Life Stage	Potential Limiting Factors	Subcategories for potential limiting factors	Available studies/information	Data/research Needs	Subjective opinion regarding likelihood of being a limiting factor (1=likely, 3 = unlikely)	Causes/Sources of Problems	Geographic reference/Comments
Salmon River Adult Holding							
	Predation	*Bears (DM)*					
	Harvest	Harrassment			3		
		Poaching(DM)				*Poaching pressure(DM)*	
	Disease		Temperature data	compile/evaluate available temperatures for maturing and spawning adults; check literature and USGS for information regarding egg viability	1-2	The model SIAM, indicates that warm temperatures for maturing fish may be a major cause of egg mortality.	
	Water Quality						
		Temperature	1990-2002 USFS/SRRC. V-Star	Model role of shade on stream temp.	1	Reduction of riparian cover due to legacy	Prefered holding temps exeeded in much of watershed.
		Thermal Refugia	regarding availability of thermal refugia; Hillemeier research on S.Fk. Trinity indicates importance of thermal refugia during low flow years.	Review available info and assess extent of refugia. If data is not available regarding thermal regugia availability, then collect.	2	mining, harvest, fire.	Per anecdotal info extent of refugia is limited.
		Dissolved Oxygen	2002 RWQCB. SR Sediment Analysis		3		
		Other Constituents	2002 RWQCB		3	Fire Retardant	
	Holding Habitat	Food Availability			2		
		Lack of Cover - coarse woody debris, etc			2		
		Pools decreasing in size and number		Quantify pool filling.	1	Legacy mining activity, road-related landslides.	Are there less pools available? Problem near Mathews Creek.

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Salmon River Adult Migration (Core: May 1 - July 31) Entry Timing into subbasin							
	Predation (natural)				3		
	Water Quality						
		Temperature	1990-2002 USFS/SRRC, Dale McCullough 1999, New EPA guidelines, Josh Strange, TMDLs	Continue and expand temperature monitoring programs. Identify sources of impairement. Identify historical temperature regimes	1	Reduction of riparian cover due to legacy mining, harvest, fire (MSJ). Run Timing (is it shifting?) (JS). (See TMDL for source of problem)	The later portion of the spring run this is particularly important. 22 deg C - upper limit for adult Chinook migration (EPA data [21 deg C] modified by JS, and other studies)
		Dissolved Oxygen			3		
		Other Constituents			2		Episodic events, such as fuel spill, Fire retardant mis drops, etc.
		suspended sediment/turbidity	need literature search	Assess recent impacts of substantially increased dredging activities	2	Increase in dredging during the past year	Currently restricted to the Lower Salmon, but potential to spread throughout the basin
		Other Constituents		We already know that contaminants such as gas, oil, etc are harmful to fish	2	Increase in dredging during the past year	Currently restricted to the Lower Salmon, but potential to spread throughout the basin
	Access to Holding/Refugia				3	Sediment barriers, low flow.	
	Water Quantity		Pending June 2003 Task Force Discussion		3	Direct Withdrawal, upslope conditions (Roads, Fire, Forest management, lack of Native burning)	
	Harvest	Poaching			3		Confluence pool legal and illegal harvest becomes a factor (pre and post August 1st)
	Barriers			movement at barriers (DM)	3		Potential localized problems, late season.
	Disease			collect pathology samples from morbund Spring Chinook	3		Most of the infections occur outside the Salmon. More likely in poor water quality/quantity, and hot years
	Habitat	*Cover (DM)*					
		Thermal Refugia	regarding availability of thermal refugia; Hillemeier research on S.Fk. Trinity indicates importance of thermal refugia during low flow years. Torgersen, etal, 1999 on John Day River - Spatial scale	If data is not available regarding thermal regugia availability, then collect. Need spatial information on available refugia, useability.	2	Only becomes important when temperature/flow becomes critical.	How do you determine quantity and quality and distribution on the river.
	Boats (DM)			Research is needed to determine if there is a problem. Put in camera and watch as boats run through.	3	Boats cast shadow that scares fish	Greatest potential conflict between boaters and steelhead. Will become a bigger issue as more boaters on river. *Keep off river during peak migration times (DM)*

