Federal Recovery Outline

North American Green Sturgeon
Southern Distinct Population Segment

Prepared by
National Marine Fisheries Service
Southwest Region

Disclaimer

This outline is meant to serve as interim guidance for recovery efforts, including recovery planning, for the southern Distinct Population Segment of North American green sturgeon, until a full recovery plan is developed and issued. A recovery outline is not subject to formal review and is not a regulatory document. This outline is intended primarily for internal use by NMFS as a pre-planning document and the recommendations and statements found herein are non-binding and intended to guide, rather than require, actions. Nothing in this outline should be considered as a commitment or requirement for any governmental agency or member of the public. Formal public participation will be invited upon the release of the draft recovery plan for this Distinct Population Segment. However, any new information or comments that members of the public may wish to offer as a result of this recovery outline will be taken into consideration during the recovery planning process. Recovery planning has been initiated and a draft recovery plan is targeted for completion by June 2011. NMFS invites public participation in the planning process. Interested parties may contact David Woodbury, Green Sturgeon Recovery Coordinator, 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404, David.P.Woodbury@noaa.gov, (707) 575-6088.

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I. INTRODUCTION

Recovery Outline Purpose

The Federal Endangered Species Act of 1973 (ESA), mandates the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) to develop and implement recovery plans for the conservation and survival of ESA-listed species under NMFS' jurisdiction. According to the 2004 NMFS Interim Recovery Planning Guidance:

> Recovery is the process by which listed species and their ecosystems are restored and their future safeguarded to the point that protections under the ESA are no longer needed. A variety of actions may be necessary to achieve the goal of recovery, such as the ecological restoration of habitat or implementation of conservation measures with stakeholders. However, without a plan to organize, coordinate and prioritize the many possible recovery actions, the effort may be inefficient or even ineffective. The recovery plan serves as a road map for species recovery – it lays out where we need to go and how best to get there.

This recovery outline presents a preliminary conservation strategy that will guide recovery actions in a systematic, cohesive way until a recovery plan is completed. The outline will assist in guiding and documenting pre-planning considerations for recovery plan development and decision-making.

General Information

Species name: Southern Distinct Population Segment of North American green sturgeon (*Acipenser medirostris*) (sDPS green sturgeon)

Listing status: Threatened

Date listed: April 7, 2006 (71 FR 17757)

Critical Habitat designated: November 9, 2009 (74 FR 52300)

Protective regulations issued (4d Rule): July 2, 2010 (75 FR 30714)

Contact Biologist/Lead Office*:* David Woodbury, Green Sturgeon Recovery Coordinator, NMFS, 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404, David.P.Woodbury@noaa.gov, (707) 575-6088

II. RECOVERY STATUS

In order to establish a recovery plan for a species, the current status of that species must be understood. The recovery status indicates how the species is doing at present and the steps that must be taken for improvement. Three components were considered when determining recovery status: (1) the biological requirements of the species, (2) the threats that negatively impact the species, and (3) the conservation efforts that positively impact the species.

Biological Requirements

Life History

The North American green sturgeon, *Acipenser medirostris*, is an anadromous fish that occurs in the nearshore Eastern Pacific Ocean from Alaska to Mexico (Moyle 2002) (Figure 1). They are long lived, late maturing, spawn infrequently in natal streams, and spend substantial portions of their lives in marine waters. Using molecular analyses and evidence of spawning site fidelity (Lindley *et al*. In Press; Israel *et al*. 2009), NMFS identified two distinct population segments (DPS) of green sturgeon. Northern DPS (nDPS) green sturgeon currently spawn in the Klamath River, California and Rogue River, Oregon and is listed as a Species of Concern (69 FR 19975). There is evidence that this DPS historically spawned in the Eel River in California and Umpqua River in Oregon. The only confirmed spawning site for southern DPS (sDPS) green sturgeon is a short stretch of the upper mainstem Sacramento River, below Keswick Dam. In 2006, NMFS determined that sDPS green sturgeon warranted listing as a threatened species under the ESA.

Green sturgeon reach sexual maturity at approximately fifteen years of age (Van Eenennaam *et al*. 2006), and may spawn every three to five years throughout their long lives (California Fish Tracking Consortium database: http://californiafishtracking.ucdavis.edu). sDPS green sturgeon spawn in the upper mainstem Sacramento River in cool (14-17ºC), deep, turbulent areas with clean, hard substrates. Larvae and juveniles migrate downstream toward the Sacramento-San Joaquin Delta/Estuary, where they rear for one to four years before migrating out to the Pacific Ocean as subadults. Once at sea, subadults and adults occupy coastal waters to a depth of 110 m from Baja California, Mexico to the Bering Sea, Alaska (Erickson and Hightower 2007). Seasonal migrations are known to occur. Fish congregate in coastal bays and estuaries of Washington, Oregon, and California during summer and fall. In winter and spring, similar aggregations can be found from Vancouver Island to Hecate Strait, British Columbia, Canada (Lindley *et al*. 2008; Lindley *et al*. In Press).

