Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Rainbow Trout								
	Reservoir Fishes	fishing	C	2	NA	adult		
		hatchery production	C	2	NA	adult, juvenile		
		reservoir drawdown	A	1	NA	adult, juvenile		
		water temperature	A,B	1	NA	adult, juvenile	temperature-survival relationships	Raleigh et al. 1984
Largemouth Bass								
	Reservoir Fishes	reservoir drawdown	A	2	NA	adult		
				2		eggs and larvae	spawning habitat model	CVPIA, Stuber et al. 1992
				2		juvenile	rearing habitat model	CVPIA, Stuber et al. 1992
		spawning habitat	C	2	NA	eggs and larvae		
		rearing habitat	C	2	NA	adult, juvenile		
	Estuarine	food availability	A,B,C	1		adult, juvenile		
		diversion	A,C	1		juvenile		
		spawning habitat	C	1		adult, eggs, larvae		
		rearing habitat	C	1		adult, juvenile		
		fishing	C	1		adult		

C-000475

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
White	**Sturgeon**							
	Squawfish-Sucker-Hardhead	flow	A	2	2	adult (spawning)	flow-spawning habitat, AFRP	Parsley and Beckman 1994, USFWS 1996
				2	1-2	larvae	narrative	Wang 1984, Kohlhorst 1976
				2	1-2	juvenile	abundance-flow and flow-habitat	DWR 1990; Kohlhorst et al. 1991; Parsley and Beckman 1994
		barrier	C	2	1	adult		
					0	juvenile		
		spawning habitat	C	2	1	adult, eggs, larvae		
		water temperature	A,B,C	1	1	eggs and larvae	temperature-survival	Kohlhorst 1976, Haynes et al. 1978
		sedimentation	A,B,C	1	1	eggs		
		diversion	A,C	1	0-1	adult, juvenile		
		rearing habitat	C	1	1	juvenile		
		pollutant	C	1	1	all		
	Deep-Bodied Fishes	flow	A	2	2	adult	flow-spawning habitat, AFRP	Parsley and Beckman 1994, USFWS 1996
				1	1-2	juvenile	abundance-flow and flow-habitat	DWR 1990; Kohlhorst et al. 1991; Parsley and Beckman 1994
		food availability	A,B,C	1		adult, juvenile		
		rearing habitat	C	1	1	juvenile		
		pollutant	C	1	1	juvenile		
	Estuarine	diversion	A,C	1	0,1	juvenile		
		rearing habitat	C	1	1,0-1	juvenile		
		fishing	C	1	1,2	adult, juvenile		
		pollutant	C	1	1,1	adult, juvenile		
	Marine	pollutants	C	1	1	adult, juvenile		
		fishing	C	1	1	adult, juvenile		

C-000476

C-000476

Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Chinook Salmon								
	Squawfish-Sucker-Hardhead	flow	A	2	2,2	adult	flow-habitat, AFRP	IFIM Studies, CVPIA
				2	2,1	eggs and larvae	flow-habitat, AFRP	IFIM Studies, CVPIA
				2	2,0-1	juvenile	flow-habitat, AFRP	IFIM Studies, CVPIA
		temperature	A,B,C	2	2, #	adult		Raleigh et al. 1986
				2	2,1-2	eggs and larvae	temperature-survival	Brett et al. 1982, Raleigh et al. 1986
				2	2,1	juvenile	temperature-survival	Raleigh et al. 1986
		food availability	A,B,C	2	1,#-1	juvenile		
		sedimentation	A,B,C	2		eggs and larvae		
		diversion	A,C	2	1,#	juvenile		
		barrier	C	2	0,0	adult		
				2	1,0	juvenile	dam passage mortality relationship	USFWS
		spawning habitat	C	2	0,#	adult, eggs, larvae		
		rearing habitat	C	2	1-2,#-1	juvenile		
		pollutants	C	2	0,#-1	eggs and larvae		
				2	0,0	juvenile		
		fishing	C	2	1,1	adult		
		hatchery production	C	2	0,0-1	juvenile		
	Deep-Bodied Fishes	temperature	A,B,C	2	2,1	adult, juvenile	temperature-survival	Raleigh et al. 1986
		diversion	A,C	2	1,0	juvenile		
		fishing	C	2	1,1	adult		
		food availability	A,B,C	1	1,#	juvenile		
		flow	A	1	2,0	adult		
				1	2,0	juvenile		
		rearing habitat	C	1	1,#	juvenile		
		hatchery production	C	1	0,0-1	juvenile		
	Estuarine	flow	A	2	2,0,#	adult		
				2	2,1-2,2	juvenile	flow-transport	Herrgesell 1991; USFWS 1993; Dettman et al. 1987
		diversion	A,C	2	2,1,2,1	juvenile		
		barrier	C	2	2,1,2	adult, juvenile	pathway and barrier survival	Kjelson et al. 1989
		hatchery production	C	2	0,#,1	juvenile		
		temperature	A,B,C	1	2,1-2,1-2	adult, juvenile	temperature-survival	Kjelson et al. 1989
		food availability	A,B,C	1	1,#,2,1	juvenile		
		rearing habitat	C	1	2,#,1-2,2	juvenile		
		pollutants	C	1	0,0,1,1	juvenile		
		fishing	C	1	1,1,#	adult		
	Marine	fishing	C	2	0,1	adult, juvenile	ocean mortality model	DFG
		hatchery production	C	1	0,#	juvenile		