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Mainstem Adult Migration in Klamath (Core: early April - late June Outer limits:late March - September)							There is a pulse once temps drop
	Predation		Yurok Tribe predation reports 1998-99		3	A few Sea lions/seals come into lower Klamath	Yurok reports indicate 2-3% predation mortality for Fall Chinook (DH) *human pressure - nets, moter boat traffic, etc.(DM)*
	Water Quality				1		
		Temperature	CA F&G CREEL. Various agencies and tribes have hydrolab data and continuous temp. Monitoring equipment; harvest data for indications of run timing (not Salmon River specific); Josh Strange's (Yurok Tribe) preliminary work; dive data of thermal refugia areas for the past couple years. Look at old Salmon River weir data for run timing to look for later spring run.	100% marking of TRH spring chinook constant fraction marking of IGH chinook. Continue research regarding role of thermal refugia for adult spring chinook migration; compare thermal regime to time of migration. For stranded adults - What % of run does this comprise? Does it affect certain substocks disproportionately? What are the effects to egg viability? Needs better coordination.	1	Hydromodification/Dams. Filling of pools, channel aggradation. Ag diversions (MSJ). Warm mainstem Klamath River temps may form a thermal barrier to spring chinook migrating during June-Mid September. What % of run does this comprise? Does it affect certain substocks disproportionately? What are the effects to egg viability? (DH).	May be more of a problem above the Trinity confluence than below the Trinity in most years.
		Thermal Refugia					
		Dissolved Oxygen	various hydrolab data (USFWS, USGS, USFS, Karuk, Yurok Tribe, NCRWQCB). F&WS hydrolab data on Klamath	review available data and continue collection	2	Roads in November and December and natural landslides in spring. decompostion of organics/algal material, nutrient loading from ag activities, bad resevoir water(turnover) in some years. Gills may get clogged up with suspended sedimment making breathing a problem. Suction Dreding and Hi Bar Mining.	Very low levels have been recorded at Big Bar trap near Orleans by F&WS.
		Turbidity/Suspended Sediment	various hydrolab data (USFWS, USGS, USFS, Karuk, Yurok Tribe, NCRWQCB).	Need to assess potential problem. Identify the relationship of turbidity to the sediment load.	2	Roads in November and December and natural landslides in spring. Gills may get clogged up with suspended sedimment making breathing a proble. Suction Dreding and Hi Bar Mining. Could be a problem when combined with high temps/stress. Episodic dam releases and tributary input. Sediment load may be source of turbidity.	
		Sediment Load (JD)		further studies on sediment load (JD)	?	aggredation, caused by low flows, resulting in braided channels (example Ah Pah in 2002), barriers, could increase water temps, inhibit migration	based on DFG priliminary fish die off report, sediment load and distribution in the Mainstem Klamath may be a limiting factor (JD). Especially when combined with certain flow events (BK).

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		Ammonia, ph, nitrates	USFWS has collected water quality grab samples during 2001 and 2002 and will release information in the future	review available data and continue collection	?	Agricultural run-off confounded with reservoirs in the mainstem	Probably not an issue except in very localized situations (RK).
		Other Constituents	various hydrolab data (USFWS, USGS, Yurok Tribe)	review available data (USFWS) and continue collection	1	herbicides/pesticides. Irrigation run-off, etc… could likely cause problems - beginning to be much work done to assess this (USFWS, Pacific Corps, possibly NCRWQCB)(DH). Fecal coliform?	
		Quantity, quality, distribution	Yurok, Karuk, Hoopa, USF&WS, USFS, SRRC- Spring Chinook Telemetry Study	run timing and harvest rates	2		
		Thermal Barriers	Thermal Refugia dive data. Josh Strange's telemetry study. Temp data relative to literature	continue ongoing research	1	Thermal barriers caused by high temps inhibits migration	
	Passage/Man Made	Dams	Fishpro study of Fish Passage Conditions on the Upper Klamath River (2000) FERC/Scottish - . Flow Study data exists for key refugia in the Mainstem Klamath	Need to do a habitat typing and water quality study for spring chinoook above the dams. Identify specific areas and develop map for key refugia areas in the Klamath Mainstem - compile existing info.	1	Klamath Dams above Iron Gate block access to historical habitat. Pressure on Salmon River spring chinook would be reduced if runs were recovered in the Upper Basin. If dams were removed there would be increased potential holding area above Iron Gate particularly in the spring fed areas.	Recovery of spring chinook in the Klamath Basin
	Physical Barriers/ Flow		USF&WS may be currently conducting a riffle barrier assessment in the Klamath	during low flow years survey shallow riffles	3	low flow barriers - braided channels caused by sediment load, falls, shallow riffles	Especially pertain to late running spring fish. May not be as much of a problem for Spring Chinook as for Fall Chinook.
	Water Quantity (flow)		Hardy phase 1&2, Balanced Hydrologics, SIAM, Trihey report, USGS report (?),	finish Hardy phase 2, continue long term Flow Study, meter irrigation diversions, Subbasin water balance studies, Assess magnitude of Jenny Creek diversion, IGD, Klamath Project, etc. NEED TO COORDINATE DATA BETTER	1	Irrigation, hydropower, drought years	Pertains to most of the limiting factors listed above. Crowding associated with low flow causes increased disease transmission. Need to utilize the BOR Water Bank in mid- June through August in conjunction with the needs of the Coho juvenile outmigrant. (Identify where coho needs overlap with spring chinook). Peakperiod releases (DM). Is there a way to look @ flows as % of total flow tied to run timing & size, i.e. is run timing coindicent w/ larger proportion of IGD flow or lower? Or no relationship? (RK).

