1. SPAWNER MIGRATION AND SPAWNING

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
1. Safe holding habitat in estuary and lower river prior to upriver migration	**LF1**: Predation of adults in the estuary and lower river by pinnipeds	-Lack of suitable estuarine habitat -Lack of riparian cover -Abundance of predators -Low water levels -High water temperatures delaying migration -Low water levels due to climate change -Change in Pinniped diet due to change in access to traditional food sources (hake)	Studies in other locations than Clayoquot Sound have suggested that upstream migrations of Pacific salmon are delayed at temperatures over 20 ^{0}C. Target water temperatures - *Migration: < 16^{0}C,*	-Seals are typically seen at the mouth of the river and occasionally in the lower river itself -Seals are more common than sea lions. -Not in any significant numbers. -Generally not seen as having a major impact.	-Sea lions and seals are occasionally seen at the mouth of the river. -Less than the Megin River and not in any significant numbers -Generally not seen as having a major impact.	-Sea lions and seals are occasionally seen at the mouth of the river. -Not in any significant numbers. -One fall sea lions were present in larger numbers (30-60) where sighted at river mouth (TCSES). -Generally not seen as having a major impact.	-Sea lions and seals are occasionally seen at the mouth of the river and in the lower river itself -Not in any significant numbers. -Approximately 12 seals may live at the mouth (AFN-FD). -Generally not seen as having a major impact.	-Sea lions and seals are occasionally seen at the mouth of the river and in the lower river itself -Seals are more common than sea lions. -Not in any significant numbers. -Generally not seen as having a major impact.	-Seals are always seen at the mouth of the river, in the lower river, and in Kennedy Lake. -Seals are more common than sea lions. -Thought that seals typically eat coho and sockeye (TFN-HC). -A year round population of seals inhabits Kennedy Lake -Not in any significant numbers. -August 2013, first year sea lions have been observed in Kennedy Lake and were believed to be eating CH (TFN-HC). -Generally not seen as having a major impact.

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2. Adequate flows to facilitate upstream passage of spawners	**LF2:** Limited or delayed spawner access	-Lack of storage -Drought conditions -Water diversion for Industrial, domestic, resource development -Reservoir operation	Min flow of > 7 cms during the CH migration period. Discharge less than 20% natural mean annual discharge during July/Sept. Compare watershed ratios for extraction and rank based on proportion (low, med, high) (Stalberg et al. 2009). Road density (km road/Km^2 of sub-basin) Higher risk: >0.4 km/km^2 Lower risk < 0.4 km/km^2 (Stalberg et al. 2009). Water depths required > 0.2m	-Adequate flow is generally present at necessary times, however, during low flow years upstream migration is can be temporally delayed. -The region has seen more dry falls than usual in recent years	-Adequate flow is generally present at necessary times, however, during low flow years upstream migration is can be temporally delayed. -The region has seen more dry falls than usual in recent years	-Adequate flow is generally present at necessary times, however, during low flow years upstream migration is can be temporally delayed. -Access to spawning grounds is difficult during low flow (Clough 2011). -The region has seen more dry falls than usual in recent years.	-Adequate flow is generally present at necessary times, however, during low flow years upstream migration is can be temporally delayed. -The region has seen more dry falls than usual in recent years	-Adequate flow is generally present at necessary times, however, during low flow years upstream migration is can be temporally delayed. -Potentially a limiting factor during dry falls, CH will avoid entering the river entirely -Once in 20 years fish have been severely delayed -The region has seen more dry falls than usual in recent years	-Adequate flow is generally present at necessary times, however, during low flow years upstream migration is can be temporally delayed. -This delay exposes the fish to higher levels of predation and this has occurred 2 of the last 3 years (TFN-HC). -The region has seen more dry falls than usual in recent years
3. Unrestricted access	**LF3:** Potential delays in upstream migration due to the physical barriers (natural or anthroprogenic)	-Woody debris accumulations at fishways or other areas, enumeration fences and falls -Sedimentation -Natural barriers - culvers at road crossings impede passage of fish to upstream habitat	Rated opportunity of upstream fish passage (good, fair or poor with parameters) Migration time through fence area	-No barriers are present in the reach accessible to anadromous fish, however, during low water years natural barriers may develop (log jams). -CH spawn mainly in the 1.6 km below Megin Lake (Brown, 1979). -Anadromous fish utilize all of lower Megin River, about 6.5 km of upper Megin River and about 9.3km of Talbot Creek for spawning and rearing (24-12).	-No barriers are present in the reach accessible to anadromous fish, however, during low water years natural barriers may develop (log jams). -13 km accessible to anadromous fish (FC TER MOO).	-No barriers are present in the reach accessible to anadromous fish. - Anadromous fish to barrier at 7km. 15 m falls @ 7.0km to anadromous fish (FISS).	-No barriers are present in the reach accessible to anadromous fish, however, during low water years natural barriers may develop (log jams). -No obstructions except gradient increase around 13.5% (Triton, 1993).	-No barriers are present in the reach accessible to anadromous fish, however, during low water years natural barriers may develop (log jams). -Impassable falls 45' high (13.7m) approximately 4 miles from mouth (Brown 1979).	-No barriers are present in the reach accessible to anadromous fish, however, during low water years natural barriers may develop (log jams).

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4. Stable channel morphology, maintenance of channel capacity and natural level of sediment transport Adequate habitat with high subgravel flow	**LF4:** Aggradation creates a migration barrier in the lower rivers during summer and early fall period.	-Bank erosion, -Channel shifting, -Habitat degradation -Riparian disturbance -Bedload aggradation -Logging -Landslides -climate change	Stable Banks and well developed thalweg Natural rates of sediment transport Location and duration of passage issues due to deposition of coarse sediments An acceptable minimum depth for CH salmon spawning is 20 cm. Deep pools are very important for adult holding. 40-60% pools optimal for cover and security Ocean CH require approximately 24m2 of gravel per spawning pair High subgravel flow	-Generally not thought to be an issue as the system is in its natural state. -Climate Change and corresponding changes to the hydrological cycle may increase impacts to systems in natural state	-Generally not thought to be an issue as the system is in its natural state. -Climate Change and corresponding changes to the hydrological cycle may increase impacts to systems in natural state -During 2006/07 a major fall storm event caused significant damage to channel morphology and these effects are still being felt. Larger pools on lower river have been filled in due to large scale gravel transportation (TCSES).	-Within the Ursus River this is generally not thought to be an issue as the system is in its natural state. - Historically lower Bedwell was severely impacted by logging activity. - In recent years the Bedwell has generally been stable with exception of channel alteration at the confluence of the Ursus. -Bedwell thalweg changed path in Nov 2012. Joined Ursus 200m upstream from original confluence; however, section of Bedwell that was bypassed was not a major spawning or holding location. The location that the thalweg now travels through was historically heavily logged. The sediment from this blow-out has filled 2 holding pools to date (20% shallower than original) (TSES). -Unusual event, major changes like this do not happen regularly on this system. -Over-widened channel with limited LWD. Highly mobile gravel = limited spawning success. Gravel bars higher than week logged off banks. Gravel bars non-vegetated and mobile. Increased sedimentation from upland sources. Increased bank erosion. Lost hardened banks, braiding/erosion/sedimentation (Clough 2011).	-Historically severely impacted by logging activity; <25% of watershed was logged. -The most heavily impacted of all Clayoquot Rivers. -Major aggradation occurring due to historic logging activity. -The river has still not stabilized and major transportation of sediment is still occurring (bottom end, Oscars, is constantly in flux). -Gravel is there but moving consistently, pools are regularly filled and formed.	-In 2012, thalweg changed, straightened and 200m of old channel dried. -15-20% of major holding pool downstream. -100m of pool was filled in (Atlantic Pool). -Unusual event, major changes like this do not happen regularly on this system.	-Upper and Lower Kennedy are generally thought to be stable. - The Sand river had stabilized following extensive logging, however, bridge was removed and caused river to straighten downstream and fill in major/minor holding pool and spawning habitat. This event has caused the major transportation of sediments downstream from this site. -no new holding habitat was created.

