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RECOVERY POTENTIAL ASSESSMENT FOR THE UPPER FRASER RIVER WHITE STURGEON DESIGNATABLE UNIT - 2016

Juvenile White Sturgeon
Photo credit: David Gluns

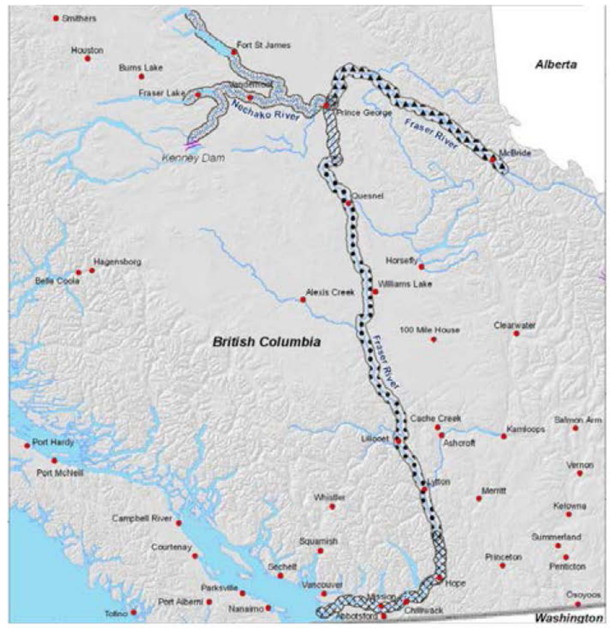

Figure 1. Upper Fraser White Sturgeon designatable unit distribution, adapted from DFO (2014)

Context:

After the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses an aquatic species as Threatened, Endangered or Extirpated, Fisheries and Oceans Canada (DFO) undertakes a number of actions required to support implementation of the Species at Risk Act (SARA). Many of these actions require scientific information on the current status of the wildlife species, threats to its survival and recovery, and the feasibility of recovery. Formulation of science advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for consideration of peer-reviewed scientific analyses into SARA processes including recovery planning.

The new Upper Fraser River White Sturgeon (Acipenser transmontanus) Designatable Unit (DU) is now comprised of an amalgamation of the Mid-Fraser, Upper Fraser and Nechako Nationally Significant Populations (NSPs). Significant recovery activities have taken place for some of these populations and it is expected that management activities will continue to be directed at this sub-DU scale. As a result, this RPA will inform recovery and listing at not only the DU scale, but where appropriate, provide advice for ongoing activities at the sub-DU level. DFO Science has been asked to undertake an RPA, based on the National RPA Guidance, in light of this new DU structure adopted by COSEWIC.

This Science Advisory Report is from the March 30 – April 1, 2016 Recovery Potential Assessment – White Sturgeon, Upper Fraser Designatable Unit. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- The Upper Fraser White Sturgeon Designatable Unit (DU) now encompasses the Mid-Fraser, Upper Fraser and Nechako Nationally Significant Populations (NSPs). Differences between the three populations, including potential genetic differences, support the continuance of management at the sub DU scale (e.g. development and management of objectives at the sub DU scale). Population abundance targets for each sub DU must be achieved in order to ensure the success of the population at the DU scale.
- White Sturgeon is the largest, longest-lived freshwater fish species in North America. It is a slow-growing, late maturing species.
- The Upper Fraser White Sturgeon DU extends from Hell's Gate upstream through the Mid- and Upper Fraser River (upstream of Prince George) and Nechako River systems.
- Important rearing habitat has been identified for adult and sub-adult sturgeon in each of the three sub-DU areas but important habitat for spawning and larval and juvenile sturgeon remains an uncertainty. No spawning sites have been confirmed for the Mid- and Upper Fraser sub-DUs and only one spawning site is known for the Nechako sub-DU.
- Current estimates of adult sturgeon abundance within the DU are 185 in the Upper Fraser, 749 in the Mid-Fraser, and 630 in the Nechako. Juvenile sturgeon are present in both the Mid- and Upper Fraser River, demonstrating that recruitment likely is occurring in these Fraser River mainstem sub-DUs. However, in the Nechako, ongoing failures of natural recruitment are apparent as very few wild juvenile sturgeon exist. Juvenile sturgeon abundance is unknown for the entire DU.
- The federal recovery strategy for White Sturgeon has identified threats for the survival or recovery of Upper Fraser White Sturgeon. Both habitat quality and quantity have declined in some areas with negative effects on survival and recruitment and overall carrying capacity. This is especially true in the Nechako where spawning habitat has been lost and/or is no longer functional. Even when habitat and food resources have not declined, there are significant risks to long-term viability when populations are small, as is the case here (at both sub-DU and DU scales).
- Recommended population abundance targets have been identified for each of the sub-DUs: 185 adults for the Upper Fraser, 749 adults for the Mid-Fraser, and 1,000 adults for the Nechako.
- Current adult estimates are at the population abundance targets for both the Mid- and Upper Fraser sub-DUs but below the target for the Nechako sub-DU where recruitment failure persists. Given that White Sturgeon is a very long-lived and late-maturing species, the changes in juvenile recruitment may not be reflected in adult abundance for decades, particularly relevant for the Nechako sub-DU.
- Currently, hatchery production is the primary source of juvenile sturgeon in the Nechako system. Although, there appears to be limited exchange among the three sub-DUs within the Upper Fraser, adaptive management of Nechako River hatchery operations should ensure hatchery-produced sturgeon do not overwhelm the other sub-DUs in this metapopulation.
- Modeling that includes both habitat productivity (Habt) and human induced mortality (HM) allows visualizations of potential trade-offs should changes to either occur. There is very little scope for improved habitat productivity for the Mid- and Upper Fraser sub-DUs.