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	Harvest	Fishing pressure in refugia (PB)	Terwer creel census	Creel census needs to be specific to refugial areas	2	fish concentrate in refugia and become vulnerable to unregulated fisheries	cold water refugia and should be closed (500ft from the mouth) (such as -Blue, Bluff, Red Cap, Camp, Dillon, Clear, Indian, Elk, Salmon River) These are hit heavy by the sport fishing. Need educational information (Brochure) . Regulations - should be closed 500ft from the mouth, July until at least September 1 in Klamath above Trinity. Need to develop monitoring group and have the Warden come more often and look for violators.
		Lack of coordinated Spring Chinook Management Plan	abundance of CWT-TRH data, draft TRH cohort model. Hoopa have come out with Management Plan	Cohort model (age composition). Predictor of abundance. Fishery impact assessment. Stock recruitment assessment. All fisheries need to be monitored.	(need to asses is HIGH, risk is unknown)	Harvest management began with most abundant stock which is fall chinook. Spring chinook are caught under fall chinook regs. There needs to be special regulations for Spring Chinook (2001 had some closures for Mid Klamath and Trinity - above 22 inches).	Need cordinated Spring Chinook management. No stand alone regulations for Spring Chinook fishing (inherit Fall Chinook regs from previous year) - should have specific spring chinook regs (GK). Need to elevate the Spring Chinook Management Plan need to the KFMC/PFMC
		Catch and Release	abundance of literature available regarding catch and release mortality rates	Assess magnitude of catch and release, related to in river escapment. Analysis of hook scar data from JC weir	2	regulations allow for catch and release fishing during high temp periods, when stress level is already high	When water quality is poor salmon become much more susceptible to disease which increases mortality.
		Poaching	Anecdotal evidence	Perform surveys (look at gear being used). How many have barbs and are snagging hooks. Need sign showing mouth is closed		,	Need coordinated creel survey at the refugia, smilar to fall survey.
	Disease		F&WS Foott, Fish Kill moitioring in 2003 & 2002 in the Klamath and Salmon river,	collect pathology samples from morbund Spring Chinook, need more monitoring of spring chinook in the Klamath and Salmon rivers, identify conditions leading to mortality. Include key fishermen in educational outreach program to look for disease and mortality. Locate fish that are dying early on. Create a better hotline for mortality.	1	late fish get stranded in refugia, low flow causes fish crowding, hot temps increase Columnaris and other potential diseases. Larger runs enhance problem. Hatchery additions may excaerbate situation.	Disease is a potential problem, but it is the conditions that exacerbate disease that are the bigger problem (GK). Disease is more of a problem during summer months with low warm water. In regards to C. Shasta, are conditions in the mid river such that aquatic growth and nutrients promote growth of the polychaete and thus the parasite? What can be done? Flushing flows to scour "weed beds"? (RK).
	Habitat						See thermal refugia, barriers, water quality above.
	Hatchery		Agency hatchery review. CH2MHill - 1985. Kier & Assoc. Look in book - "Salmon Without Rivers" for references. Lichatowitch paper (RK).	Need to look at the impacts that hatchery releases cause on the returning adults.	1	Density issue related to hatcheries.If there is limited space in the refugia, natural fish may be pushed out causing more mortality and increased disease.	
	Recreation		anecdotal evidence				*Boat put in at mouth of Indian Creek*

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Mainstem Adults in the Estuary (March thru August) Core time-May							
	Harvest	Tribal	KRTAT	KRTAT (KFMC) needs to continue ongoing work regarding harvest rates, harvest objectives, time/area harvest impacts, etc…, Need to identify when the Salmon River fish are in the estuary. Finalize odelith study - establish juvenile baseline , once completed move forward with adult odelith collection	2	Prelimary indications are that combined harvest rates may be within the range of 15 to 20 % for Salmon River fish, however need to finalize cohort reconstruction so can quantitatively assess. Need better understanding of run timing of various stock. What is the stock composition of the springers caught in the estuary during August? All fisheries need to be monitored so impacts can be assessed (e.g. in river sport fishery is not monitored).	Estimated Harvest Rate = Total Tribal Harvest divided by Total In River Run = Apply HR to total Spring Chinook returns. Seems that just having some estimate of relative % of springers in estuary fishery through the year would be useful - high % early (apr-aug), lesser % later (aug - oct/nov) (RK).
		Sport	Yurok has one year of creel information	Need to do creel study on spring run/ coordinate from CDFG - / Same as above	2	Need better understanding of the magnitude of catch and release mortality (especially in warm Klamath River temperatures) (DH).	Estimated Harvest Rate = Total Sport Harvest divided by Total In River Run = Apply HR to total Spring Chinook returns. Significant portion occurs in the Lower Klamath above estuary for Spring Chinook. July/August spring run may have increased harvest impacts in the estuary. Unsure on Salmon River fish.
	Predation	Pinipeds	Yurok Tribe study regarding marine mammal predation in the estuary	Study could be performed on spring chinook fish	2	Studies indicate that predation rates on fall chinook ranged from about 2-3% during 1998 and 1999. Seems likely that predation in estuary increases during years of El Nino low ocean productivity (DH). *Seals, nets, motor boat traffic (DM) This data is for fall fish. Spring Chinook impacts may be less because there are less California Sea Lions in estuary during the spring, but could be could add to a more % of the run be taken.*	Sea lions catch is very visible. Although some are seen on the surface many more are passing by underneath.