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5. High quality migration route with adequate refuge habitat	**LF5:** Loss of safe migration route through the lower rivers due to channelization, loss of habitat complexity and instream cover features	-Lack of riparian cover and LWD in streams leading to high levels of predation on spawners due to visibility	% loss riparian cover Mature riparian cover allows for stable undercut banks which provide cover LWD levels Well developed thalweg	-Generally not thought to be an issue.	-Generally not thought to be an issue.	-Limited complexity of habitat in lower river (downstream Ursus confluence), however, this is not thought to reduce migration. -Limited pools that support adult holding, channel is primarily glide. Lack of instream LWD & boulder cover. Unstable SG during peak flows. During low flow access to spawning is difficult. (Clough 2011).	-Generally not thought to be an issue. -1999 – 2000: 3 pond areas built to provide spawner holding areas (DFO042). -Loss of riparian habitat and functional LWD. Alternation in LWD characteristics (Taylor 1997).	-Generally not thought to be an issue.	-Generally not thought to be an issue.

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6. Suitable water quality	**LF6**: High water temperatures in the lower river and estuary during the late summer/early fall migration period can increase migration mortality and sublethal stress **LF7**: Poor water quality conditions during the late summer/early fall migration period (low DO, coliform levels, deleterious substances)	-High temps, low flows -Water extraction -Warm surface runoff -Climate change (snow pack reduction and timing of rain events) -Pollution: input from sewage and septic systems, industrial run off etc -Water Chemistry (PH and DO)	Studies in other locations than Clayoquot Sound have suggested that upstream migrations of Pacific salmon are delayed at temperatures over 20 ^{0}C. Additionally temperatures over 12.8 ^{0}C resulted in increased mortality of females prior to spawning. Target water temperatures - Migration: < 16^{0} incubation: 10^{0}C Rearing: 15^{0}C Adult migration: 16^{0}C. (Richter and Kolmes 2005). CH Upper optimum Temp Range (UOTR) is 14 ^{0}C and Impairment Temperature (IT) is 20^{0}C. As percent saturation decreases during incubation, growth decreases and abnormalities and mortality increase. Lower lethal limit = 1.6 mg/l. Silt loads exceeding 4,000 mg/l may stop the upstream migration of adult salmon.	**LF6:** - Generally not thought to be an issue. – Very rarely see dead, un-spawned CH (1/500 adults will die on average w/no visible reason) (TSES). -Slight slowdown of migration during periods of warm water temp. -2013 warmest year in past 30 (1-2^{0}C warmer than past years on lake fed systems) max water temp = ~18^{0}C (TSES). **LF7:** -Generally not thought to be an issue.	**LF6:** -Generally not thought to be an issue. – Very rarely see dead, un-spawned CH (1/500 adults will die on average w/no visible reason). -Slight slowdown of migration during periods of warm water temp. -Snowmelt fed systems may be warmer on years of low snow pack. **LF7:** -Generally not thought to be an issue.	**LF6:** -Generally not thought to be an issue. – Very rarely see dead, un-spawned CH (1/500 adults will die on average w/no visible reason). -Slight slowdown of migration during periods of warm water temp. -Snowmelt fed systems may be warmer on years of low snow pack. **LF7:** -Generally not thought to be an issue.	**LF6:** -Generally not thought to be an issue. – Very rarely see dead, un-spawned CH (1/500 adults will die on average w/no visible reason). -Slight slowdown of migration during periods of warm water temp. -Snowmelt fed systems may be warmer on years of low snow pack. **LF7:** -Generally not thought to be an issue.	**LF6:** -Generally not thought to be an issue. – Very rarely see dead, un-spawned CH (1/500 adults will die on average w/no visible reason). -Slight slowdown of migration during periods of warm water temp. -Snowmelt fed systems may be warmer on years of low snow pack. **LF7:** -Generally not thought to be an issue.	**LF6:** -Generally not thought to be an issue. – Very rarely see dead, un-spawned CH (1/500 adults will die on average w/no visible reason). -Slight slowdown of migration during periods of warm water temp. -Snowmelt fed systems may be warmer on years of low snow pack (Sand/Upper Kennedy). -2013 warmest year in past 30 (1-2^{0}C warmer than past years on lake fed systems) max water temp = ~18^{0}C -During warm water years stress levels are generally thought to be much higher as upstream migration is also limited due to low flows. Increased exposure to estuarine predation also results. **LF7:** -Generally not thought to be an issue.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
7. Availability of high quality and sufficient quantity spawning habitat	**LF8**: Lack of high quality and quantity of spawning habitat	-Absence of major tributaries to deliver bedload to mainstem -Development -Landslides –Flooding -Logging impacts -Climate Change	Bedload recruitment/ delivery of ____ cm/year at major spawning sites Ocean-type CH require about 24 m^2 of gravel per spawning pair. Particles of less than 6.4 mm have the potential to infiltrate redds and prevent the emergence of fry.	-Generally not thought to be an issue due to natural state of the system. -Less available spawning habitat relative to other systems of this length, however, this is not an issue as sufficient habitat exists for the amount of fish that historically return to the system. -Changing hydrological regimes could cause spawning habitat to degrade or become inaccessible. This is a data gap. -Low escapement levels may be reducing natural level of spawning gravel maintenance.	-Generally not identified as an issue. -Changing hydrological regimes could cause spawning habitat to degrade or become inaccessible. This is a data gap	-There is uncertainty as to the presence of sufficient quality spawning habitat within the Bedwell -Changing hydrological regimes could cause spawning habitat to degrade or become inaccessible. This is a data gap. -Low escapement levels may be reducing natural level of spawning gravel maintenance.	-Generally not thought to be an issue. -Changing hydrological regimes could cause spawning habitat to degrade or become inaccessible. This is a data gap.	-Generally not thought to be an issue. -Changing hydrological regimes could cause spawning habitat to degrade or become inaccessible. This is a data gap.	-Insufficient amounts of spawning gravel in lower Kennedy for current CH escapement (significant hatchery contributions to natural population (~1500 ch)) *(TFN-HC)*. -Staghorn and Murial Creeks have provided spawning habitat for CH thought to have 'wandered' from Lower Kennedy population. -Changing hydrological regimes could cause spawning habitat to degrade or become inaccessible. This is a data gap. -Sand River has very limited spawning grounds. This was compounded due to aggradation following bridge removal and channelization resulting in a loss of spawning habitat.