However habitat improvement is essential in the Nechako sub-DU where spawning habitat restoration efforts are required to restore naturally sustained recruitment.

- Since human induced mortality was considered low for all three sub-DUs, there is limited scope to reduce it further, except perhaps the Mid-Fraser where there is more uncertainty.
- The Nechako sub-DU is well below its recovery target of 1,000 adult fish, so there is limited scope for additional allowable harm to this sub-DU and any should be in support of conservation objectives.
- Potential allowable harm for Mid- and Upper Fraser sub-DUs was evaluated by modeling changes in HM while maintaining current Hab_t values. If HM increased 2× for the Mid-Fraser sub-DU or 3× for the Upper Fraser sub-DU over current HM levels, it would have substantial negative effects on the abundance of White Sturgeon.

BACKGROUND

Within Canada, White Sturgeon (*Acipenser transmontanus*) occur only in British Columbia and in 2003 six Nationally Significant Populations (NSPs) were identified based on differences in geography and genetics: the lower, middle and upper Fraser River; Nechako River; Columbia River; and Kootenay River. White Sturgeon was designated as Endangered by the Committee on the Status of Wildlife in Canada (COSEWIC) and following their listing, a Recovery Potential Assessment (RPA) was undertaken (Wood et al. 2007) followed by advice on the identification of critical habitat (Hatfield *et al.* 2013). Four Nationally Significant Populations (NSPs) are legally listed under Canada's Species at Risk Act (SARA): the Upper Fraser; Nechako, Columbia; and Kootenay. A Recovery Strategy was initiated in 2009 and was finalized in 2014 following consultations.

In 2012, COSEWIC re-assessed White Sturgeon and found there to be four Designatable Units (DUs): Lower Fraser; Upper Fraser; Upper Columbia; and Upper Kootenay (COSEWIC 2012). In this exercise, the Fraser River White Sturgeon upstream from Hells Gate, including those fish in the Nechako River, were re-classified as the Upper Fraser DU. Given this change, Fisheries and Oceans Canada (DFO) was asked to prepare a RPA for this new DU that will inform potential listing recommendations. However, it is recognized that management actions may be required at the sub-DU scale (i.e., for the Mid-, Upper Fraser, and Nechako) consistent with the Recovery Strategy for White Sturgeon (*Acipenser transmontanus*) in Canada published in March 2014 on the Species at Risk Public Registry (Fisheries and Oceans Canada 2014). Further, a RPA is intended to provide the best possible advice on recovery potential, using available data and to identify information gaps so for the Upper Fraser White Sturgeon DU, this includes information at the sub-DU scale. In addition, this Recovery Strategy identifies critical habitat for the Nechako and Upper Fraser sub-DUs and important habitat for the Mid-Fraser sub-DU (DFO 2014).

ASSESSMENT

Biology, Abundance, Distribution and Life History Parameters

White sturgeon, *Acipenser transmontanus*, is the largest, longest-lived freshwater fish species in North America with fish over 6 m in length and over 100 years of age reported from the Fraser River (Scott and Crossman 1973). White Sturgeon is a slow-growing species with a delayed onset of sexual maturity. Survival rates are very low during the first year but become substantially higher for late juvenile and adult stages (Gross et al. 2002). Growth rates and maturity vary significantly throughout the White Sturgeon's range primarily due to temperature and food availability.

The Upper Fraser DU encompasses the Fraser River from Hells Gate upstream for a river distance of almost 1,000 km to approximately the confluence with the Morkill River, and includes the fish in the Nechako River basin, historically the largest tributary of the Upper Fraser River (Figure 1). Within the Upper Fraser DU, there are three genetically distinct sub-DUs: the Mid-Fraser downstream of the Nechako River confluence, the Upper Fraser upstream of the Nechako River confluence, and the Nechako River (COSEWIC 2012). Tagging data indicate some movement among sub-DUs but genetic data suggests these sub-DUs are distinct (COSEWIC 2012, Smith et al. 2002).