	Water Quality	Temperature	Yurok Tribe water quality work. On-going Yurok radio tagging study. DWR may have studies from 1960- 1980	Determine role of estuary as holding habitat and thermal refugia. Identify interaction between temp and low DO on stressing fish and making them susceptible to disease (MSJ). Yurok Tribe is currently compiling/analyzing water quality data from the estuary for 2001 and 2002 (DH). Need to continue to improve radio tagging research	1		
		Thermal Refugia	Yurok Tribe water quality work. On-going Yurok radio tagging study.	Need to continue to improve radio tagging research. Determine the role between river flows, estuary morphology, and thermal refugia and disease.	3	At certain times Salt wedge may not be sufficient in quality and quantity (especially when mouth of estuary is constricted by low flows)	Conditions are usually better during early/mid run in May
		Dissolved oxygyen	Yurok Tribe water quality work 2001, 2002, 2003; CDFG in early 1990. See smolt in estuary info	Look at DO in the Salt Wedge	3	August, when there is not much debris, turbulence can cause some areas to reach low levels	August, when debris and not much turbulence can cause some areas to reach low levels
		migration barriers			2	bar open/closed (DM), high temperatures particularly greater than 22 C, low flows potentially leading to lack of migrational clues, shallow riffles	Definitely a problem for fish entering in late June (in some years), July and August
	Water Quantity				1	Low flow and elevated temps in Klamath restrict migration, causing crowding in estuary, susceptible to disease.	
	Thermal Refugia - Salt Wedge		Preliminary results from Josh Strange's Radio Tagging study, Water Quality data is available through the Yurok and CDFG. Yurok thermal refugia dive data for 2001 and 2002, Yurok estuary water quality data for 2001 and 2002. Look at fish kill monitoring report.	Perform Yurok tribe sonic tagging in 2004. Continue research regarding role of thermal refugia for adult spring chinook migration; review thermal refugia dive data for the past couple years, review estuary water quality/temperature profile data, compare estuary geopmorphology to historic data (ongoing work by the Yurok Tribe)	2	Thermal refugia may be reduced relative to historic availability (e.g. confluence pools may be filled in, estuary size may be reduced). Harvest may be a problem at thermal refugia areas.	Definitely a problem for fish entering in late June (in some years), July and August
	Disease		Preliminary results from Radio Tagging study.	Determine the relationship between river flow, water quality, estuary morphology, fish behavior, and disease		Potential problems related to low flows, high temps, fish crowding leading to stress and disease transmission	

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Ocean							
	Predation		NMFS studies regarding marine mammal predation (Joe Scordino has copy)	review literature from the past few years	3		
	Ocean Conditions	Food (PB)	USFWS info. Literature regarding relationship between ocean conditions and salmon abundance		2	El Nino, PDO	Has large influence upon salmn anundance, but not something that managers can affect (may be able to use to predict abundance for management purposes) (DH).
		PDO and El Nino					Optimal conditions for food supply exist whne there are cool ocean temps and upwelling off the coast. These conditions exist in La Nina years and when PDO has shifted to cool.Upselling brings nutrients to surface, and reduce competition from southern fish.
	Harvest	*Foreign and domestic fisheries (DM)*	KRTAT	KRTAT (KFMC) needs to continue ongoing work regarding harvest rates, harvest objectives, time/area harvest impacts, etc…	2	Historically this could have been a problem, but unlikely to have been a substantial problem since the early 1990's. However, certain fisheries could be a red flag (e.g. spring fisheries near the Klamath) (DH).	PFMC, on recommendations from KFMC, manages ocean fisheries for a max harvest rate on age-4 Klamath fall chinook that would be from 20-25% except that there's a cap of 16% to protect coastal fall chinook. So if management equalled reality (usually within 20% of target; i.e., if target is 16%, observed is usually between about 12% and 20%), we'd never catch more than 16% of the age-4 Klamath fall chinook in the ocean as of May 1.We've always assumed that our harvest rate on Klamath spring chinook is a bit lower than that on fall chinook, based on what we think we know about the distribution of the fish and fishing effort in the ocean. Basically KFMC tech team is asked to discover: just how correct is this assumption? (DB) Optimal conditions for Spring Chinook to avoid harvest exist when populations of salmon from other stocks are higher than predicted, when fishery is restricted by regulation, and when bad weather impedes fishing. Ocean harvest mortality consists not only of fish brought back to ports, but of salmon caught, released and dead.
	Disease						
	Habitat	Pollution		Where do Salmon River Spring Chinook go in the ocean?			