8. An agreed - upon and Enforceable Fishing Plan	**LF9(a):** Mortality due to illegal fishing	-Poaching -Overfishing -Under Reported Catch -Lack of enforcement of catch and release methodology (e.g. fishing derby)		-On multiple occasions gillnets have been observed fishing across the entire Megin River (at the estuary).	-Generally not identified as an issue.	-Generally not identified as an issue.	-There is concern that illegal recreational fishing occurs at the mouth of the Cypre River (both in the estuary and in the river).	-Generally not identified as an issue.	-Generally not identified as a major issue. -Occasionally illegal recreational fishing occurs in Cannery Bay.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
	LF9(b): Mortality due to legal unsanctioned and under reported fishing	-Legal Food Fishing unauthorized by First Nation		-There is concern that a significant level of unsanctioned food fishing occurs at the mouth of the Megin River. -Ahousaht First Nation members have food fished here in past years using hook and line and gillnet techniques but are generally thought to be targeting sockeye salmon before CH have entered into the river (AFN-FD). -Ahousaht First Nation members have been observed targeting CH with hook and line techniques by Ahousaht Fisheries Managers (AFN-FD).	-There is concern that a significant level of unsanctioned food fishing occurs at the mouth of the Moyeha River. -Ahousaht First Nation members have food fished here in past years using hook and line and gillnet techniques but are generally thought to be targeting chum salmon after CH have passed into the river *(AFN-FD)*.	-Generally not identified as an issue.	-There is concern that a notable level of unsanctioned food fishing occurs at the mouth of the Cypre River. -Ahousaht First Nation members have food fished for CH here in past years using trolling and hook and line techniques (AFN-FD).	-Generally not identified as an issue.	-Generally not identified as a major issue. -Occasionally unsanctioned food fishing occurs at the mouth of the Lower Kennedy (It is thought that Tla-o-qui-aht First Nation Chiefs often initiate these fisheries on behalf of their families) (TFN-HC).
	LF9(c): Mortality due to authorized, sanctioned fisheries	-Commercial Fisheries -Food Fisheries -Rec Fisheries		-Commercial, Recreational and FSC Fishing is not permitted in the immediate vicinity of the estuary. -Catch and Release Recreational fishing for salmon and trout is permitted in the river. -Ahousaht First Nation Fisheries occasionally beach seines in the Megin estuary, selective fishing allows for the release of CH *(AFN-FD)*.	-Commercial, Recreational and FSC Fishing is not permitted in the immediate vicinity of the estuary. -Catch and Release Recreational fishing for salmon and trout is permitted in the river.	-Commercial, Recreational and FSC Fishing is not permitted in the immediate vicinity of the estuary. -Catch and Release Recreational fishing for salmon and trout is permitted in the river.	-Commercial, Recreational and FSC Fishing is not permitted in the immediate vicinity of the estuary. -Catch and Release Recreational fishing for salmon and trout is permitted in the river.	-Commercial, Recreational and FSC Fishing is not permitted in the immediate vicinity of the estuary. -Catch and Release Recreational fishing for salmon and trout is permitted in the river.	-Commercial, Recreational and FSC Fishing is not permitted in the immediate vicinity of the estuary. -Occasionally Sockeye will be harvested by Tla-o-qui-aht First Nations for special occasions (Hatchery crew conducts selective fishery aimed at minimizing CH by-catch) *(TFN-HC)*. -Catch and Release Recreational fishing for salmon and trout is permitted in rivers and Kennedy Lake. -Catch and Release Recreational fishing for coho salmon is common (12 ppl/day) in the Lower Kennedy River and there is concern that CH bi-catch mortality rates are high as they have been observed on multiple occasions *(TFN-HC)*.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
9. Lack of invasive plant and animal species affecting spawning habitat	**LF10:** Loss of spawning habitat due to Atlantic salmon competition	-Atlantic salmon competition for spawning grounds	Loss of spawning habitat Loss of vegetation	-Generally not identified as an issue. -Enumeration crews have not seen an Atlantic salmon for 6-7 years in the river (10 years previous 1-2/year).	-Generally not identified as an issue. -Enumeration crews have not seen an Atlantic salmon for 6-7 years in the river (10 years previous 1-2/year).	-Generally not identified as an issue. -Enumeration crews have not seen an Atlantic salmon for 6-7 years in the river (10 years previous 1-2/year). -10 years ago ~ 60 Atlantic salmon were found on spawning beds following a large escape. The fish did not appear to spawn and seemed confused and domesticated (TSES).	-Generally not identified as an issue. -Enumeration crews have not seen an Atlantic salmon for 6-7 years in the river (10 years previous 1-2/year).	-Generally not identified as an issue. -2013 one Atlantic salmon was observed by enumeration crews in Tranquil (3rd of October) -Previous to this Enumeration crews have not seen an Atlantic salmon for 6-7 years in the river (10 years previous 1-2/year). - There is a pool called the *Atlantic Pool* in the lower river.	-Generally not identified as an issue. -Enumeration crews have not seen an Atlantic salmon for 6-7 years in the river. -Previous to 2006, ~12 Atlantic salmon were observed in the lower Kennedy River/year for ~3 years *(TFN-HC)*. -During this period 17 Atlantic salmon were counted in the Upper Kennedy one year *(TFN-HC)*.
10. Lack of anthropogenic disturbance	**LF11:** Disturbance to natural spawning activity due to anthropogenic impacts	-Boats/Drift Boats -Urban development -Quads/Dirt Bikes/Horses -Noise/Lights -Pollution		-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue but horses and river kayaking during spawning may be a minor concern depending on frequency of activity.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as a major issue. -Human impacts such as illegal shake blocking and small scale gold mining have been observed very occasionally on the Upper Kennedy during the fall *(TCSES)*.
11. Low levels of predation during migration and spawning	**LF12:** Mortality due to predation at spawning grounds	-Bear, seal predation	Abundance of bears at spawning grounds Presence & abundance of seals at spawning grounds	-No unusual abundance of bears or seals at spawning grounds.	-No unusual abundance of bears or seals at spawning grounds.	-No unusual abundance of bears or seals at spawning grounds.	-No unusual abundance of bears or seals at spawning grounds.	-No unusual abundance of bears or seals at spawning grounds.	-No unusual abundance of bears or seals at spawning grounds.

