

<b>TABLE OF CONTENTS</b>	<b>PAGE</b>
<b>DISCLAIMER .....</b>	<b>I</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>II</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>I</b>
<b>LIST OF FIGURES .....</b>	<b>I</b>
<b>LIST OF TABLES .....</b>	<b>I</b>
<b>LIST OF APPENDICES .....</b>	<b>II</b>
<b>LIST OF ACRONYMS .....</b>	<b>II</b>
<b>APPROACH TO RECOVERY &amp; DOCUMENT STRUCTURE .....</b>	<b>1</b>
<b>PROLOGUE .....</b>	<b>3</b>
Let The Fish Tell The Story.....	3
<b>CHAPTER 1: OVERVIEW OF THE CCC COHO SALMON ESU .....</b>	<b>18</b>
A Species at the Brink of Extinction.....	18
The Taxonomy, Range and ESA Listing of Coho Salmon.....	21
The Imperiled CCC Coho Salmon.....	23
Coho Salmon Life History.....	27
Life History Habitat Requirements .....	31
<b>CHAPTER 2: THE ESA &amp; NMFS RECOVERY PLANNING.....</b>	<b>42</b>
The Federal Endangered Species Act.....	42
Recovering Salmonids under the Federal ESA .....	43
California's Recovery Domains .....	44
Goals of This Draft Recovery Plan.....	44
Recovery: A Collaborative Effort.....	45
North Central California Coast Recovery Domain .....	45

<b>CHAPTER 3: FACTORS LEADING TO FEDERAL LISTING.....</b>	<b>47</b>
<b>Purpose.....</b>	<b>47</b>
<b>Factors Affecting CCC Coho Salmon at the Time, and Since, Listing.....</b>	<b>48</b>
Factor A (At Time of Listing): Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range .....	49
Factor A (Since Listing): Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range .....	50
Factor B (At Time of Listing): Overutilization for Commercial, Recreational, Scientific, or Educational Purposes .....	50
Factor B (Since Listing): Overutilization for Commercial, Recreational, Scientific, or Educational Purposes .....	51
Factor C (At Time of Listing): Disease or Predation .....	51
Factor C (Since Listing): Disease or Predation Since Time of Listing.....	52
Factor D (At Time of Listing): Inadequacy of Existing Regulatory Mechanisms	52
Federal Efforts .....	52
Non-Federal Efforts .....	54
Factor D (Since Listing): Inadequacy of Existing Regulatory Mechanisms.....	56
Factor E (At Time of Listing): Other Natural and Man-made Factors Affecting the Species' Continued Existence .....	56
Factor E (Since Listing): Other Natural and Man-made Factors Affecting the Species' Continued Existence.....	57
<b>CHAPTER 4: ASSESSMENT OF PROTECTIVE EFFORTS .....</b>	<b>60</b>
<b>Federal Register Assessment of Protective Efforts .....</b>	<b>60</b>
Conservation Efforts at, and Since, the Listing of CCC Coho Salmon .....	61
Federal Efforts at Time of Listing .....	61
Federal Efforts Since Listing.....	63
State Efforts at Time of Listing.....	65
State Efforts Since Listing .....	66
Local Government Efforts At Listing .....	67
Local Government Efforts Since Listing .....	67
Non-Governmental Efforts At Listing .....	67
Non-Governmental Efforts Since Listing .....	68

Priority Conservation Efforts .....	68
<b>CHAPTER 5: POPULATION STRUCTURE &amp; VIABILITY .....</b>	<b>70</b>
<b>Historical Population Structure &amp; Biological Viability Criteria.....</b>	<b>70</b>
Viable Salmonid Populations.....	71
Historical Population Structure .....	72
Intrinsic Habitat Potential.....	72
Defining Populations for the CCC coho salmon ESU.....	74
Grouping Populations: ESU Diversity Strata.....	75
Results from Historical Structure Analysis.....	76
Biological Viability Criteria .....	79
Population Viability Criteria .....	79
ESU Viability Criteria .....	80
ESU Viability Criteria .....	81
<b>Applying TRT Framework to coho salmon ESU Recovery Criteria.....</b>	<b>82</b>
Recovery Goals for Independent Populations .....	83
Recovery Goals for Dependent Populations .....	84
Considering the SF Bay Stratum .....	85
<b>CHAPTER 6: ASSESSMENT OF HABITATS &amp; THREATS .....</b>	<b>86</b>
<b>Methods to Assess Habitat Conditions and Threats.....</b>	<b>86</b>
Conservation Action Planning.....	87
CAP Workbook Structure .....	88
The Viability Table.....	88
Conservation Targets.....	88
Key Attributes .....	89
Indicators and Indicator Ratings .....	89
Geographic Limits of Analysis.....	90
Viability Table Data Sources .....	92
Contributions from the Sonoma Ecology Center .....	92
Spatial Analysis .....	93