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Estuary to the Ocean (Yearling Chinook? - Hatchery - Oct; Trinity - Nov; IGH - Mixed January thru May). (Young of Year Chinook? - March thru October when survey stopped) Young of year could be present year round. Peak Young of Year - Late June to Early July; (Wet years are later). Trinity Yearling - Oct - Late Nov/Dec. IGH - Yearlings still present in March							
	Water Quality						

		Temperature	There is much temp data available. Olson (1996) regarding time of emigration. Mike Wallace - In some years fish are pooled in areas of brackish water on the bottom. May be potential problem in summer months. Late June can typically be over 20 degress C. Cools in July. Heats up again in August. Salt wedge didn't set up in 1994, when mouth access was hampered (filled in). Michael Banks has genetic research that distinguish spring chinook from fall chinook	estuary is difficult, & Salmon R. smolts are more difficult. Need to check numbers of springers in tributaries of MS above Salmon R. Need to distinguiish Sp Ch from Fall Ch. Also distinguish Salmon R. Sp Ch from other sources (Trinity-hatchery & natural). Need to research the use of genetic, odelith/scales/coded wire tags. Use Salmon R. screw trap. Look at when pulses of Sp Ch smolts are coming out of the Salmon R. Identify timing of movement of Sp Ch smolts throughout the Salmon/Klamath. Utilize traps down the river & coord w/ other groups to create unique mark & notify other monitors. Would be good to collect more emigration data from "spring chinook only" areas, to quantitavely evaluate time of emigration (DH). Mike Wallace has electronic files of Salt wedge study from 1991-1994. Terwer Guage site articulates when estuary was backed-up. Once Salmon R. Sp Ch are isolated we need to look more at salt wedge influence &	1-2	Not likely a problem for the smolts that emigrate in October - likely would be a problem for the earlier emigrating smolts (especially July). Olson (1996) indicates a large % emigrate in October, however no population numbers generated from traps (just catch numbers) and October had much lower flows than other times of year (i.e. likely higher efficencies). Scales indicate large % of survivors had type II life history, however don't know if this was in Salmon or mainstem, or whether the Type I just did not survive because of parameters such as Klamath R. water quality. In summary, it seems likely that a large % emigrate in October, however the rest may face terrible Klamath R. conditions (DH). Temperatures from June to August are stress times.	
		Dissolved Oxygen	hydrolab data from varous entities (Tribes, USFWS, USGS)	review existing data and continue collection	3	There didn't seem to be much of a DO problem. During juvenile fish kill there still wasn't a problem. In deep isolated and small areas there was some readings of below 4.	
		Nutrient	NCRWQCB may have info from 1960's thru 1980?. No recent studies, except TMDL	review existing information. Yurok/Monica and USF&WS (George G.)	3	Fertilizers. Cows in the estuary in North side tribs.- Salt Creek	Estuary is very productive. No evidence of over nutrification, which is related to DO problems.
		Sediment - deposition and suspended		Herbicides- Need to do literature search to see if there is info to determine estuary volume/depth. May need more research. Relevant for adults as well	3		Tribal elder reports indicate estuary is filling in - they remember 40 foot holes. DF&G has depth data maps from the early 1990's - deepest pools were 25 feet. USF&WS has maps done of the lower mile done in the mid-late 1980's. No big differences in depth were noticed by DFG. 1920's Highway department showed that depths were not much deeper than 30'. Jet boat tour folks have photos.

		Other Constituents	hydrolab data from varous entities (Tribes, USFWS, USGS)	review existing data and continue collection. Talk to CATS. Talk to Lori McKinnon. Talk with Jen Kalt	2	Irrigation run-off, etc… could likely cause problems - beginning to be much work done to assess this (USFWS, Pacific Corps, possibly NCRWQCB), Look at problems related to development on the estuary. Simpson uses herbicides on the upslope. Boats may leak fuel (MTBE), Caltrans sprays highway. Old Penta chloro site exists in Hoppaw Creek.	
	Thermal Refugia	Quantity, quality, distribution	DFG has observed that there is an order of magnitude of high density at the mouth of Hunter Creek. Need to look to see what salt wedge provides as refugia, smolts usually don't want to be in salt wedge too much. Are fish in transitional salt wedge area?	May need to look at relationship to estuary and Ocean effect on survival of smolts infected in the Mainstem Kalmath with C. Shasta. Talk to Scott Foote.	2	Refugia may have shrunk over time if estuary is filling. Have Wakell, Hoppaw, Hunter, Richardson Creeks been altered and reduced/eliminated thermal refugia? Also refugia may have shrunk due to lower trib flows and increased trib temps from tribes harvest (RK). Need to isolate timing of Salmon River fish.	Lump in with temperature concerns. Once we isolate Salmon River springers.
	Habitat/rearing		Food Study was done by DFG. Yurok has started additional studies. McBeth wrote a book identifying soundings in the estuary done in the early 1800's. Del Norte Historical Society may have info. Check with Yurok.	need to do literature search to see if there is info to determine estuary volume/depth. May need more research. Relevant for adults as well Need to see if hatchery fish are competing with naturals for food source. Need to look at hatchery natural interactions.	Density Dependant = 1 , Habitat Rearing + 2	Edge habitat effected by the rip rap below old 101 bridge and extends 2-3 miles. Sinuosity may have changed because of the rip rap	May not have been much wood historically, Need to look at the affects of hatchery smolts on the SR… Chinook hang out at gravel cobble beach front. May be skewed by gear.
	Disease		Need to look at estuary effect on C. Shasta	Talk to Scott F.	1	Most are naturally occuring. Water Quality and water temp enhances disease. Crowding may create problems with disease. Temp shortens the time to death for an infected fish but not the infection rate. But we know that stressed fish must be more suseptible, and high temp = stress (RK).	Temp concerns for disease (C. Shasta) could be lower than general stress. 16-18 is in the range. Scott Foote found less incidence or effect of C. Shasta in the estuary than in the Mainstem. C, Shasta may heavily affect smolts when they make the change into the ocean, due to stress on kidneys. Check with Scott Foote.

