sites is given in Table 1.1.

In 2019, suitability evaluations were made for two of the proposed index sites, the Longary River (Zolotukin 2019a) and Gur River (Zolotukin 2019b). The purpose of these evaluations was to assess the physical character and observe densities and distribution of spawning salmon. Similar reports for other potential index sites will be prepared in the future, either based on existing, but as yet not summarized information, or using new information collected during a site visit.

Table 1.1. Proposed survey streams within the Amur and adjacent regions tentatively identified for annual salmon spawner density measurement, by fishery management area and species group.

Species Group	Fishery Management Area				
	Sakhalin Gulf	Amur Estuary	Amur River		
			Lower	Middle	Upper
Pink Salmon	Longari, Tyvlinka, and Iska	Chome	Ul, Hilka, Nilan, Dugi, Kerby, Im, Somnaya		
Summer Chum			Ul, Hilka, Nilan, Dugi, Kerby, Im, Somnaya		
Fall Chum	Tyvlinka and Iska	Chome	Ul, Hilka, Nilan, Dugi, Kerby, Im, Somnaya	Gur, Anyui	Khor, Tunguska

The count of spawners in each index section will be recorded each survey. These counts will then be adjusted by the number of times each stream section was visited during the survey season and the expected stream life for pink and chum salmon spawners. Spawner stream life defined as is the number of days a fish will be present on the spawning grounds until it dies or otherwise leaves the spawner area. This adjusted season count would then be divided by the stream area surveyed to yield a spawner density estimate, expressed as the number of spawners per 100 m^2.

These spawner density estimates would provide the means to assess whether or not management targets were being met on an annual basis.

Alternative Run-size Method

In this proposed method, a sampling gillnet would be drift through a test section of the lower Amur River near the town of Nikolayevsk-on-Amur. The number of fish caught would be converted into an estimate of fish per unit of water volume fished. The water volume would be calculated from the width and depth of the net multiplied by how far the net swept downstream during the sampling drift. The concept is that the density of fish observed in this sample of river volume would be assumed to represent the density in other portions of the river that were not sampled. An expansion factor based on the ratio of unsampled versus sampled river water volumes could then be used to expand the catch from a sample to an estimate of fish for the entire river during that time period. Such sampling would be repeated throughout the season and used to estimate the total run-size at this point in the river.

One critical element of this approach would involve supplemental gillnet sampling to determine if there were patterns of fish density at different points across the width of the river. Should differences be found to exist, then the procedure for estimating fish density in the unfished portion of the river from densities calculated from the portion sampled would need adjustment.

As described earlier, escapement would be estimated by totaling all of the known harvest and subtracting it from the estimated run-size. However, an estimate of illegally caught fish should also be subtracted from this run-size for a more realistic escapement calculation. Estimates for illegal harvest are not available at this time, however it may be possible to use a range of possible values based on other locations in Russia where illegal harvest has been measured. This would be viewed as a temporary measure until illegal fishing impacts, specific to the Amur basin can be empirically determined.

Finally, this method has not been tried in this location. It is therefore not known whether it is feasible. Therefore, the first year of work would be considered a pilot or exploratory phase of this methodology. Only if it is determined that this approach holds promise for gathering the necessary information will it be incorporated into long-term monitoring and assessment activities.

Implementation

The plan activities described here would begin in 2020 and extend five years to 2024. Lead investigators would be S.F. Zolotukhin and S.M. Shishman. Financial support would be in part dependent on a contractual agreement with Ukhta-Prom. One important component would be the establishment of an operations camp at Nikolayevsk-on-Amur as a base for collecting information for the alternative run-size methodology described earlier. At this location Ukhta-Prom fishermen and Dalrybvtuz (Far Eastern State Technical Fisheries University in Vladivostok https://dalrybvtuz.ru/en/) specialists would coordinate their test fishing efforts and gather information about the spatial and temporal distribution of fish in the river cross-section.

Densities of spawning pink and chum salmon based on information collected by KhabNIRO in the Amgun basin (lower Amur) and proposed survey sections in the middle and upper Amur (Table 1.1) would be combined with data obtained from surveys financed by the clients (and implemented by S.F. Zolotukhin and S.M. Shishman). These combined results would provide the basis for annual estimates of spawner escapement for all three fishery management areas of the assessment area.

Annual estimates of the previous year's fishery harvest totals for the Amur River, Amur Estuary, Sakhalin Bay areas would be requested each March from the Amur Regional Administration (a local branch of the Federal Fisheries Agency).