As adults and subadults, nDPS and sDPS green sturgeon are known to co-occur in marine and estuarine areas along the west coast of North America (Moser and Lindley 2007; Israel *et al*. 2009; Lindley *et al*. In Press). Distinguishing between nDPS and sDPS green sturgeon can be difficult; however, genetic analysis can be used to assign fish to one DPS or the other, provided a tissue sample is obtained. To date, acoustically tagged subadult or adult sDPS green sturgeon have not been observed inhabiting waters upstream of tidal influence in rivers north of and including the Eel River, California. Similarly, no observations of tagged subadult or adult nDPS green sturgeon entering San Francisco Bay have been made (Lindley *et al*. In Press).

In preparation for spawning, adult sDPS green sturgeon enter San Francisco Bay between mid-February and early-May, and migrate rapidly (on the order of a few weeks) up the Sacramento River (Heublein *et al*. 2009). Most fish follow a direct path up the Sacramento River, but a small percentage have been observed to move toward the eastern part of the Delta, following the San Joaquin River and subsequently enter the Sacramento River via the Mokelumne River. Spawning occurs from April through early July, with peaks of activity that depend on a variety of factors including water temperature and water flow rates (Poytress *et al*. 2010; Poytress *et al*. 2009). Post-spawn fish typically hold for several months in a few deep pools in the upper mainstem Sacramento River near spawning sites and migrate back downstream when river flows increase in fall. They re-enter the ocean during the winter months (November through January) and begin their marine migration north along the coast (California Fish Tracking Consortium database).

Critical Habitat

Critical habitat was designated for sDPS green sturgeon on October 9, 2009, and includes marine, coastal bay, estuarine, and freshwater areas (74 FR 52300). In freshwater, critical habitat includes the mainstem Sacramento River downstream of Keswick Dam (including the Yolo and Sutter bypasses), the Feather River below Fish Barrier Dam, the Yuba River below Daguerre Point Dam, and the Sacramento-San Joaquin Delta. Critical habitat within marine waters includes areas within the 60 fathom isobath from Monterey Bay to the U.S.-Canada border. Many coastal bays and estuaries are designated as critical habitat, including: San Francisco Estuary and Humboldt Bay in California; Coos, Winchester, Yaquina, and Nehalem bays in Oregon; Willapa Bay and Grays Harbor in Washington; and the lower Columbia River estuary from the mouth to rkm 74. Primary Constituent Elements (PCEs) considered in the designation of critical habitat include food resources, substrate type/size, water flow, water depth, water quality, sediment quality, and migratory corridor.

Status

Attempts to evaluate the status of sDPS green sturgeon have been met with limited success due to the lack of reliable long term data. Interpretations of available abundance data for green sturgeon are confounded by small sample sizes, intermittent reporting, fishery-dependent data, lack of directed sampling, subsampling, and potential confusion with white sturgeon (Heppell and Hofmann 2002; Adams *et al*. 2002). Based on available scientific data (Adams *et al*. 2007) and ongoing conservation efforts, NMFS concluded in the final rule designating this species that sDPS green sturgeon were likely to become endangered in the foreseeable future throughout all of its range. Reduction of potential spawning habitat, severe threats to the single remaining spawning population coupled with the inability to alleviate these threats using current conservation measures, and the continued observance of declining numbers of juveniles collected in the past two decades were determined to be the most critical factors in the formulation of this conclusion. Recent research efforts have focused on monitoring early life history stages and estimating adult abundance to better evaluate overall species status (Israel and May 2010).

Population Structure and Viability

Green sturgeon stocks from the DPSs are genetically differentiated (Israel *et al*. 2004, Israel *et al*. 2009). Genetic differentiation is moderate and statistically similar between the southern and northern DPSs. In the northern DPS, the stocks on the Rogue and Klamath rivers are genetically similar suggesting gene flow between these populations.

In general, sturgeon year class strength appears to be episodic with overall abundance dependent on a few successful spawning events. Genetic techniques were used to estimate the number of sDPS green sturgeon spawners contributing to juvenile production between 2002 and 2006 in the upper segment of spawning habitat above the Red Bluff Diversion Dam and estimated between 10 and 28 individuals contributed to juvenile production (Israel and May 2010). Since populations appear to be not at equilibrium, conclusions regarding equilibrium dynamics are uncertain given the lack of information. Work is ongoing to ascertain life history diversity and potential finer-scale population structure.

For green sturgeon, Beamesderfer *et al*. (2007) generated a hypothetical population demographic model to evaluate life-stage specific mortality and determine impacts to spawning stock biomass and overall species status. Their study indicated that, in an average green sturgeon population considered over a period of time, subadults comprise the majority (63%) of the population, and adults only 12%. With an average spawning periodicity of four years at adulthood, the modeling estimated that the annual spawning population represents only a very small fraction of the actual census population. The sensitivity of sturgeon to increasing mortality is highlighted by abrupt declines in numbers and reproductive potential in hypothetical life table analyses. Even very low rates of mortality can have a significant impact on sturgeon population dynamics when results accrue across multiple life stages.