2. INCUBATION

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
1.Good water quality conditions	**LF13:** High suspended sediment loads, low DO and high water temperatures that reduce egg to fry survival and emergence of alevins Other possible LFs include low DO, high water temperatures	-Unstable and eroding channel banks -Widening of channel and aggradation effecting DO -Riverside development and natural erosion of clay banks. -Logging, landslides	-TSS < 25_mg/L in 24 hrs when background is ≤ 25 mg/L (Stalberg 2009) at established sampling sites in the middle and lower reaches of the mainstem -# of out-migrating CH fry through operation of downstream trapping program through June to calculate egg to fry survival rates on an annual basis -Temperature range for the incubation of CH eggs if from 4.5 to 12.8 ^{0}C. (Carol believes it should be 2.6 to 12.8)	-Generally not identified as an issue.	-Generally not identified as a major issue, however, more frequent, large scale precipitation events have led to heightened concerns within this watershed. -Historically not an issue, however, large fall rain event in Fall 2006 caused large scale sedimentation in upper reaches. This sedimentation rate has stabilized following this event *(TCSES)*.	-Generally not identified as a major issue, however, more frequent, large scale precipitation events have led to heightened concerns within this watershed. -Historical logging practices would have caused sedimentation issues in the Bedwell. -Lower alkalinity & other measures of productivity than provincial and Clayoquot Sound averages (Triton 1993; Wright 1998). -In recent years the system has generally been stable but development of a new channel at the Ursus confluence would have caused major sedimentation downstream. -The possibility of effluent from historical mining activity as well as known tailing dumps into tributaries within the Bedwell and Ursus is of concern. This is a data gap.	-Generally not identified as a major issue, however, more frequent, large scale precipitation events have led to heightened concerns within this watershed. -Historical logging practices would have caused significant sedimentation issues in the Cypre. -Logging roads pinpointed as contributing high loads of sediment (Taylor 1996). -The Cypre was so heavily logged that the river is still changing dramatically and causing a high level of sediment to move downstream during high flow events. -This situation is slowly improving, however, there is concern that it will get worse before it gets better due to high levels of unnatural sediment at the headwaters of the river slowly traversing the length of the system.	-Generally not identified as a major issue, however, more frequent, large scale precipitation events have led to heightened concerns within this watershed. -Historical logging practices would have caused sedimentation issues in the Tranquil. -Major landslides have historically occurred in this watershed due to logging. -8-9 years ago a landslide occurred in the Tranquil that caused high turbidity for at least 2 weeks (during fall months) *(TCSES)*. -Erosion at the corner of *Atlantic Pool* has caused sedimentation downstream.	-Generally not identified as a major issue in the Kennedy River, however, more frequent, large scale precipitation events have led to heightened concerns within this watershed. -Historical logging practices would have caused sedimentation issues in the Sand River. - High erosion rates in the Sand River following bridge removal. -During a significant rain event in October 2013 water quality in the Lower Kennedy was caring a very high sediment load for 4-5 days. This was an unusual occurrence *(TFN-HC)*.
2.Stable flow regime	**LF14:** Lower low flows that dewater redds and reduce incubation survival	-Drought during the fall/winter due to alteration of natural hydrologic regime from climate change or resource development (e.g. forest harvesting)	-Frequency, timing, magnitude & duration of discharge -% watershed altered by development type, road density	-Generally not identified as an issue as CH typically spawn dead center in the stream.	-Generally not identified as an issue as CH typically spawn dead center in the stream.	-Generally not identified as an issue as CH typically spawn dead center in the stream.	-Generally not identified as an issue as CH typically spawn dead center in the stream.	-Generally not identified as an issue as CH typically spawn dead center in the stream.	-Generally not identified as an issue as CH typically spawn dead center in the stream.