Implementation Benchmarks and Reports

By March of 2020, a report will be prepared cooperatively with KhabNIRO and other affected fish management agencies describing the recommended management targets based upon spawner densities for pink salmon, summer chum and fall chum salmon. This will be the end product of the effort described above to examine management targets documented in other areas of Russia and Alaska and using this information to develop comparable spawner density targets for the three areas described in this plan (Amur River, Amur Estuary, Sakahalin Bay).

By March of each year, lead investigators will prepare a schedule and work plan for the upcoming field season.

By December 15 of each year, Dalrybtuz specialists will submit a report that contains the annual results of obtained using the alternative run-size method described previously in this plan for the Amur River. These reports will contain run-size estimates for pink salmon, summer chum salmon, and fall chum salmon. They will also include a discussion of modifications as necessary to improve method accuracy and efficiency.

Also by December 15 of each year, S.F. Zolotukhin will submit a report describing the result of spawning ground surveys conducted in index streams of the Amur River, Amur Estuary, and Sakhalin Bay management areas. This report will also contain analyses and information of chum and pink salmon stock dynamics for these same three areas.

Goal 2 - Description of in-season management strategy to ensure management targets are met.

Approach

To ensure fishery management targets are met, especially in years of poor returns, a supportive in-season management strategy is needed. Conceptually, this strategy will rely on catch per unit of effort (CPUE) information collected by KhabNIRO staff throughout each fishing season. If CPUE values are found to be substantially lower than expected for the sampling time period, a recommendation will be made to close the fishery. Data collected in previous years that had acceptable run-sizes, will be used to develop CPUE expectations for each sampling time period.

This in-season strategy may need to be modified once the management targets for the associated fisheries have been revised. This is because the question of whether the proposed in-season management strategy will ensure the management targets are met can not be evaluated until the management targets are known. After these targets are established, it will be possible to make such an evaluation.

It is recognized that development of this strategy must be a cooperative effort, led by KhabNIRO and other governmental groups involved with the management of fisheries in the Amur. It is also evident that this effort will require a considerable review of available past data and subsequent analysis of different options. Therefore, additional time will be required to fully develop this in-season management strategy.

To help refine this strategy, a synthesis of the management decisions and rationale used during the 2019 fishing season will be developed. This will include the rationale leading to fishing closures that were imposed for the first time in 2019 because of poor returns. It will also include the information used to institute similar closures expected for the upcoming 2020 season because of concern about low run-sizes. It is expected that a thorough description of events leading to these closures would provide a useful perspective in developing an effective in-season management strategy. The description should include potential strategies for restricting harvest of weak stocks while allowing some harvest opportunities for salmon species with strong returns.

Implementation

As has been done for the past 15 years, KhabNIRO plans to collect CPUE data for Amur River monitoring stations distributed over 300 km of river between Nikolaevsk-na-Amure southward to Komsomolsk-na-Amure. This sampling effort generates CPUE data which would form the basis of an in-season management strategy. The comparison of CPUE values to those expected for each sampling period would be conducted by KhabNIRO staff. Weekly updates of this analysis, including any recommendation of fishing closure, would be provided to fishery managers.

By December 15, 2019 a report of fishery management and related actions from 2017-2019, as described in the approach section above, was completed by S.M. Shishman and S.F. Zolutukhin.

By December 15, 2023 S.M. Shishman will complete a report that summarizes fishery management strategies implemented during the five-year period from 2019 to 2023.

Goal 3 – Develop a plan to improve fishery independent information on stock status, including the impact on illegal harvests, that will provide management agencies a means to achieve management targets.

Approach

The spawner density monitoring plan described previously under Goal 1 will be the primary means to improve the fishery independent information on stock status. Surveys of representative spawning streams will be used to develop a long-term database of spawner densities.

The Goal 3 plan will also include the gathering of information on the magnitude and impact of illegal fishing. The method proposed to accomplish this objective is expected to provide approximate levels of impact from poaching of salmon on the spawning grounds for caviar. However, estimates are unlikely to be precise. Nor does the method address different forms of illegal fishing that occur at locations other than the spawning grounds. Regardless, this approach should provide information that will help assess the relative impact of illegal fishing on the achievement of management targets.