Threats Assessment

A threat is defined as any factor that could represent an impediment to recovery. Primary threats to sDPS green sturgeon are similar to the two primary threats of harvest and destruction of spawning habitat impeding sturgeon conservation globally. Historically, harvest of adults likely resulted in direct declines in abundances, and destruction of spawning and rearing habitats lead to reduced population sizes and resilience. It is imperative that a comprehensive identification and analysis of threats and their sources is made in order to successfully document and implement actions that will lead to the recovery of green sturgeon. In this recovery outline, both natural and human-related threats are outlined and organized under the following five ESA listing factors.

Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Reduction in Spawning Habitat

The principle threat to sDPS green sturgeon is currently the reduction of historically accessible spawning habitat, most notably by impoundments. These include Shasta and Keswick dams on the Sacramento River, Oroville Dam on the Feather River, and Daguerre Point Dam on the Yuba River (Mora *et al*. 2009; NMFS 2005). Spawning currently appears to be limited to the upper

portion of the mainstem Sacramento River, below Keswick Dam. It appears that suitable spawning habitat existed upstream of Keswick Dam prior to its construction, although there are no recorded accounts of green sturgeon spawning there historically. Adult green sturgeon have been observed in the Feather and Yuba rivers, although there has been no direct evidence of spawning activity (*i.e*., collection of eggs, larvae, or juveniles). Recently, a few tagged adult green sturgeon briefly entered the Feather River in the spring, subsequently exited, and continued their migration toward spawning sites in the upper Sacramento River. This behavior may be indicative of historic spawning activities that have since been curtailed by habitat loss and modification. Adult green sturgeon have been observed in the Yuba River in December, indicative of post-spawned fish. Severely reduced river flows in these watersheds result in silt accumulation, and elevated water temperature leads to algae growth, both adversely affecting potential spawning substrate. Adequate spawning conditions may have been present in the San Joaquin River and several of its tributaries, including the Stanislaus, Tuolumne, and Merced rivers, although it is unknown whether sDPS green sturgeon used these rivers for spawning (Beamesderfer *et al*. 2004). Historical information indicates that sturgeon were once common in the Russian River, Sonoma County, California (Collins 1892). Unfortunately, records do not identify the species as white or green sturgeon.

Alteration of Habitat

Green sturgeon habitat in the mainstem Sacramento River and Sacramento-San Joaquin Delta/Estuary has been greatly modified since the mid-1800s. Although the following examples are not exhaustive, they illustrate the relationships between threats to green sturgeon and specific types of habitat alteration:

- Hydraulic gold mining resulted in the removal of gravel and the deposition of mercury-laced fine sediment within streams, rivers, and the estuary.
- Agricultural practices have converted tidal and seasonal marshlands and continue to release contaminants into California's Central Valley waterways.
- Levees have been created extensively along the Sacramento River and the Delta, resulting in the removal of riparian vegetation and channel complexity.
- The hydrographs of the Sacramento, Feather, and Yuba rivers below their respective dams have been substantially altered. River flow and temperature are now highly regulated for flood control, agricultural activities, and conservation of endangered winter-run Chinook salmon. Recent studies indicate that current water management practices may be having deleterious effects on green sturgeon (Poytress *et al*. 2009, 2010). Erickson and Webb (2007) found that patterns in upstream spawning migration distances of green sturgeon in the Rogue River may be correlated with spring and early summer flows. In white sturgeon, there appears to be a strong correlation between mean daily freshwater outflow (April to July) and year class strength in the Sacramento-San Joaquin Estuary. This implies that insufficient flow rates may pose a substantial threat to sDPS green sturgeon (CDFG 1992; USFWS 1995).
- In-river water diversions alter flow and potentially entrain larval/juvenile green sturgeon.
- Introduced and invasive species have likely modified trophic relationships in both freshwater and estuarine habitats. This may result in increased predation on young green sturgeon, as well as reduced growth and fitness as a result of feeding on non-optimal prey resources.

As a result, the ecosystems of the Sacramento River and Sacramento-San Joaquin Delta/Estuary function much differently today than they did historically, which has numerous suspected and potential negative impacts on green sturgeon.

Delayed Migration

Temporary dams, altered flows, and entrainment in water diversions can delay both upstream spawning migrations of adult green sturgeon and downstream migrations of juveniles (Heublein *et al*. 2009). Potential barriers such as the Red Bluff Diversion Dam (RBDD) on the Sacramento River, and Shanghai Bench and Sunset Pumps on the Feather River, may cause delays that could lead to reduced spawning success by forcing the fish to choose less suitable spawning habitat. Continued management action at RBDD is necessary, as data indicate that delayed gate closure has recently allowed more adults to reach preferred spawning habitats. This could result in increased annual spawning success and quicker recovery of the species. Construction of the Red Bluff Fish Passage Improvement Project that would eliminate closure of RBDD is slated to be completed in 2012.

The Delta Cross Channel (DCC), located near the city of Walnut Grove, California, was constructed in 1951 to facilitate the transfer of fresh water from the Sacramento River to federal and state pumps located in the south Delta. Flow from the Sacramento River into the DCC is controlled by two radial arm gates that can be opened and closed depending on water quality, flood protection, and fish protection requirements. When the gates are open, Sacramento River water is diverted into the Mokelumne and San Joaquin rivers. The gates are closed in fall to protect migrating salmonids, then opened the following spring. Thirty-percent of the tagged adult green sturgeon migrating down the Sacramento River after spawning entered the DCC (Israel *et al*. 2010). Most of these fish were able to successfully negotiate their way through the Delta and reach the Pacific Ocean. However, four fish were detected in the south Delta, with only one surviving to reach the Pacific Ocean. Juvenile green sturgeon may also be entrained into the interior delta during the summer when the DCC is open. Further studies are necessary to investigate the threat this alternative route through the Delta poses for these fish.