Compared to other White Sturgeon DUs in British Columbia, there were less historical abundance data for the Upper Fraser DU, especially for the Mid- and Upper Fraser sub-DUs. The Fraser River White Sturgeon Monitoring Program (FRWSMP) used a range of sampling techniques to estimate sub-DU-specific population sizes based on mark recapture data between 1995 and 1999 (RL&L Environmental Services Ltd. 2000). COSEWIC (2012) provides updated abundance estimates (Table 1). Although the abundances of the Mid- and Upper Fraser sub-DUs appear within the historic range, the declining trend in abundance for the Nechako sub-DU reflects ongoing recruitment failure. Comparing FRWSMP data with that collected in 1982 shows a scarcity of younger (< 30 years old) sturgeon over a 25 year period in the Nechako River (Korman and Walters 2001) while size distribution data for the Mid- and Upper Fraser sub-DUs show a greater occurrence of individuals younger than 20 years, more consistent with age distributions expected for healthier populations. A Recovery Plan for Nechako River White Sturgeon identified the need to culture and release wild origin, hatchery-reared juvenile fish to maintain adult population abundance (Nechako White Sturgeon Recovery Initiative 2004).

Table 1. Adult White Sturgeon population estimates for the Upper Fraser DU.

Upper Fraser Section	Adult White Sturgeon Abundance
Upper Fraser DU	1,177 to 1,564
Mid-Fraser sub-DU	749
Upper Fraser sub-DU	185
Nechako sub-DU	243 to 630

Habitat and Residence Requirements

White Sturgeon require suitable habitats, an abundant food base, and appropriate flows and water conditions. Most habitat use studies have been conducted on regulated rivers and the studies completed on the Fraser River, which is the only unregulated system in the species' range, indicate that habitat use may be quite different. Although information about habitat preferences is relatively limited for the Upper Fraser DU, especially for the Mid- and Upper Fraser sub-DUs, Fisheries and Oceans Canada (2014) has identified a limited number of important habitats for each of the three sub-DUs. Habitat in the Nechako River has been affected by regulation/diversion with the Kenney Dam regulating flow since the 1950s (COSEWIC 2012). Diversion has reduced flows overall, especially freshet flows. The development of this hydroelectric project has been hypothesised to be a direct or indirect cause of the majority of the threats to the Nechako sub-DU; however, the precise mechanisms involved are unclear (Korman and Walters 2001).

Based on the SARA definition, the residence must support a life cycle function, there must be an element of investment in the creation or modification of the structure, and it must be occupied by one or more individuals. White Sturgeon are broadcast spawners and they do not modify their environment for the purpose of “breeding, rearing, staging, wintering, feeding or hibernating;” the concept of residence therefore does not apply.

Threats and Limiting Factors to the Survival and Recovery

Twelve threats to White Sturgeon in the Fraser River are discussed in detail in Hatfield et al. (2004) and Fisheries and Oceans Canada (2014) and shown in Table 2. Only the higher risk elements will be discussed briefly here.

The large rivers occupied by White Sturgeon have a variety of interlinked habitats, including main channel, tributary confluence, foreshore, and seasonally-inundated areas. Both habitat quality and quantity have declined throughout the species’ range thereby impacting recruitment and overall carrying capacity. Further, the life history of White Sturgeon is closely linked to river hydrology and although the precise mechanisms responsible for the observed population decline and recruitment failure for the Nechako sub-DU are unknown, river regulation due to Kenney Dam has been heavily implicated (McAdam et al. 2005).

There are significant risks to long-term viability when populations are small, even when habitat and food resources are not limiting. Long lived species with small populations are especially susceptible to random demographic and environmental variability because small increases in mortality may suppress the population and its recovery potential for long periods of time. Thus, the Upper Fraser and Nechako sub-DUs are likely at greater risk than the Mid-Fraser population due to their smaller population sizes.

The elimination, reduction, or alteration of White Sturgeon’s prey base may have important effects on abundance and distribution. There are numerous factors that could result in reduced food supply including: climate change, overharvesting, and habitat loss. Historically, significant reductions in important food sources for White Sturgeon in the Upper Fraser DU are known to have occurred, most notably related to Pacific Salmon and Pacific Lamprey (DFO 2012).

Table 2. Assessed threats to White Sturgeon in the Upper Fraser DU.