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	LF15: More frequent and higher peak flows over winter can scour/disturb redds	-Greater flow variation due to resource development, primarily forestry, land development, land clearing activities		-Generally not identified as an issue as system has relatively stable flows. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased scouring and disruption.	-Generally not identified as an issue as system has relatively stable flows. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased scouring and disruption. -Movement of LWD during high flow events focus damage on locations utilized for spawning.	-Generally not identified as an issue as system has relatively stable flows. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased scouring and disruption. -Movement of LWD during high flow events focus damage on locations utilized for spawning.	– It is generally believed that the Cypre experiences the highest level of scour/disruption of redds of all Clayoquot systems due to high levels of deforestation (<25%). - Levels of lower riparian cover and overall recovery of deforested areas have substantially improved in the last 20 years and are not thought to be a factor causing increased high flow events (WW). -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased scouring and disruption.	-Generally not identified as an issue as system is relatively short and volume and velocity of water during precipitation events is proportionally smaller than most other systems in Clayoquot. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased scouring and disruption. -Movement of LWD during high flow events focus damage on locations utilized for spawning.	-Generally not identified as an issue in the Upper/Lower Kennedy. – Generally believed that the Sand experiences a high level of scour/disruption of redds due to high levels of deforestation. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased scouring and disruption. -Movement of LWD during high flow events focus damage on locations utilized for spawning.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
3.Appropriate spawning gravel	**LF16:** Egg mortality due to choking and inadequate spawning gravel	-Inadequate numbers of fish for spawning gravel maintenance -Sediment derived from resource development, primarily forestry, land development, land clearing activities	-Gravel – 15cm is upper usable limit, 2-10cm preferred -Particles of less than 6.4 mm have the potential to infiltrate redds and prevent the emergence of fry. -≤5% silt (≤0.8mm) is optimal	-Generally not identified as an issue, however, data relating to inter-gravel flows and their effect on incubation is limited. This is a data gap. -Low escapement levels may be reducing natural level of spawning gravel maintenance	-Generally not identified as an issue, however, data relating to inter-gravel flows and their effect on incubation is limited. This is a data gap. -Low escapement levels may be reducing natural level of spawning gravel maintenance	-Generally not identified as an issue, however, data relating to inter-gravel flows and their effect on incubation is limited. This is a data gap. - Low escapement levels may be reducing natural level of spawning gravel maintenance. -Historical logging activity would have caused issues on the Bedwell. -Historical aggregate gravel mining occurred in the Bedwell -Upper Ursus has had major issues following large rain events. -Generally the systems have been stable in recent years but development of new channel at Ursus confluence would have caused major sedimentation downstream.	-Generally not identified as an issue, however, data relating to inter-gravel flows and their effect on incubation is limited. This is a data gap. - Low escapement levels may be reducing natural level of spawning gravel maintenance. -Historical logging activity would have and continues to cause, major sedimentation issues on the Cypre. -This situation is slowly improving, however, there is concern that it will get worse before it gets better due to high levels of unnatural sediment at the headwaters of the river slowly traversing the length of the system. -There is concern that green algae is growing over spawning gravel within this system due to lack of spawning gravel maintenance in some areas.	-Generally not identified as an issue, however, data relating to inter-gravel flows and their effect on incubation is limited. This is a data gap. -Sedimentation from major landslides in the upper river as well as erosion in the vicinity of the *Atlantic Pool* has caused some degree of sedimentation in the past.	-Generally not identified as an issue, however, data relating to inter-gravel flows and their effect on incubation is limited. This is a data gap. - Low escapement levels may be reducing natural level of spawning gravel maintenance in the Upper Kennedy. -Historical logging activity would have caused issues on the Upper Kennedy. -Historical logging activity would have and continues to cause, major sedimentation issues on the Sand. -High rates of erosion have been noted in the vicinity of the bridge that was removed on the Sand River. -Historical aggregate gravel mining occurred in the Kennedy watershed (streams and river beds).
4.Minimal disturbance to redds	**LF17:** Reduced egg to fry survival due to chum overspawn	-Overspawn, -Scour -Flow levels -Distribution of chum spawners	-Frequency of overspawn	-Generally not identified as an issue as chum and CH spawn in different locations. -In addition, chum escapement numbers are increasingly on the decline, further limiting possible competition.	-Generally not identified as an issue as chum and CH spawn in different locations. -In addition, chum escapement numbers are increasingly on the decline, further limiting possible competition.	-Generally not identified as an issue as chum and CH spawn in different locations. -In addition, chum escapement numbers are increasingly on the decline, further limiting possible competition.	-Generally not identified as an issue as chum and CH spawn in different locations. -In addition, chum escapement numbers are increasingly on the decline, further limiting possible competition.	-Generally not identified as an issue as chum and CH spawn in different locations. -Tranquil chum are the earliest of all Clayoquot chum returns and have typically vacated the system before the CH spawn. -In addition, chum escapement numbers are increasingly on the decline, further limiting possible competition.	-Generally not identified as an issue as chum and CH spawn in different locations. -In addition, chum escapement numbers are increasingly on the decline, further limiting possible competition.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
5.Minimal predation of eggs and alevins	**LF18:** Predation of eggs and alevins by fish (sculpins, trout) and birds (mergansers/American Dipper)	-Natural predatory behaviour	-Degree of predation on eggs and alevins -% Egg to emergent fry survival -Bears, raccoons, bird, minks, otters abundance	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened..	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened..	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.
6. Lack of invasive species	**LF19**: Egg mortality due to redd disturbance by invasive species such as crayfish	-Loss and disturbance to spawning habitat	-Abundance of AIS	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.
7. Lack of anthropogenic disturbance	**LF20:** Egg mortality due to redd disturbance by humans	-Speedboats, urban development, docks, horses, drift boats	-Population density/growth -Abundance of speedboats/docks	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue, however, there is concern that recreational activities (white water kayaking tours, trail ridding with horses in the river) within the Bedwell River may impact eggs during the later fall months during low flows.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.