The proposed method will be based on the number of salmon carcasses observed by anti-poaching brigades alongside spawning streams that have been killed and opened up to remove eggs for the illegal caviar market. The number of fish killed at each of these poaching locations would be counted. Then at the season end, the number of stream kilometers inspected for evidence of poaching would be totaled. The number of stream kilometers inspected would then be expressed as a fraction of all the salmon spawning habitat (in kilometers) for the basin. The total illegal catch of salmon could then be estimated by dividing this inspection fraction into the combined number of poached salmon observed at all sites.

Implementation

Information on the incidence of illegal fishing activity would be collected by the special anti-poaching brigades assigned to fishery observation and enforcement duties as described under Goal 11. Additional information from other enforcement entities in terms of number of fish at each violation and number of stream km inspected per season would also be obtained.

Each year, an end of season summary report that includes the data and an estimate of illegal fishing for the entire basin would be prepared. The submission date for this report would be March 15 of each year.

Goal 4 – Develop a plan to improve stock status monitoring of pink and chum salmon in the Amur watershed.

Approach

The approach to improve status monitoring of pink and chum salmon in the Amur will be largely based on the methodology developed to address Goal 1 concerns as described earlier. This will involve estimates of total run-size and density of fish on the spawning grounds. Biological information with regard to size, age, sex ratios, run timing, and other characteristics will also be collected during the gillnet sampling efforts by KhabNIRO in the lower Amur River as described previously under Goal 2. Similar information will also be obtained, as is feasible, during the survey of index spawning streams.

Implementation

Each year a work plan and schedule for the field season will be prepared. This work plan will detail how information on spawner densities and other biological characteristics of returning fish will be collected (locations, dates, field crew). This work plan will be completed by March 15 of each year.

By December 15 of each year a summary of status monitoring findings will be completed. This will be in conjunction with a similar report prepared as part of the implementation of Goal 1 activities described earlier.

Goal 5 – Describe practices of hatcheries operating in the Amur watershed that are intended to minimize ecological and genetic impacts on wild salmon. In addition, develop a plan to assess the impact of Amur basin hatchery programs on wild chum salmon

Description

There is not much information concerning how hatcheries in the Amur basin are currently being operated to minimize genetic and ecological impacts on wild salmon. However, regarding genetic impacts, only fall chum salmon are raised at the five hatcheries within the Amur basin. Therefore, adverse genetic impacts on summer chum salmon and pink salmon are unlikely because hatcheries focus on the production of only fall chum salmon. In addition, the distribution of hatcheries throughout the Amur basin is widespread (Figure 5.1).

Figure 5.1. Map of Amur River basin showing location of fall chum salmon hatcheries.

Juveniles produced at each hatchery are released directly from the facility and not transported to other release sites. Therefore, it is expected these fish imprint on a specific hatchery location and when they return as adults do not wander far from where they were released. Essentially, by releasing all the production at the hatchery site, it is expected the straying of returning adult hatchery fish is minimized. However, there have been no studies yet that confirms this for the Amur hatchery program because very few marked hatchery fish have been released. Without marked fish, hatchery and wild adult salmon are virtually indistinguishable, at least to date.

Recently however, a new study has been suggested for Amur River chum salmon to assess whether it is possible to distinguish hatchery fish from wild fish on the basis on expected differences in otolith microchemistry (Mikheev, 2019). The otolith structure in fish (sometimes given the misnomer ‘earbone’) effectively records the growth pattern of the individual, in a way similar to growth rings on a tree. However, with modern techniques it is possible to achieve high resolution of these patterns, in some cases detection of daily increments of growth is possible. In addition, the mix of microchemicals incorporated into otolith growth rings is variable depending on the environmental conditions experienced by the fish. Fish originating from the same environment tend to have similar microchemical signatures. Conversely, fish originating from different locations (environments) can be distinguished based on their divergent otolith microchemistry characteristics. Therefore, it is possible to identify the natal origin of fish sampled from mixed populations by looking for such differences. Furthermore, observed differences in microchemistry composition of otoliths has been used to distinguish hatchery from wild fish as summarized by Mikheev (2019). It is this potential – distinguishing hatchery and wild fish - that this study would assess. Should such an evaluation demonstrate the utility of this methodology then a longer-term strategy could be implemented to collect and analyze otolith information as needed to assess the impact of hatchery fish on wild populations.

Possible ecological impacts of the hatchery program are most likely related to the impact of hatchery juveniles on downstream habitats and the adverse competition between the offspring of naturally spawning hatchery fish with wild fish of similar or related species. In the case of competition among hatchery and wild offspring, the impact is limited to the areas where stray hatchery fish spawn under natural conditions. If straying of hatchery adults is relatively concentrated to a small area near each hatchery then it would be expected that these zones of competitive impact among juveniles would also be relatively small.