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Steelhead Trout								
	Squawfish-Sucker-Hardhead	flow	A	2	2,0	adult		
				2	2,1	eggs and larvae	flow-habitat	IFIM Studies, Raleigh et al. 1984
				2	2,1	juvenile	flow-habitat	IFIM Studies, Raleigh et al. 1984
		temperature	A,B,C	2	2,1	all	temperature-survival	Raleigh et al. 1984
		food availability	A,B,C	2	1,#	juvenile		
		sedimentation	A,B,C	2		eggs and larvae		
		diversion	A,C	2	1,#	juvenile		
		barrier	C	2	0,0	adult		
				2	1,0	juvenile		
		spawning habitat	C	2	0,#	adult, eggs, larvae		
		rearing habitat	C	2	1-2	juvenile		
		pollutants	C	2	0,0	eggs and larvae		
				2	0,0	juvenile		
		fishing	C	2	1,2	adult		
		hatchery production	C	2	0,0	juvenile		
	Deep-Bodied Fishes	temperature	A,B,C	2	2,1	adult, juvenile	temperature-survival	Raleigh et al. 1984
		diversion	A,C	2	1,#	juvenile		
		fishing	C	2	1,2	adult		
		flow	A	1	2,0	adult		
				1	2,#	juvenile		
		food availability	A,B,C	1	1,#	juvenile		
		rearing habitat	C	1	1,#	juvenile		
		hatchery production	C	1	0,0	juvenile		
	Estuarine	flow	A	2	2,#,1	adult, juvenile		
		barrier	C	2	2,0,1	adult, juvenile		
		hatchery production	C	2	0,0,1	juvenile		
		food availability	A,B,C	1	1,#,1	juvenile		
		diversion	A,C	1	2,0,1	juvenile		
		rearing habitat	C	1	2,#,1	juvenile		
		pollutants	C	1	0,#,1	juvenile		
		fishing	C	1	1,#	juvenile		
		temperature	A,B		2,#,1	adult, juvenile		

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Sacramento Squawfish								
	Squawfish-Sucker-Hardhead	barrier	C	2		adult		
		spawning habitat	C	1		adult, eggs, larvae		
		rearing habitat	C	1		adult, juvenile		
		pollutants	C	1		all		
	Deep-bodied Fishes	food availability	A,B,C	1		adult, juvenile		
		rearing habitat	C	1		adult, juvenile		
		spawning habitat	C	1		adult, eggs, larvae		
American Shad								
	Deep-Bodied Fishes	flow	A	2	2,0,1	adult	flow-virgin shad relationship, AFRP flows	DFG 1981, CVPIA
				2	2,2,1	eggs and larvae	flow-abundance index	Stevens and Miller 1983
				2	0,0,2	juvenile		
		spawning habitat	C	2	2,#,2	adult, eggs, larvae		
		fishing	C	2	0-1,#,1	adult		
		temperature	A,B,C	1	1,1,1	adult, eggs, larvae	temperature-survival	Steir and Crance 1985
				1	1,1,2	juvenile	temperature-survival	Steir and Crance 1985
		food availability	A,B,C	1	0,1,1	juvenile		
		diversion	A,C	1	1-2,1,#	eggs, larvae, juvenile		
		rearing habitat	C	1	1,1,1	juvenile		
		pollutants	C	1	0-1,#,0	eggs and larvae		
				1	0-1,#,0	juvenile		
		barrier	C		0,1,0	adult		
	Estuarine	diversion	A,C	2	1-2,1,0,2	eggs, larvae, juvenile	pathway diversion index	CVPIA
		fishing	C	2	1	adult		
		flow	A	1	#,0,2	juvenile		
				1	1,0,1	eggs and larvae		
		food availability	A,B,C	1	#,1,1,1	juvenile		
		barrier	C	1	1-2,0	adult, juvenile		
		spawning habitat	C	1	#,0,2,2	adult, eggs, larvae		
		rearing habitat	C	1	0,1,1,2	juvenile		
		pollutant	C	1	0-1,0,1	all		