3. EARLY REARING

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
1.Suitable water temperature, TSS, dissolved oxygen levels, pH, hardness, supersaturation	**LF21:** Mortality or fitness impacts as a result of poor water quality	-Industrial development waste discharge, accidental spills, input from sewage, septic systems and agriculture -Bank erosion and ss loads can be exacerbated by forestry, rural land clearing and urban development -Air temperature, N and pH levels, municipal/domestic sewage discharge, agricultural activities, urban development, effluent from fish hatchery operations throughout the watershed	Target WQ parameters: DO: 5-9 mg/L, water Temp: Spawning, incubation:10C, Rearing: 15C Adult migration: 16C. (Richter and Kolmes 2005). CH upper optimum temp (UOTR) is 14C, Impairment Temp (IT) is 20 C. Sedimentation: Levels of 509 to 1217 ppm are fatal to juveniles. Levels of 500 ppm result in stress responses. Levels of 100 to 300 ppm result in reduced feeding.	-Generally not identified as a major issue, however, there is concern that water temperatures may be rising within the Megin River.	-Generally not identified as an issue.	-Generally not identified as an issue. -Lower alkalinity & other measures of productivity than provincial and Clayoquot Sound averages (Triton 1993; Wright 1998). -The possibility of effluent from historical mining activity within the Bedwell and Ursus is of concern. This is a data gap.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
2.Adequate food supply	**LF22:** Mortality or fitness impacts as a result of lack of food	-Urban and resource development can reduce productivity by reducing the food availability as well as the quantity and quality of natural rearing habitat. -Type and quality of substrate can impact type of invertebrate populations available. -Riparian condition, presence of overhead vegetation impact food availability -Food supply may be related to low nutrient levels -Lack of returning spawner carcasses ('cascade effect') -Change in riparian composition; red alder dominance in some systems in not historically common. A shift in benthic invertebrates has been observed in areas where red alder dominates (difference in allochthonous input and amount and timing of input) = increase in pH/change in nutrients.	Riparian: Good status: 90% intact, high ecological complexity. Moderate status: 5-25% fragmented, moderate level of ecological complexity. Lower status: >25% fragmentation, partially functioning (see excerpt from nhc 2009) Optimal substrate for the maintenance of a diverse and healthy invertebrate population includes a combination of fine sediments and organics, gravel and rubble with rubble dominant.	-There is a dramatic contradiction as to historical primary productivity of the Megin, Historical accounts describe the river as both highly productive as well as 'sterile looking.' -This topic requires further research, however, given the overall decline in salmon returns it is likely that nutrient levels are not at historic levels and this may be an issue. - It is likely that due to the fact that all CH stocks in Clayoquot are ocean type CH (S0), in-stream nutrient levels may not affect local stocks to the degree that they may impact stream-type CH (S1) elsewhere. (Coho would be a logical species to study in this regard in Clayoquot systems.)	-This topic requires further research, however, given the overall decline in salmon returns it is likely that nutrient levels are not at historic levels and this may be an issue. - It is likely that due to the fact that all CH stocks in Clayoquot are ocean type CH (S0), in-stream nutrient levels may not affect local stocks to the degree that they may impact stream-type CH (S1) elsewhere.	-This topic requires further research, however, given the overall decline in salmon returns it is likely that nutrient levels are not at historic levels and this may be an issue. - It is likely that due to the fact that all CH stocks in Clayoquot are ocean type CH (S0), in-stream nutrient levels may not affect local stocks to the degree that they may impact stream-type CH (S1) elsewhere. -The riparian conditions within this system may be contributing to a deficiency in invertebrate population. A data gap exists in regards to the status of the riparian zone on this system. GIS Mapping will address this gap to some degree and information will be made available for discussion. (MC Wright)	-This topic requires further research, however, given the overall decline in salmon returns it is likely that nutrient levels are not at historic levels and this may be an issue. - It is likely that due to the fact that all CH stocks in Clayoquot are ocean type CH (S0), in-stream nutrient levels may not affect local stocks to the degree that they may impact stream-type CH (S1) elsewhere. -The riparian conditions within this system may be contributing to a deficiency in invertebrate population. A data gap exists in regards to the status of the riparian zone on this system. GIS Mapping will address this gap to some degree and information will be made available for discussion. (MC Wright) -Scouring events may also cause a reduction in available invertebrates.	-This topic requires further research, however, given the overall decline in salmon returns it is likely that nutrient levels are not at historic levels and this may be an issue. - It is likely that due to the fact that all CH stocks in Clayoquot are ocean type CH (S0), in-stream nutrient levels may not affect local stocks to the degree that they may impact stream-type CH (S1) elsewhere. -The riparian conditions within this system may be contributing to a deficiency in invertebrate population. A data gap exists in regards to the status of the riparian zone on this system. GIS Mapping will address this gap to some degree and information will be made available for discussion. (MC Wright)	-This topic requires further research, however, given the overall decline in salmon returns it is likely that nutrient levels are not at historic levels and this may be an issue. - It is likely that due to the fact that all CH stocks in Clayoquot are ocean type CH (S0), in-stream nutrient levels may not affect local stocks to the degree that they may impact stream-type CH (S1) elsewhere. -The riparian conditions within this system may be contributing to a deficiency in invertebrate population. A data gap exists in regards to the status of the riparian zone on this system. GIS Mapping will address this gap to some degree and information will be made available for discussion. (MC Wright) -A sufficient amount of invertebrate life has been observed within this system and this is not thought to be a limiting factor by some people.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
3.Adequate instream complexity and riparian complexity	**LF23:** Mortality or fitness impacts as a result of inadequate in-stream complexity and riparian complexity	-Inadequate lake & riparian complexity can result in reduced productivity and food availability, increased predation, reduced fry survival. -Primarily due to urban and resource development	% pool habitat: Good: >55%, Fair 40-55% and Poor: <40%. Pool frequency: G < 2 channel width per pool, Fair: 2-4 CWPP, Poor: > 4 CWPP. LWD pieces per channel width: G > 2, F: 1-2 and P: < 1. Bldr cover in riffles: G: >20% F: 10-30% and P: <10%. (Johnstone and Slaney 1996).	-Generally not identified as a major issue. -It is unclear if there is sufficient side channel habitat for CH within this system. This is a clear data gap. -Ocean-type CH (S0) may not require side channel habitat within small coastal systems as it is generally thought that they rear in the mainstream of Clayoquot systems.	-Generally not identified as a major issue. -It is unclear if there is sufficient side channel habitat for CH within this system. This is a clear data gap. -Ocean-type CH (S0) may not require side channel habitat within small coastal systems as it is generally thought that they rear in the mainstream of Clayoquot systems.	-Generally not identified as a major issue. -It is unclear if there is sufficient side channel habitat for CH within this system. This is a clear data gap. -Ocean-type CH (S0) may not require side channel habitat within small coastal systems as it is generally thought that they rear in the mainstream of Clayoquot systems. -Channel primarily a glide, lacking adequate depth, ,almost no stable LWD and a lack of boulder cover in all lower reaches. (Clough 2011).	-Generally not identified as a major issue. - Majority of channels surveyed were found to be deficient in functional fish habitat (Taylor & Ebell, 1997). -It is unclear if there is sufficient side channel habitat for CH within this system. This is a clear data gap. -Ocean-type CH (S0) may not require side channel habitat within small coastal systems as it is generally thought that they rear in the mainstream of Clayoquot systems. -Side channel habitat (3 different locations), LWD and boulder complexing work has been completed by DFO within the Cypre (~2000).	-Generally not identified as a major issue. -It is unclear if there is sufficient side channel habitat for CH within this system. This is a clear data gap. -Ocean-type CH (S0) may not require side channel habitat within small coastal systems as it is generally thought that they rear in the mainstream of Clayoquot systems.	-Generally not identified as a major issue. -It is unclear if there is sufficient side channel habitat for CH within this system. This is a clear data gap. -Ocean-type CH (S0) may not require side channel habitat within small coastal systems as it is generally thought that they rear in the mainstream of Clayoquot systems. -It is thought that there may be stream-type CH (S1) within the Upper Kennedy.

Critical Habitat Requirements	**Limiting Factors**	**Possible Causal Mechanisms**	**Benchmarks**	**Megin**	**Moyeha**	**Bedwell**	**Cypre**	**Tranquil**	**Kennedy**
4.Adequate water levels and connectivity	**LF24:** Increased stranding in isolated off-channel habitat and tributaries can occur with rapid decreases in flow.	-Increased mortality results from predation or lack of food/drying up of habitat -Low water levels due to extraction of water. -Riverside and floodplain development , urban development -Industrial and domestic water use/extraction -Low flows -Operation of the weir, amount of total water storage available -Rainfall -Change in hydrology due to climate change -Change in bedload, and channel morphology	Optimal depth for juvenile rearing is from 30 to 122 cm.	-Generally not identified as a major issue. -CH have typically vacated Clayoquot rivers by the time the dry season arrives. CH primarily rear in mainstream of Clayoquot systems. -Off-channel habitat has been observed to be staying dry significantly longer than usual in recent years.	-Generally not identified as a major issue. -CH have typically vacated Clayoquot rivers by the time the dry season arrives. CH primarily rear in mainstream of Clayoquot systems. -Off-channel habitat has been observed to be staying dry significantly longer than usual in recent years.	-Generally not identified as a major issue. -CH have typically vacated Clayoquot rivers by the time the dry season arrives. CH primarily rear in mainstream of Clayoquot systems. -Off-channel habitat has been observed to be staying dry significantly longer than usual in recent years.	-Generally not identified as a major issue -CH have typically vacated Clayoquot rivers by the time the dry season arrives. CH primarily rear in mainstream of Clayoquot systems -Off-channel habitat has been observed to be staying dry significantly longer than usual in recent years.	-Generally not identified as a major issue -CH have typically vacated Clayoquot rivers by the time the dry season arrives. CH primarily rear in mainstream of Clayoquot systems -Off-channel habitat has been observed to be staying dry significantly longer than usual in recent years.	-Generally not identified as a major issue -Off-channel habitat has been observed to be staying dry significantly longer than usual in recent years. -CH have typically vacated Clayoquot rivers by the time the dry season arrives. CH primarily rear in mainstream of Clayoquot systems -It is thought that there may be stream-type CH (S1) within the Upper Kennedy