Impaired Water Quality

The installation of the Shasta Dam temperature control device in 1997 has reduced the threat of increased water temperature in the mainstem Sacramento River on endangered winter-run Chinook salmon. Temperatures higher than 16°C have not been recorded at RBDD since it began operating (California Data Exchange Center - http://cdec.water.ca.gov/). However, sDPS green sturgeon thermal requirements for egg incubation and larval growth may be higher than those of salmonids and should be considered by those managing water temperature in this stretch of river. In contrast, water is diverted from the Feather River immediately below Oroville Dam, warmed in a shallow impoundment, and then released back into the Feather River at the Thermalito Afterbay Outlet to increase agricultural yields. This warm water likely prohibits spawning of green sturgeon in that system (USFWS 1995, CDFG 2002). Unlike Shasta Dam, there is no temperature control device on Oroville Dam.

Contaminant loads in the Sacramento River increased substantially during the mid-1970s (USFWS 1995) and are thought to have deleteriously affected the larvae of striped bass (Bailey *et al*. 1994). In addition, Baxter *et al*. (2008) discuss that toxins may be at least partially

responsible for the pelagic organism decline in the Delta. Similar effects may be occurring to green sturgeon as larvae and juveniles are present in the Sacramento River and juveniles are present in the Delta. Although unknown for green sturgeon, white sturgeon residing in the estuary are known to contain body burdens of contaminants (Greenfield *et al*. 2005). Although green sturgeon spend more time in the marine environment than white sturgeon and, therefore, may have relatively less exposure to contaminants in the Central Valley and Delta, some degree of risk from both current and legacy contamination probably still occurs (71 FR 17757).

Dredging and Ship Traffic
Juvenile sDPS green sturgeon residing within the San Francisco Bay Estuary/Delta may be entrained during hydraulic suction dredging, which is conducted to maintain adequate depth within navigation areas or to mine sand for commercial use. Additionally, the disposal of dredged material at aquatic sites within the estuary might bury green sturgeon or their prey, and expose green sturgeon to elevated levels of contaminated sediments. Passage of large, ocean-going vessels into estuaries along the west coast is facilitated through dredging, which maintains deep channels within the estuaries. The presence of these large vessels within the estuaries may result in propeller strikes on green sturgeon. The introduction of nonnative invasive species through ballast water discharge has been facilitated by allowing ships to enter inland ports through dredged-maintained channels. This has contributed to a biotic community in the Delta/Estuary dominated by non-native species.

Ocean Energy Projects
Projects that harness the ocean's energy are currently being considered along the entire west coast. Potential concerns for green sturgeon include, but are not limited to, exposure to electromagnetic field (EMF) emissions, blade strikes, turbine entrainment, and ocean energy facilities functioning as fish aggregation devices.

One of the primary concerns involves the exposure of green sturgeon to EMF generated from project cables, turbine structures, and junction boxes. Green sturgeon use electroreceptors for feeding and perhaps migration, and these activities may be affected by EMF.

The proposed installation and operation of energy-generating turbines at the mouths of several estuaries (San Francisco Bay and Puget Sound) may lead to injury and mortality as a result of potential blade strikes in association with turbine operation.

Additionally, wave buoy and tidal turbine arrays may act as artificial reefs (*e.g*., DuPont 2008) or fish aggregation devices for marine mammals, fish, and invertebrates. If so, related changes to the local marine community, predator-prey interactions (*i.e*., increased presence of sea lions), or the distribution and abundance of marine species around ocean energy installation sites are also possible, and these sites are within the migratory corridors of green sturgeon.

Commercial, Recreational, Scientific, or Educational Overutilization

Commercial, tribal, and recreational fishing probably had negative impacts on sDPS green sturgeon in the past. Current fishing regulations in Washington, Oregon, and California prohibit

retention of green sturgeon in all commercial and recreational fisheries, although a small number of tribes still retain green sturgeon captured in some coastal bays and estuaries.

Recreational anglers targeting white sturgeon incidentally capture several hundred green sturgeon annually. This take is of particular concern in California's Central Valley and the lower reaches of the Columbia River. Although a small number of green sturgeon are retained illegally by fishers who misidentify them as white surgeon, the primary concern is the extent to which injury or mortality occurs during the capture and release of these fish. In March 2010 the California Department of Fish and Game (CDFG) prohibited fishing for either white or green sturgeon within the upper mainstem Sacramento River between Keswick Dam and Butte Bridge (Hwy 162) in an effort to protect adult green sturgeon during their spawning runs.