Threat		Level of Relative Risk		
Stressor	**Activity**	**Mid Fraser**	**Upper Fraser**	**Nechako**
Abiotic				
Habitat loss	Flow regulation, sand/gravel extraction, land use change, flood risk management works	Moderate	Moderate	High
Habitat fragmentation	River impoundment, dyke construction	Low	Low	Low
Altered hydrograph components	Flow regulation, climate change	Low	Low	High
Pollution	Point sources (e.g., pulp mill effluents) and non-point sources (e.g., agricultural runoff)	Moderate	Low	Low

Threat		Level of Relative Risk		
Stressor	Activity	Mid Fraser	Upper Fraser	Nechako
Fishing and industrial effects	Fishing: poaching, by-catch Industrial effects: interactions with industrial facilities	Moderate	Low	Moderate
Reduced turbidity	Flow regulation	Low	Low	Low
Altered thermal regime	Flow regulation, climate change	Low	Low	Low
Biotic				
Effects of small population size	Anthropogenic factors causing recruitment failure	Moderate	High	High
Hatchery and aquaculture effects	Conservation or commercial aquaculture	Moderate	Moderate	Moderate
Reduced or altered food supply	Multiple: e.g., fishing, climate change, land use change	High	High	High
Change in ecological community	Multiple: e.g., fishing, species introductions, climate change	Low	Low	Low
Disease	Multiple: e.g., aquaculture, climate change, pollutant stressors	Low	Low	Low

Human activities that pose a threat to White Sturgeon habitats include those associated with residential and commercial developments; agriculture; energy production and mining; transportation and service corridors, and recreational activities (Salafsky et al. 2008). However, these threats may be lower for the Upper Fraser DU compared to others, especially the Upper Fraser sub-DU sturgeon that inhabits a relatively pristine environment.

The intrinsic biological factors most limiting to White Sturgeon population growth are very low early survival and delayed maturation. The late maturity of White Sturgeon can result in long time lags between changing physical or biological parameters and population responses, especially when the number of mature fish is limited (Wood et al. 2007).

Scenarios for Mitigation of Threats and Alternatives to Activities

Fisheries and Oceans Canada (2014) describe a number of research and management activities needed to meet recovery targets for White Sturgeon across their range in Canada.

Those most relevant to the Upper Fraser DU fall into broad categories including protecting important habitats, clarifying and mitigating threats, increasing public awareness, and maintaining ecosystem functions. Protecting important habitats and mitigating threats have the potential to maintain or increase habitat productivity thereby increasing survivorship. Although survivorship may be improved with additional limits to both direct (e.g., poaching) and indirect (e.g., by-catch, latent mortality) effects of fishing, regulations are already in place to limit these effects on White Sturgeon. Given compliance appears to be acceptable, further improvements may not be substantial.

The potential for productivity increases through habitat improvements but opportunities for habitat restoration or enhancement may be limited in scope. Restoration and enhancement of substrate at spawning sites has been considered for White Sturgeon populations with ongoing recruitment failure and may be effective at the sub-DU scale, notably in the Nechako (McAdam 2012).

The recruitment failure noted for the Nechako sub-DU was the motivation for a hatchery program that releases juvenile White Sturgeon into the system. There are specific risks to naturally-reproducing White Sturgeon from conservation and commercial aquaculture programs, including population and genetic effects, and disease transfer. Also, there is concern regarding imprinting behaviour and whether hatchery-reared fish will be able to find or select suitable spawning locations at maturity. Further, hatchery inputs in one sub-DU may affect the metapopulation structure of this DU. Although hatchery inputs are required to mitigate the existing condition of recruitment failure, adaptive management of conservation fish culture will be required to diminish potential negative consequences associated with this activity. For example, swamping the Mid- and Upper Fraser sub-DUs with hatchery fish might not be ideal for long-term maintenance of the Upper Fraser DU.

Recovery Targets

Abundance

The Upper Fraser DU is composed of three sub-DUs with some exchange of individuals between them and it is important to note that declines in abundance in one sub-DU could be compensated by migration from other sub-DUs within the metapopulation at stable or increasing levels, either naturally or via hatchery inputs. In addition, sub-DUs within the Upper Fraser DU have naturally low abundances. The Mid- and Upper Fraser sub-DUs have only 749 and 185 adult fish, respectively but are considered to be within their historical abundance ranges, which are likely naturally limited by suitable habitat (Fisheries and Oceans Canada 2014). Thus, abundance targets for these two sub-DUs should reflect their current abundances which is consistent with the Recovery Strategy (Fisheries and Oceans Canada 2014). In contrast, the Nechako sub-DU has experienced a decline in abundance that reflects ongoing recruitment failure. The current estimate for the Nechako of 630 adults does not reflect a healthy population structure as younger cohorts are virtually absent. Back-calculated estimates suggest the Nechako sub-DU had a minimum historical abundance of about 1,628 adult fish. Recognizing that recovery may occur below historical abundance, the Recovery Strategy identified an interim abundance target of 1,000 mature White Sturgeon for the Nechako sub-DU within 50 years (Fisheries and Oceans Canada 2014). Although the abundance targets noted here are for adult White Sturgeon there also is a recovery target of a natural age and sex structure, supported by self-sustaining wild reproduction. Thus, hatchery inputs alone cannot meet all recovery targets.