The ecological impact of hatchery juveniles after release is less certain. The combined release of fish from all five hatcheries in the Amur basin over the past 21 years has averaged 80 million juveniles. (Table 5.1). There are few estimates of the production level of natural chum juveniles for the Amur basin. However, estimates of natural juvenile chum production reported in the Ukhta-Prom pre-assessment range from 100 to 500 million juveniles. If these estimates are sufficiently accurate, wild production relative to hatchery production ranges from nearly equal to six times larger. The potential for ecological interaction therefore seems significant in years when the wild juvenile production is low. However, until hatchery fish can be distinguished from wild fish, either via otolith marking or microchemistry differences, it will not be possible to perform an accurate assessment of the potential ecological risk from the release of hatchery fish.

Table 5.1. Number of juvenile chum salmon (thousands) released by Russian hatcheries in the Amur River Basin, 2007-2017.

Name	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Teplovsky	8,280	10,900	8,005	12,330	12,840	17,060	10,970	20,30	16,920	10,280	10,810
Bidzhansky	5,543	14,680	15,100	26,490	23,350	24,980	17,504	26,240	23,680	19,140	16,140
Gursky	12,510	12,390	9,222	16,040	9,018	8,172	11,910	7,689	6,606	8,064	9,420
Udinsky	8,209	8,668	17,170	11,540	12,400	15,000	13,450	10,420	7,152	9,104	12,590
Aniuisky	23,820	35,480	28,100	36,110	36,450	35,750	34,050	32,840	33,110	33,650	31,550
Total	58,362	82,118	77,597	102,510	94,058	100,962	87,884	77189	87,468	80,238	80,510

Approach

One of the significant problems that must be overcome to assess the impact of the five hatcheries in the Amur basin on wild chum salmon is the fact that none of the juvenile fish released are marked, with the exception of those from Anuisky Hatchery. Approximately seven million of the 32 million juvenile chum salmon released from Anuisky Hatchery since 2014 have been otolith marked via shock treatment.

Without the marking of hatchery fish it is not possible to distinguish hatchery and wild adults. Even if all the hatcheries began marking fish in 2020, the life history of chum salmon is such that it would be at least another four years before it would be possible to start counting adult hatchery and wild fish separately.

This constraint could be overcome if the otolith microchemistry methodology, described earlier, is found to be a reliable means to discriminate between hatchery and wild fish. However, even if the otolith microchemistry study is implemented now, it would be several years before the feasibility of this approach would be known. Therefore, the assessment of the impact of hatchery fish will start this year based on the information from marked fish released from Anuisky Hatchery. This approach is described as follows.

Starting in 2018 a portion of the Anuisky Hatchery origin adults carried identifying otolith marks. Based on the analyses of otoliths collected from these returns to the Aniuisky Hatchery, the rate of marked hatchery fish could be determined. From this mark recovery rate, the contribution of hatchery production to the observed adult return could be determined. In addition, based on this contribution rate, it may be possible to infer the contribution of the other four hatcheries in the Amur basin in terms of returning hatchery fish. Eventually, it is hoped that all the hatcheries in the Amur basin will release marked fish, or that they can be identified via otolith microchemical differences. However, until that occurs the approach described here represents a good step to understanding the magnitude and significance of the interaction between hatchery and wild fish.

For this approach to work, it is first necessary to ensure the current level marking at Anuisky Hatchery (about 22% of the hatchery production) is maintained or ideally increased. This will provide the long-term opportunity to sample adult fish at the hatchery and natural spawning areas for the presence of marked fish.

At least 200 and preferably more adults returning to the hatchery will be sampled for otolith marks. Samples of fish collected from nearby areas of natural spawning will also be obtained to determine the incidence stray hatchery fish that may potentially spawn with wild fish.

Since only 22% of the release is marked each mark recovery would represent the presence of 1 / 0.22 = 4.5 hatchery fish. Using this expansion factor, the number of hatchery fish for the sample could be estimated. The number of hatchery fish (as estimated from the expansion factor) would then be subtracted from the total number of fish sampled to yield an estimate for the number of wild fish.

With such estimates it would then be possible to estimate the proportion of wild fish that were being used as broodstock for the hatchery program. It would also be possible to estimate the proportion of fish on the natural spawning grounds that were of hatchery origin. The potential for adverse genetic impacts from hatchery fish increases as their proportion on the spawning ground goes up and theoretically decreases as the proportion of wild fish used as broodstock for the hatchery program goes up. There is a wealth of literature to associate such proportions with the degree of genetic risk to populations of wild fish.