CDFG Habitat Typing Survey Data and UC Hopland Research.....	93
UC Berkeley, Lawrence Berkeley Laboratory and Microsoft Research.....	94
The Threats Table.....	95
Stresses.....	95
Sources of Stresses .....	95
Threats Data Sources .....	96
Recovery Actions .....	96
Strategies (a.k.a. Recovery Action) Data Sources .....	97
Revisions to the CAP Workbook .....	97
<b>CHAPTER 7: POPULATION, HABITAT &amp; THREATS RESULTS.....</b>	<b>98</b>
<b>Introduction .....</b>	<b>98</b>
<b>Populations Selected for Recovery .....</b>	<b>98</b>
Revisiting IP in the Coastal Diversity Stratum .....	99
<b>CAP Workbook: ESU Population Results .....</b>	<b>102</b>
<b>CAP Workbook: Current Habitat Condition Results.....</b>	<b>104</b>
Habitat Results by Freshwater Attribute.....	106
Habitat Results by Freshwater Life Stage.....	109
<b>CAP Workbook: Threats and Diversity Strata Results.....</b>	<b>110</b>
ESU Threat Results .....	110
Diversity Strata Threat Results .....	112
Lost Coast.....	112
Navarro Point-Gualala Point.....	112
Coastal-Gualala Point.....	112
San Francisco Bay.....	112
Santa Cruz Mountains.....	112
<b>CHAPTER 8: STRATEGY FOR RECOVERY.....</b>	<b>117</b>
<b>Preventing the Extinction of CCC Coho Salmon .....</b>	<b>117</b>
Prioritizing Populations .....	118

Priority Areas within Populations.....	118
Timing for Recovery .....	120
<b>CHAPTER 9: RECOVERY CRITERIA .....</b>	<b>121</b>
<b>Framework for Downlisting &amp; Delisting.....</b>	<b>121</b>
<b>Recovery Goals and Objectives.....</b>	<b>121</b>
<b>Recovery Criteria.....</b>	<b>122</b>
Biological Viability Criteria versus Delisting Recovery Criteria.....	124
Downlisting and Delisting Recovery Criteria for Populations and ESU .....	124
Population Level Recovery Criteria for Independent Populations .....	125
Population Level Recovery Criteria for Dependent Populations .....	126
ESU Recovery Criteria for Delisting.....	128
Downlisting Recovery Criteria for Watershed Health and Threats .....	130
Delisting Recovery Criteria for Watershed Health and Threats .....	130
Listing Factor Criteria.....	131
Listing Factor A: Present or threatened destruction, modification, or curtailment of habitat or Range .....	132
Listing Factor B: Overutilization for commercial, recreational, scientific, or educational purposes .....	132
Listing Factor C: Disease or predation.....	132
Listing Factor D: The inadequacy of existing regulatory mechanisms ..	133
Listing factor E: Other natural and manmade factors affecting the species' continued existence.....	134
<b>CHAPTER 10: RECOVERY ACTIONS.....</b>	<b>135</b>
<b>Taking Action for Salmon.....</b>	<b>135</b>
<b>Priority Recovery Actions for CCC Coho Salmon .....</b>	<b>136</b>
<b>ESU Level Recovery Actions.....</b>	<b>137</b>
<b>Diversity Strata Recovery Actions .....</b>	<b>141</b>
Lost Coast .....	141
Navarro-Gualala Point.....	141
Coastal .....	142