Distribution

The Upper Fraser DU occurs in the mainstem Fraser River upstream of Hells Gate, as well as the Nechako River. Within the Upper Fraser DU, the three sub-DUs include: the Mid-Fraser downstream of the Nechako River confluence; the Upper Fraser upstream of the Nechako River confluence, and the Nechako. The recommended distribution target is to maintain the current geographical distribution of these three sub-DUs (i.e., no reduction in spatial extent).

Metapopulation Models

For this RPA, the White Sturgeon model presented in Appendix 2 of Wood *et al.* (2007) was adopted but included metapopulation structure, which allows for exchange of individuals between the three sub-DUs in the Upper Fraser DU.

In the model, abundance is influenced by scalars that simulate changes in habitat productivity for early life history stages (Hab_t) and human-induced mortality on adult fish (HM). However, the magnitude of effect from these two parameters was not equal such that even small changes in HM had a substantial effect on adult population abundance. For both the Mid- and Upper Fraser sub-DUs where habitat productivity appears to be maintaining healthy White Sturgeon populations there is very little scope for improvement. In contrast, the Nechako sub-DU has experienced ongoing recruitment failure and the population modeling reflects the fact that habitat improvement is essential to restore naturally sustained recruitment for the Nechako sub-DU.

Allowable harm was simulated by considering the effects of changes to HM while maintaining current Hab_t values. Results are summarized using contour plots that allow visualization of trade-offs between changes in Hab_t and HM for each sub-DU under both no exchange and limited migration scenarios over both 50 year and 100 year periods (Figures 2-4).