Another important question that could be answered by this analysis is how well juvenile hatchery fish survive between the time they are released, and they return as adults. The stated goal of hatchery operational plans developed by AmurRybvod is for the hatchery juvenile to adult survival rate to be 1.5%. However, the actual survival rate has not yet been measured for any of the hatcheries. If it is possible for the Anuisky Hatchery to count each adult that returns, then the proportion of hatchery fish in the return could be expanded to estimate the total number of returning hatchery fish. This could be critical information. If the survival rate is considerably less than 1.5%, then fewer hatchery fish would be present to adversely interact with wild fish. Conversely if the survival rate is higher, then there would be more hatchery fish to interact with wild fish.

The results for the Anuisky Hatchery could be used to infer what might be occurring at other hatcheries that are currently not releasing marked fish. First, the observed hatchery-produced juvenile to adult survival rate could be used to estimate how many of the fish counted at the other hatcheries were of hatchery origin. Second, the degree to which hatchery fish stray into natural spawning areas could be used to estimate the size of the natural spawning area that may likely be impacted by hatchery fish. Finally, it may be possible to use this information to estimate what fraction of the fish used for hatchery program broodstock are wild fish and what fraction are hatchery fish.

Implementation

Each year adult chum salmon returning to the Anuisky Hatchery would sub-sampled for otolith collection. Otoliths would also be taken from a sub-sample of fish found in naturally spawning areas at a variety of distances from the hatchery. In both cases, the age of fish would also be determined so an assignment to the year of smolt outmigration would be known.

These otoliths would then be examined for the presence of marking. A tally of marked and unmarked fish for each sub-sample would be prepared.

Once the season count of marked and unmarked recoveries was completed, the proportion of hatchery fish in the naturally spawning locations and the proportion of wild fish in the hatchery broodstock would be determined. These proportions would be expanded to estimate hatchery juvenile to returning adult survival by release year.

By March 15 of each year a report would be prepared summarizing these findings.

Goal 6 – Develop a plan to estimate the catch of non-target species in the fishery, with special attention to ETP species.

Approach

Other fish species are caught by the salmon fisheries covered in this FIP. By regulation, this bycatch is typically limited to no more than 2% of the total weight of fish caught while fishing for salmon. At various fishery operations, the bycatch is handled by fishermen differently with part of it being delivered along with Pacific salmon species to fish processors. General data on the bycatch composition and the proportion of each bycatch species is presented to the chief technologist of the processing facility on a daily basis.

For more detailed information gathering, catch and bycatch cards for each type of fishing gear used by "Ukhta-Prom" have been developed: drift gill net, set gill net, zayezdok, coastal trap net, and beach seine. In each fishing district (the Amur River, Amur estuary, Sakhalin Bay) and for one of its fishery parcels, a fishing operations manager or a technologist is tasked to record bycatch species for a part of the total catch daily. Thus, a data sample of the bycatch in each district by gear type will be accumulated. Based on the initial results, it may be necessary to sample more than one fishery parcel per district to obtain an accurate assessment of non-target species catch. It also may be found that sampling does not need to be done on a daily basis.

Data analysis will provide the following information:

1. Bycatch species,
2. Dynamics of the quantity of major bycatch species,
3. Percentage of protected and rare species in the total commercial catch.

Implementation

Each year, from 2021 to 2024, S.F. Zolotukhin will organize and conduct field work at the Ukhta-Prom fishing sites near Nikolaevsk-on-Amur, as well as the Amur estuary and Sakhalin Gulf. It is expected that this effort will occur for 10 days in July and 10 days in September. This schedule is intended to focus the bycatch effort on the summer and fall chum salmon fishing seasons.

Each year, S.F. Zolotukhin will prepare a report that includes the findings and evaluation of the sampling the commercial fisheries for bycatch of those species that are classified as protected or rare.

Goal 7 – Develop a plan to assess the long-term direct and indirect impacts of fishing and other activities on ETP species.

Approach and Implementation

Use the information collected by the activities described under Goal 6 above to assess the direct and indirect impacts of fishing on ETP species.

Each year, beginning December 15, 2020 an annual ETP bycatch summary report by S.F. Zolotukhin & S.M. Shishman will be completed. This report will provide a summary of bycatch data collected at various Ukhta-prom fishing sites and with various types of fishing gear.