San Francisco Bay.....	142
Santa Cruz Mountains:.....	143
<b>Implementation Schedule .....</b>	<b>143</b>
<b>Introduction to Population Level Actions.....</b>	<b>144</b>
 <b>ALBION RIVER .....</b>	 <b>146</b>
 <b>APOTOS CREEK.....</b>	 <b>158</b>
 <b>BIG RIVER .....</b>	 <b>177</b>
 <b>BIG SALMON CREEK.....</b>	 <b>192</b>
 <b>CASPAR CREEK.....</b>	 <b>202</b>
 <b>COTTANEVA CREEK .....</b>	 <b>214</b>
 <b>GARCIA RIVER.....</b>	 <b>223</b>
 <b>GAZOS CREEK.....</b>	 <b>236</b>
 <b>GUALALA RIVER.....</b>	 <b>248</b>
 <b>LAGUNITAS RIVER.....</b>	 <b>261</b>
 <b>NAVARRO RIVER.....</b>	 <b>280</b>
 <b>NOYO RIVER .....</b>	 <b>295</b>
 <b>PESCADERO CREEK.....</b>	 <b>311</b>
 <b>PINE GULCH CREEK .....</b>	 <b>334</b>
 <b>PUDDING CREEK .....</b>	 <b>343</b>
 <b>REDWOOD CREEK .....</b>	 <b>356</b>

<b>RUSSIAN RIVER.....</b>	<b>373</b>
<b>SALMON CREEK .....</b>	<b>401</b>
<b>SAN GREGORIO CREEK.....</b>	<b>414</b>
<b>SAN LORENZO RIVER .....</b>	<b>434</b>
<b>SAN VICENTE CREEK.....</b>	<b>462</b>
<b>SCOTT CREEK.....</b>	<b>478</b>
<b>SOQUEL CREEK.....</b>	<b>502</b>
<b>TEN MILE RIVER.....</b>	<b>524</b>
<b>USAL CREEK.....</b>	<b>537</b>
<b>WADDELL CREEK.....</b>	<b>548</b>
<b>WAGES CREEK.....</b>	<b>561</b>
<b>WALKER CREEK.....</b>	<b>571</b>
<b>CHAPTER 11: MONITORING .....</b>	<b>584</b>
<b>Introduction .....</b>	<b>584</b>
<b>Monitoring CCC Coho Salmon ESU VSP Status and Trends .....</b>	<b>585</b>
VSP Adult Spawner Abundance.....	585
VSP Productivity .....	587
VSP Spatial Distribution .....	587
VSP Diversity .....	587
<b>Monitoring CCC Coho Salmon Listing Factors and Threats.....</b>	<b>588</b>
<b>Data Management and Reporting.....</b>	<b>589</b>
<b>Costs Estimates.....</b>	<b>589</b>

<b>CHAPTER 12: IMPLEMENTATION &amp; COSTS .....</b>	<b>590</b>
<b>Integrating Recovery into NMFS Actions .....</b>	<b>590</b>
Working with Constituents .....	591
Ongoing Regulatory Practices.....	592
ESA Section 4 .....	595
ESA Section 5 .....	595
ESA Section 6 and the PCSRF.....	595
ESA Section 7 .....	596
ESA Section 9 .....	599
ESA Section 10.....	599
Fisheries Management and EFH.....	601
Coordination with other NMFS Divisions .....	602
<b>Time and Cost Estimates .....</b>	<b>602</b>
<b>CHAPTER 13: RESTORATION .....</b>	<b>604</b>
<b>Restoring Our Watersheds .....</b>	<b>604</b>
<b>Prioritizing Restoration Actions .....</b>	<b>604</b>
<b>Restoration PLANNING.....</b>	<b>606</b>
<b>Restoration Partners .....</b>	<b>608</b>
<b>Restoration Assistance .....</b>	<b>609</b>
<b>CHAPTER 14: 5-YEAR REVIEWS AND POST-DELISTING.....</b>	<b>612</b>
<b>5-Year Reviews of Species Status.....</b>	<b>612</b>
<b>Post-Delisting Monitoring .....</b>	<b>613</b>
<b>LITERATURE CITED.....</b>	<b>615</b>