Coastal groundfish trawl fisheries have been substantially reduced since the 1990s due to increasingly restrictive management measures. These include reduced trip limits, increased gear restrictions, and a vessel buyback program, all of which are expected to reduce green sturgeon bycatch. Recent modifications to existing fishing regulations have almost certainly reduced overall green sturgeon take, but the impact of discard mortality and sublethal effects of capture remain unknown. Upcoming changes to marine bottom trawl regulations may result in increased fishing in nearshore waters, which could subsequently increase the exposure of green sturgeon to capture and release.

The demand for sturgeon caviar continues to increase both nationally and globally, and enforcement to protect sturgeon from poaching within the Central Valley is a high priority (CDFG 2002), as noted by the number of sturgeon poaching operations that have been discovered there in recent years. Although eggs from green sturgeon are not as prized for making caviar as are the eggs from white sturgeon, those poaching sturgeon are not likely to release a large green sturgeon if captured, even if targeting only white sturgeon. However, the degree to which poaching of sDPS green sturgeon occurs is largely unknown.

The amount of green sturgeon take associated with scientific research has recently become a concern. Given that we do not know how many sturgeon there are, we need to carefully review any project (or suite of projects) that allows green sturgeon to be taken and, if warranted, alter take amounts to better conserve the species.

Disease and Predation

A number of viral and bacterial infections have been reported for sturgeon in general (Mims *et al*. 2002), however specific issues related to diseases of green sturgeon have not been studied or reported. Therefore, it is not known if disease has played a role in the decline of sDPS green sturgeon.

The significance of predation on each life stage of green sturgeon has not been determined. There has been an increasing prevalence of nonnative species in the Sacramento-San Joaquin River and Delta systems (CDFG 2002) and this may pose a significant threat. Striped bass, an introduced species, may affect the population viability of Chinook salmon (Lindley *et al*. 2004), and probably preys on other species, such as sturgeon (Blackwell and Juanes 1998). Sea lions

have been photographed taking adult green sturgeon on the Rogue River, and green sturgeon have been observed in the Rogue River with bite marks from sea lions (Dan Erickson pers. comm.). Estimated annual predation of white sturgeon by sea lions at Bonneville Dam on the Columbia River has increased from 315 in 2006 to 1,897 in 2010 (Stansell *et al*. 2010), but the extent of predation on green sturgeon in that river is unknown. Similarly, it is likely that sea lions consume green sturgeon in the San Francisco Bay estuary, but again the extent to which this occurs is unknown.

Inadequacy of Existing Regulatory Mechanisms

Inadequacy of existing regulatory mechanisms has contributed significantly to the decline of the sDPS green sturgeon and to the severity of threats they currently face. During the process of developing the 4(d) rule for sDPS green sturgeon (70 FR 17386), NMFS noted several Federal, State, and local regulatory programs that have been implemented to help reduce historical risk. However, growing conflicts between the protection of other species (*e.g*., Sacramento River winter-run Chinook salmon and sea lions) may prove problematic for green sturgeon. Additionally, the establishment of Individual Fishing Quotas may result in the increase of fishing effort in areas where green sturgeon reside in coastal waters. Lastly, although some effort has been made to improve habitat conditions across the range of the sDPS green sturgeon, less has been accomplished through regulatory mechanisms to reduce threats posed by water diversions or blocked passage to spawning habitat.

Other Natural or Man-made Factors Affecting the Species' Continued Existence

The displacement of native prey by nonnative invasive species is a major concern. For example, the overbite clam, *Potamocorbula amurensis*, is a non-native invasive bivalve established in the San Francisco Bay Estuary in 1988 and has since become the most common food of white sturgeon in the Estuary (CDFG 2002). There is evidence that overbite clams can pass undigested through the gut of white sturgeon (Kogut 2008). Additionally, overbite clams bioaccumulate selenium, a toxic metal that green sturgeon are known to be highly sensitive to (Linville *et al*. 2002; White *et al*. 1989). This suggests that a potentially important estuarine food resource for green sturgeon is either indigestible or, if digested, could expose green sturgeon to a toxic contaminant (70 FR 17386). Non-native sea grass (*Zostera japonica*) invasions in Willapa Bay may also contribute to reduction in food abundance and quality by binding the sediment and potentially limiting the ability of sturgeon to penetrate the sediment in order to forage. This grass may also limit or change available food resources.

Larval and juvenile green sturgeon entrainment or impingement from screened and unscreened agricultural, municipal, and industrial water diversions along the Sacramento River and within the Delta is still considered an important threat (71 FR 17757). In 1997, NMFS and CDFG developed screening criteria designed to prevent entrainment and impingement of juvenile salmonids. Similar criteria for larval and juvenile sDPS green sturgeon have not been developed and although discussions regarding their development are occurring, there has been no timeline created as to when guidelines would be available.

Although population size is unknown for sDPS green sturgeon, it is clearly small and therefore susceptible to catastrophic events (Adams *et al*. 2002; BRT 2005). Events such as toxic oil or chemical spills in the upper Sacramento River could result in the loss of both spawning adults and their progeny, and lead to year-class failure (BRT 2005).

Conservation Assessment

The following actions have been or are currently underway to address the conservation needs of sDPS green sturgeon.