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Smolt in the Mainstem Klamath				*More info about When Smolts head out (DH+)*			
	Water Quality	Temperature	1980-2002 USFS/SRRC	I.d. temp conditions in locations known as rearing habitat.	1	Lack of shade, hydromodification in Klamath. *Downriver Fishermen say non-native Duckgrass may be a potential problem (DM, Yurok)*	Mainstem temps exceed prefered rearing temp range.
		Flows (DM)					
		Dissolved oxygen	USFWS/Karuk		2		
		Ammonia					
		pH					
		Nutrients				fertilizers	
		Ag Chemicals					
	Water Quantity						
		Stranding					
		Habitat Availability					
		Competition					
	Disease					C. shasta and other diseases. Hatchery practices (example large smolt releases from IGH result in crowding)	*Substantial % of the Klamath fish are infected with C. shasta (ALL).* What is relationship of upper area weed beds to disease incidence? (RK).
	Cover						
	Predation						

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Smolt to the mainstem Klamath (Up to 14 months after emergence?)							
	Water Quality						
		Temperature	Olsen (1996)	Collect emigration data throughout the basin to assess time of emigration	2	Olson indicates a large % of smolts emigrate in October, which is a time of cool temps. However, it would be good to re-assess the time of emigration utilizing screw traps (larger sample size) with efficiencies (for emigration estimate).	
		suspended sediment/turbidity	need literature search	Assess recent impacts of substantially increased dredging activities	2	Increase in dredging during the past year	Currently restricted to the Lower Salmon, but potential to spread throughout the basin
		Other Constituents		We already know that contaminants such as gas, oil, etc are harmful to fish	2	Increase in dredging during the past year	Currently restricted to the Lower Salmon, but potential to spread throughout the basin
		Flows (DM)					
	Habitat						
	Predation				2		
	Disease				3		
	Stranding (PB)	see Fry			?		*Are bathing dams a problem for type 2s? (NP,JS)*

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Fry: April thru May (Emergence) to Smolt				**Need more info about dates**			
	Rearing habitat	Cover	West 1991, West 1988, West 1990, ?	Review available USFS habitat survey information. Could conduct study to assess rearing habitat conditions and compare to literature criteria for optimal conditions.	1-2	West cites Olson (pers. Comm) "Other factors including presence of vegetative cover or woody cover, thermal refuge, and proximity to sediment free interstices may plan a role in rearing habitat importance. West notes less than optimal wood debris availalble (according to Seddel criteria)	Fish can be rearing for more than a year and cover may become a problem
		Food - lack of nutrients from lack of carcasses	available spawning abundance data; recent literature regarding importance of carcasses as nutrient supply. *Dr. Bret Harvey RSL (JS)*	Don't know much. Summarize available literature; could conduct studies to assess productivity (primary production and invertebrate production)	1-2	Recent literature clarifies importance of carcasses as nutrient supply, temperature could be limiting primary production	
		Habitat Availability		Analyze FS Habitat Surveys temporally	1-2	Sedell suggests minimum pool frequency & depth	
		Other					
	Predation	Habitat Complexity	Tons of Info, not specifically for Salmon R., and not for non-natives	How does it effect different types of Fry	2-3		Imbalanced natural predator presence, and some introduced predators (Chad)
June - July	Stranding			ID annual stranding; Opp for using stranded fish for research	3	Freshets	

	Water Quality	Temperature	1980-2002 USFS/SRRC. available temperature data; McCullough 1999	I.d. temp conditions in locations known as rearing habitat (MSJ). Compare Salmon River fry required temperature regime to the literature; assess/model how temperature is affected by riparian canopy on the Salmon R. and Tribs (DH).	1	Reduction of riparian cover due to legacy of mining, harvest, fire (MSJ). Salmon River temps seem to be above optimal conditions, but not lethal. Could interact with available food supply to reduce growth (I.e. warmer temperature (up to about 21C require more, food, which may not be available)(McCullough). West notes "High summer water temperatures have long plagued the Salmon River. Riparian area damage suffered in the 1955 and 1964 floods was severe and most heavily damaged areas *are recovering, but there are still problems.* (West et al. 1990)." (DH)*(FP+)*	Temperatures in much of watershed exceed prefered rearing temps (MSJ)
		Dissolved Oxygen	2002 RWQCB		3		No an issue
	Disease		in Klamath	More info on C. shasta - signs of disease (health) @ screw trap	?	C shasta and others	Not Known