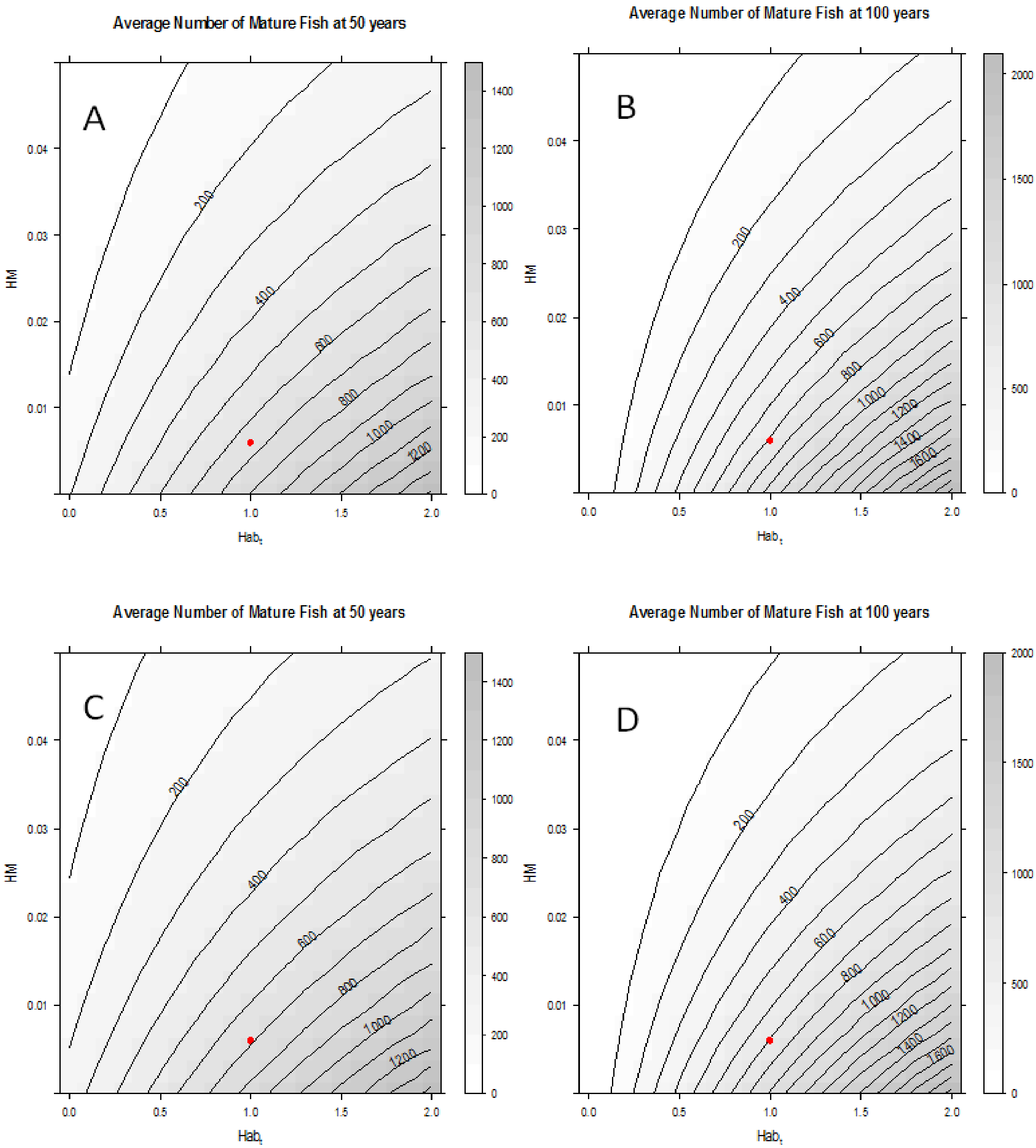

Figure 2. Contour plots of Mid-Fraser White Sturgeon abundance at 50 and 100 years, with an exchange rate of 0% (A and B) and 0.1% (C and D). The red reference point represents the assumed current values of HM and Hab_t -- not abundance.

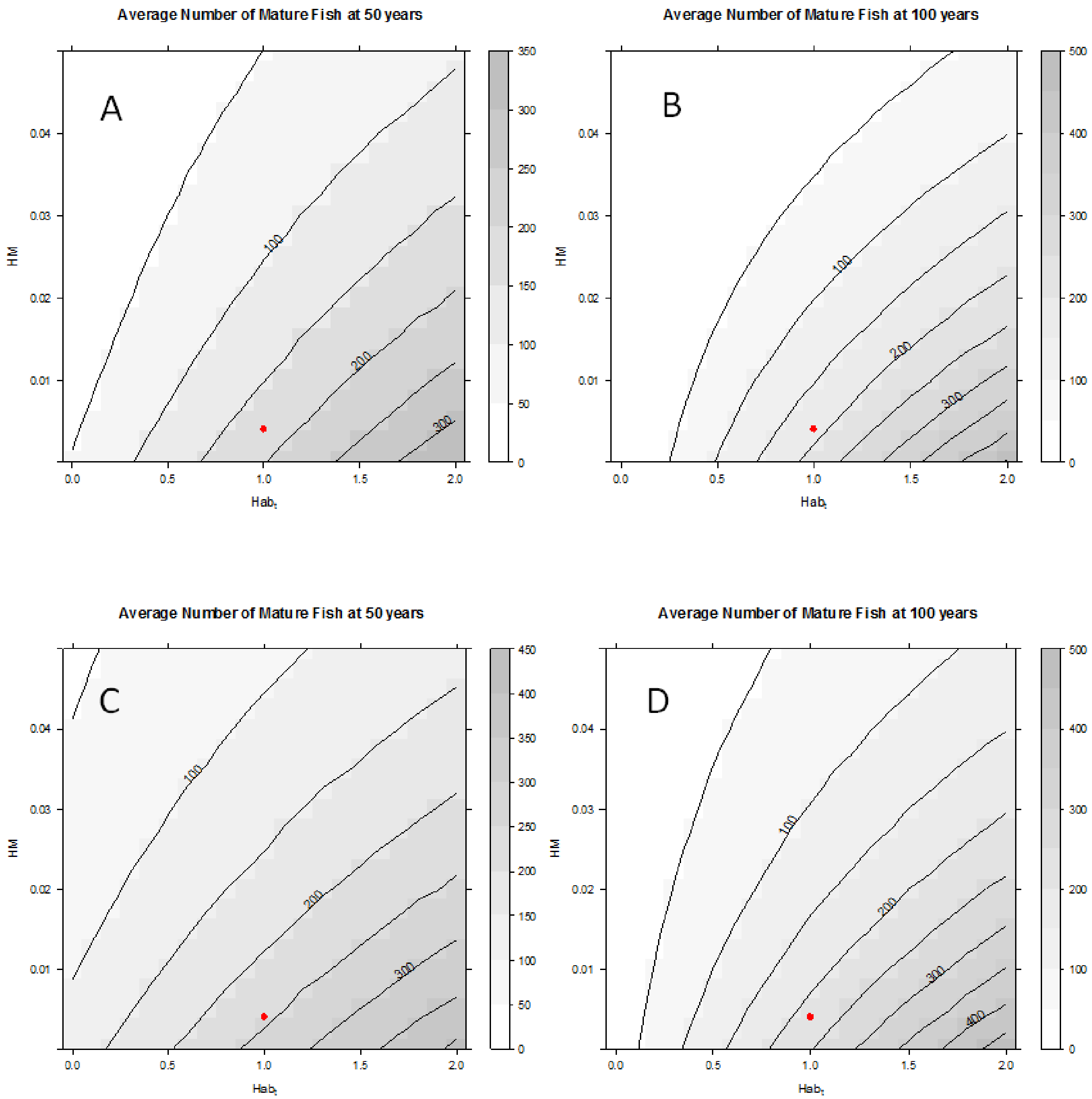

Figure 3. Contour plots of Upper Fraser White Sturgeon abundance at 50 and 100 years, with an exchange rate of 0% (A and B) and 0.1% (C and D). The red reference point represents the assumed current values of HM and Hab_t -- not abundance.