## LIST OF FIGURES

---

Figure 1: Exponential Growth of Sawmills and Human Population.....	7
Figure 2: Visual Representation of Extinction Vortex of Coho Salmon .....	19
Figure 3: Historical and Current Estimate of Coho Salmon Abundance .....	23
Figure 4: Adult coho salmon returns to Noyo Egg Collecting Station (1965 – 2009) .....	25
Figure 5: Historical Range of CCC coho salmon and Focus Populations for Recovery .....	26
Figure 6: General overview of life stages (modified from Reeves 2009). ....	28
Figure 7: California's Four Salmon and Steelhead Recovery Domains.....	46
Figure 8: Hierarchical Structure of Populations .....	70
Figure 9: Temperature Mask Example.....	73
Figure 10: Viability and Self-Recruitment .....	75
Figure 11: Population, Diveristy Strata and ESU Structure.....	75
Figure 12: Historical population structure of the CCC coho salmon ESU, arranged by Diversity Strata .....	78
Figure 13: Example DFG Data Outputs.....	94
Figure 14: Current "Percent Poor" values for habitat and population attributes across all populations .....	104
Figure 15: Current "Percent Poor" values across life stages.....	105
Figure 16: Current "Percent Poor" habitat and population attributes for CCC coho salmon summer and winter rearing across all populations .....	106

## LIST OF TABLES

---

Table 1: Historical Estimates of coho spawner abundance across the CCC coho salmon ESU ...	24
Table 2: Seasonal calendar of coho salmon presence .....	29
Table 3: Maternal brood year lineage.....	30
Table 4: Habitat requirements for each life stage of CCC coho salmon.....	32
Table 5: Federal Register Notices analyzed to assess threats and protective measures .....	48
Table 6: Listing Factors, Status and Associated Recovery Criteria References .....	58

Table 7: Population Extinction Risk Criteria.....	80
Table 8: Independent Population Adult Spawner Abundance Targets for Recovery.....	83
Table 9: Dependent Population Adult Spawner Abundance for Recovery.....	84
Table 10: CAP Example Workbook Page and Life Stage Targets.....	89
Table 11: Example CAP Workbook Table of Key Attributes, Indicators and Ratings .....	90
Table 12: Targeted Life Stage, Habitat Attributes and Indicators .....	91
Table 13: Proposed Abundance Targets for the Russian River and Coastal Diversity Stratum	102
Table 14: CAP data analysis results for current conditions across life stages and populations	114
Table 15: CAP threat rank results across populations.....	115
Table 16: CCC Coho Salmon ESU Focus Populations, Spawner Targets and Threats.....	116
Table 1: Outline and Hierarchy of Recovery Criteria for CCC coho salmon ESU.....	122
Table 2: Population, Watershed Condition and Threat Criteria.....	123
Table 3: Population Extinction Risk Criteria.....	125
Table 4: Delisting & Downlisting Spawner Abundance Criteria for Independents.....	126
Table 21: Delisting and Downlisting Spawner Abundance Criteria for Dependents.....	128
Table 22: Recovery Plan Implementation under the ESA and MSFCMA by NMFS .....	594

## LIST OF APPENDICES

---

- Appendix A      Marine and Climate Scenarios for CCC coho salmon
- Appendix B      *A Framework for Assessing the Viability of Threatened and Endangered Salmon and Steelhead in North-Central California Coast Recovery Domain (Spence et al. 2008)*
- Appendix C      NCCC Recovery Domain, Conservation Action Planning Viability Table Report for CCC Coho Salmon, Draft September 2009
- Appendix D      CCC Coho Salmon Recovery Plan Threats Description and Taxonomy
- Appendix E      NMFS Strategies Database Bibliography
- Appendix F      NMFS Watershed Characterizations
- Appendix G      NMFS PRD Strategic Plan 2007-2011
- Appendix H      *Habitat Restoration Cost References for Salmon Recovery Planning; Coho Salmon Recovery in California: A Summary of Recent Economic Evidence*

## LIST OF ACRONYMS

---

*The following is a list of selected acronyms and abbreviations used throughout the plan.*