Fisheries Regulations

Recreational fishing regulations: The retention of green sturgeon is prohibited along the west coast of North America. California also revised its regulations to provide additional protection for green sturgeon. Effective March 1, 2010, sturgeon fishing was prohibited year-round in the mainstem Sacramento River from Highway 162 to Keswick Dam to protect spawning adults.

Commercial fishing regulations: The retention of green sturgeon is prohibited along the west coast of North America.

ESA regulations

The final critical habitat designation for the sDPS green sturgeon became effective on November 9, 2009, and includes: Sacramento, Feather and Yuba rivers, Yolo and Sutter bypasses; San Francisco Bay/Delta/Estuary; coastal bays and estuaries in California, Oregon, and Washington; and coastal marine waters to 60 fathoms from Monterey Bay in California to the Strait of Juan de Fuca, Washington.

Protective regulations governing the take of sDPS green sturgeon (4(d) rule) became effective July 2, 2010.

Federal agencies, in consultation with NMFS under ESA section 7, ensure that their activities (carried out, funded, or permitted) do not jeopardize listed species or adversely modify critical habitat.

Ongoing research and conservation actions

Salvage and relocation of green sturgeon occurs at the Tracy Fish Collection Facility and the Skinner Delta Fish Protective Facility in the South Delta.

Distribution, migration, spawning habitat utilization, and population genetic research is being conducted by UC Davis, Bureau of Reclamation, US Fish and Wildlife Service, California Department of Water Resources, CDFG, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, US Geological Survey, and NMFS.

Floodplain and river restoration; riparian habitat protection; fish screening and passage projects; environmental water acquisitions; and contaminant studies are being conducted under the Central Valley Project Improvement Act, the Anadromous Fish Restoration Program, and the California Bay-Delta Program for the conservation of the sDPS green sturgeon and other anadromous fishes.

Summary Statement of Recovery Needs

Major threats to sDPS green sturgeon still exist, even with the protections afforded by the listing, 4(d) rule, and critical habitat designation. The foremost threat is the restriction of spawning habitat in the Sacramento River. Another major threat is the alteration of freshwater and estuarine habitats from human activities, including agriculture and urban development. Restoration of freshwater and estuarine habitats with optimal physical conditions (*e.g.*, dissolved oxygen, temperature, and salinity) and adaptive water management practices will need to be addressed to resolve the long-term needs of this species.

Important threats to abate for the sDPS green sturgeon include:

1. Blockage of access to spawning habitat on Sacramento, Feather, and Yuba rivers
2. Deleterious hydrograph and water temperature regimes below Keswick and Oroville dams
3. Fisheries bycatch and discard, illegal retention in recreational fisheries, and poaching
4. Activities that impact spawning, rearing, and feeding habitats
5. Entrainment or impingement at water diversions, ocean energy projects, and vessel strikes
6. Displacement of native prey species by non-native invasive species
7. Exposure to contaminants
8. Loss of estuarine/delta function

Recent and ongoing conservation efforts have been implemented, but are not sufficient to fully address these threats. Recovery potential for sDPS green sturgeon is considered moderate to high; however, certain life history characteristics (*e.g.*, long-lived, delayed maturity) indicate recovery could take many decades, even under the best circumstances. The feasibility of reducing some of these threats may be an issue due social and economic factors, such as the competing demand of water for agricultural or municipal use. Further research is needed on the status and requirements of this single-spawning-site population.

Key recovery needs and implementation measures identified for the sDPS green sturgeon include the following:

Additional spawning and egg/larval habitat

- Restore access to suitable habitat
- Improve potential habitat
- Establish additional spawning populations
- Ensure adequate spatial separation of spawning populations

- Ensure all spawning populations are of sufficient size to meet genetic diversity criteria

Research/Monitoring

- Determine current and future population abundance and distribution of all life stages
- Obtain data needed for population viability assessment
- Determine fisheries-specific discard mortality rates and effects of capture
- Identify feeding habitats and prey resources
- Determine effects of non-native species
- Determine contaminant exposure and its effects
- Determine potential effects from proposed nearshore ocean energy projects
- Determine risk from sea lion predation

III. PRELIMINARY RECOVERY STRATEGY

The preliminary recovery strategy describes initial decisions that have been made about how to recover sDPS green sturgeon. First, a Priority Number was determined for sDPS green sturgeon to rank its priority for recovery plan development and implementation. Next, a Recovery Vision Statement was made to clearly define the overall goal of recovery. Priority tasks were then developed which, if implemented, would improve the potential for recovery. Finally, a preliminary action plan for NMFS was written. This plan outlines potential coordination efforts between divisions within NMFS and with other entities involved in green sturgeon management and recovery. This is a starting point from which the full recovery strategy for sDPS green sturgeon will be developed.

Recovery Priority Number

On a scale of 1-10, the recovery priority number assigned to sDPS green sturgeon is 5, indicating the risk of extinction is believed to be moderate. The recovery potential for this species is likely high if recreational and commercial fisheries remain closed and if activities that decrease habitat quality and quantity, particularly in spawning and rearing habitat, are carefully monitored and limited. However, conflict exists between the recovery of the sDPS green sturgeon and economic interests. Central Valley agriculture, other water users, and commercial and recreational fisheries are among the entities that may be affected by efforts to recover sDPS green sturgeon.