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Alevin to fry (hatching November - January Emerging early April - late May							
	Spawning Gravel Quality - Redd Characteristics	Inability to emerge	temperature criteria technical workgroup report.	use spawning channel as setting for study	1-2	redd capping due to sedimentation, temperature delaying or speeding emergence	
		Sedimentation	West, 1991, states E. Fork volume of sediment = mean of 6%, S.Fork mean = 14%., Olson (1996) data indicates emergence of fry to average 13.4%, 14.5%, and 19.2% in the East Fork, Upper South Fork, and South Fork respectively - however given range of variability and small sample size, this could be re-evaluated. Salmon River Subbasin Restoration Strategy. Silver, Warren, Doudoroff 1963. Sari Sommerstrom www.cdec.water.ca.gov	Could use an updated, spatially distributed assessment of gravel sedimentation near primary spawning locations. DO measurments in Redds are needed for Salmon specifically	1-2	Reduces flow and oxygen to redds. Redds can become smothered with sediment. Roads and Fire have been identified as primary contributers of sediment to Salmon.	areas that are landslide prone or have chronic road problems, are more likely to contribute to this problem. To what extent do DG areas impact salmon spawning areas? (RK). If DO drops too much alevin will emerge from redds earlier than normal.
	Water Quantity	dewatering	www.cdec.water.ca.gov	look at rate of occurance in relationship to precipitation, etc	3	flow can be effected by upslope management. Climatic fluctuations.	in upper extent of spawning reaches, dewatering of redds can be a problem - especially in years of high spring flow and low fall flows when adults are able to spawn far up into the wilderness

		high flows	Silver, Warren, Doudoroff 1963. www.cdec.water.ca.gov	look at rate of occurance in relationship to precipitation, etc	2	scouring of the redds in winter and spring high water	lower in system (Sawyers, Cecilville) and tribs (LNF, Knownothing) are more at risk
	Water Quality	Temperature	1990-2002 USFS/SRRC	I.d. temp conditions in locations known as incubation habitat.	1	Natural flow regime and aspect can contribute to temperature variation. Very cold air/water in winter causes anchor ice to occur, leading to mortality.	Temperature can delay or speed emergence.
		Dissolved oxygen	2002 RWQCB Silver, Warren, Doudoroff 1963		3		
	Predation (DM)						No know information on this subject
	Fry Mortality	entrainment	Griffith and Andrews 1981		3	suction dredging	
		superimposition		search literature.	2	from fall chinook spawners	
		redd disturbance		needs further study	2	pedestrian traffic in river	low water river crossings (Mountain Lion Mine, Plummer, Jackass) pool tailouts, tanker fill sites.

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Incubation							
	Flow/oxygen	Sedimentation	West, 1991, states E. Fork volume of sediment = mean of 6%, S.Fork mean = 14%., Olson (1996) data indicates emergence of fry to average 13.4%, 14.5%, and 19.2% in the East Fork, Upper South Fork, and South Fork respectively - however given range of variability and small sample size, this could be re-evaluated	Could use an updated, spatially distributed assessment of gravel sedimentation near primary spawning locations	1-2	West (1990, page 13) states much granitic sand contributed between Petersburg and Big Flat.	Potentially Upper South Fork and other areas
	Temperatures						
		Adequate Range	Olson 1996, Available temperature data; McCullough 1999	Compile additional temperature data that is available (especially late September and October), Olson presents data from 1991-1994, and compare to the literature (McCullough, 1999)		Various literature summarized in McCullogh (1999) indicates that mortality of eggs may occur at temps >14 C, which may occur during the early weeks of incubation on the Salmon. Low temperature thresholds do not seem to be a problem, as long as initial incubation occurs at temps > 5C. Olson's study notes the extended incubation time for Salmon River spring chinook (>six months), which is natural.	
		Anchor Ice	West 1991, Olsen 1996	Compile/evaluate available temperature data; during coldest times of the winter, check for anchor ice near redd locations. Olson (1996, Figure 7) indicates anchor ice was not a problem from 1991-1995 in the Upper South Fork.	2-3	West states anchor ice may be a problem in some habitats - Olson's observations from 1991-1994 don't indicate this as a problem (however, one redd had no survival to fry stage).	
	Disease						
	Disturbance of Redds	Scouring	See Felice's list of studies regarding the relationship of vegetation management and flows	Could conduct cross sections in redd zones to determine magnitude of flows required to scour redds	2-3	Removal of vegetation could alter hydrology so that the magnitude of winter flow events is increased	
		Disturbance from people, animals, vehicles			3	Given the remoteness of the country, and time of spawning, disturbance from people/eggs is likely minimal.	
		Superimposition	West 1991		3	In light of depressed populations and availability of spawning gravel (West 1991), this is not likely a problem.	
		De-watering	Redd distribuation data	problem. Collect 'water depth over the redd' info (RK).	3		
	Viability		Compile temperature data for maturing adults in the Salmon River and Klamath Rivers: McCullogh, 1999 (synthesis of literature regarding water temperature and salmonids)	Consult with literature and USGS regarding the relationship between temperatures that maturing adults are exposed to relative to egg viability.	1-2	exposure of adult females holding ripe eggs to temperatures above 14°C can cause egg mortality and delayed inhibition of alevin development (Rice 1960, Leitritz and Lewis 1976 as cited in McCullough, 1999). Olson's water temp data from 1991-1994 indicate ranging from 14-19 during August and September	
	Water Quality	Temperature	1990-2002 USFS/SRRC	I.d. temp conditions in locations known as incubation habitat.	1	Reduction of riparian cover due to legacy mining, harvest, fire. How do extensive mine tailings impact riparian zone? (RK).	Temperatures in much of watershed exceed prefered incubation temps
		Dissolved Oxygen	2002 RWQCB		3		
		Turbidity/ Particulates (DM)				*Flooding (DM)*	
		Metals		Sample based on known mining and other toxic sites; Could it affect fish fecundity? Need Literature search.	3	mercury contamination from historic mining (DH)	Not detected but may be a factor in localized sites