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Sacramento Blackfish								
	Deep-Bodied Fishes	spawning habitat	C	1		adult, eggs, larvae		
		rearing habitat	C	1		adult, juvenile		
		pollutants	C	1		all		
		fishing	C	1		adult		
	Estuarine	rearing habitat	C	2		adult, juveniles		
		spawning habitat	C	1		adult, eggs, larvae		
Sacramento Splittail								
	Deep-Bodied Fishes	flow	A	2	1,2,2	adults		
				2	#,2,2	eggs, larvae, juvenile	flow-abundance relationship	DFG 1992
		spawning habitat	C	2	#,2,2	adult, eggs, larvae		
		fishing	C	2	#,0,0	adult		
		rearing habitat	C	1	1,2,1	adult, juvenile		
		pollutants	C	1	#,#,1	all		
		temperature	A,B		1,0,0	larvae		
	Estuarine	flow	A	2	#,1,2	all		
		diversion	A,C	2	1,1,1,1	juvenile		
		rearing habitat	C	2	1,1,1,2	adult, juvenile		
		estuarine salinity	A,B,C	1		adult, juvenile		
		barrier	C	1	#,#,0	adult, juvenile		
		spawning habitat	C	1	#,2,2	adult, eggs, larvae		
		pollutants	C	1	#,#,1,0	all		
		fishing	C	1	#,1,0	adult		
		food availability	C		2	adult, juvenile		

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Striped Bass								
	Deep-Bodied Fishes	flow	A	2	1-2,1,2	adult, eggs, larvae	flow-survival relationship	DFG 1993
		spawning habitat	C	2	1,0,2	adult, eggs, larvae		
		pollutants	C	2	1-2,0-1,2	eggs and larvae		
		temperature	A,B,C	1	1,#,1	adult (spawning)	temperature-spawning relationships	DFG 1987
				1	1,#,1	eggs and larvae	temperature-survival relationships	Crance 1984
		diversion	A,C	1	1,1,2	eggs and larvae		
		fishing	C	1	0,1,2	adult		
	Estuarine	flow	A	2	1,#,2	eggs, larvae, juveniles	flow-abundance model	Botsford and Brittnacher 1994
		estuarine salinity	A,B,C	2	2,0	eggs and larvae	X2-abundance relationship	Jassby et al. 1995
				2	2,#	juvenile		
		food availability	A,B,C	2	1	adult, larvae, juvenile		
		diversion	A,C	2	2,1,2,2	eggs, larvae, juvenile	diversion-abundance model	Botsford and Brittnacher
		barrier	C	2	1,0,1	eggs, larvae, juvenile		
		spawning habitat	C	2	1,0,2,2	adult, eggs, larvae		
		rearing habitat	C	2	0,2,2,2	adult, juvenile		
		fishing	C	2	1,1,2	adult, juvenile		
		hatchery production	C	2	1,#,2	juvenile		
		temperature	A,B		1,0,1	juvenile		
		pollutants	C	1	1,#,1-2,1	all		
	Marine	fishing	C	2	1,#	adult, juvenile		
		pollutants	C	1	1,#	adult, juvenile		
		hatchery production	C	1	1,#	juvenile		
		rearing habitat	C		1,#	adult, juvenile		

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Table I. Selected Species and Assessment Variables.