Recovery Vision Statement

The Green Sturgeon Recovery Team reached consensus on the following statement regarding their vision of what a recovered population of sDPS green sturgeon should look like in the future.

“Healthy, self-sustained, viable populations of sDPS green sturgeon exist within their historic range. This includes spawning in multiple rivers, with the DPS represented by multiple strong

year-classes. These green sturgeon are sufficiently abundant, productive, and diverse in healthy ecosystems to provide ecological and public benefits."

Recovery Tasks to Improve Potential for Recovery

The goal of this recovery outline is to set out a plan to conserve and recover sDPS green sturgeon by identifying actions that may improve its potential for recovery. These include, but are not limited to, the following:

1. Improve existing and initiate novel research and monitoring on distribution, status, trends, and life-stage survival of sDPS green sturgeon at the population level.
2. Establish better inter- and intra-agency coordination regarding scientific research conducted on green sturgeon under ESA sections 7, 10, and 4(d).
3. Evaluate the significance of green sturgeon bycatch in commercial fisheries through the implementation of directed surveys.
4. NMFS Office of Law Enforcement (OLE) should monitor and collaborate with state enforcement agencies along the west coast related to illegal retention of green sturgeon in recreational fisheries.
5. NMFS OLE should collaborate with CDFG wardens to address sturgeon poaching in the Central Valley.
6. Assess the potential for establishing independent spawning populations in areas outside of the mainstem Sacramento River (*e.g.*, Feather, Yuba, Russian rivers, as well as tributaries of San Joaquin River).
7. Address the need to develop a multiple species water flow and temperature management plan for Shasta, Keswick, Oroville and Englebright dams.
8. Address the application of pesticides (Carbaryl and others) and herbicides applied to control burrowing shrimp and non-native plants in estuaries.
9. Identify and prioritize potential contaminants of concern in the Central Valley.
10. Ensure that screens are placed on water diversions on the upper mainstem Sacramento River below Keswick Dam and that they are designed to be protective of larval and juvenile green sturgeon. Research on screening criteria should be initiated as soon as feasible.
11. Continue to support the removal of the Red Bluff Diversion Dam.
12. Monitor hydraulic suction dredges for potential entrainment of juvenile sDPS green sturgeon.
13. Determine the impact of non-native species.
14. Determine if electromagnetic fields produced by offshore energy projects alter green sturgeon migration patterns.

Recovery actions will be further refined in the recovery plan and will be specific to several regions, including the Sacramento River, the Delta/Estuary, and coastal marine areas, which include several estuaries/bays. These regions have different characteristics and will require different types of actions to achieve recovery. Actions specific to life-stages in each region will be identified to address more localized factors that currently suppress potential for recovery for sDPS green sturgeon.

Preliminary Action Plan

While NMFS is responsible for developing and implementing recovery plans, the plans will have a greater likelihood of success if they are developed in partnership with entities that have the responsibility and authority to implement specific recovery actions. Hence, NMFS is considering initiating a series of outreach events, workshops and presentations in various forums to ensure high levels of communication and interaction with the public, stakeholders and agencies throughout the development and finalization process of the recovery plan, including the following:

- NMFS will coordinate with the tribes in California, Oregon, Washington, Alaska, and Canada during the development of the recovery plan.

- NMFS Protected Resources Division will coordinate with other NMFS divisions including Habitat Conservation Division, Sustainable Fisheries Division, NOAA Restoration Center, NOAA Office of Law Enforcement, and NMFS Science Centers to ensure consistency and effectiveness in the recovery plan development.

- NMFS shall focus on linking and coordinating ESA programs to recovery planning, and developing stronger, more collaborative partnerships with other entities whose decisions affect green sturgeon. This should include providing outreach to federal action agencies regarding their obligations under ESA section 7(a)(1) to implement actions that conserve and recover sDPS green sturgeon. NMFS will also need to coordinate and improve communication with federal and state agencies regarding joint management responsibilities as well as diverging responsibilities such as water supply management and allocations, and competing species' needs.

IV. PRE-PLANNING DECISIONS

Product

Draft Recovery Plan for sDPS green sturgeon.

Scope of Recovery Plan

Species _X_ Recovery Unit __ Multi-Species __ Ecosystem __

Recovery Plan Preparation

NMFS has appointed an 11-member recovery team comprised of scientists knowledgeable in green sturgeon biology and conservation policy. The NMFS Southwest Region Protected Resources Division will initiate the preparation of a draft recovery plan for sDPS green sturgeon (using the most recent Recovery Planning Guidance from October 2006) with a goal of releasing an internal draft by June 30, 2011. Primary authorship of the Recovery Plan will be the responsibility of NMFS staff.

Outreach by NMFS to state, federal, and private partners will be central to the recovery effort.

Administrative Record

The administrative record will be housed in the NMFS SWR North Central Coast office in Santa Rosa, California.