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Spawning (Core Period: Sept. 15 - Oct. 15, Outer Limit: Sept. 15 - Nov. 1)							
	Spawning Habitat						
		Adequate Gravel	USFS/SRRC surveys. West, 1991; West 1988 may address the East Fork, West 1990 may also address; West (1991; page 12) states lots of gravel available. *Look at 97-98 data (BO)*	need more locational spawning data - habitat inv., overlap with fall chinook	2		Above Blindhorse is a problem - seemed to be more fish than gravel could support in 2002. West (1990, page 12) states North and South Forks can support 3248 redds, while the East Fork can support 1182 redds - however, available spawning habitat does not infer adequate spawning habitat. West notes that spawning habitat use does not seem to be related to availability (page 12)
							Not above Blindhorse
		Embeddedness	West, 1991, states E. Fork volume of sediment = mean of 6%, S.Fork mean = 14%. *Look at 97-98 data (BO)*	Could use an updated, spatially distributed assessment of gravel sedimentation near primary spawning locations	1	West (1990, page 13) states much granitic sand contributed between Petersburg and Big Flat. Sedimentation from Taylor Crk - management related	Blind Horse - East Fork may be embedded. Taylor Creek downstream for a few miles is embedded. Tribs may have unique problems - e.g. Methodist Crk is a sediment source
		Gravel too loose - susceptible to scour	FS Report on scour chains (Al Olson) (RSL)		3	Mining tailings	Site specific
		Proximity to cover	WAs. Habitat Surveys.	West 1988 (for East Fork of South Fork)	2-3	West 1991 states that the S. Fork does not meet Seddel's recommendations for woody debris, however likely to be more of a problem with fry/juvenile rearing *Not just CWD; Veg, pools, etv (BO)*	Entire Salmon River
		Quantity of flow	*McDonald's Studies re: Base flows (AO)*	begin to quantify hydrograph for eventual relationship to land management practices	3	Scour potential in low flow years when fish are forced to spawn in mid channel	Salmon R. Tribs utilization affected by flow availability

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	Predation				3	*Bears, Otters, Humans (DM, BO)*	More of a problem in Low Flow years
	Water Quality	Temperature	1980-2002 USFS/SRRC; www.critfc.org/tech/EPA report.htm	I.d. temp conditions in locations known as spawning habitat (MSJ) *Examine Available Data for spawning dist. Spatially & Temporaly (AO+)*	2	reduction of riparian cover due to legacy of mining, harvest, fire (MSJ). Likely more of a problem for maturing adults and resultant affect on egg survival (DH).	Temperatures in much of watershed exceed prefered spawning temps; concern for temp related delay of spawning
		Other Constituents					
	Availability of mates spatially		Spawning ground survey data	Spatially analyze spawning ground survey data (redds and fish) to determine if a problem	3	In years with low population and low water. Unlikely, except years of extremely low abundance. Do spawning ground surveys indicate this as a problem (DH)?	
	Population size/genetics		Nelson and Soule (1987); Spawning ground abundance data and annual census surveys (with post survey mortality estimated; Banks (2000) genetic study	Genetic studies *Look at information already collected for Salmon River Fish (PB+) Josh Israel @ UCD - interested in doing genetic research on S.R. genetics (NP)*	1-2	Could be a problem in low abundance years; Nelson and Soule suggest a minimum population size of 100 adults may be necessary to prevent problems with inbreeding (DH).	Use NMFS protocol needs for collecting genetic samples for fish; Collect "Library" of genetics for different areas - will allow ID of ocean fish *(JS) on NMFS website*
	Cover/Holding water (DM)			*Identify holding areas (DM)*	3	*weather, lack of shade/cover (DM)*	