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
5. Stable flow regime	**LF25:** High flows impacting fry and smolts	-Precipitation -Increased runoff rates due to forestry and agricultural development/land clearing activities	Select water velocities ranging from 0 to 60 cm/s with an optimal range of 0 to 40 cm/s at depths of greater than 15 cm.	-Generally not identified as a major issue during late winter and spring. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased impacts on fry and smolts.	-Generally not identified as a major issue during late winter and spring. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased impacts on fry and smolts.	-Generally not identified as a major issue during late winter and spring. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased impacts on fry and smolts.	-Generally not identified as a major issue during late winter and spring. -Historic levels of LWD and water levels were extreme during the period following heavy logging in the Cypre. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased impacts on fry and smolts.	-Generally not identified as a major issue during late winter and spring. -Changing hydrological regimes could cause more frequent and higher peak flows leading to increased impacts on fry and smolts.	-Generally not identified as a major issue during late winter and spring.
6.Lack of aquatic invasive species	**LF26:** Mortality or fitness impacts as a result of competition with AIS	-Presence of aquatic invasive species		-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.
7.Lack of competition with other species/hatchery fry	**LF27:** Mortality or fitness impacts as a result of competition with other species/hatchery fry	-Presence of hatchery fry or other competitive species	% of hatchery vs. wild production	-Generally not identified as an issue due to the lack of enhancement activity within the system.	-Generally not identified as an issue due to the lack of enhancement activity within the system.	-Generally not identified as a major issue but data gaps do exist. -TSES hatchery procedure is as follows: hatchery CH are released at 5g (2x size of natural) and are released at upper reaches of tidal reach. They are thought to head directly downstream and are believed to not compete with wild smolts in the river (TSES).	-Generally not identified as a major issue but data gaps do exist. -TSES hatchery procedure is as follows: hatchery CH are released at 5g (2x size of natural) and are released at upper reaches of tidal reach. They are thought to head directly downstream and are believed to not compete with wild smolts in the river.	-Generally not identified as a major issue but data gaps do exist. -TSES hatchery procedure is as follows: hatchery CH are released at 5g (2x size of natural) and are released at upper reaches of tidal reach. They are thought to head directly downstream and are believed to not compete with wild smolts in the river.	-Generally not identified as a major issue but data gaps do exist. -Due to historically high levels of hatchery input and low wild fish escapement within the Lower Kennedy, it is generally thought that virtually all CH within the lower river are now 'hatchery' *(TFN-HC)*. -A percentage of hatchery CH are released in the upper river; however, due the large amount of habitat available competition is not thought to be intense. -It is thought that there may be stream-type CH (S1) within the Upper Kennedy and hatchery release in this system may create competition.

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
8.Lack of other sources of interference	**LF28:** Mortality or fitness impacts as a result of anthropogenic disturbance	-Boats/Marinas/Flo at homes -Buildings etc creating noise and light pollution -		-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.
9.Low levels of predation	**LF29:** Mortality as a result of high levels of predation	-Density of predators -Availability of alternate food sources (invertebrates) - Amount of refuge habitat for fry -Change in stream morphology may reduce cover and increase predation		-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue and no unnatural levels of predation have been observed - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue and no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as an issue, however, heightened levels of predation have been observed in recent years. Specifically numbers of mergansers and river otters have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.
10. Low levels of fish disease	**LF30:** Mortality or fitness impacts as a result of disease	-Crowding/lack of appropriate habitat	Many fish diseases become more virulent at temperatures over 15.6 ^{0}C.	-Generally not identified as an issue, however, sampling would be required to determine health of wild CH smolts.	-Generally not identified as an issue, however, sampling would be required to determine health of wild CH smolts.	-Generally not identified as an issue, however, sampling would be required to determine health of wild CH smolts.	-Generally not identified as an issue, however, sampling would be required to determine health of wild CH smolts.	-Generally not identified as an issue, however, sampling would be required to determine health of wild CH smolts.	-Generally not identified as an issue, however, sampling would be required to determine health of wild CH smolts.
11. Adequate suitable habitat	**LF31:** Mortality or fitness impacts as a result of lack of suitable habitat	-Urban development -Oil -Medications		-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.

4. REARING IN THE ESTUARY

Critical Habitat Requirements	Limiting Factors	Possible Causal Mechanisms	Benchmarks	Megin	Moyeha	Bedwell	Cypre	Tranquil	Kennedy
1.Adequate food supply to minimize competition with hatchery smolts and other stocks for food and habitat	**LF32:** Low early marine survival of CH fry and smolts in the estuary due to the lack of adequate food supply (particularly in first 4 months of marine life) and reduced water quality	-Reduced food availability		- This is a data gap and would require further research. -There have been decreased amounts of herring observed in the estuary in recent years (AFN-FD).	- This is a data gap and would require further research. -There have been decreased amounts of herring observed in the estuary in recent years.	- This is a data gap and would require further research. -There have been decreased amounts of herring observed in the estuary in recent years.	- This is a data gap and would require further research. -There have been decreased amounts of herring observed in the estuary in recent years.	- This is a data gap and would require further research.	- This is a data gap and would require further research.
2.Adequate water temps for smoltification and outmigration	**LF33:** Mortality or reduced fitness as a result of failure to develop to smolt	-High water temperatures e.g. climate change, warm water outflows due to lack of riparian cover	Temperature range for smoltification and outmigration is from 3.3 to 12.2 ^{0}C. Smolt lethal and loading stress occurs at temperatures over 18.3 ^{0}C.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue. -Warmest temp in estuary ever noted during sea penning is 12^{0}C (2m depth) (TSES).	-Generally not identified as an issue. -Warmest temp in estuary ever noted during sea penning is 16^{0}C (2m depth) (TSES).	-Generally not identified as an issue.