ABAG	Association of Bay Area Governments
a.k.a.	also known as
BACI	before after control impact
BKD	bacterial kidney disease
BLM	Bureau of Land Management
BMPs	best management practices
BOF	California Board of Forestry
CalFire	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
C	Celsius
CAP	Conservation Action Planning
CCC	Central California Coast
CCR	California Code of Regulations
CDF	California Department of Forestry and Fire Protection
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFPA	California Forest Practices Act
CFIP	California Forest Improvement Program
cfs	cubic feet per second
CGS	California Geological Survey
CHERT	County of Humboldt Extraction Review Team
Commission	California Fish and Game Commission
CPS	coastal pelagic species
CRMP	coordinated resources management planning
CRT	California Statewide Coho Salmon Recovery Team
CV	coefficient of variation
CWA	Clean Water Act
CWT	coded wire tag
DBH	diameter (of a Tree) at breast height
DFG	California Department of Fish and Game
DOC	Department of Conservation
DP	dependent population

DPR	California Department of Parks and Recreation
DPS	distinct population segment
DWR	California Department of Water Resources
ECS	egg collection station
EEZ	U.S. Exclusive Economic Zone
EIS	Environmental Impact Statement
ENSO	El Niño/Southern Oscillation
EPA	United States Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
ESU	evolutionarily significant unit
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FEMAT	Forest Ecosystem Management Assessment
FERC	Federal Energy Regulatory Commission
FGC	California Fish and Game Code
FIP	Functionally Independent Population
FLPMA	Federal Land Policy and Management Act
FMP	Fishery Management Plan
FPA	Forest Practice Act
FPR	Forest Practice Rules
FRGP	Fisheries Restoration Grant Program
GIS	geographic information system
GRTS	generalized random tessellation sampling
HCD	Habitat Conservation Division
HCP	habitat conservation plan
HGMP	hatchery genetic management plan
IP	intrinsic potential
IPHC	International Pacific Halibut Commission
IP-km	intrinsic potential per kilometer
IUCN	International Union for Conservation of Nature
JDSF	Jackson Demonstration State Forest
LWD	large woody debris

mg	milligrams
mm	millimeter
MMWD	Marin Municipal Water District
MOU	memorandum of understanding
MRC	Mendocino Redwood Company
MBSTP	Monterey Bay Salmon and Trout Project
MWAT	maximum weekly average temperature
MWMT	maximum weekly maximum temperature
OLE	Office of Law Enforcement
NCCC Domain	North Central California Coast Recovery Domain
NCRWQCB	North Coast Regional Water Quality Control Board
NCWAP	North Coast Watershed Assessment Program
NFWF	National Fish and Wildlife Foundation
NFP	National Forest Plan
NGO	non governmental organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NTP	non-industrial timber plan
NTU	nephelometric turbidity unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCSRF	Pacific Coast Salmon Restoration Fund
PDO	Pacific (inter)decadal oscillation
PFMC	Pacific Fishery Management Council
PIP	potentially independent population
PIT	passive integrated transponder
ppm	parts per million
PRD	Protected Resources Division
PSMFC	Pacific States Marine Fisheries Council
RC	Restoration Center

RCD	Resource Conservation District
R/K	Rogue/Klamath
RM	river mile
ROD	record of decision
RPA	reasonable and prudent alternative
RPF	registered professional foresters
RWQCB	California Regional Water Quality Control Board
SEC	Sonoma Ecology Center
SLC	State Lands Commission
SMARA	Surface Mine and Reclamation Act
SONCC	Southern Oregon/Northern California Coasts
SPAWN	Salmon Protection and Watershed Network
SWRCB	State Water Resources Control Board
SWFSC	Southwest Fisheries Science Center
SYP	sustained yield plans
T & I	threatened and impaired water body
THP	timber harvest plan
TMDL	total maximum daily load
TNC	The Nature Conservancy
TRT	Technical Review Team
TU	Trout Unlimited
UC	University of California
UCCE	University of California Cooperative Extension
UPGMA	unweighted pair group method with arithmetic averages
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UILT	upper incipient lethal temperature
UUILT	upper ultimate incipient lethal temperature

VSP	viable salmonid populations
WRP	Wetlands Reserve Program
WOC	Washington, Oregon, and California
WSH	Warm Springs Hatchery