Annual ETP bycatch impact analysis reports will be prepared by S.F. Zolotukhin and S.M. Shishman each year from 2021 to 2024. In this report an analysis of bycatch data collected at various fishing sites and by gear type will be conducted. This analysis will include, as appropriate, recommendations to improve fishery strategies that will better avoid the bycatch of ETP species in Ukhta-prom fisheries.

Goal 8 – Describe existing strategies used during hatchery construction and operations that protect natural habitats.

Description

As discussed under Goal 5, there are five hatcheries that operate within the Amur basin. They only produce fall chum salmon. As noted from the map showing the location of each hatchery, they are dispersed widely throughout the Amur basin.

These hatcheries are operated in a manner that is consistent with government regulations related to fish passage barriers, use of chemicals, water diversions, effluent water pollution.

A more comprehensive description of the strategies used to comply with these regulations and limit the impact on the function of natural habitats will be completed by December 15, 2020.

Goal 9 – Describe fishery management measures that will minimize impacts to the freshwater ecosystem.

Description

In general, fishing activities are operated such that they are consistent with regulations aimed at the protection of natural ecosystems. For example, zayezdok fishing structures are not permanent and are removed each year after the fishing season is complete. In addition, the type of fishing gear used in Amur salmon fisheries has little if any mechanical impact on the ecosystem structure of benthic communities.

A more comprehensive description of the strategies used to minimize impacts of fishing on the freshwater ecosystem will be completed by December 15, 2020.

Goal 10 – Describe in-season management actions and associated justifications taken by the Anadromous Fish Commission during 2017, 2018, and 2019 seasons.

Description

A summary of fishery management actions taken by the Khabarovsk Region, Anadromous Fish Commission for the 2017 thru 2019 seasons was prepared to document these actions and associated justifications (Shisman, 2019). Of particular note was the closure of commercial fisheries in for a portion of the 2019 season because of concerns about predicted low run-size.

Goal 11 – Develop a plan to ensure illegal fishing is effectively controlled.

Approach

The strategy for addressing the illegal fishing problem for this area has three components: enforcement, monitoring, and public awareness. In terms of enforcement there will be combined efforts between government enforcement agencies and "anti-poaching" brigades financed by Ukhta-Prom. Currently anti-poaching brigades are divided into four security posts, each staffed by five or more Ukhta-Prom employees working with representatives from the police. There are reports that these efforts have been successful when they can be focused on a particular area. For example, the poaching rate on the Anuisky River reportedly decreased from 50% of the run to only 10% of the run after a security post was established at this location in 2011. Success in reducing poaching levels as a result of intensive efforts by anti-poaching brigades has also been reported by Zolotukin (2019a) for the Longary River. However, in other locations high levels of poaching may still be ongoing. For example, Zolotukin (2019b) reports findings from other studies that estimate from 15% to 45% of the spawners are removed by poaching.

A more detailed description of efforts to combat illegal fishing activities in the assessment area from 2017 to 2019 is provided in summary prepared by ForSea Solutions (2019b).

The method proposed to monitor the magnitude of the illegal fishing problem is that described under the presentation for activities for Goal 3. Monitoring will be an important aspect to ensure poaching is effectively curtailed because it will identify areas where enforcement effort may need to be redirected. It will help assess the effectiveness of various enforcement strategies.

Finally, public awareness of the severity of the illegal fishing problem and its impact on the long-term health of the salmon stocks in the Amur river will help build support for enforcement efforts and other measures to conserve the salmon resource. To accomplish this, annual summaries of enforcement and monitoring efforts will be prepared along with information from the Amur Regional Administration and KhabNIRO concerning in-season management actions used to protect salmon stocks in the Amur basin. Included will be information on compliance with fishery closures (passing days) and estimates of fish escaping to the spawning grounds. This information will be assembled into a media release that will highlight the success of efforts by Ukhta-Prom groups to help ensure a sufficient number of salmon survive to spawn naturally in the habitat that has remained environmentally healthy.

Implementation

Each year, beginning December 15, 2020 a report will be completed that summarizes the effectiveness of the combined effort in the region to enforce fishery regulations and prevent the illegal fishing of salmon in the Amur basin.

Information on the monitoring of illegal fishing will be provided in the annual report described as one of the implementation items under Goal 3.

Finally, the annual media release that summaries for the public key elements of the salmon fishery, enforcement, and conservation successes will be completed by December 15 of each year beginning in 2020.

References

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