3.Good Habitat complexity (adequate vegetation for cover/to ameliorate water temps)	**LF34:** Loss of good quality foreshore, estuarine and nearshore habitat ie loss of natural abundance and composition of benthic communities, eelgrass habitat, kelp forests and associated ecological communities.	-Historical log booming, log dumps, channelization and diking, infilling for industrial developments, -Amount of development and/or disturbance to natural riparian, foreshore, intertidal and nearshore habitat	% or area of altered subtidal, intertidal and foreshore habitat	-Generally not identified as an issue as estuary is in natural state. - The Megin has always had limited estuary habitat due to physiology of the estuary itself. -Very small estuary. Estuary rated 5 out of a possible 10 (low value) for biological values (FC TER MOO).	-Generally not identified as an issue as estuary is in natural state.	-Generally not identified as an issue as estuary has not been altered for many years. -The Bedwell estuary was impacted during mining era (infill), however, the extent of this infilling is not well known. This may have reduced natural habitat complexity. - 1950-60's Logging operations dredged out a booming ground in the tidal slough and built a causeway. Carried out a considerable amount of dredging and diking of the estuary to facilitate their operations. Caterpillars used to skid logs by yoke to the beach over a depressed mud road. The bulk of this disturbance occurred on the west side of the estuary. (Guppy 1988, 2000). -Change in habitat complexity between 1994 and 2013 will be looked at via GIS mapping prior to the workshop and information will be made available for discussion (MC Wright) -Log dumping and barge loading all occurred over deep water in the west side of Bedwell Inlet. Estuary relatively stable since early 1990's (Clough 2011).	- Generally not identified as an issue as estuary has not been altered for many years. -Gravel was extracted from the estuary during construction of the Long Beach Airport (during WWII). This may have reduced natural habitat complexity. -Change in habitat complexity between 1994 and 2013 will be looked at via GIS mapping prior to the workshop and information will be made available for discussion (MC Wright)	-Generally not identified as a major issue as no unnatural levels of predation have been observed. -1986: Logging camp and log dump in Tranquil Inlet. -Log pile in estuary that was never removed (CS Salmon Review 2007). -Change in habitat complexity between 1994 and 2013 will be looked at via GIS mapping prior to the workshop and information will be made available for discussion (MC Wright)	- Generally not identified as an issue as estuary has not been altered for many years. -A salmon cannery and associated infrastructure was operated in Kennedy/Cannery Bay 1897-1930, however, little remains of these structures. This may have reduced natural habitat complexity.
4. Low levels of predation of fry in lower river and estuary	**LF35:** Predation of fry in the lower river and estuary	-Predation is affected by the abundance & type of predators.	____% or __ ha of eelgrass and other vegetative cover in the estuary	-Generally not identified as a major issue as no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened. -seals have been noted as a significant predator.	-Generally not identified as a major issue as no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened. -seals have been noted as a significant predator.	-Generally not identified as a major issue as no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened. -seals have been noted as a significant predator.	-Generally not identified as a major issue as no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened. -seals have been noted as a significant predator.	-Generally not identified as a major issue as no unnatural levels of predation have been observed. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.	-Generally not identified as a major issue, however, number of mergansers and gulls at rapids during May-June has increased significantly in recent years. - As escapement of all salmon species increasingly fluctuates, predation on remaining stocks can be heightened.

5.Good water quality	**LF36:** Reduced fry survival due to decreased water quality from ballast dumping, industrial discharge, and sewage effluent in the estuary.	-Effluent from agricultural development -Sewage treatment facilities, septic fields -Industrial use -Pleasure boats, marinas	DO levels between 5-9 mg/L Stratification?	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as a major issue. -The possibility of effluent from historical mining activity within the Bedwell and Ursus is of concern. This is a data gap. -Potential impacts from leachate from garbage / metal / etc. in the estuarine infill (historical industrial use of the estuary).	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.
6.Low levels of competition or predation from aquatic invasive species	**LF37:** Mortality of fry and smolts due to predation and competition from AIS and exotic species.	-Presence of aquatic invasive species -Mackerel -Humboldt squid		-Mackerel could be a major issue, however, their impact may vary from year to year based on their presence and sea temperatures. -Mackerel could be more significant limiting factor in the future due to warming ocean temps.	-Mackerel could be a major issue, however, their impact may vary from year to year based on their presence and sea temperatures. -Mackerel could be more significant limiting factor in the future due to warming ocean temps.	-Mackerel could be a major issue, however, their impact may vary from year to year based on their presence and sea temperatures. -Mackerel could be more significant limiting factor in the future due to warming ocean temps.	-Mackerel could be a major issue, however, their impact may vary from year to year based on their presence and sea temperatures. -Mackerel could be more significant limiting factor in the future due to warming ocean temps.	-Mackerel could be a major issue, however, their impact may vary from year to year based on their presence and sea temperatures. -Mackerel could be more significant limiting factor in the future due to warming ocean temps.	-Mackerel could be a major issue, however, their impact may vary from year to year based on their presence and sea temperatures. -Mackerel could be more significant limiting factor in the future due to warming ocean temps.
7. Low levels of other interference e.g. light/sound pollution	**LF38:** Mortality or reduced fitness as a result of anthropogenic interference	-Boats/marinas etc -Log Salvage		-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue.	-Generally not identified as an issue. -Log Salvage operators may cause disturbance during salvage operations.	-Generally not identified as an issue.	-Generally not identified as an issue.

8. Adequate amount of suitable estuary habitat	**LF39:** Mortality or reduced fitness as a result of loss of suitable estuarine habitat	-Industrialization -Roadway -Diking		-Generally not identified as an issue as estuary is in natural state.	-Generally not identified as an issue as estuary is in natural state.	-Generally not identified as an issue. -The Bedwell estuary was impacted during mining era (infill), however, the extent of this infilling is not well known. This may have reduced natural habitat complexity. -Logging operations dredged out a booming ground in the tidal slough and built up a causeway. Carried out a considerable amount of dredging and diking of the estuary to facilitate their operations (Guppy 1988). -The estuary has not been altered for many decades. -Good estuary complexity with numerous channels and dense vegetation. See relatively low volume of marine traffic. Appears undisturbed from historic developments (Clough 2011). -Change in suitable estuarine habitat between 1994 and 2013 will be looked at via GIS mapping prior to the workshop and information will be made available for discussion (MC Wright).	-Generally not identified as an issue. -Gravel was extracted from the estuary during construction of the Long Beach Airport (during WWII). This may have reduced natural habitat complexity. -The estuary has not been altered for many decades. -Change in suitable estuarine habitat between 1994 and 2013 will be looked at via GIS mapping prior to the workshop and information will be made available for discussion (MC Wright).	-Generally not identified as an issue as estuary is in near to natural state. -Change in suitable estuarine habitat between 1994 and 2013 will be looked at via GIS mapping prior to the workshop and information will be made available for discussion (MC Wright).	-Generally not identified as an issue as estuary is in near to natural state. -The estuary has not been altered for many decades.
9.Low levels of competition with hatchery released fry in lower river and estuary	**LF40:** Competition with hatchery fry in the lower river and estuary	-Competition for food and habitat may vary with relative size of hatchery releases.	-Offset timing of hatchery CH fry release.	-Generally not identified as an issue as there is no enhancement activity in the river.	-Generally not identified as an issue as there is no enhancement activity in the river.	-Generally hatchery and wild smolts are present in the estuary at the same time. -Hatchery smolts are 2x the size of wild smolts (TSES). -Comment was not provided as this LF was added following interviews.	-Generally hatchery and wild smolts are present in the estuary at the same time. -Hatchery smolts are 2x the size of wild smolts. -Comment was not provided as this LF was added following interviews.	-Generally hatchery and wild smolts are present in the estuary at the same time. -Hatchery smolts are 2x the size of wild smolts. -Comment was not provided as this LF was added following interviews.	-Generally hatchery and wild smolts are present in the estuary at the same time. -Comment was not provided as this LF was added following interviews.