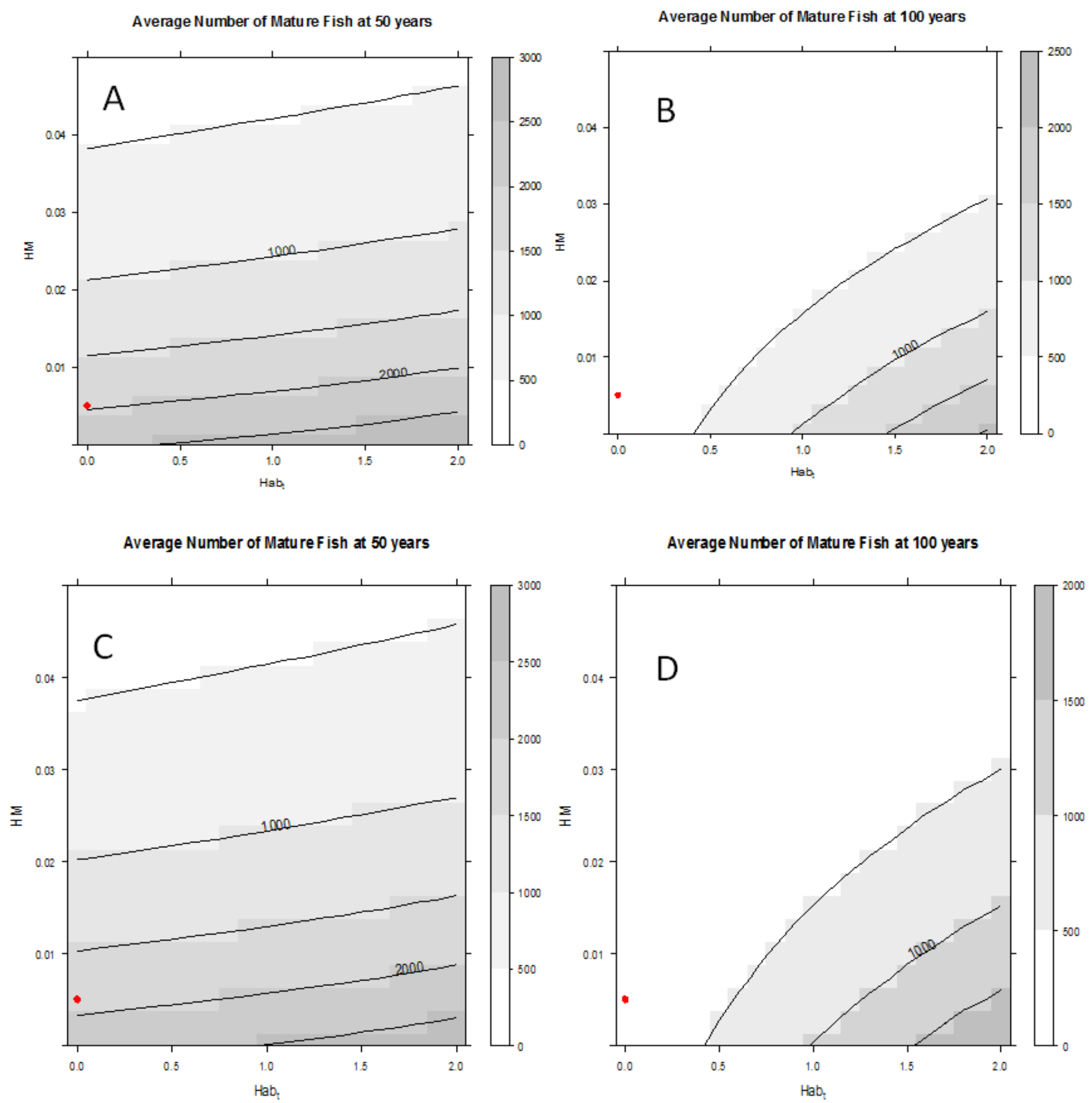

Figure 4. Contour plots of Nechako White Sturgeon abundance at 50 and 100 years, with an exchange rate of 0% (A and B) and 0.1% (C and D) under a stocking scenario. The red reference point represents the assumed current values of HM and Hab_t but does not represent current abundance. Hab_t would increase if spawning habitat near Vanderhoof is improved.