Schedule and Responsibility for Draft Recovery Plan Modules

Completed:
October 2009

- Met with internal NMFS recovery guidance team
- Published 'Notice of Intent to Prepare a Recovery Plan'

December 2009

- Kick-off meeting with sDPS green sturgeon Recovery Team; discussing threats

September 2010

- Meeting with sDPS green sturgeon Recovery Team; developing recovery actions and delisting criteria

To be completed:
Winter 2011

- Initiate recovery planning website for public outreach
- Initiate development of recovery plan chapters
- Initiate development of threats assessment
- Conduct outreach on draft threats assessment
- Finalize recovery outline
- Develop outreach brochures

Spring 2011

- Host workshops for public involvement in recovery planning process
- Post products on website for review and comment

Summer 2011

- Issue draft recovery plan for internal review by June 30, 2011
- Issue draft recovery plan for co-manager review

Fall 2011

- Issue draft recovery plan for public review
- Initiate independent peer review

Summer 2012

- Revise draft recovery plan pursuant to comments received, and finalize
- Post final plan on website
- Outreach to initiate recovery plan implementation for priority actions

Outreach and Stakeholder Participation

In order to facilitate communication with various stakeholders, NMFS will construct and maintain a web site that provides technical information about sDPS green sturgeon life history, species needs, and viable population structure to enable access by federal, state, regional planning organizations, county governments, special interest groups, non-governmental organizations, and the public. The web site will also identify actions that could conserve and recover sDPS green sturgeon.

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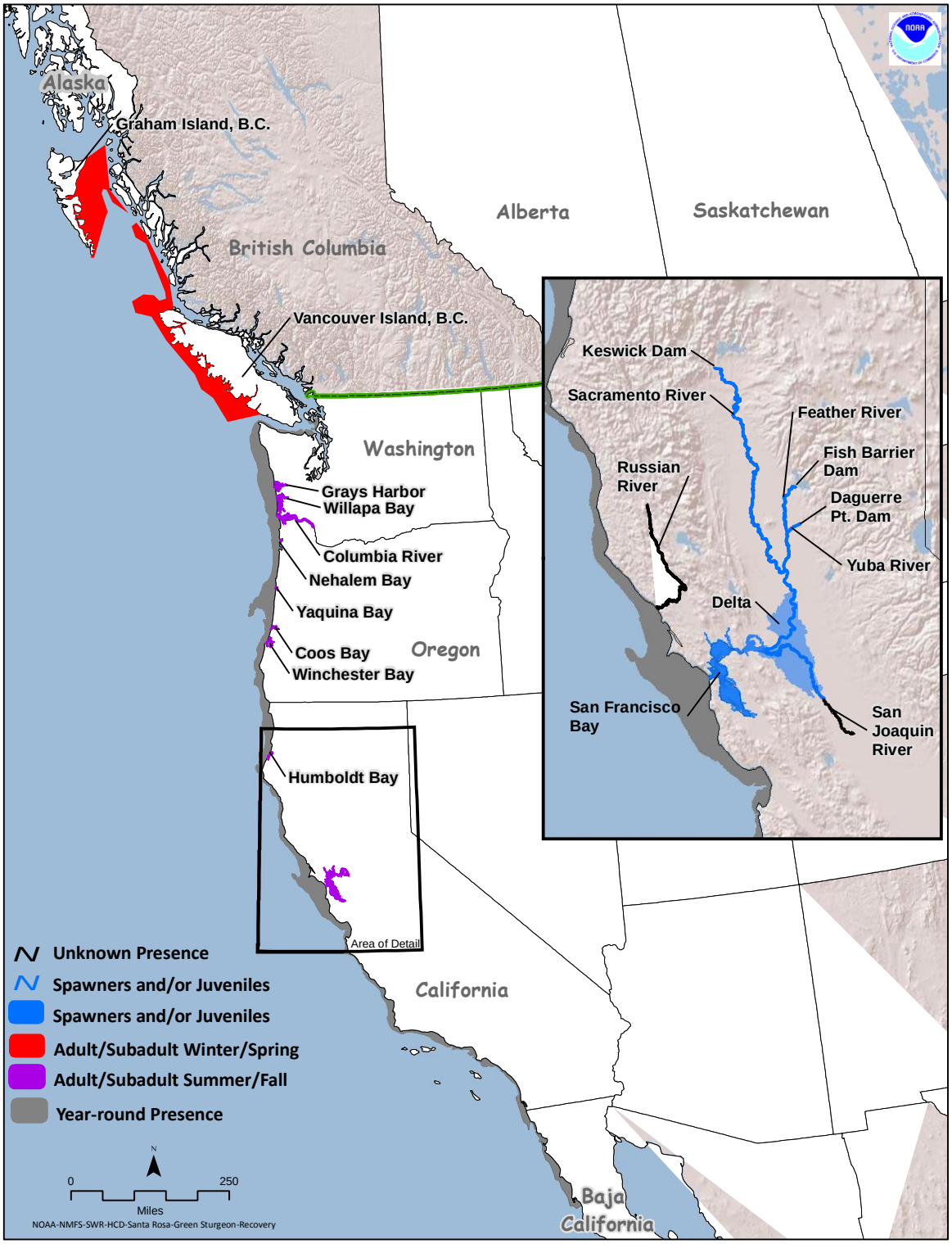

Figure 1. Map of sDPS green sturgeon distribution.