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Smallmouth Bass								
	Deep-Bodied Fishes	food availability	A,B,C	1		adult, juvenile		
		spawning habitat	C	1		adult, eggs, larvae		
		rearing habitat	C	1		adult, juvenile		
White Catfish								
	Estuarine	diversion	A,C	2	2	juvenile		
		fishing	C	2		adult		
		spawning habitat	C	1	1	adult, eggs, larvae		
		rearing habitat	C	1	1	adult, juvenile		
		pollutants	C	1	1	all		
		food availability	A,B,C		1	adult, juvenile		
Inland Silverside								
	Estuarine	diversion	A,C	1		all		
		spawning habitat	C	1		adult, eggs, larvae		
		rearing habitat	C	1		adult, juvenile		

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Delta Smelt								
	Estuarine	flow	A	2	2,1	all		
		estuarine salinity	A,B,C	2	1	all	salinity-habitat model	Unger 1994
		food availability	A,B,C	2	1	all		
		sedimentation	A,B,C	1		eggs		
		diversion	A,C	2	#,2,2	adult, larvae, juvenile		
		barrier	C	2	0,1	adult, larvae, juvenile		
		spawning habitat	C	2	#,2,2	adult, eggs, larvae		
		rearing habitat	C	2	1,2,2	adult, juvenile		
		pollutants	C		2,2	all		
Longfin Smelt								
	Estuarine	flow	A	2	0-2,2,2	all		
		estuarine salinity	A,B,C	2		all	X2-abundance relationship	Jassby et al. 1995, Unger 1994
		food availability	A,B,C	2	1	all		
		sedimentation	A,B,C	2		eggs		
		diversion	A,C	2	1,1,1,1	adult, larvae, juvenile		
		spawning habitat	C	2	0,0,1,2	adult, eggs, larvae		
		rearing habitat	C	2	2,1,2,2	adult, juvenile		
		barrier	C	1	0,#,0	adult, larvae, juvenile		
	Marine	flow	A	2	1,1,2	adult, juvenile		
		estuarine salinity	A,B,C	2		adult, juvenile		
		rearing habitat	C	2	2,1,1	adult, juvenile		
Pacific Herring								
	Marine	spawning habitat	C	2		adult, eggs, larvae		
		fishing	C	2		adult, eggs		
		flow	A	1		all		
		estuarine salinity	A,B,C	1		all		
		rearing habitat	C	1		juvenile		

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Terrestrial Invertebrates								
	Squawfish-Sucker-Hardhead	rearing habitat	C	2		NA		
	Deep-Bodied Fishes	rearing habitat	C	2		NA		
	Estuarine	rearing habitat	C	2		NA		
Other Aquatic Invertebrates								
	Squawfish-Sucker-Hardhead	flow	A	2		NA		
		sedimentation	A,B,C	1		NA		
		rearing habitat	C	1		NA		
		pollutants	C	1		NA		
	Deep-Bodied Fishes	rearing habitat	C	2		NA		
		flow	A	1		NA		
		sedimentation	A,B,C	1		NA		
		pollutants	C	1		NA		
Crayfish								
	Deep-Bodied Fishes	pollutants	C	1		all		
		fishing	C	1		adult		
	Estuarine	fishing	C	2		adult		
		rearing habitat	C	1		adult, juvenile		
		pollutants	C	1		all		

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Table I. Selected Species and Assessment Variables

Species	Fish Community	Assessment Variable	CALFED Action	Species Response Level	Species Response Variation*	Affected Life Stages	Impact Assessment Tools	Notes
Rotifers								
	Estuarine	flow	A	1	2	NA		
		rearing habitat	C	1	2	NA		
		pollutants	C	1	1	NA		
		food availability	A,B,C		1	NA		
		diversion	A,C		1	NA		
Native Mysid Shrimp								
	Estuarine	flow	A	2	2	NA		
		estuarine salinity	A,B,C	2	1,2	NA	X2- abundance relationship	Jassby et al. 1993
		food availability	A,B,C	1	1	NA		
		rearing habitat	C	1	2	NA		
		pollutants	C	1	1	NA		
		diversion	A,C		1	NA		
Asian Clam								
	Estuarine	flow	A	1	2	all		
		estuarine salinity	A,B,C	1	2	all		
		food availability	A,B,C	1	1	adult, juvenile, larvae		
		spawning habitat	C	1	2	eggs and larvae		
		rearing habitat	C	1	2	adult, juvenile		
		pollutants	C		2	all		
	Marine	estuarine salinity	A,B,C	1	2	all		
		flow	A	1	2	all		
		spawning habitat	C	1		eggs and larvae		
		rearing habitat	C	1		adult, juvenile		
Bay Shrimp								
	Marine	flow	A	2	2,2	all		
		estuarine salinity	A,B,C	2	1,2	all	X2-abundance relationship	Jassby et al. 1993
		rearing habitat	C	1	2,2	adult, juvenile		
		fishing	C		1	adult		
		food availability	A,B,C		1	all		

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