Allowable Harm Assessment

The Nechako sub-DU is well below its recovery target of 1,000 adult fish and will continue to decline until hatchery-produced fish recruit to the adult population. Thus, it was assumed that there is limited scope for additional allowable harm for this sub-DU and any risk of harm should only be undertaken in support of conservation objectives. As for the Mid- and Upper Fraser sub-DUs, allowable harm was evaluated by modeling changes in HM while maintaining current Hab_t values. Due to the long-lived nature of this species, population trajectories were run for 500 years at increasing levels of HM (1.5 – 3x current estimate) for these two sub-DUs to evaluate stability. In addition, exceedance plots were generated to determine the probability that each of these sub-DUs would be above their abundance targets after 50 years.

Abundance decreased with increasing HM but none of the population trajectories for the Mid-Fraser sub-DU resulted in a population crash and median abundance stabilized within 100 years. Although the median population abundance for each HM value reached a stable equilibrium value, the median population abundance decreased as HM increased. Based on the exceedance plots, 49% of the iterations at 50 years were equal to or greater than the current abundance (749 adults) at current HM values (Annual mortality rate: 0.006). When HM was increased to 1.5× (0.009), 13% of the iterations at 50 years were equal to or greater than the current abundance. When HM was increased to 2× (0.012), 3% of the iterations at 50 years were equal to or greater than the current abundance and when HM was 2.5× or greater, <1% of the iterations at 50 years were equal to or greater than the current abundance.

Similarly, abundance decreased with increasing HM but none of the population trajectories for the Upper Fraser sub-DU resulted in a population crash and the median abundance stabilized within 100 years. Although the median population abundance for each HM value reached a stable equilibrium value, the median population abundance decreased as HM increased. Based on exceedance plots, 57% of the iterations at 50 years were equal to or greater than the current abundance (185 adults) at current HM values (Annual mortality rate: 0.004). When HM was increased to 1.5× (0.006), 34% of the iterations at 50 years were equal to or greater than the current abundance. When HM was increased to 2× (0.008), 17% of the iterations at 50 years were equal to or greater than the current abundance. When HM was increased to 2.5× (0.01), 9% of the iterations at 50 years were equal to or greater than the current abundance. Finally, when HM was increased to 3× (0.012), 3% of the iterations at 50 years were equal to or greater than the current abundance.

This allowable harm analysis demonstrates that increasing the current human-induced mortality (HM) by 2× for the Mid-Fraser sub-DU or 3× for the Upper Fraser sub-DU can have substantial effects on the abundance of White Sturgeon. Such an increase in HM may exceed a level of harm that can maintain population abundances.

Sources of Uncertainty

Existing information suggests that both the Mid- and Upper Fraser sub-DUs are likely at roughly historical abundances but admittedly long time series are not available. Further, the modeling assumed habitat productivity was maintaining the current abundance level. However, if historical abundances were higher and/or habitat was more productive or human induced mortality lower, then the suggested recovery targets would have been underestimated here.

The RPA identifies (and scores) 12 potential threats for each of the three Upper Fraser sub-DUs. However, it is not possible to link these threats directly to changes in habitat productivity (or human-induced mortality). For example, knowing that the risk of altered food supply is high for all three sub-DUs does not directly translate to a specific change of Hab_t in the model. Similarly, it is not possible to quantify how much actual habitat would need to be rehabilitated based on Hab_t to result in successful recruitment for the Nechako sub-DU, only that this must occur to increase abundance.

There were no direct measures of human-induced mortality (HM) for any of the three sub-DUs and these might be higher than what has been modelled here, especially for the Mid-Fraser sub-DU where there are more adult fish and greater potential for encounters with recreational or aboriginal fisheries. Better resolution of HM for all sub-DUs would refine model outputs and could inform potential management options.

The long term goal of stocking in the Nechako is to ensure a self-sustaining population but due to recruitment failure and the long-lived nature of this species, access to brood stock will be limited over time. It is not clear if these hatchery-reared fish have the same evolutionary fitness as wild fish or how interactions between wild and hatchery fish will ultimately affect survival, growth, reproduction, and recruitment and thus ultimately sustainability. However, hatchery inputs will need to be managed to ensure recovery of the Nechako sub-DU without overwhelming the other sub-DUs in the Upper Fraser River metapopulation due to migration.

Critical habitat was not identified through this process. The Recovery Strategy for White Sturgeon (*Acipenser transmontanus*) in Canada, published in March 2014 on the Species at Risk Public Registry, identifies critical habitat for the Nechako and Upper Fraser sub-DUs as well as important habitats for the Mid-Fraser sub-DU. Additional work could be undertaken to ensure a relatively complete inventory.

There has already been considerable work undertaken on White Sturgeon in the Upper Fraser DU, especially for the Nechako sub-DU, and existing or planned monitoring efforts will go a long ways to addressing many of these sources of uncertainty.

SOURCES OF INFORMATION

This Science Advisory Report is from the March 30 – April 1, 2016 Recovery Potential Assessment – White Sturgeon, Upper Fraser Designatable Unit. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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